ASSAM DON BOSCO UNIVERSITY

REGULATIONS AND SYLLABUS 2024

for

FOUR YEAR UNDERGRADUATE PROGRAMMES AS PER NEP 2020
FIVE YEAR INTEGRATED PROGRAMMES
TWO YEAR POST GRADUATE PROGRAMMES

ASSAM DON BOSCO UNIVERSITY

REGULATIONS AND SYLLABUS

2024-2025

Four Year Undergraduate Programmes

School of Technology

1. Bachelor of Computer Applications
2. Bachelor of Technology Civil Engineering
3. Bachelor of Technology Computer Science and Engineering
4. Bachelor of Technology Electrical and Electronics Engineering
5. Bachelor of Technology Electronics and Communication Engineering
6. Bachelor of Technology Mechanical Engineering
7. Bachelor of Technology Artificial Intelligence and Machine Learning

School of Commerce and Management

1. Bachelor of Business Administration
2. Bachelor of Commerce

School of Fundamental and Applied Sciences

1. Bachelor of Science Chemistry
2. Bachelor of Science Mathematics
3. Bachelor of Science Physics

School of Life Sciences

1. Bachelor of Science Botany
2. Bachelor of Science Zoology

School of Humanities and Social Sciences

1. Bachelor of Arts Economics
2. Bachelor of Arts Education
3. Bachelor of Arts English
4. Bachelor of Arts Mass Communication
5. Bachelor of Arts Philosophy
6. Bachelor of Arts Psychology
7. Bachelor of Arts Public Administration
8. BSc Hospitality and Hotel Administration

Five Year Integrated Programmes

School of Technology

1. Integrated Master of Computer Applications

School of Commerce and Management

1. Integrated Master of Business Administration

Two Year Postgraduate Programmes

School of Technology

1. Master of Technology Computer Science and Engineering
2. Master of Technology Civil Engineering
3. Master of Technology Electrical and Electronics Engineering
4. Master of Technology Electronics and Communication Engineering
5. Master of Computer Applications

School of Commerce and Management

1. Master of Commerce

School of Fundamental and Applied Sciences

1. Master of Science Chemistry
2. Master of Science Mathematics
3. Master of Science Physics

School of Life Sciences

1. Master of Science Biochemistry
2. Master of Science Biotechnology
3. Master of Science Microbiology
4. Master of Science Botany
5. Master of Science Zoology

School of Humanities and Social Sciences

1. Master of Arts Economics
2. Master of Arts Education
3. Master of Arts English
4. Master of Arts Mass Communication
5. Master of Science Psychology
6. Master of Arts Public Administration
7. Master of Social Work

ASSAM DON BOSCO UNIVERSITY

Tapesia Gardens, Sonapur, 782402 | Azara, Guwahati 781017 | Kharguli Campus, Guwahati 781004

NOTE

This handbook contains important information to help guide and inform you during your programme of study. We recommend that you keep this handbook for the duration of your studies in the University so that you can refer to it as needed. Please note that the onus of ignorance of the regulations and information contained in this handbook will be on the student and will not be ground for any consideration. You are also required to keep abreast of the amendments and additions to the regulations and syllabus that will be officially notified from time to time.

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FOUR YEAR UNDERGRADUATE PROGRAMMES (FYUG)

CONTENTS

REGULATIONS FOR FOUR YEAR UNDERGRADUATE PROGRAMMES

ASSAM DON BOSCO UNIVERSITY REGULATIONS 2024-2025

GRADUATE DEGREE PROGRAMMES

(Applicable to All B.TECH, BA, BSC, BCOM, BBA and BCA)

Subject to the provisions of *NEP 2020 with Multiple Entry and Multiple Exit*, following are the regulations of Assam Don Bosco University concerning the Graduate Programmes leading to the award of the Bachelor's Degree in various disciplines of Engineering, three-Year (Bachelor's Degree) and/or Four-Year (Honours/Research).

1.0 Academic Calendar

1.1 Semester**:** Each academic year is divided into two semesters of approximately 90 working days: An Autumn Semester (July – December) and a Spring Semester (January – June). The Autumn Semester shall ordinarily begin in July for students already on the rolls and the Spring Semester shall ordinarily begin in January. However, the first semester (autumn, for newly admitted students) may begin later depending on the completion of admission formalities.

1.2 Summer Term: A summer term is for eight weeks during summer vacation. Internship/apprenticeship/work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study. Regular courses may also be offered during the summer on a fast-track mode to enable students to do additional courses or complete backlogs in coursework.

1.3 The schedule of academic activities approved by the Academic Council for each semester, inclusive of the schedule of continuous evaluation for the semester, dates for the conduct of end-semester examinations, the schedule of publication of results, etc., shall be laid down in the Academic Calendar for the semester.

2.0 Admission

2.1 All admissions to the Graduate Degree Programmes of the University shall be on the basis of merit. There may, however, be provision for direct admission for a limited number of NRI/FN students.

2.2 **Eligibility Criteria**: To be considered for admission to a Graduate Degree Programme a candidate should have passed the Higher Secondary examination of a recognized Board of Higher Secondary Education or an equivalent examination of any University / Board/ or equivalent stage of education corresponding to Level-4 * (cf. 3.1)

2.2.1 Admission will be on the basis of performance of the candidate at the qualifying examination, entrance test and/or personal interview and/or CUET Score/JEE /CEE/ any other entrance tests approved by the competent authority.

2.2.2 All Engineering Programmes shall follow the AICTE guidelines for grade/marks and subjects requirement from qualifying examinations for the respective engineering disciplines.

2.3 Reservation of seats for the programme shall be as per the guidelines laid out in the Statutes of the University (As approved by the competent authority) .

2.4 Admissions shall ordinarily close after a specified period from the date of commencement of the first semester, through a notification. However, in exceptional cases, admission of a candidate after the last date may be recommended to the University with justification, by the School / Departments concerned. Under such an event, this period shall not exceed four weeks from the date of commencement of the first/third semester.

2.4.1 The attendance of such students shall be computed from the date of admission.

2.4.2 Such students may be offered the opportunity of taking part in in-semester assessment modules which may have already been completed.

2.5 All candidates shall be required to satisfy the norms prescribed by the University for Medical Fitness prior to admission.

2.6 **Anti-Ragging Affidavit:** Students and Parents Undertaking Affidavit In compliance of the UGC Regulations, it is compulsory for each student and every parent to submit an online Anti-Ragging undertaking affidavit every academic year. The Link to fill out the online undertaking affidavit by students and parents is : www.antiragging.in/affidavit_registration_disclaimer.html www.c4yindia.org/Home/Undertaking

2.7 **B.TECH Lateral Entry into Programmes**

2.7.1 Polytechnic diploma holders in any branch of Engineering and Technology and B.Sc. Degree holders having Physics, Chemistry and Mathematics shall be eligible for admission to degree courses in Engineering and Technology in the third semester B.TECH Programme against vacancies and/or seats in addition to the sanctioned intake in the first year.

2.7.2 Such diploma holders should have been bonafide students of polytechnics duly approved by the government and should have pursued an AICTE approved three-year diploma curriculum in an appropriate branch of Technology.

2.7.3 Only diploma holders who have secured a minimum of 45% in the aggregate in the relevant discipline and B.Sc. students who have secured a minimum of 45% marks in the aggregate shall be eligible for consideration for admission. The

students belonging to B.Sc. Stream would have to clear the subjects: Engineering Graphics/Engineering Drawing and Engineering Mechanics of the First Year Engineering Programme along with the Second year subjects.

2.7.4 Such admissions shall be on the basis of merit in the ADBU entrance test and a personal interview.

3.0 Programmes of Study

3.1 The University follows an outcome based learning approach following National Higher Education Qualification Framework (NHEQF)*, explicitly defining the course/programme outcomes and programme specific outcomes, in the curriculum for all the Graduate Degree Programmes. (* available at https://www.ugc.gov.in/pdfnews/2990035_Final-NHEQF.pdf)

3.2 The Non Engineering Undergraduate Programme (UG) is structured with multiple exit options of Certificate, Diploma, basic Bachelor' Degree at the completion of first, second and third years respectively. The students who complete four years Undergraduate Programme, either in one stretch or through multiple exits and re-enter would get a Bachelor's Degree with Honours. If the student completes a rigorous research project in their major area(s) of study during the fourth year of a Bachelor's Degree will be awarded Honours with research.

3.3 The Engineering Undergraduate B.TECH Programme is structured with multiple exit options of Certificate, Diploma, B.Sc Engineering/ B. Voc Degree at the completion of first, second and third years respectively. The students who complete four years Undergraduate Programme, either in one stretch or through multiple exits would get a Bachelor's Degree in Engineering.

3.4 **B.TECH Honours**

A student of B.Tech can obtain Honours by completing additional 18-20 credits in emerging areas of the same discipline of study. Departmental Board of Studies shall finalize the emerging areas of study. (Refer 8.1)

3.5 **B.TECH Minor Engineering**

A student of B.Tech can obtain Minor by completing additional 18-20 credits in emerging areas of another discipline of study. Departmental Board of Studies shall finalize the emerging areas of study. (Refer 8.2)

4.0 Duration of the Programme

4.1 The duration of the Undergraduate (UG) programme for all non-engineering disciplines is 4 years or 8 semesters. Students who desire to undergo a 3-year UG Programme may opt to exit after completion of the 3rd year.

4.2 Students choosing to exit after the first or second year will receive a UG Certificate or UG Diploma, respectively, contingent upon fulfilling the required number of credits as outlined in *Table 1.*

4.3 Students who exit with a UG certificate or UG diploma are permitted to re-enter within three years and complete the degree programme.

4.4 Students may take a break from their studies, provided that the total duration of their programme does not exceed 7 years.

4.5 Students who successfully complete their Bachelor's Degree with Honours, with suitable grades are eligible to enter the doctoral (Ph. D) Programme in the relevant discipline or enter the "Two-semester" Master's Degree Programme. (Ref 12.5)

4.6 The duration of the Bachelor of Technology (B.TECH) programme is 4 years or 8 semesters.

4.6.1 Students who do not meet some degree requirements in their first attempt may be granted an additional 4 semesters (2 years) to fulfill all programme requirements

4.6.2 Under exceptional circumstances and depending on the merit of each case, a period of 2 more semesters (1 year) may be granted for the completion of the programme. (Ref. 12.5)

4.7 The provisions outlined in clauses 3.2 and 3.3 are also applicable to all engineering graduate programmes.

4.8 Students can earn B.TECH Honours or B.TECH Minor engineering by completing additional 18-20 credits during their Engineering graduate programme.

5.0 Curriculum Components

5.1 **Non Engineering disciplines:** The curriculum consists of major courses, minor courses and courses from other disciplines, language courses, skill courses, and a set of courses on Environmental education, understanding India, Digital and technological solutions, Health & Wellness, Yoga education, and sports & fitness.

5.1.1 At the end of the second semester, students can decide either to continue with the chosen major or request a change of major. (Ref 7.3)

5.2 **Engineering disciplines:** The curriculum for graduate degree programmes in engineering is organized into two categories: Core Courses and Elective Courses

5.2.1 **Core Courses:** Core courses are those in the curriculum, the knowledge of which is deemed essential for students who are pursuing the said Degree Programme.

5.2.1.1 Students are required to complete all core courses offered in their programme.

5.2.1.2 The number of credits required from core courses shall be as prescribed by the competent academic authority.

5.2.1.3 Core courses include Professional Core Courses (DC), Engineering Science Courses (IC), Basic Science Courses (IC), Humanities and Social Science Courses (IC), Mandatory Courses (IC), Project Work, Seminar and Internship in Industry.

5.2.2 **Elective Courses:** Elective courses provide opportunities for specialization and cater to students' interests and career goals. These courses may be selected by the student and/or offered by the department conducting the programme, following the norms set by the competent academic authority.

5.2.2.1 The number of credits which may be acquired through elective courses shall be prescribed by the competent academic authority.

5.2.2.2 Elective courses include Professional Elective Courses and Open Elective Courses.

5.2.2.3 It shall be the prerogative of the department not to offer an elective course which has less than 5 students opting for it.

5.2.3 At the end of the second semester, students can decide either to continue with the chosen engineering discipline/branch or request a change of branch. (Ref 7.4)

6.0 Credit hours and Course structure

6.1 The medium of instruction, as well as examinations and project reports shall be in English except for Modern Indian language courses.

6.2 The course structure and syllabi of the Graduate Degree Programmes shall be approved by the Academic Council of the University. Departmental Boards of Studies (DBOS) shall discuss and recommend the syllabi of all the courses offered by the department from time to time. The proposals from the departments are forwarded to make recommendations to the Academic Council for consideration and approval.

6.3 The workload for a course is quantified in terms of credit hours, which represent the unit of measurement for coursework. A credit indicates the number of hours of instruction required per week over the duration of a semester. Courses may include:

- lecture and tutorial components
- lecture and practicum components
- lecture, tutorial, and practicum components
- only practicum components

6.3.1 A one-credit Lecture/tutorial in a course is equivalent to 15 hours of engagement.

6.3.2 A one-credit course in practicum or lab work or Seminar or Internship or Studio activities or Field practice/projects or Community engagement and service, and fieldwork is equivalent to 30 hours of engagement.

6.4 **Type of Courses and Credit distribution:**

6.4.1 **Non Engineering disciplines:** The UG programme will consist of the following categories of courses and the minimum credit requirements for 3-year UG and 4-year UG (Honours) or UG (Honours with Research) programmes are given below:

Table 1: Course Categorization and Credit Distribution for UG/Bachelor's Programme

S.No	Category of Courses	Minimum Credit Requirement	
		3-year UG	4-Year UG
1	Major Courses	60	80
2	Minor Courses	24	32
3	Multidisciplinary Courses	9	9
4	Ability Enhancement Courses (AEC)	8	8
5	Skill Enhancement Courses (SEC)	9	9
6	Common Value Based Courses for all UG	4	4
7	Community Engagement (CE)	4	4
8	Summer Internship	2	2
9	Research Project / Dissertation	-	12
10	Mandatory Courses/Audit Courses	-	-
	Total	**120**	**160**

Note:

- Exit option with UG Certificate (with the completion of courses across semesters 1, 2 and additional 4 credits in skill based vocational courses offered during summer term or internship equal to a minimum of 44 credits)
- Exit option with UG Diploma (with the completion of courses across semesters 1-4 and additional 4 credits in skill based vocational courses offered during first year or second year summer term equal to a minimum of 84 credits)

- Exit option with 3- year UG Degree (with the completion of courses across semesters 1-6 including 2 credits of Internship offered during second year summer term equal to a minimum of 120 credits)
- Students will be awarded UG Degree (Honours) /UG Degree (Honours) with Research in the relevant Discipline (with the completion of courses equal to a minimum of 160 credits)

6.4.2 **Engineering disciplines:** Here is the combined table with a range of credits* for various categories across B.TECH in the disciplines of Mechanical Engineering (MNE), Computer Science and Engineering (CSE), Electronics and Communication Engineering (ECE), Civil Engineering (CVE), Electrical and Electronics Engineering (EEE) and Artificial Intelligence and Machine Learning (AIML)

Table 2: Course Categorization and Credit Distribution for B.Tech Programmes

S.No.	Category of Courses	MNE	CSE	ECE	CVE	EEE	AI ML
1	Humanities and Social Sciences including Management courses	12	16	15	6	15	10
2	Basic Science courses	29	23	23	24	20	16
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer, etc.	27	29	17	20	14	8
4	Professional core courses	58	59	61	62	47	71
5	Professional Elective courses relevant to chosen specialization/branch	9	12	12	26	47	16
6	Open subjects – Electives from other technical and/or emerging subjects	9	9	12	12	14	6
7	Project work, seminar, and Summer internship in industry or elsewhere	16	15	20	16	16	38
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]/ Audit Courses	(non-credit)	(non-credit)	(non-credit)	IKS 02	(non-credit)	(non-credit)
	Total	160*	163*	160*	168*	173*	165*

Note:
(*) indicate credits that may be modified in accordance with AICTE guidelines to meet the specific needs of the respective discipline

6.4.3 **Internship/apprenticeship** can be carried out during the summer break mandatorily for students who exit after two semesters or four semesters of study in addition to the skill based courses.

6.4.4 **Audit Courses:** Students who secure a CGPA of at least 8 at the end of the 4th semester may opt to take one audit course per semester from any Department from the 5th semester onwards, provided the course teacher permits the auditing of the course. This shall be done under the guidance of the Departmental Faculty Advisor/mentor. The student is free to participate in the evaluation process for such courses. However, an attendance of 75% is necessary for obtaining a P grade for such courses. When auditing courses are offered by other departments, it shall be the responsibility of the student to attend such courses without missing courses of one's own department and semester.

6.4.5 **Bridge Courses:** The Departments shall make provision for Bridge Courses to facilitate admission of students from varied backgrounds to a programme of their choice.

6.4.6 **Value-added Courses:** Each department shall offer value-added courses. Value-Added courses are part of the curriculum designed to provide necessary skills to increase the employability quotient and equipping the students with essential skills to succeed in life. Certificates will be awarded to those who successfully complete the course.

6.4.7 In addition to the prescribed credit requirement, a student shall have to complete Institutional mandatory courses with Pass grade, as prescribed by the competent academic authority, from time to time, which shall be recorded in the Grade sheet but not taken into account for computing the SGPA and the CGPA.

6.4.8 In addition, students may also opt for additional courses in consultation with their mentors (Cf. 6.4.9). Courses may also be chosen from SWAYAM/NPTEL. Students are required to participate in the evaluation process of such courses. The grades obtained for such courses shall be recorded in the grade sheet, but not taken into account for computing SGPA and CGPA. (Ref. 6.2)

6.4.9 **Faculty Advisor/Mentor:** A faculty advisor/mentor (and a co-mentor to perform the duties of a mentor during the absence of the mentor) shall be assigned for each student. Generally the faculty advisor/mentor shall be assigned by the concerned department, in consultation with the Director of the School concerned. (Faculty advisors/ mentors shall help their mentees to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them.

6.5 **Academic Bank of Credits (ABC)** a national-level facility for "credit transfer" is created for students to transfer and consolidate the credits earned by them by undergoing courses from any recognized HEIs. The ABC allows for credit redemption through the process of commuting the accrued credits in the Academic Bank Account maintained in the ABC for the purpose of fulfilling the credits requirements for the award of certificate/diploma/degree by the authorized HEIs. Upon collecting a certificate, diploma or degree, all the credits earned till then, in respect of that certificate, diploma or degree, shall stand debited and deleted from the account concerned. The procedure for depositing credits earned, its

shelf life, and redemption of credits would be as per UGC (Establishment and Operationalization of ABC scheme in Higher Education) regulations and its amendments, 2021.

7.0 Major and Minor disciplines:

7.1 Major discipline is the discipline or subject of main focus and the degree will be awarded in that discipline. Students should secure the prescribed number of credits (about 50% of total credits) through core courses in the major discipline.

7.1.1 Minor discipline helps a student to gain a broader understanding beyond the major discipline. For example, if a student pursuing an Economics major obtains a minimum of 12 credits from a bunch of courses in Statistics, then the student will be awarded B.A. degree in Economics with a Minor in Statistics.

7.2 In order to qualify for a Graduate Degree, a student is required to complete the minimum credit requirements as prescribed by the competent academic authority. (Refer 4.4)

7.3 **Change of Major Discipline:** The University may permit a student to change from one major discipline of study to another after the first two semesters.

7.3.1 Students shall be allowed a change in major discipline provided that the strength of a Programme offering the specific Major discipline should not fall below the existing strength by more than ten percent and should not go above the sanctioned strength by more than ten percent.

7.3.2 Only those students shall be eligible for consideration of a change of major discipline, who has completed all the credits required in the first two semesters of their studies, in their first attempt. (Ref 6.4.5 for fulfilling any deficient and/or prerequisite courses to be completed)

7.3.3 Applications for a change of major discipline must be made by intending eligible students in the prescribed form. The Office of the Registrar shall call for applications at the beginning of the third semester and the completed forms must be submitted by the last date specified in the notification.

7.3.4 Students may enlist up to two choices of major disciplines, in order of preference, to which they wish to change over. It shall not be permissible to alter the choice after the application has been submitted.

7.3.5 Change of major discipline shall be made strictly in order of merit of the applicants. For this purpose the CGPA obtained at the end of the second semester shall be considered. In case of a tie, the following shall be considered in the given order: the SGPA of the second semester, the SGPA of the first semester, grades obtained by the applicants in the courses of the second semester in an order given in the grade and approved by the Office of the Registrar.

7.3.6 A committee consisting of the Directors and Head of Departments of the concerned School, chaired by the Registrar shall examine the applications and consider them on the basis of the criteria laid out above.

7.3.7 The details of major discipline changes effected shall be notified to the students by the Registrar, within 7 days of the submission of applications.

7.3.8 All changes of major discipline shall be final and binding on the applicants. No student shall be permitted, under any circumstance, to refuse the change of major discipline offered.

7.3.9 All changes of major discipline made in accordance with the above rules shall be effective from the third semester of the applicants concerned. No change of branch shall be permitted after this.

7.4 **B.Tech Change of Branch**:

7.4.1 Normally a student admitted to a particular branch of the B.TECH programme shall continue studying in that branch till completion. However, in special cases the university may permit a student to change from one branch of studies to another after the first two semesters.

7.4.2 Students shall be allowed a change in branch subject to the limitation that the strength of a branch should not fall below the existing strength by more than ten percent and should not go above the sanctioned strength by more than ten percent.

7.4.3 Only those students shall be eligible for consideration of a change of branch, who have completed all the credits required in the first two semesters of their studies, in their first attempt.

7.4.4 Applications for a change of branch must be made by intending eligible students in the prescribed form. The Office of the Registrar shall call for applications at the beginning of the third semester and the completed forms must be submitted by the last date specified in the notification.

7.4.5 Students may enlist up to two choices of branch, in order of preference, to which they wish to change over. It shall not be permissible to alter the choice after the application has been submitted.

7.4.6 Change of branch shall be made strictly in order of merit of the applicants. For this purpose the CGPA obtained at the end of the second semester shall be considered. In case of a tie, the following shall be considered in the given order: the SGPA of the second semester, the SGPA of the first semester, grades obtained by the applicants in the courses of the second semester in an order to be determined by the Office of the Registrar.

7.4.7 A committee consisting of the Director and heads of departments of the concerned School, chaired by the Registrar shall examine the applications and consider them on the basis of the criteria laid out above.

7.4.8 The details of branch changes effected shall be notified to the students by the Registrar, within 7 days of the submission of applications.

7.4.9 All changes of branch shall be final and binding on the applicants. No student shall be permitted, under any circumstance, to refuse the change of branch offered.

7.4.10 All changes of branch made in accordance with the above rules shall be effective from the third semester of the applicants concerned. No change of branch shall be permitted after this.

8.0 B.TECH Honours and B.TECH Minor Engineering:

8.1 **B.TECH Honours**

A student of B.Tech can obtain Honours by completing additional 18-20 credits in emerging areas of the same discipline of study. Departmental Board of Studies shall finalize the emerging areas of study. Students eligible for Honours programme shall have a CGPA of 6.5 till 2nd Semester. In case of lateral entry students, they should have 1st class in their qualifying examination. Students will be permitted to enroll for Honours in 3rd or 4th semester which may continue till 8th semester until they complete 18-20 credits. In any semester, they will be advised to take not more than 6 credits of courses.

** Students may be allowed to opt from SWAYAM/NPTEL courses. Teaching and evaluation of the courses will be as per university norm followed for any other courses.

For the students, who opted for Honours but could not earn the minimum 18 credits till 8th semester examination, all the courses completed shall be printed in the Transcript to recognize the additional effort of the students. The opportunity of additional chance may be given to the willing students whose deficiency is marginal (at the most 6 credits).

8.2 **B.TECH Minor Engineering**

A student of B.Tech can obtain Minor by completing additional 18-20 credits in emerging areas of another discipline of study. Departmental Board of Studies shall finalize the emerging areas of study. Students eligible for Honours programme shall have a CGPA of 6.5 till 2nd Semester. In case of lateral entry students, they should have 1st class in their qualifying examination. Students will be permitted to enroll for Minor in 3rd or 4th semester which may continue till 8th semester until they complete 18-20 credits. In any semester, they will be advised to take not more than 6 credits of courses.

Students may be allowed to opt from SWAYAM/NPTEL courses. Teaching and evaluation of the courses will be as per university norm followed for any other courses.

For the students, who opted for Minor but could not earn the minimum 18 credits till 8th semester examination, all the courses completed shall be printed in the Transcript to recognize the additional effort of the students. The opportunity of additional chance may be given to the willing students whose deficiency is marginal (at the most 6 credits).

9.0 Transfer of Admission

Transfer of admissions is permissible only for autumn semesters (at the end of second, fourth and sixth semesters for students of other universities and within the University.

9.1 **Evaluation Committee for Multiple entry and Exit:** With the provision of multiple entry and exit, students from other HEIs will be allowed entry to appropriate Level. Evaluation Committee will be set up to see the eligibility of such students who desire to join the University from other HEIs with a lateral entry.

9.1.1 Applications for exit received on or before 31st March after completion of first year/second year/third year, shall be evaluated by the Evaluation Committee.

9.2 The Conditions for transfer admission of students of other Universities

9.2.1 A Candidate migrating from any other University may be permitted to join odd semester of the degree programme provided he/she has passed all the subjects of previous semesters with 4 credits of internship completed. Such candidates must satisfy all other conditions of eligibility stipulated in the regulations of the University.

9.2.2 His/her transfer admission shall be within the intake permitted in the University.

9.2.3 He/she shall fulfill the attendance requirements as per the University Regulation.

9.2.4 The candidate who is migrating from other Universities is eligible for overall SGPA/CGPA or Class and not for ranking. He/ She shall complete the programme as per the regulation governing the maximum duration of completing the programme as per this regulation.

10.0 University Registration

10.1 Candidates who are admitted to a programme shall have to register as bona-fide students with the University as per the University regulations within a period specified by the University, by a formal application routed through the Director of the School concerned.

11.0 Attendance

11.1 To be permitted to appear for the end-semester examination of a particular course, a student is required to have a minimum attendance of 75% for that course.

11.2 Deficiency in attendance up to 10% may be condoned by the Director of the School in the case of leave taken for medical

and other grievous reasons, which are supported by valid medical certificates and other requisite documents.

11.3 Some students, due to exceptional situations like their own serious sickness and hospitalization or death of members of the inner family circle (restricted to only father, mother, siblings), may have attendance below 65%. Such students may be given bonus attendance percentage for a particular course based on his/her attendance for that course during the remaining days of the current semester, as given in the following table**:**

Attendance during the remaining days of the current semester	**Bonus percentage available in the current semester**
95% or more	5
90% or more but less than 95%	4
85% or more but less than 90%	3
80% or more but less than 85%	2
75% or more but less than 80%	1

They shall be permitted to appear for the end-semester examination of the course if on the strength of this bonus attendance percentage, they obtain 65% attendance for that course.

11.4 If the sum of the credits of the courses for which a student is unable to appear at the end- semester examinations exceeds 50% of the total credits allotted for the semester, he/she shall not be permitted to appear for the entire end-semester examinations.

11.5 The School may propose to set aside a certain portion of the in-semester assessment marks for attendance. The number of marks and modalities of their allotment shall be made known to the students at the beginning of each semester.

11.6 **Leave**

11.6.1 Any absence from classes should be with prior sanctioned leave. The application for leave shall be submitted to the Office of the Director of the concerned School on prescribed forms, through proper channels, stating fully the reasons for the leave requested along with supporting documents.

11.6.2 In case of emergency such as sickness, bereavement or any other unavoidable reason for which prior application could not be made, the parent or guardian must promptly inform the office of the Director of the concerned School.

11.6.3 If the period of absence is likely to exceed 10 days, a prior application for grant of leave shall have to be submitted through the Director of the concerned School to the Registrar of the University with supporting documents in each case; the decision to grant leave shall be taken by the Registrar on the recommendation of the Director of the concerned School.

11.6.4 The Registrar may, on receipt of an application, also decide whether the student be asked to withdraw from the programme for that particular semester because of long absence.

11.7 It shall be the responsibility of the student to intimate the concerned teachers regarding his/her absence before availing the leave.

12.0 Grading System

12.1 **Three types of courses are offered in the Graduate programmes:**

Graded courses: For the majority of the courses, students shall be assessed and given grades.

Pass/Non-Pass courses: There are some courses for which the students are expected to obtain a P grade to be eligible for the degree.

Audit Courses: A third category of courses are audit courses. These are optional. However, students who opt for these courses must have the required attendance to obtain a P grade in the course.

12.2 Based on the performance of a student, each student is awarded a final letter grade in each graded course at the end of the semester and the letter grade is converted into a grade point. The correspondence between percentage marks, letter grades and grade points is given in the table below:

Marks (x) obtained (%)	**Grade**	**Description**	**Grade Points**
90 ≥ x ≤ 100	O	Outstanding	10
80 ≥ x < 90	A+	Excellent	9
70 ≥ x < 80	A	Very Good	8
60 ≥ x < 70	B+	Good	7
50 ≥ x < 60	B	Above Average	6
41 ≥ x < 50	C	Average	5
x = 40	P	Pass	4
x < 40	F	Fail	0
	AB	Absent	0
	PS	Pass	0
	NP	Not Passed	0
	X	Not Permitted	0

12.2.1 Audit Courses can be graded as 'PS' Pass and 'F' Fail[1] without any credits

12.2.2 In addition, a student may be assigned the grades 'P' and 'F' for pass marks and non- passing marks respectively, for Pass/No-pass courses, or the grade 'X' (not permitted).

12.2.3 A student shall be assigned the letter grade 'X' for a course if he/she is not permitted to appear for the end semester examination of that course due to lack of requisite attendance.

12.2.4 A letter grade 'F' or 'X' in any course implies failure in that course.

12.2.5 A student is considered to have completed a course successfully and earned the credits if she/he secures a letter grade other than 'F', or 'X'.

12.3 At the end of each semester, the following measures of the performance of a student in the semester and in the programme up to that semester shall be computed and made known to the student together with the grades obtained by the student in each course:

12.3.1 The Semester Grade Point Average (SGPA): From the grades obtained by a student in the courses of a semester, the SGPA shall be calculated using the following formula:

$$SGPA = \frac{\sum_{i=1}^{n} GP_i \text{ x } NC_i}{\sum_{i=1}^{n} NC_i}$$

Where, GP_i = Grade points earned in the i^{th} course
NC_i = Number of credits for the i^{th} course
n = the number of courses in the semester

12.3.2 The Cumulative Grade Point Average (CGPA): From the SGPAs obtained by a student in the completed semesters, the CGPA shall be calculated using the following formula:

$$CGPA = \frac{\sum_{i=1}^{n} SGP_i \text{ x } NSC_i}{\sum_{i=1}^{n} NSC_i}$$

Where,
SGP_i = Semester Grade point of the i^{th} semester
NSC_i = Number of credits for the i^{th} semester
n = the number of semesters completed

12.3.3 The CGPA may be converted into a percentage by multiplying CGPA by 10.

12.3.4 Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such. Whenever these CGPA are to be used for official purposes, only the rounded off values shall be used.

12.4 In the case of an audit course, the letters 'P' or 'F' shall be written alongside the course name in the Grade Sheet. Such courses are not taken into account in the calculation of the SGPA or CGPA. However, the award of the degree is subject to obtaining a 'P' grade in all such courses. A student is not required to register again for passing the failed audit courses.

12.5 Only those students who secure CGPA of 7.5 and above in the first six semesters may choose to undertake research in the fourth year

13.0 Assessment of Performance

13.1 A student's performance is evaluated through a continuous system of evaluation comprising tests, quizzes, assignments, seminars, minor projects, major projects and end-semester examinations.

13.2 **Theory Courses**: Theory courses shall have two components of evaluation – in- semester assessment of 40% weightage and an end-semester examination having 60% weightage.

13.2.1 The modalities of the conduct of in-semester assessment and weightages attached to its various components shall be as published by the School at the beginning of each semester.

13.3 **Lab Courses**: Lab courses shall be evaluated on the basis of attendance; assessment of tasks assigned and end semester test/viva voce. The weightage assigned for these components of the evaluation is given in the following table:

Component	Weightage
Attendance	10
Assessment of Tasks Assigned	30
End-semester test / viva voce	60

13.3.1 The modalities of the conduct of evaluation under the heading "Assessment of tasks assigned", its components and the weightages attached to its various components shall be published by the department concerned at the beginning of each semester.

13.3.2 The evaluation of the end-semester test for a lab course may be done on the basis of criteria and weightage to be specified in the question paper, among which are included

- Organisation of the experiment
- Actual conduct of the experiment assigned and accuracy of the result

- Extent of completion
- A comprehensive viva-voce which examines the overall grasp of the subject

13.4 **End Semester examinations**

13.4.1 End-semester examinations for the theory courses, generally of three hours' duration, shall be conducted by the University. The Director of the concerned school and the Examination department shall make the arrangements necessary for holding the examinations.

13.4.2 In the end-semester examinations, a student shall be examined on the entire syllabus of the courses.

13.4.3 A student shall not obtain a pass grade for a course without appearing for the end- semester examination in that course.

13.5 **Industry Training/Internship Programme**

13.5.1 Departments require students to undergo industry training/internship programmes.

13.5.2 Departments are to notify the students at the beginning of their programmes about the details of industry training/internship.

13.5.3 After the Industry Training/Internship programme, the student shall furnish a certificate from the organisation where he/she underwent the programme as proof of successful completion.

13.5.4 The student shall submit a training/internship report to the department in a format to be laid down by the concerned department. He/she shall also give a seminar to present the learning outcomes of the programme in the presence of the faculty members and students of the department. The student shall be evaluated on the basis of the report, the seminar and interaction during the seminar and grades shall be assigned. These grades shall be given a weightage of two credits in the subsequent semester.

13.6 **Field-based learning/ Minor project:**

13.6.1 Minor project work is conducted during the sixth semester of the programme, and is to be done individually or in groups within the campus/Outside the campus with due permissions.

13.6.2 Each department shall constitute a Departmental Project Evaluation Committee (DPEC) consisting of the Head of the Department, Project Co-ordinator and two senior teachers from the department, with the Project Co-ordinator as the convenor. The DPEC shall co-ordinate the conduct and assessment of the project.

13.6.3 The DPEC shall notify the schedule and modalities for the following stages in the implementation of the project.

- Submission of the topic of the project
- Notification for assignment of project supervisors
- Submission of the synopsis
- Schedule and modality for the submission of weekly activity reports
- Schedule for the seminar presentation of synopsis
- Schedule for Progress Seminars, submission of progress reports and viva voce examination
- Date for the submission of the project report and a brief summary
- Dates for the external evaluation of the project

13.6.4 The DPEC may ask a student to resubmit a synopsis if the same does not get its approval.

13.6.5 The Convener of the DPEC shall submit to the Controller of Examinations a panel of at least three names of external examiners at least three weeks before the external examination. The Controller of Examinations shall appoint the external examiner(s) from this panel. The project supervisor shall be the internal examiner.

13.6.6 Each student shall submit to the DPEC three bound, typed copies of the project report, and prepared according to the prescribed format, after the pre-submission seminar, by the due date. The student shall also submit three copies of a brief summary of the project that shall be forwarded to the concerned examiners.

13.6.7 The DPEC shall make the arrangements necessary to conduct the external evaluation in consultation with the examiner(s) appointed by the University, during the dates notified.

13.6.8 The DPEC shall forward the in-semester assessment marks to the Controller of Examinations by the date specified by the Examination Department.

13.6.9 The end-semester assessment shall have the following components:

- Project implementation: 40 marks
- Seminar presentation: 20 marks
- Viva voce examination: 20 marks
- Project documentation: 20 marks

13.6.10 Those who obtain an 'F' grade for the minor project shall be required to re-enrol for it in the subsequent semesters.

13.7 **Major Projects /Dissertation**

13.7.1 Students of the B.TECH programme shall undertake a Major Project during the course of their graduate studies. The B.TECH major project work is normally conducted in two phases during the seventh and eighth semesters of the programme and is to be done individually or in groups within the campus. A department may substitute this with two independent projects in the seventh and eighth semesters with prior permission from the statutory authority.

13.7.2 Each department shall constitute a Departmental Project Evaluation Committee (DPEC) consisting of the Head of the Department, Project Co-ordinator and two senior teachers from the department, with the Project Co-ordinator as the convenor. The DPEC shall co-ordinate the conduct and assessment of the project.

13.7.3 The DPEC shall notify the schedule and modalities for the following stages in the implementation of the project.

- Submission of the topic of the project
- Notification for assignment of project supervisors
- Submission of the synopsis
- Schedule and modality for the submission of weekly activity reports
- Schedule for the seminar presentation of synopsis
- Schedule for Progress Seminars, submission of progress reports and viva voce examination
- Date for the submission of the project report and a brief summary.
- Dates for the external evaluation of the project

In the case of the B.TECH project, some of these activities may be performed during semester VII (Phase I) and others during Semester VIII (Phase II) as shall be notified by the DPEC.

13.7.4 The DPEC may ask a student to resubmit a synopsis if the same does not get its approval.

13.7.5 The Convenor of the DPEC shall submit to the Controller of Examinations a panel of at least three names of external examiners at least three weeks before the external examination. The Controller of Examinations shall appoint the external examiner(s) from this panel. The project supervisor shall be the internal examiner.

13.7.6 Each student shall submit to the DPEC three bound, typed copies of the project report, and prepared according to the prescribed format, after the pre-submission seminar, by the due date. The student shall also submit three copies of a brief summary of the project that shall be forwarded to the concerned examiners.

13.7.7 The DPEC shall make the arrangements necessary to conduct the external evaluation in consultation with the examiner(s) appointed by the University, during the dates notified.

13.7.8 Phase I of the project shall be evaluated through in-semester assessment only. The modality and components of the assessment and their weightages shall be determined by the School and the same shall be notified at the beginning of each semester.

13.7.9 Phase II of the project shall be evaluated through in-semester and end-semester assessments of equal weightage. The in-semester assessment shall be done by the DPEC and the project supervisor and the end-semester assessment shall be done by the external examiner(s) and the project supervisor, assisted by the DPEC. The modality and components of the in-semester assessment and their weightages shall be determined by the school and the same shall be notified at the beginning of each semester.

13.7.10 The DPEC shall forward the in-semester assessment marks to the Controller of Examinations by the date specified by the Examination Department.

13.7.11 The end-semester assessment shall have the following components:

- Project implementation: 40 marks
- Seminar presentation: 20 marks
- Viva voce examination: 20 marks
- Project documentation: 20 marks

13.7.12 Independent projects as envisaged in clause 13.7.1 shall be evaluated in the same manner as Phase II of the major project.

13.7.13 Those who obtain an 'F' grade for the major project shall be required to re-enrol for it in the subsequent semesters.

13.8 **Minor and Mini Projects**

13.8.1 Students may be assigned minor and mini projects by the department from the fourth semester onwards to ensure that their learning becomes a hands-on experience. These projects shall be executed by the students individually or in groups under the guidance of faculty members appointed by the department.

13.8.2 The mode of evaluation of these projects shall follow the pattern of evaluation of Lab Courses (vide clause 8.3) and the modalities for the conduct of evaluation, its components and the weightages attached to these components shall be published by the department concerned at the beginning of each semester.

13.8.3 The students may be required to submit project reports in the format specified. The evaluation of the Minor and Mini Projects shall take into consideration these project reports.

13.9 The evaluation of performance in non-credit courses shall be done by the authorities conducting them and they shall communicate the grades to the Director of the concerned School who shall forward them to the Controller of Examinations.

13.10 The Director of the concerned School shall forward the marks obtained in the in- semester evaluation to the Controller of Examinations within the prescribed time as may be notified.

13.10.1 All evaluated work in a course except the end semester answer scripts shall be returned to the students promptly.

13.9 **Eligibility for appearing in the end-semester examinations:** A student shall be permitted to appear for the end-semester examinations, provided that

13.9.1 A student has not been debarred from appearing in the end semester examinations as disciplinary action for serious breach of conduct.

13.9.2 He/she has satisfactory attendance during the semester according to the norms laid out in the clause 8 of these regulations.

13.9.3 He/she has paid the prescribed fees and any other dues of the university within the date specified.

13.10 Registration for end-semester Examinations

13.10.1 The University shall, through a notification, invite applications from students to register for the end-semester examinations.

13.10.2 Students who have registered with the University (vide clause 9) and those who have applied for such registration may apply to appear for the end- semester examinations of the university, in response to the notification issued by the University, provided that they fulfill the eligibility norms as laid down in clause (ref 12.9)

13.10.3 All eligible candidates shall be issued an admit card for the relevant examination and for specified courses. A student who does not have a valid admit card may not be permitted to write the end-semester examinations.

13.10.4 A student who secures an 'F' grade in any course in a semester may register for the end-semester examination for that course in a subsequent semester when that course is offered again, within the maximum period of time allotted for the completion of the programme. The in-semester assessment marks obtained by him/ her in the last semester in which the said course was attended by him/her shall be retained.

13.10.5 Similarly, in case of an 'NP' grade in non-credit courses the student shall have to re-register for it in the appropriate semester of the next academic session.

13.10.6 When a student re-registers for the end semester examination of a course, in accordance with clause 10.10.4 above, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

13.11 Conduct of Examinations: The University shall conduct the end-semester examinations in accordance with the applicable regulations on such dates as are set down in the Academic Calendar or as notified.

13.12 Declaration of Results: The University shall declare the results of a semester and make available to the students their grade sheets within the time-frame prescribed by the relevant regulations of the university and specified in the academic calendar.

13.13 The University may withhold the results of a student for any or all of the following reasons

- he/she has not paid his/her dues
- there is a disciplinary action pending against him/her
- he/she has not completed the formalities for University Registration according to the requirement of section 5 of these Regulations.

13.14 Re-examining of answer scripts

13.14.1 If a student feels that the grade awarded to him/her in a course is not correct, he/she may apply to the University for the re-examining of his/her answer script.

13.14.2 Re-examining of scripts may be of two different categories – scrutiny and re- evaluation.

13.14.3 **Scrutiny:** The activities under this category shall ordinarily be confined to checking correctness of the total marks awarded and its conversion into appropriate letter grades whether any part/whole of a question has been left unevaluated inadvertently correctness of transcription of marks on the tabulation sheet and the grade sheet issued in respect of the course under scrutiny.

13.14.4 **Re-evaluation:** Re-evaluation of the answer script by independent experts in the concerned subject(s).

13.14.5 Application for re-examining of answer scripts

- A student may apply for scrutiny or re-evaluation for one or more courses of the just-concluded end-semester examinations within seven calendar days from the date of publication of its results in the application form prescribed for this purpose.
- He/she shall pay the prescribed fee to the University as notified.
- A student applying for scrutiny/re-evaluation shall expressly state on the application form whether the application made is for Scrutiny or for Re- evaluation. In each case, the student may also request to see his/her answer script.
- All applications for scrutiny/re-evaluation must be routed through the Director of the concerned School.

13.14.6 If in the process of re-examining, the grade obtained in a course changes, the better of the two grades shall be assigned to the course. If there is a change, the new grade shall be recorded and a new grade sheet shall be issued to the student.

13.14.7 Without prejudice to any of the clauses of section 10.14, a student who has been found to have used unfair means during an examination shall not be eligible to apply for scrutiny or re-evaluation of answer scripts.

13.15 Repeat Examination: The University shall conduct repeat examination for those with F grade at a different time slot, as set down in the Academic Calendar or as notified. Such students should register for these examinations.

13.16 Improvement Examination

13.16.1 After the completion of the entire programme of study, a student may be allowed the provision of improvement examinations. These are to be availed of only once each in the Autumn and Spring semesters that immediately follow the completion of the programme, and within the maximum number of years permissible for a programme.

13.16.2 A student who has taken migration from the University shall not be eligible to appear for Improvement Examination.

13.16.3 A student may not choose more than the number of courses specified below for improvement examinations.

Programme	Number of Courses for Improvement Examinations		
	Autumn Semester	Spring Semester	Total
BCA	4	4	8
BCOM	4	4	8
BBA	4	4	8
BA	4	4	8
BSc	4	4	8
B.TECH	6	6	12

13.16.4 After the improvement examination, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

13.16.5 If the student improves his/her grades through the improvement examination, new grade sheets and comprehensive transcripts shall be issued to the student.

13.17 Special Examination

13.17.1 The University shall conduct Special Examinations to benefit the following categories of students:

13.17.1.1 Students who, on the completion of the final semester, have some 'F' graded courses in the two final semesters, but no 'F' graded courses in any of the previous semesters

13.17.1.2 Students who have only one 'F' graded course in a semester other than the two final semesters and do not have 'F' graded courses in the two final semesters.

13.17.2 The Special Examinations shall ordinarily be conducted each year within a month of the declaration of the results of the Spring Semester.

13.17.3 Students who fail to secure 50% of the credits offered in the final semester shall not be eligible to appear for the special examinations. Such students will be governed by the provisions of clause 10.5 of these regulations. However, this restriction shall not apply in the case of students who are unable to appear in the end semester examinations due to exceptional situations like their own serious illness and hospitalisation or death of members of the inner family circle (restricted to only father, mother, siblings).

13.17.4 Students who have 'X' graded courses only in the last two semesters may be offered the opportunity for participating in a Tutorial Programme which may be conducted during the semester break immediately following the end-semester examinations of the final semester and students who earn 85% attendance for the programme shall be permitted to appear for the Special Examinations. Separate fees shall be charged for the Tutorial Programme.

13.17.5 Students who do not obtain pass grades in any course at the special examinations shall have to apply in the prescribed format and appear for the end-semester examination of these courses when they are scheduled by the University during subsequent relevant end-semester examinations.

14 Enrolment (for semesters other than the first)

14.10 Every student is required to enroll for the relevant courses before the commencement of each semester within the dates fixed for such enrolment and notified by the Registrar.

14.11 Students who do not enroll within the dates announced for the purpose may be permitted late enrolment up to the notified date on payment of a late fee.

14.12 Only those students shall be permitted to enroll who have

- Cleared all University, Departmental, Hostel and Library dues and fines (if any) of the previous semester,
- Paid all required University, Departmental and Hostel fees for the current semester, and
- Not been debarred from enrolling on any specific ground.

14.13 No student may enroll for a semester if he/she has not appeared, for whatever reason, in the end semester examinations of the previous semester.

14.14 Students who due to lack of due attendance have been debarred from exams in any semester (including first and second) will have to re-enroll for the same.

15 Eligibility for the Award of the Graduate Degree

15.10 A student shall be declared to be eligible for the award of the four –year Graduate Degree for which he/she has enrolled if he/she has

15.10.1 completed all the credit requirements for the degree with grade 'C' or higher grade in each of the mandatory graded

courses and grade 'PS' in all mandatory non-graded courses;

15.10.2 satisfactorily completed all the non-credit requirements for the degree viz., Extra Academic Activities, Industry Training, Field Work, Internship Programme, etc. (if any);

15.10.3 Obtained a CGPA of 5.00 or more at the end of the semester in which he/she completes all the requirements for the degree;

15.10.4 Owes no dues to the University, School, Department, Hostels; and

15.10.5 Has no disciplinary action pending against him/her.

15.11 The award of the Graduate Degree must be recommended by the Academic Council and approved by the Board of Management of the University.

15.11.1 Degree will be awarded, to student completes least fifty per cent of the credits from the University awarding the degree or diploma or certificate (https://www.ugc.gov.in/pdfnews/9327451_Academic-Bank-of-Credicts-in-Higher-Education.pdf)

16 Termination from the Programme

16.10 If more than the number of years permitted for the completion of a programme have elapsed since the student was admitted, and the student has not become eligible for the award of Degree, the student shall be removed from the programme.

16.11 A student may also be required to leave the Programme on disciplinary grounds on the recommendations of the Students' Disciplinary Committee of the concerned School.

SCHEME OF IN-SEMESTER ASSESSMENT
GRADUATE DEGREE PROGRAMMES

EVALUATION OF THEORY COURSES

For theory courses, in-semester assessment carries 40% weightage. Different components along with the weightage of each are given in the table below:

Component	Weightage	Remarks
Class Test (Two Class tests of one and a half hour duration)	20	Average of the two marks shall be considered
Assignment (Individual and Group)	10	Group assignments for two courses and individual assignments for the remaining courses
Non-formal evaluation	5	Based on response and interaction in class, quizzes, open book tests, etc.
Attendance	5	For norms regarding attendance cfr. clause 11 of the Regulations for Undergraduate Programmes

There shall be no re-test for In-semester assessment under any circumstance. The original marks of all the In-semester assessment components shall be retained for all further repeat examinations.

ATTENDANCE

Marks for attendance will be given according to the following scheme:

	Marks Allotted	
Attendance Percent (x)	Theory	Lab
75 <= x < 80	2	4
80 <= x < 90	3	6
90 <= x < 95	4	8
95 <= x 100	5	10

EVALUATION OF LABORATORY COURSES/ SKILL ENHANCEMENT COURSES/INTERNSHIPS

All Laboratory courses, Skill enhancement course, internships are evaluated on the basis of attendance; performance of tasks assigned and end semester test/viva voce examination. The distribution of marks within these components will be specified by individual departments along the lines of the break-up given below:

Component	Weightage
Attendance	10
Assessment of tasks assigned	30
End Semester Test and/or Viva-Voce Examination	60
Total	100

EVALUATION OF PROJECTS

The guidelines for the conduct and evaluation of Minor and Mini Projects shall be laid down by the Department. The components of evaluation and allotment of marks may be as follows:

In Semester Evaluation (weightage 60)	Marks	End Semester Evaluation (Weightage 40)	Marks
Synopsis	10	Project Implementation	16
Seminar presentation of synopsis (Analysis and Design)	15	Seminar Presentation	8
Progress Seminar (Implementation)	15	Viva Voce Examination	16
Project Documentation	10		
Attendance	10		
Total	60		40

RULES, PROCEDURES AND BEHAVIOURAL GUIDELINES

1. Dress Code and Identity Card

1.1 The dress code of the University consists of shirt / top (of the prescribed colour and material), trousers (of the prescribed colour and material), shoes (black) and socks (dark grey), a belt (black/dark brown, if required) and a tie (blue, with diagonal stripes). Students are required to come to the University following this dress code. The tie will be required to be worn only on formal occasions. An apron (of the prescribed colour) is to be worn in the Chemistry Lab and during Workshop Practice. During winter, students may wear only a blazer and/or a sweater (full sleeve or sleeveless) of the prescribed colour and material.

1.2 The Student Identity Card is to be brought to the University every day and is to be produced whenever asked for. Entry to the University campus shall be only on production of the Identity Card. The Identity Card is also the Library Card.

1.3 All students should wear the ID card around the neck from entry in the morning to exit in the evening.

2. Morning Assembly

2.1 The morning assembly is a daily programme in the university on all class days during which all members, i.e., students, faculty, staff and management meet together. The assembly starts at the prescribed time. During the assembly, important announcements are made and a thought or insight is shared. The assembly is concluded with an invocation to God to bless the activities of the day. Note that any announcement made at the morning assembly is considered as being equivalent to notifying the same in the notice boards. All students should reach the assembly venue before prescribed time. Immediately after assembly all should proceed to the classroom to start class. Any change in procedures will be notified by the concerned School at the beginning of the Semester.

2.2 One of the following prayers may be used to conclude the Morning Assembly:

The Our Father

Our Father, who art in heaven,
Hallowed be thy name, Thy kingdom come, Thy will be done on earth as it is in heaven.
Give us this day, our daily bread
And forgive us our trespasses
As we forgive those who trespass against us. And lead us not into temptation,
But deliver us from all evil, Amen.
Or

Prayer for Peace

Lord, make me an instrument of your peace,
where there is hatred, let me sow love;
where there is injury, pardon;
where there is doubt, faith;
where there is despair, hope;
where there is darkness, light;
where there is sadness, joy;
O Divine Master, grant that I may not so much seek to be consoled as to console;
to be understood as to understand;
to be loved as to love.
For it is in giving that we receive;
it is in pardoning that we are pardoned;
and it is in dying that we are born to eternal life. Amen

3. Punctuality in Attending Classes

3.1 All are expected to be at their respective assembly venues five minutes before assembly time.

3.2 Normally no student shall leave the University before all the classes are over. In case of an emergency, a student may leave with proper written permission from the HOD of the concerned department.

3.3 While all students are encouraged to have their lunch in the University Canteens, students are permitted to take lunch outside the University.

4. Make-up Classes, Leave of Absence and Earned Attendance

4.1 If any student misses any laboratory class due to illness or other grievous problems, he/she is required to meet the concerned teacher for completing the experiments as soon as possible. Such make-up attendance will be taken into consideration at the end of the semester if attendance is less than 75%. At most two make-up attendances may thus be earned by any student.

4.2 Any student who is required to be engaged in a University activity or a pre-planned training and placement activity during class hours, may apply for the grant of an 'earned attendance' from the concerned HODs in the prescribed form available at the Reception. Such applications must be forwarded by the Activity In-Charge. For club related activities, Faculty Advisor of the concerned club will be the Activity In- Charge. In all other cases, Faculty In-Charge or Assistant Faculty In-Charge of Student Affairs will be the Activity In-Charge. Filled up forms shall be submitted preferably before or in case of emergency, immediately after the activity for which earned attendance is to granted.

4.3 Any student going to participate in any activity or competition outside the University must apply to the Faculty In-Charge of student Affairs using the prescribed form which must be forwarded by the Assistant Faculty In-Charge of Student Affairs in consultation with respective Club Advisers. On return, these students must report back to the Assistant Faculty In-Charge of Student Affairs for recording the outcome.

4.4 Any student who is not able to attend classes due to medical or other grievous reasons are required to apply for leave in the prescribed form along with valid medical certificates and other requisite documents, to the Faculty In-charge, students' affairs within seven days of joining back. Such applications must be signed by a parent of the student and forwarded by the mentor of the concerned student and the HOD of the concerned department. Only these students will be considered for condonement of deficiency in attendance.

5. Discipline

5.1 Personal, academic and professional integrity, honesty and discipline, a sense of responsibility and a high degree of maturity is expected of all students inside and outside the campus. Integrity calls for being honest in examinations and assignments, avoiding plagiarism and misrepresentation of facts.

5.2 Indulging in acts of violence, riotous or disorderly behaviour directed towards fellow students, faculty members or other employees of the institution/hostel in the campus or outside is considered to be a serious breach of discipline and will attract penalty.

5.3 Respect for Common Facilities: Care and respect for common facilities and utilities are an essential component of social responsibility. Any willful damage to University property must be made good by the persons concerned. Further, maintaining cleanliness of the classrooms and the entire campus is everyone's responsibility.

5.4 Substance Abuse: Chewing of tobacco, betel nut and the likes, smoking and the use of other addictive substances and alcoholic drinks are strictly prohibited. These should not be brought into or used within the campus of the University. Violation of this norm will lead to stern action.

5.5 Use of Cell Phones: Cell phones may be used in the University lawns, canteens andother open areas. However, the use of cell phones in classrooms and labs are strictly prohibited except when used for teaching/learning purposes with the explicit permission of the teacher concerned. The cell phone of anyone found violating this rule shall be confiscated and his/ her SIM card shall be taken away and retained in the University office for 7 days. If a person violates the norm for a second time, his/her mobile will be confiscated and retained in the University office till the end of the semester.

5.6 Use of Internet: The entire campus is wi-fi enabled and the students may use the Internet freely for educational purposes. Students may also use the Computing Centre for browsing the Net. However, the use of Internet to access unauthorized and objectionable websites is strictly prohibited.

5.7 All cases of indiscipline will be brought before the Students' Disciplinary Committee and the decisions made by the Committee for dealing with such cases shall be final.

6. Class Tests and Examinations

6.1 The conduct of examinations will be governed by the norms of the University.

6.2 The Student Identity Card shall be the Admit Card for the class tests

6.3 During class tests, all students are expected to enter the venue of the class test 15 minutes before the scheduled time of commencement. However, no one will be permitted into the examination hall after 15 minutes of the commencement of the class test and No one will be allowed to leave the examination hall until an hour has elapsed from the commencement of the class test.

6.4 No one is to leave the hall during examination for any purpose, except in case of an emergency.

6.5 Malpractices during class tests and examinations will not be tolerated and will attract stern action.

7. Ragging

Ragging and eve-teasing are activities which violate the dignity of a person and they will be met with zero tolerance. Anti-ragging norms have been given to each student at the time of admission and all students and parents have signed the anti-ragging affidavit. Any case of ragging and eve-teasing must be reported to the anti-ragging squad. All cases of violation of anti-ragging norms will be taken up by the anti-ragging Committee and punished according to the norms.

8. Grievance Redressal

The University has constituted a Grievance Redressal Cell to redress any genuine grievance students may have. Any student having a genuine grievance may make a representation to the Grievance Redressal Cell through his/her mentor. The representation should be accompanied by all relevant documents in support of the genuineness of the grievance.

9. School Association

9.1 The School Association is an association of the representatives of the various stake holders of the School – students, staff, faculty and management. It is the responsibility of the School Association to take charge of organizing most of the co-curricular activities such as the annual festivals, quizzes, debates, competitions and social events.

9.2 A male and a female student are elected by the students of each class as "class representatives" to represent them in the School Association. Class representatives are expected to be outstanding students who are academically competent and having qualities of leadership.

10. Participation in University Activities

10.1 In order to provide opportunities for the holistic development of the human person, a large number of co-curricular and extra-curricular activities are designed and implemented under the banner of the University Association and student clubs. Some of the most important activities are D'VERVE & BOSCOSIADE (intra- University sports and cultural festival during University Week), PRAJYUKTTAM (the inter-University technical festival). All students are expected to take part actively in such activities to showcase their talents, to develop leadership qualities and to gain the experience of working in groups.

10.2 **Training and Placement Activities:** The training and Placement Cell of DBCET has been incorporated with the objective of minimizing the gap between industry and academia and giving the students training and exposure so that they can capitalize on every opportunity for placement. It is the prime responsibility of the cell to look after all matters concerning 'Training to enhance employability' and 'guiding students for placement'. In the first two semesters, students are trained for communication skills development under the department of Humanities and Social Sciences, and personal development programmes under the department of campus ministry. From the third semester onwards, in every semester, students are given systematic training in aptitude tests, communication skills, group discussion, etc. They are also made to undergo mock HR and Technical Interviews. These activities of the training and placement cell find a place in the curriculum as Extra Academic Programmes (EAP) and all students are required to get a P grade for these activities by taking an active part in these activities regularly.

Other departments of the University offer customised services in training and placement of their students.

11. Free Time

Some hours without class may be available for some students during the day. Students are expected to use such 'free time' for visiting the library, meeting teachers and mentors, self- study, carrying out lab or project related activities, etc.

12. Faculty Performance Feedback

In order to improve the teaching and learning process in the University, students will be required to give feedback about the performance of their teachers from time-to-time. All students are expected to participate in the online feedback sessions concerning their teachers with sincerity and responsibility.

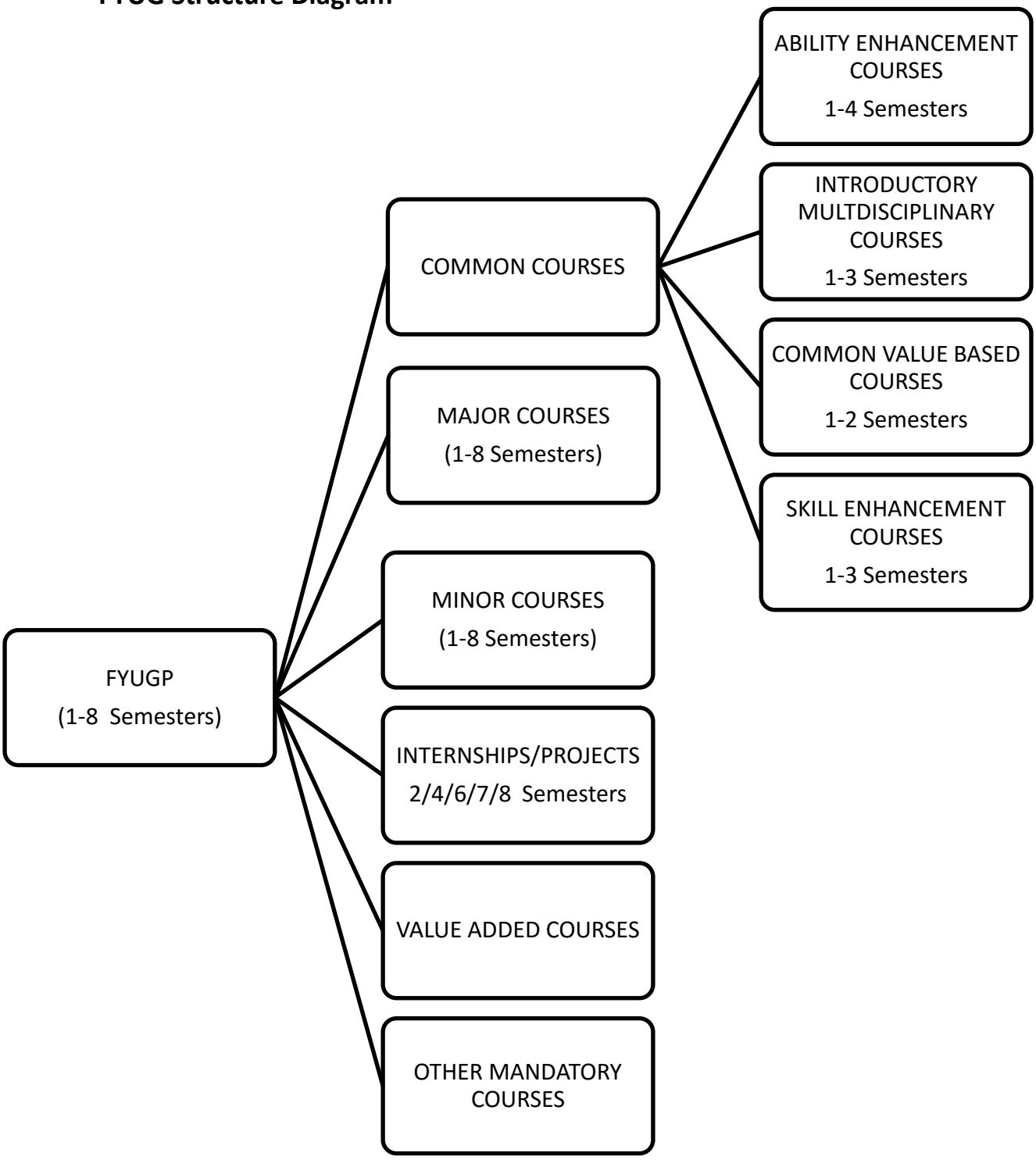
13. Mentoring

All students are assigned mentors from among the faculty members for their guidance. Directors of Schools in collaboration with the Heads of Departments will take care of assigning mentors. Mentors shall help the students to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them. Although students should meet their mentors on a regular basis to get timely help, specific days have been set aside in the calendar for meeting mentors to ensure proper documentation of achievements, activities, shortcomings and problems faced by the students. Every student must meet the mentor during these days.

14. Interaction Meet with Parents

The University organises interaction meetings with parents once a year in which the parents are invited to interact with teachers and management to appraise themselves about the performance of their ward and also to offer their suggestions for the betterment of the institution. It is the responsibility of the students too to invite their parents to come and participate in the event and make the event meaningful.

FYUG Structure Diagram



THE FOUR YEAR UNDER GRADUATE PROGRAMME STRUCTURE

Year	Semester	Category	Description	Credit
I	Semester 1	Major Course 1, Introductory level	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 1	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	4
		Multi-disciplinary Course 1	Choose basic courses from the disciplines Commerce/Humanities/Science	3
		Ability Enhancement Compulsory Course 1	Language course - Communicative English -I /Communicative Hindi-I / Communicative Assamese-I	2
		Skill Enhancement Course 1	Hands-on training course	3
		Common Value Based Course 1	Understanding India/ Digital and Technological Solutions/ Health and Wellness, Yoga Education, and Sports and Fitness/ Environmental Studies	1
		Common Value Based Course 2	Understanding India/ Digital and Technological Solutions/ Health and Wellness, Yoga Education, and Sports and Fitness/ Environmental Studies	1
		Community Engagement Course 1	Service Learning Theory	2
			Total Credits	**20**
	Semester 2	Major Course 2, Introductory level	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 2	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	4
		Multi-disciplinary Course 2	Choose basic courses from the disciplines Commerce/Humanities/Science	3
		Ability Enhancement Compulsory Course 2	Language course - Communicative English –II /Communicative Hindi-II / Communicative Assamese-II	2
		Skill Enhancement Course 1	Hands-on training course	3
		Common Value Based Course 3	Understanding India/ Digital and Technological Solutions/ Health and Wellness, Yoga Education, and Sports and Fitness/ Environmental Studies	1
		Common Value Based Course 4	Understanding India/ Digital and Technological Solutions/ Health and Wellness, Yoga Education, and Sports and Fitness/ Environmental Studies	1
		Community Engagement Course 2	Service Learning Practice	2
			Total Credits	**20**
*Exit option with **UG Certificate** (with the completion of courses and 4 credits in work based vocational courses offered during summer term or internship equal to a minimum of 44 credits)*				
II	Semester 3	Major Course 3	Disciplinary Major course (Theory + Lab/ Theory)	4
		Major Course 4	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 3	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	4
		Multi-disciplinary Course 3	Choose basic courses from the disciplines Commerce/Humanities/Science	3
		Ability Enhancement Compulsory Course 3	Communicative English -I /Communicative Hindi-I / Communicative Assamese-I	2
		Skill Enhancement Course 2	Hands-on training course	3
		Total Credits		**20**
	Semester 4	Major Course 5	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course 6	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course 7	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 4	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	4
		Ability Enhancement Compulsory Course 4	Communicative English -II /Communicative Hindi-II / Communicative Assamese-II	2
			Total Credits	**20**

*Exit option with **UG Diploma** (with the completion of courses additional 4 credit in skill based vocational courses offered during first year or second year summer term equal to a minimum of 84 credits)* *Or* *Completion of 2 credit Internship during Summer Term and evaluation during Semester 5*				
III	**Semester 5**	Major Course 8	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course 9	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course 10	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 5	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	4
		Internship	Internship	2
			Total Credits	**20**
	Semester 6	Major Course 11	Disciplinary Major course (Theory + Lab/ Theory)	4
		Major Course 12	Disciplinary Major course (Theory + Lab/ Theory)	4
		Major Course 13	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 6	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	4
		Major Course 14 Project Work	Minor Project	4
			Total Credits	**20**
*Exit option with **3- year UG Degree** (with the completion of courses equal to a minimum of 120 credits)*				
IV	**Semester 7**	Major Course 15	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course 16	Disciplinary Major course (Theory + Lab/ Theory)	5
		Minor Course 7	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	3
		Minor Course 8 Research Methodology	Research Methodology	2
		Research Project/ Dissertation	Dissertation Phase – I	6
			Total Credits	**21**
	Semester 8	Major Course 17	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course18	Disciplinary Major course (Theory + Lab/ Theory)	5
		Minor Course 9	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	3
		Research Project/ Dissertation	Dissertation Phase – II	6
			Total Credits	**19**
*Exit option with **UG Degree (Honours)** (with the completion of courses equal to a minimum of 160 credits)*				
IV	**Semester 7**	Research Methodology	Research Methodology	2
		Research Project/Dissertation	Dissertation Phase – I	18
			Total Credits	**20**
	Semester 8	Research Project/Dissertation	Dissertation Phase – II	**20**
			Total Credits	**20**
*Students will be awarded **UG Degree (Honours) with Research** in the relevant Discipline (with the completion of courses equal to a minimum of 160 credits)*				

ABILITY ENHANCEMENT COURSES

INTRODUCTORY MULTI DISCIPLINARY COURSES

COMMON VALUE BASED COURSES

COMMUNITY ENGAGEMENT COURSES

VALUE ADDED COURSES

MANDATORY COURSES

ABILITY ENHANCEMENT COURSES
(Compulsory for all Programmes)

Semester	Category	Course Code	Course Name	Credits	Page No
1/3	A E Course 1	AECE100T/AECE200T	Communicative English I	2	67
2/4	A E Course 2	AECE101T/ AECE201T	Communicative English II	2	68
1/3	A E Course 3	AECH100T/AECH200T	Communicative Hindi I	2	69
2/4	A E Course 4	AECH101T/ AECH201T	Communicative Hindi II	2	70
1/3	A E Course 5	AECA100T/AECA200T	Communicative Assamese I	2	71
2/4	A E Course 6	AECA101T/AECA201T	Communicative Assamese II	2	72
1/3	A E Course 7	AEFR100T/AEFR200T	French Beginner Level I	2	73
2/4	A E Course 8	AEFR101T/AEFR201T	French Beginner Level II	2	74
1/3	A E Course 9	AEGR100T/AEGR200T	Introduction to German Language – I	2	75
2/4	A E Course 10	AEGR101T/AEGR201T	Introduction to German Language – II	2	75

MULTI DISCIPLINARY COURSES
(Choose Multidisciplinary Courses from the stream other than the stream which he/she has studied in class 12)

AZARA CAMPUS

For students who studied in Science stream in class 12

Semester	Category	Course Code	Course Name	Offered by the Department	Credits	Page No
1	MD Course 1	CMBO108T	Business Organisation and Commercial Practices	Commerce	3	77
1	MD Course 2	MTFB107T	Fundamentals of Business, Management & Economics	Management	3	79
1	MD Course 3	CAOP108T	Office Productivity Tools	Computer Applications	3	86
2	MD Course 1	CMAC109T	Accountancy	Commerce	3	78
2	MD Course 2	MTIE108T	Indian Economy	Management	3	80
3	MD Course 1	CMBI110T	Banking and Insurance	Commerce	3	78
3	MD Course 2	MTEI109T	Emotional Intelligence	Management	3	81

For students who studied in Arts stream in class 12

Semester	Category	Course Code	Course Name	Offered by the Department	Credits	Page No
1	MD Course 1	CMBO108T	Business Organisation and Commercial Practices	Commerce	3	77
1	MD Course 2	MABM109T	Basic Mathematics	Basic Sciences	3	82
1	MD Course 3	CAOP108T	Office Productivity Tools	Computer Applications	3	86
2	MD Course 1	CMAC109T	Accountancy	Commerce	3	78
2	MD Course 2	BOBI111T	Biology	Basic Sciences	3	76
2	MD Course 3	CAPY108T	Python For Business Analytics	Computer Applications	3	87
3	MD Course 1	CMBI110T	Banking and Insurance	Commerce	3	78
3	MD Course 2	PSNN106T	Nanoscience and Nanotechnology	Basic Sciences	3	88
3	MD Course 3	CHFN115T	Food and Nutrition	Basic Sciences	3	102

For students who studied in Commerce stream in class 12

Semester	Category	Course Code	Course Name	Offered by the Department	Credits	Page No
1	MD Course 1	MTFB107T	Fundamentals of Business, Management & Economics	Management	3	79
1	MD Course 1	MABM109T	Basic Mathematics	Basic Sciences	3	82

1	MD Course 3	CAOP108T	Office Productivity Tools	Computer Applications	3	86
2	MD Course 2	MTIE108T	Indian Economy	Management	3	80
2	MD Course 2	BOBI111T	Biology	Basic Sciences	3	76
2	MD Course 2	CAPY109T	Python For Business Analytics	Computer Applications	3	87
3	MD Course 3	MTEI109T	Emotional Intelligence	Management	3	81
3	MD Course 3	PSNN106T	Nanoscience and Nanotechnology	Basic Sciences	3	88
3	MD Course 2	CHFN115T	Food and Nutrition	Basic Sciences	3	102

TAPESIA CAMPUS						
For students who studied in Science stream in class 12						
Semester	**Category**	**Course Code**	**Course Name**	**Offered by the Department**	**Credits**	**Page No**
Humanities						
1	MD Course 1	PCCP108T	Community Psychology	Psychology	3	97
1	MD Course 2	ENMB107T	Money and Banking	Economics	3	99
1	MD Course 3	MCCJ108T	Basics of Communication and Journalism	Mass Com	3	96
2	MD Course 1	EGDH107T	Digital Humanities	English	3	95
2	MD Course 2	PCHW109T	Psychology of Health and Wellbeing	Psychology	3	98
2	MD Course 3	ENSM108T	Introduction to Stock Market	Economics	3	100
3	MD Course 1	MCFC109T	Fashion Communication	Mass Com	3	96
3	MD Course 2	ENED110T	Entrepreneurship Development	Economics	3	101
3	MD Course 3	PCPM110T	Psychology and Media	Psychology	3	99
For students who studied in Arts/ Commerce stream in class 12						
1	MD Course 1	CHFN115T	Food and Nutrition	Chemistry	3	102
1	MD Course 2	MABM111T	Basic Mathematics I	Mathematics	3	83
1	MD Course 3	BOBC116T	Biodiversity Conservation	Botany	3	90
1	MD Course 4	ZGNC110T	Nutrition for Community Health	Zoology	3	92
2	MD Course 1	PSNN106T	Nanoscience and Nanotechnology	Physics	3	88
2	MD Course 2	CHEE116T	Energy and Environment	Chemistry	3	102
2	MD Course 3	BOGN117T	Gardening and Nursery Management	Botany	3	91
2	MD Course 4	ZGVB113T	Public Health and Vector Born Diseases	Zoology	3	94
2	MD Course 5	MABM112T	Basic Mathematics II	Mathematics	3	84
3	MD Course1	PSRS107T	Radiation and Safety Measurements	Physics	3	88
3	MD Course 2	BOEB118T	Economic Botany	Botany	2	91
		BOEB119L	Economic Botany Lab		1	92
3	MD Course 3	ZGIB112T	Introduction to Biology of Insecta	Zoology	3	93
3	MD Course 4	MABM212T	Basic Mathematics III	Mathematics	3	85
3	MD Course 5	PSAA212T	Astrophysics and Astronomy	Physics	3	89
BA Philosophy						
1	MD Course1	MDBM100T	Basics in Mathematics	Philosophy	3	103
2	MD Course 2	MDBA101T	Basics in Accounting	Philosophy	3	104
3	MD Course 3	MDGS200T	Introduction to General Science	Philosophy	3	104

COMMON VALUE BASED COURSES
(Compulsory for all Programmes)

Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
1	C V B Course 1	CBES101T	Environmental Studies	1	106
1	C V B Course 1	CBHY102T	Health and Wellness, Yoga Education, and Sports and Fitness	1	107
2	C V B Course 1	CBDT103T	Digital and Technological Solutions	1	107
2	C V B Course 1	CBUI104T	Understanding India	1	108

COMMUNITY ENGAGEMENT (SERVICE LEARNING)
(Compulsory for all Programmes)

Semester	Category	Department	Course Code	Course Name	Credits	Page No
Theory						
1	CE Course	Computer Applications	CACE109T	Service Learning	2	821
1	CE Course	Commerce	CMCE111T	Service Learning	2	821
1	CE Course	Management	MTCE110T	Service Learning	2	821
1	CE Course	Chemistry	CHCE117T	Elements of Service Learning in Chemistry	2	823
1	CE Course	Mathematics	MACE110T	Community Engagement and Service Learning	2	823
1	CE Course	Physics	PSCE108T	Elements of Service Learning in Physics	2	824
1	CE Course	Education	EDCE106T	Service Learning (A Community-University Engagement Programme)	2	824
1	CE Course	English	EGCE108T	Service Learning- Language Communication	2	826
1	CE Course	Mass Communication	MCCE110T	Community Media	2	826
1	CE Course	Psychology	PCCE111T	Service Learning	2	828
1	CE Course	Economics	ENCE111T	Service Learning	2	828
1	CE Course	Public Administration	PACE110T	Service Learning	2	828
1	CE Course	Botany	BOCE112T	Service Learning on Ethnobotanical Practices	2	829
1	CE Course	Zoology	ZGCE110T	Foundations of Service Learning	2	830
1	CE Course	Hospitality and Hotel Administration	HACE110T	Introduction to Community Engagement	2	831
1	CE Course	Philosophy	CESL100T	Service Learning: Theory	2	831
Practice						
2	CE Course	ALL	CESL102P	Service Learning Practice	2	

VALUE ADDED COURSES

Course Name	Page no
DEPARTMENT OF COMPUTER APPLICATIONS	
CARP6051: Robotic Process Automation	833
CABC6052: Blockchain	833
CAAW6053: Advanced Web Application Development Techniques	834
CADV6054: Data Visualisation	834
DEPARTMENT OF COMMERCE	
CMII6011: Ideation to Innovation	835
CMSS6012: Statistical Software Packages for Data Analysis	836
CMAS6013: Accounting Software Package	837
CMIT6014: Income Tax Return Filling	837
CMCR6015: Customer Relationship Management	838
DEPARTMENT OF MANAGEMENT	
MTII6011: Ideation to Innovation	839
MTFS6012: Fundamental Selling Skills: Techniques and Applications	840
DEPARTMENT OF CHEMISTRY	
CHPC6137: Petroleum Chemistry	840
CHPA6138: Pharmaceutical Chemistry and its Applications	841
DEPARTMENT OF MATHEMATICS	
MAFG0154: Fractal Geometry and Applications	842
MAML0152: Essential Mathematics for Machine Learning	843
MACS6005: Computational Mathematics with Sage Math	843

MANDATORY COURSES

MAJOR COURSES

MINOR COURSES

SKILL ENHANCEMENT COURSES

INTERNSHIPS

RESEARCH PROJECT /DISSERTATION

SCHOOL OF TECHNOLOGY

DEPARTMENT OF COMPUTER APPLICATIONS

PROGRAMME: BACHELOR OF COMPUTER APPLICATIONS (BCA) (Honours/Honours with Research)

MAJOR COURSES

MINOR COURSES

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	CACF106L	Computer Fundamentals	3	139
2	S E Course 2	CAHS107L	Hardware and Server Maintenance	3	140
3	S E Course 3	CAMG214L	Multimedia and Graphics	3	141

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	CAIN107I	Internship	4	142
4	Internship	CAIN213I	Internship	4	
5	Internship	CAIN314I	Internship	2	142

RESEARCH PROJECT /DISSERTATION

BCA (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	CADI410P	Dissertation Phase I	6	143
8	Research Project/Dissertation	CADI411P	Dissertation Phase II	6	144
BCA (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	CADI412P	Dissertation Phase I	18	146
8	Research Project/Dissertation	CADI413P	Dissertation Phase II	20	146

SCHOOL OF COMMERCE AND MANAGEMENT

DEPARTMENT OF MANAGEMENT

PROGRAMME: BACHELOR OF BUSINESS ADMINISTRATION (BBA) (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	MTMP100T	Management Process, Principles and Practices	4	148
2	Major Course 2	MTHB101T	Fundamentals of Human Resources Management & Organisation Behaviour	4	149
3	Major Course 3	MTMM200T	Marketing Management	4	150
3	Major Course 4	MTAI201T	Introduction to Aviation Industry	4	151
4	Major Course 5	MTFM202T	Fundamentals of Financial Management	5	151
4	Major Course 6	MTCB203T	Consumer Behaviour	5	152
4	Major Course 7	MTMD204T	Business Mathematics and Statistics for Decision Making	4	153
5	Major Course 8	MTME300T	Managerial Economics	5	154
5	Major Course 9	MTEG301T	Business Ethics and Corporate Governance	5	155
5	Major Course 10	MTPO302T	Production and Operations Management	4	156
6	Major Course 11	MTPM303T	Business Policy and Strategic Management	4	157
6	Major Course 12	MTFI304T	Financial Markets and Institutions	4	158
6	Major Course 13	MTCL305T	Corporate and Business Law	4	159
6	Major Course 14	MTMP306P	Minor Project - 1	4	160
7	Major Course 15	MTCF400T	Corporate Finance	5	160
7	Major Course 16	MTSC401T	Supply Chain Management	5	161
8	Major Course 17	MTSM402T	Services Marketing	5	162
8	Major Course 18	MTCR403T	Corporate Restructuring	5	163

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	MTBO102T	Business Organisation	4	164
2	Minor Course 2	MTMF103T	Management Fundamentals	4	165
3	Minor Course 3	MTBI205T	Banking and Insurance	4	166
4	Minor Course 4	MTFT206T/ MTCM207T/ MTIM208T/ MTAO209T	Fundamentals of Investment / Compensation Management/ International Marketing / Airport Operations	4	166-169
5	Minor Course 5	MTSH307T/ MTPF308T/ MTMR309T/ MTGH310T	Strategic HRM/ Personal Financial Planning / Marketing Research/ Ground Handling Services at Airport	4	170 171 172 173
6	Minor Course 6	MTIR311T/ MTIP312T/ MTDM313T/ MTAC314T	Management of Industrial Relations/ Investment Analysis and Portfolio Management/ Digital Marketing / Air Cargo Operations	4	173 174 175 176
7	Minor Course 7	MTBE404T/ MTAR405T	Business Environment / Airport Resource Planning and Services Management	3	177 178
7	Minor Course 8	MTRM406T	Research Methodology	2	179
8	Minor Course 9	MTIB407T	International Business	3	179

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	MTED104L	Entrepreneurship Development	3	181
2	S E Course 2	MTOM105L	Office Organization and Management	3	182
3	S E Course 3	MTRM210L	Retail Management	3	183

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	MTIN106I	Internship	4	184
4	Internship	MTIN211I	Internship	4	184
5	Internship	MTIN315I	Internship	2	185

RESEARCH PROJECT /DISSERTATION

BBA (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	MTDI408P	Dissertation-I	6	186
8	Research Project/Dissertation	MTDI409P	Dissertation-II	6	187
BBA (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	MTDI410P	Dissertation-I	18	187
8	Research Project/Dissertation	MTDI411P	Dissertation- II	20	188

SCHOOL OF COMMERCE AND MANAGEMENT

DEPARTMENT OF COMMERCE

PROGRAMME: BACHELOR OF Commerce (BCOM) (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	CMFA100T	Financial Accounting	4	192
2	Major Course 2	CMMP101T	Management Principles and Applications	4	193
3	Major Course 3	CMBL200T	Business Law	4	194
3	Major Course 4	CMBE201T	Business Economics	4	196
4	Major Course 5	CMHR202T	Human Resource Management	5	197
4	Major Course 6	CMCM203T	Cost and Management Accounting	5	197
4	Major Course 7	CMQT204T	Quantitative Techniques for Business	4	199
5	Major Course 8	CMMM300T	Marketing Management	5	199
5	Major Course 9	CMCA301T	Corporate Accounting	5	200
5	Major Course 10	CMBE302T	Business Environment	4	201
6	Major Course 11	CMAG303T	Auditing and Corporate Governance	4	202
6	Major Course 12	CMFM304T	Financial Management	4	203
6	Major Course 13	CMTL305T	Taxation Law and Practices	4	204
6	Major Course 14	CMAT306P/	Audit Training/	4	205
		CMST307P/	Salesperson training/		206
		CMSA308P/	SWOT Analysis of an industry/		207
		CMIN309P/	Internship/		
		CMMP310P	Project		
7	Major Course 15	CMAA400T	Advanced Accounting	5	208
7	Major Course 16	CMFS401T	Financial Statement Analysis	5	209
8	Major Course 17	CMCR402T	Consumer Behaviour and Relationship Management	5	210
8	Major Course 18	CMIF403T	International Finance	5	211

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	CMFA102T	Fundamentals of Accounting	4	212
2	Minor Course 2	CMFI103T/ CMEP104T	Financial Market and Institutions/ Export Import Procedures	4	213 214
3	Minor Course 3	CMIR205T	Intellectual Property Rights	4	215
4	Minor Course 4	CMSM206T/ CMCT207T	Investment in Stock Market/ Corporate Tax Planning	4	215 216
5	Minor Course 5	CMFM311T/ CMIL312T/ CMCR313T	Fundamentals of Marketing Management/ Industrial Relations and Labour Laws/ Corporate Restructuring and Valuation	4	217 218 219
6	Minor Course 6	CMTF314T/ CMFA315T	Tax Filing & E-Return/ Financial Analytics	4	220 221
7	Minor Course 7	CMFF404T/ CMSP405T/ CMCR406T	Fundamentals of Financial Management/ Security Analysis and Portfolio Management/ Corporate Financial Reporting & Analysis	3	222 222 223
7	Minor Course 8	CMRM407T	Research Methodology	2	224
8	Minor Course 9	CMSM408T/ CMFC409T/ CMSL410T	Service Marketing/ Financial & Commodity Derivatives/ Supply Chain and Logistics Management	3	225 226 227

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	CMBP105T	Business & Professional Communications	3	228
2	S E Course 2	CMTI106T	Trading and Investment in Share Market	3	229
3	S E Course 3	CMED208T	Entrepreneurship Development	3	229

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	CMIN107I	Internship	4	231
4	Internship	CMIN208I	Internship	4	
5	Internship	CMIN315I	Internship	2	

RESEARCH PROJECT /DISSERTATION

BCOM (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	CMDI411P	Project Phase I	6	233
8	Research Project/Dissertation	CMDI412P	Project Phase II	6	234
BCOM (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	CMDI410P	Dissertation I	18	234
8	Research Project/Dissertation	CMDI411P	Dissertation II	20	234

SCHOOL OF FUNDAMANTAL AND APPLIED SCIENCES

DEPARTMENT OF CHEMISTRY

PROGRAMME: BACHELOR OF SCIENCE (BSC) in CHEMISTRY (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	CHFC100T	Fundamentals of Chemistry I (3-0-0)	4	239
		CHFC101L	Fundamentals of Chemistry I Lab (0-0-1)		241
2	Major Course 2	CHFC102T	Fundamentals of Chemistry II (3-0-0)	4	242
		CHFC103L	Fundamentals of Chemistry II Lab (0-0-1)		243
3	Major Course 3	CHOF200T	Organic Chemistry I: Oxygen containing functional group (3-0-0)	4	244
		CHOF201L	Organic Chemistry I: Oxygen containing functional group Lab (0-0-1)		245
3	Major Course 4	CHTH202T	Physical Chemistry I: Thermodynamics (3-0-0)	4	246
		CHTH203L	Physical Chemistry I: Thermodynamics Lab(0-0-1)		247
4	Major Course 5	CHHC204T	Organic Chemistry II: Heterocyclic chemistry (4-0-0)	5	247
		CHHC205L	Organic Chemistry II: Heterocyclic chemistry Lab (0-0-1)		248
4	Major Course 6	CHPC206T	Physical Chemistry II: Phase equilibria and chemical kinetics (4-0-0)	5	249
		CHPC207L	Physical Chemistry II: Phase equilibria and chemical kinetics Lab (0-0-1)		250
4	Major Course 7	CHSP208T	Inorganic Chemistry I: s and p block elements (3-0-0)	4	251
		CHSP209L	Inorganic Chemistry I: s and p block elements Lab (0-0-1)		251
5	Major Course 8	CHBI300T	Organic Chemistry III: Biomolecules (4-0-0)	5	252
		CHBI301L	Organic Chemistry III: Biomolecules Lab (0-0-1)		253
5	Major Course 9	CHCO303T	Inorganic Chemistry II: Coordination Chemistry (4-0-1)	5	253
		CHCO304L	Inorganic Chemistry II: Coordination Chemistry Lab (0-0-1)		254
5	Major Course 10	CHSQ305T	Physical Chemistry III: Spectroscopy and quantum Chemistry (3-0-0)	4	255
		CHSQ306L	Physical Chemistry III: Spectroscopy and quantum Chemistry (0-0-1)		256
6	Major Course 11	CHOS307T	Organic Chemistry IV: Organic Spectroscopy (3-0-0)	4	257
		CHOS308L	Organic Chemistry IV: Organic Spectroscopy Lab (0-0-1)		258
6	Major Course 12	CHBO309T	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (3-0-0)	4	258
		CHBO310L	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (0-0-1)		259
6	Major Course 13	CHEL311T	Physical Chemistry IV: Electrochemistry (3-0-0)	4	260
		CHEL312L	Physical Chemistry IV: Electrochemistry Lab (0-0-1)		261
6	Major Course 14	CHMP313P	Minor Project	4	
7	Major Course 15	CHAI400T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	5	262
		CHAI401L	Inorganic Chemistry IV: Advanced Inorganic Chemistry Lab (0-0-1)		263
7	Major Course 16	CHQC402T	Quantum Chemistry and Group theory (5-0-0)	5	263
8	Major Course 17	CHAP403T	Physical Chemistry V: Advanced Physical Chemistry (5-0-0)	5	264
8	Major Course 18	CHRO404T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	5	266
		CHRO405L	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies Lab (0-0-1)		266

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	CHAS104T	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (3-0-1)	4	268
		CHAS105L	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab (0-0-1)		270
		CHGC106T	Green Chemistry (3-0-1)	4	270
		CHGC107L	Green Chemistry Lab (0-0-1)		271
2	Minor Course 2	CHSP108T	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (3-0-0)	4	272
		CHSP109L	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (0-0-1)		274
		CHIM110T	Inorganic materials and Industrial Importance (3-0-0)	4	274
		CHIM111L	Inorganic materials and Industrial Importance Lab (0-0-1)		275
3	Minor Course 3	CHFG210T	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I (3-0-0)	4	276
		CHFG211L	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I Lab (0-0-1)		277
		CHPC212T	Polymer Chemistry (3-0-0)	4	278
		CHPC213L	Polymer Chemistry Lab (0-0-1)		279
4	Minor Course 4	CHSP214T	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (3-0-1)	4	280
		CHSP215L	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (0-0-1)		281
		CHRO216T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	4	282
5	Minor Course 5	CHDQ314T	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (3-0-0)	4	283
		CHDQ315L	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (0-0-1)		284
		CHAC316T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	4	285
6	Minor Course 6	CHBC317T	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (3-0-0)	4	286
		CHBC318L	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (0-0-1)		287
		CHAP319T	Physical Chemistry V: Advanced Physical Chemistry (4-0-0)	4	288
7	Minor Course 7	CHAM406T	Analytical Methods in Chemistry (3-0-0)	3	289
7	Minor Course 8	CHRM407T	Research Methodology	2	290
8	Minor Course 9	CHML408T	Molecules of Life (3-0-0)	3	291

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	CHBC112L	Basic Analytical Chemistry (1-0-2)	3	293
2	S E Course 2	CHCH113L	Chemoinformatics (1-0-2)	3	293
3	S E Course 3	CHIP217L	Intellectual Property Rights (3-0-0)	3	294

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	CHIN114I	Internship	4	296
4	Internship	CHIN218I	Internship	4	296
5	Internship	CHIN320I	Internship	2	296

RESEARCH PROJECT /DISSERTATION

BSC CHEMISTRY (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	CHDI409P	Research Project Phase I	6	296
8	Research Project/Dissertation	CHDI410P	Research Project Phase II	6	297
BSC CHEMISTRY (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	CHDI411P	Dissertation I	18	297
8	Research Project/Dissertation	CHDI412P	Dissertation II	20	297

SCHOOL OF FUNDAMANTAL AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS

PROGRAMME: BACHELOR OF SCIENCE (BSC) in MATHEMATICS (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	MACA100T	Calculus	4	301
		MACA101L	Calculus Lab		314
2	Major Course 2	MAAL102T	Algebra	4	302
3	Major Course 3	MAMC200T	Multivariate Calculus	4	302
3	Major Course 4	MADE201T	Differential Equations	4	303
		MADE202L	Differential Equations Lab		315
4	Major Course 5	MARA203T	Real Analysis	5	304
4	Major Course 6	MANM204T	Numerical Methods and Coordinate Geometry	5	305
4	Major Course 7	MAAA205T	Abstract Algebra	4	306
5	Major Course 8	MALA300T	Linear Algebra	5	306
5	Major Course 9	MAPS301T	PDE and Systems of ODE	5	307
		MAPS302L	PDE and System of ODE Lab		316
5	Major Course 10	MAPB303T	Probability and Statistics	4	308
6	Major Course 11	MAMS304T	Metric Space and Complex Analysis	4	309
6	Major Course 12	MARI305T	Riemann Integration and Series of Functions	4	310
6	Major Course 13	MANT306T	Number Theory	4	310
6	Major Course 14	MAMP307P	Minor Project	4	311
7	Major Course 15	MAAB400T	Advanced Abstract Algebra	5	311
7	Major Course 16	MAAP401T	Applied Analysis	5	312
8	Major Course 17	MATP402T	Topology	5	313
8	Major Course 18	MAFA403T	Functional Analysis	5	314

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	MAEC103T	Elementary Calculus	4	317
2	Minor Course 2	MAEA104T	Elements of Algebra	4	318
3	Minor Course 3	MAON206T	ODE and Numerical Methods	4	318
		MASD207T	Statics and Dynamic		319
4	Minor Course 4	MARC208T	Real and Complex Analysis	4	320
		MAGT209T	Graph Theory		321
5	Minor Course 5	MAVC308T	Vector Calculus and Coordinate Geometry	4	322
		MALP309T	Linear programming and Applications		322
		MABI310T	Bio-Mathematics		323
		MAFE311T	Finite Elements Methods		324
6	Minor Course 6	MAEL312T	Metric Space and Linear Algebra	4	325
		MAAF313T	Elementary Fuzzy Mathematics		326
		MAMC314T	Mechanics		326
		MADG315T	Differential Geometry		327
7	Minor Course 7	MABA404T	Boolean Algebra	3	328
		MAIG405T	Introduction to Game Theory		328
7	Minor Course 8	MARM406T	Research methodology in Mathematical Science	2	329
8	Minor Course 9	MADS407T	Discrete Mathematics	3	330
		MACT408T	Coding Theory		331
		MAIC409T	Introduction to Cryptography		331

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	MAPC105T	Programming in C	3	333
		MALS106T	Logic and Sets		334
2	S E Course 2	MAIP107T	Introduction to Python	3	334
3	S E Course 3	MALM210T	LaTeX for Mathematics	3	335

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	MAIN108I	Internship	4	336
4	Internship	MAIN211I	Internship	4	336
5	Internship	MAIN316I	Internship	2	336

RESEARCH PROJECT /DISSERTATION

BSC MATHEMATICS (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	MADI410P	Research Project Phase I	6	336
8	Research Project/Dissertation	MADI411P	Research Project Phase II	6	337
BSC CHEMISTRY (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	MADI412P	Dissertation I	18	337
8	Research Project/Dissertation	MADI413P	Dissertation II	20	337

SCHOOL OF FUNDAMANTAL AND APPLIED SCIENCES

DEPARTMENT OF PHYSICS

PROGRAMME: BACHELOR OF SCIENCE (BSC) in PHYSICS (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	PSMC100T	Mechanics (3-0-0)	4	341
		PSMC101L	Mechanics Lab (0-0-1)		342
2	Major Course 2	PSMP102T	Introduction to Modern Physics (3-1-0)	4	343
3	Major Course 3	PSMA200T	Mathematical Physics (3-1-0)	4	344
3	Major Course 4	PSEM201T	Electricity and Magnetism (3-0-0)	4	345
		PSEM202L	Electricity and Magnetism Lab (0-0-1)		345
4	Major Course 5	PSTP203T	Thermal Physics and Statistical Mechanics (4-1-0)	5	346
4	Major Course 6	PSQM204T	Quantum Mechanics (4-1-0)	5	347
4	Major Course 7	PSEN205T	Electronic Circuits, Networks and Devices (3-0-0)	4	348
		PSEN206L	Electronic Circuits, Networks and Devices Lab (3-0-1)		349
5	Major Course 8	PSCM300T	Condensed Matter Physics (3-1-0)	5	349
		PSCM301L	Condensed Matter Physics Lab (0-0-1)		350
5	Major Course 9	PSET302T	Electromagnetic Theory (3-1-0)	5	351
		PSET303L	Electromagnetic Theory Lab (0-0-1)		352
5	Major Course 10	PSSD304T	Semiconductor Devices (3-0-1)	4	352
		PSSD305L	Semiconductor Devices Lab (3-0-1)		353
6	Major Course 11	PSQM306T	Advanced Quantum Mechanics (3-1-0)	4	354
6	Major Course 12	PSNP307T	Atomic and Nuclear Physics (3-1-0)	4	355
6	Major Course 13	PSCM308T	Classical Mechanics (3-1-0)	4	356
6	Major Course 14	PSMP309P	Minor Project	4	
7	Major Course 15	PSED400T	Electrodynamics (4-1-0)	5	357
7	Major Course 16	PSPP401T	Particle Physics and Accelerators (4-1-0)	5	358
8	Major Course 17	PSSM402T	Statistical Mechanics (4-1-0)	5	359
8	Major Course 18	PSAM403T	Advanced Mathematical Physics (4-1-0)	5	360

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	PSAO103T	Wave - Acoustics and Optics (3-1-0)	4	362
2	Minor Course 2	PSMP102T	Introduction to Modern Physics (3-1-0)	4	363
3	Minor Course 3	PSEM201T	Electricity and Magnetism (3-0-0)	4	364
		PSEM202L	Electricity and Magnetism Lab (0-0-1)		365
4	Minor Course 4	PSMP209T	Mathematical Physics-II (3-1-0)	4	365
5	Minor Course 5	PSAP310T	Introduction to Astrophysics and Plasma Physics(3-1-0)	4	366
		PSCM300T	Condensed matter Physics (3-0-1)		367
		PSCM301L	Condensed matter Physics Lab (0-0-1)		368
		PSED311T	Electrodynamics (3-1-0)		368
6	Minor Course 6	PSSD312T	Semiconductor Devices (3-1-0)	4	369
		PSST313T	Statistical Mechanics (3-1-0)		370
7	Minor Course 7	PSMP404T	Materials Physics (3-0-0)	3	371
7	Minor Course 8	PSRM405T	Research Methodology	2	
8	Minor Course 9	PSSA406T	Physics of Sensors and Actuators (3-0-0)	3	372

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	PSTI104L	Basics of lab tools and Instrumentation (1-0-2)	3	374
2	S E Course 2	PSPC105T	Basics of Programming (C/C++/Fortran) (1-0-2)	3	375
3	S E Course 3	PSPP210L	Computational Physics using Python (1-0-2)	3	376

INTERNSHIP

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	PSIN105I	Internship	4	378
4	Internship	PSIN211I	Internship	4	378
5	Internship	PSIN314I	Internship	2	378

RESEARCH PROJECT /DISSERTATION

BSC PHYSICS (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	PSDI407P	Research Project Phase I	6	379
8	Research Project/Dissertation	PSDI408P	Research Project Phase II	6	379
BSC PHYSICS (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	PSDI409P	Dissertation I	18	379
8	Research Project/Dissertation	PSDI410P	Dissertation II	20	380

SCHOOL OF LIFE SCIENCES

DEPARTMENT OF BOTANY

PROGRAMME: BACHELOR OF SCIENCE (BSC) in BOTANY (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	BOPM100T	Phycology and Microbiology	4 (3-0-1)	384
		BOPM101L	Phycology and Microbiology Lab		385
2	Major Course 2	BOMY102T	Mycology	4 (3-0-1)	386
		BOMY103L	Mycology Lab		386
3	Major Course 3	BOBC200T	Biomolecules and Cell Biology	4 (3-0-1)	387
		BOBC201L	Biomolecules and Cell Biology Lab		388
3	Major Course 4	BOAR202T	Archegoniates	4 (3-0-1)	389
		BOAR203L	Archegoniates Lab		389
4	Major Course 5	BOPG204T	Plant Genetics	5 (3-0-2)	390
		BOPG205L	Plant Genetics Lab		391
4	Major Course 6	BOMA206T	Morphology and Anatomy of Angiosperms	5 (3-0-2)	392
		BOMA207L	Morphology and Anatomy of Angiosperms Lab		393
4	Major Course 7	BOPE208T	Plant Ecology	4 (3-0-1)	393
		BOPE209L	Plant Ecology Lab		394
5	Major Course 8	BOPP300T	Plant Physiology	5 (3-0-2)	395
		BOPP301L	Plant Physiology Lab		395
5	Major Course 9	BOPS302T	Plant Systematics	5 (3-0-2)	396
		BOPS303L	Plant Systematics Lab		397
5	Major Course 10	BORB304T	Reproductive Biology of Angiosperms	4 (3-0-1)	397
		BORB305L	Reproductive Biology of Angiosperms Lab		398
6	Major Course 11	BOPM306T	Plant Metabolism	4 (3-0-1)	399
		BOPM307L	Plant Metabolism Lab		400
6	Major Course 12	BOMO308T	Molecular Biology	4 (3-0-2)	400
		BOMO309L	Molecular Biology Lab		401
6	Major Course 13	BOEC310T	Economic Botany	4 (3-0-1)	402
		BOEC311L	Economic Botany Lab		403
6	Major Course 14	BOMP312P	Minor Project	4	425
7	Major Course 15	BOAT400T	Analytical Techniques in Plant science	5 (3-0-2)	404
		BOAT401L	Analytical Techniques in Plant science Lab		405
7	Major Course 16	BOBS402T	Biostatistics	5 (3-0-2)	405
		BOBS403L	Biostatistics Lab		406
8	Major Course 17	BOPL404T	Plant Biotechnology	5 (3-0-2)	406
		BOPL405L	Plant Biotechnology Lab		407
8	Major Course 18	BOPA406T	Plant Pathology	5 (3-0-2)	408
		BOPA407L	Plant Pathology Lab		408

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	BONV104T	Introduction to non-vascular plants	4 (3-0-1)	410
		BONV105L	Introduction to non-vascular plants Lab		411
2	Minor Course 2	BOVP106T	Introduction to vascular plants	4 (3-0-1)	411
		BOVP107L	Introduction to vascular plants Lab		412
3	Minor Course 3	BOFP210T	Morphology and Anatomy of flowering plants	4 (3-0-1)	412
		BOFP211L	Morphology and Anatomy of flowering plants Lab		413
4	Minor Course 4	BOEB212T	Introduction to Economic Botany	4 (3-0-1)	414
		BOEB213L	Introduction to Economic Botany Lab		415

5	Minor Course 5	BOET313T	Ethnobotany	4 (3-0-1)	415
		BOET314L	Ethnobotany Lab		416
6	Minor Course 6	BOMD315T	Microbial diversity	4 (3-0-1)	417
		BOMD316L	Microbial diversity Lab		417
7	Minor Course 7	BOIM408T	Industrial Microbiology	3 (2-0-1)	418
		BOIM409L	Industrial Microbiology Lab		418
7	Minor Course 8	BORM410T	Research Methodology	2	
8	Minor Course 9	BOFM411T	Fundamentals of Molecular Biology	3 (2-0-1)	419
		BOFM412L	Fundamentals of Molecular Biology Lab		420

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	BOBT108L	Biofertilizer Technology	3 (1-0-2)	421
2	S E Course 2	BOEB109L	Essentials of Bioinformatics	3 (2-0-1)	421
3	S E Course 3	BONS215L	Practical Applications of Nature-Based Solutions for Sustainable Development	3 (2-0-1)	423

INTERNSHIP

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	BOIN110I	Internship	4	424
4	Internship	BOIN215I	Internship	4	424
5	Internship	BOIN317I	Internship	2	424

RESEARCH PROJECT /DISSERTATION

BSC BOTANY (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	BODI413P	Research Project Phase I	6	425
8	Research Project/Dissertation	BODI414P	Research Project Phase II	6	425
BSC BOTANY (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	BODI415P	Dissertation I	18	426
8	Research Project/Dissertation	BODI416P	Dissertation II	20	426

SCHOOL OF LIFE SCIENCES

DEPARTMENT OF ZOOLOGY

PROGRAMME: BACHELOR OF SCIENCE (BSC) in ZOOLOGY (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	ZGDN100T	Diversity of Non-Chordates	4 (3-0-1)	430
		ZGDN101L	Diversity of Non-Chordates Lab		431
2	Major Course 2	ZGDC102T	Diversity of Chordates	4 (3-0-1)	432
		ZGDC103L	Diversity of Chordates Lab		433
3	Major Course 3	ZGCB200T	Cell Biology	4 (3-0-1)	434
		ZGCB201L	Cell Biology Lab		435
3	Major Course 4	ZGBS202T	Biosystematics	4 (3-0-1)	435
		ZGBS203L	Biosystematics Lab		437
4	Major Course 5	ZGCC204T	Animal Physiology: Controlling and Coordinating System	5 (3-0-2)	437
		ZGCC205L	Animal Physiology: Controlling and Coordinating System Lab		438
4	Major Course 6	ZGPE206T	Perspectives in Ecology	5 (3-0-2)	438
		ZGPE207L	Perspectives in Ecology Lab		439
4	Major Course 7	ZGPG208T	Principles of Genetics	4 (3-0-1)	440
		ZGPG209L	Principles of Genetics		441
5	Major Course 8	ZGFB300T	Fundamentals of Biochemistry	5 (3-0-2)	441
		ZGFB301L	Fundamentals of Biochemistry Lab		442
5	Major Course 9	ZGLS302T	Animal Physiology: Life-Sustaining Systems	5 (3-0-2)	443
		ZGLS303L	Animal Physiology: Life-Sustaining Systems Lab		444
5	Major Course 10	ZGDB304T	Developmental Biology	4 (3-0-1)	444
		ZGDB305L	Developmental Biology Lab		445
6	Major Course 11	ZGMB306T	Molecular Biology	4 (3-0-1)	446
		ZGMB307L	Molecular Biology Lab		447
6	Major Course 12	ZGIM308T	Immunology	4 (3-0-1)	447
		ZGIM309L	Immunology Lab		448
6	Major Course 13	ZGBT310T	Biotechnology	4 (3-0-1)	449
		ZGBT311L	Biotechnology Lab		450
6	Major Course 14	ZGMP312P	Minor Project	4	450
7	Major Course 15	ZGEB400T	Evolutionary Biology	5 (3-0-2)	450
		ZGEB401L	Evolutionary Biology Lab		451
7	Major Course 16	ZGEZ402T	Economic Zoology	5 (3-0-2)	452
		ZGEZ403L	Economic Zoology Lab		453
8	Major Course 17	ZGCA404T	Comparative Anatomy of Vertebrates	5 (3-0-2)	454
		ZGCA405L	Comparative Anatomy of Vertebrates Lab		455
8	Major Course 18	ZGMP406T	Biochemistry of Metabolic Processes	5 (3-0-2)	455
		ZGMP407L	Biochemistry of Metabolic Processes Lab		456

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	ZGAN104T	Animal Diversity I	4 (3-0-1)	457

		ZGAN105L	Animal Diversity I Lab		458
2	Minor Course 2	ZGAD106T	Animal Diversity II	4 (3-0-1)	459
		ZGAD107L	Animal Diversity II Lab		460
3	Minor Course 3	ZGPH210T	Environment and Public Health	4 (3-0-1)	460
		ZGPH211L	Environment and Public Health Lab		461
4	Minor Course 4	ZGAZ212T	Applied Zoology I	4 (3-0-1)	461
		ZGAZ213L	Applied Zoology I Lab		462
5	Minor Course 5	ZGAY313T	Applied Zoology II	4 (3-0-1)	463
		ZGAY314L	Applied Zoology II Lab		464
6	Minor Course 6	ZGPE315T	Principles of Ecology	4 (3-0-1)	465
		ZGPE316L	Principles of Ecology Lab		466
7	Minor Course 7	ZGAB408T	Animal Biotechnology	3 (2-0-1)	466
		ZGAB409L	Animal Biotechnology Lab		467
7	Minor Course 8	ZGRM410T	Research Methodology	2	467
8	Minor Course 9	ZGWC411T	Wildlife Conservation and Management	3 (2-0-1)	468
		ZGWC412L	Wildlife Conservation and Management Lab		469

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	ZGAC108L	Apiculture	3 (0-0-3)	471
2	S E Course 2	ZGSE109L	Sericulture	3 (0-0-3)	471
3	S E Course 3	ZGAK214L	Aquarium Fish Keeping	3 (2-0-1)	472

INTERNSHIP

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	ZGIN109I	Internship	4	474
4	Internship	ZGIN215I	Internship	4	474
5	Internship	ZGIN317I	Internship	2	474

RESEARCH PROJECT /DISSERTATION

BSC ZOOLOGY (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	ZGDI413P	Research Project Phase I	6	475
8	Research Project/Dissertation	ZGDI414P	Research Project Phase II	6	475
BSC ZOOLOGY (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	ZGDI415P	Dissertation I	18	475
8	Research Project/Dissertation	ZGDI416P	Dissertation II	20	475

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

PROGRAMME: BACHELOR OF ARTS (BA) in ECONOMICS (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	ENMI100T	Introductory Microeconomics	4	478
2	Major Course 2	ENMA101T	Introductory Macroeconomics	4	479
3	Major Course 3	ENIC200T	Intermediate Microeconomics	4	480
3	Major Course 4	ENSM201T	Statistical Methods for Economics	4	481
4	Major Course 5	ENIA202T	Intermediate Macroeconomics	5	482
4	Major Course 6	ENIE203T	International Economics	5	482
4	Major Course 7	ENFE204T	Fundamentals of Econometrics	4	483
5	Major Course 8	ENDE300T	Development Economics	5	484
5	Major Course 9	ENEE301T	Environmental Economics	5	485
5	Major Course 10	ENIF302T	Indian Financial System	4	486
6	Major Course 11	ENPO303T	Population Economics	4	487
6	Major Course 12	ENPB304T	Public Economics	4	488
6	Major Course 13	ENLE305T	Labour Economics	4	489
6	Major Course 14	ENPR306P	Project on Resource Mapping (Rural/Urban)	4	506
7	Major Course 15	ENAE400T	Applied Econometrics	5	490
7	Major Course 16	ENAG401T	Agricultural Economics	5	490
8	Major Course 17	ENHE402T	Health Economics	5	491
8	Major Course 18	ENED403T	Economics of Education	5	492

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	ENIN102T	Indian Economy	4	494
2	Minor Course 2	ENNE103T	Economy of North East India	4	495
3	Minor Course 3	ENET205T	History of Economics Thoughts	4	496
4	Minor Course 4	ENGE206T	Gender Economics	4	497
5	Minor Course 5	ENPU307T	Public Finance	4	498
6	Minor Course 6	ENRD308T	Rural Development	4	498
7	Minor Course 7	ENID404T	Industrial Economics	3	499
7	Minor Course 8	ENRM405T	Research methodology in social sciences	2	500
8	Minor Course 9	ENCD406T	Contemporary Development Policies	3	501

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	ENME104L	Fundamentals of Mathematical Economics	3	503
2	S E Course 2	ENDA105L	Data Analysis and Interpretation	3	503
3	S E Course 3	ENSP207L	Hands-on training on Data Analysis with a Statistical Package	3	504

INTERNSHIP

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	ENIN106I	Internship	4	505
4	Internship	ENIN208I	Internship	4	505
5	Internship	ENIN309I	Internship	2	505

RESEARCH PROJECT /DISSERTATION

BA ECONOMICS (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	ENDI407P	Research Project Phase I	6	506
8	Research Project/Dissertation	ENDI408P	Research Project Phase II	6	506
BA ECONOMICS (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	ENDI409P	Dissertation I	18	506
8	Research Project/Dissertation	ENDI410P	Dissertation II	20	507

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF EDUCATION

PROGRAMME: BACHELOR OF ARTS (BA) in EDUCATION (Honours/Honours with Research)

MAJOR COURSES

MINOR COURSES

SKILL ENHANCEMENT COURSES

INTERNSHIP

RESEARCH PROJECT /DISSERTATION

BA EDUCATION (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	EDDI407P	Research Project Phase I	6	542
8	Research Project/Dissertation	EDDI408P	Research Project Phase II	6	542
BA EDUCATION (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	EDDI409P	Dissertation I	18	542
8	Research Project/Dissertation	EDDI410P	Dissertation II	20	542

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF ENGLISH

PROGRAMME: BACHELOR OF ARTS (BA) in ENGLISH (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	EGIG100T	Introduction to Literary Genres 3-1-0	4	545
2	Major Course 2	EGIL101T	Introduction to English Literature 3-1-0	4	546
3	Major Course 3	EGBR200T	British Literature : 14^{th}-17 C	4	547
3	Major Course 4	EGBL201T	British Literature : 17^{th}-18 C	4	547
4	Major Course 5	EGBT202T	British Literature : 18^{th}-19^{th}C	5	548
4	Major Course 6	EGBE203T	British Literature : 19^{th}-21^{st}C	5	549
4	Major Course 7	EGIW204T	Indian Writing in English	4	549
5	Major Course 8	EGEC300T	European Classical Literature	5	550
5	Major Course 9	EGAL301T	American Literature	5	551
5	Major Course 10	EGDL302T	Diaspora Literature	4	552
6	Major Course 11	EGPC303T	Postcolonial Literature	4	552
6	Major Course 12	EGLC304T	Literary Criticism	4	553
6	Major Course 13	EGWW305T	Women's Writing	4	554
6	Major Course 14	EGMP306P	Community Based Minor Project	4	555
7	Major Course 15	EGLT400T	Literary Theory	5	556
7	Major Course 16	EGLL401T	Language and Linguistics	5	557
8	Major Course 17	EGIC402T	Indian Classical Literature	5	558
8	Major Course 18	EGPL403T	Popular Literature	5	559

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	EGBL102T	Basic Language Skills	4	560
2	Minor Course 2	EGBI103T	Basic Linguistics	4	560
3	Minor Course 3	EGAW205T	Academic Writing and Composition	4	561
4	Minor Course 4	EGEL206T	English Language Teaching	4	562
5	Minor Course 5	EGTS307T	Translation Studies	4	562
6	Minor Course 6	EGGS308T	Introduction to Gender Studies	4	562
7	Minor Course 7	EGCS404T	Introduction to Culture Studies	3	564
7	Minor Course 8	EGRM405T	Research Methodology : Research Paper and Dissertation	2	565
8	Minor Course 9	EGLA406T	Language, Literature and Culture	3	566

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	EGCW104L	Creative Writing	3	567
2	S E Course 2	EGSS105L	Soft Skills	3	567
3	S E Course 3	EGEP207L	Editing and Proofreading	3	568

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	EGN106I	Internship	4	569
4	Internship	EGIN208I	Internship	4	570
5	Internship	EGIN309I	Internship	2	571

RESEARCH PROJECTS /DISSERTATIONS

BA ENGLISH (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	EGDI407P	Research Project Phase I	6	573
8	Research Project/Dissertation	EGDI408P	Research Project Phase II	6	573
BA ENGLISH (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	EGDI409P	Dissertation I	18	573
8	Research Project/Dissertation	EGDI410P	Dissertation II	20	574

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF MASS COMMUNICATION

PROGRAMME: BACHELOR OF ARTS (BA) in MASS COMMUNICATION (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	MCIM100T	Introduction to Media and Communication	4	577
2	Major Course 2	MCIJ101T	Introduction to Journalism	4	578
3	Major Course 3	MCVC200T	Visual Communication	4	578
3	Major Course 4	MCAD201T	Advertising	4	579
4	Major Course 5	MCIV202T	Introduction to Video Production	5	580
4	Major Course 6	MCPR203T	Public Relations and Corporate Communications	5	581
4	Major Course 7	MCML204T	Media Laws and Ethics	4	582
5	Major Course 8	MCDC300T	Development Communication	5	583
5	Major Course 9	MCDP301T	Digital Photography	5	584
5	Major Course 10	MCAV302T	Animation and VFX	4	585
6	Major Course 11	MCFS303T	Film Studies	4	586
6	Major Course 12	MCMS304T	Community Media and Society	4	587
6	Major Course 13	MCMS305T	Media, Culture and Society	4	588
6	Major Course 14	MCMP306P	Media Project	4	
7	Major Course 15	MCGM400T	Global Media and Politics	5	588
7	Major Course 16	MCMM401T	Media Management and Entrepreneurship	5	589
8	Major Course 17	MCMN402T	Media in North East India	5	590
8	Major Course 18	MCDJ403T	Data Journalism	5	591

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	MCPC103T	Professional Communication	4	592
2	Minor Course 2	MCWM104T	Writing for Media	4	593
3	Minor Course 3	MCHM205T	History of Media	4	593
4	Minor Course 4	MCNM206T	Introduction to New Media	4	594
5	Minor Course 5	MCDP307T	Documentary Production	4	595
6	Minor Course 6	MCCD308T	Communication and Disaster Management	4	596
7	Minor Course 7	MCFM404T	Folk Media	3	597
7	Minor Course 8	MCIR405T	Introduction to Research	2	598
8	Minor Course 9	MCSB406T	Communication for Social Behavioural Change	3	598

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	MCNA105L	News Reading and Anchoring	3	600
2	S E Course 2	MCRP106L	Radio Production	3	601
3	S E Course 3	MCGD207L	Graphic Designing	3	602

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	MCN107I	Internship	4	604
4	Internship	MCIN208I	Internship	4	604
5	Internship	MCIN309I	Internship	2	604

RESEARCH PROJECTS /DISSERTATIONS

BA MASS COMMUNICATION (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	MCDI407P	Research Project Phase I	6	605
8	Research Project/Dissertation	MCDI408P	Research Project Phase II	6	605
BA MASS COMMUNICATION (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	MCDI409P	Dissertation I	18	605
8	Research Project/Dissertation	MCDI410P	Dissertation II	20	605

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF PSYCHOLOGY AND COUNSELLING

PROGRAMME: BACHELOR OF ARTS (BA) in PSYCHOLOGY (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	PCIP101T	Introduction to Psychology	4	608
2	Major Course 2	PCSP102T	Social Psychology	4	609
3	Major Course 3	PCPR201T	Psychological Research and Testing	4	609
3	Major Course 4	PCDP202T	Developmental Psychology	4	610
4	Major Course 5	PCPR203T	Statistics in Psychological Research	5	611
4	Major Course 6	PCBP204T	Bio Psychology	5	612
4	Major Course 7	PCOP205T	Organizational Psychology	4	613
5	Major Course 8	PCGP301T	Geriatric Psychology	5	613
5	Major Course 9	PCCP302T	Cognitive Psychology	5	615
5	Major Course 10	PCHP303T	Health Psychology	4	615
6	Major Course 11	PCFP304T	Forensic Psychology	4	616
6	Major Course 12	PCCO305T	Counselling Psychology	4	617
6	Major Course 13	PCAP306T	Abnormal Psychology-I	4	617
6	Major Course 14	PCMP307P	Minor Project/Field Study	4	631
7	Major Course 15	PCAB401T	Abnormal Psychology-II	5	618
7	Major Course 16	PCFP402T	Foundations of Psychotherapy	5	619
8	Major Course 17	PCPA403T	Psychotherapeutic Approaches	5	620
8	Major Course 18	PCCP404T	Criminal Psychology	5	621

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	PCHS103T	History and Systems of Psychology	4	622
2	Minor Course 2	PCPP104T	Human Resource Management: A Psychological Perspective	4	623
3	Minor Course 3	PCEM206T	Emotional Intelligence	4	624
4	Minor Course 4	PCEA207T	Eastern Approaches to Psychology	4	624
5	Minor Course 5	PCYG308T	Youth, Gender and Identity	4	625
6	Minor Course 6	PCPO309T	Positive Psychology	4	
7	Minor Course 7	PCCM405T	Community Psychology	3	626
		PCPW406T	Psychology for health and Wellbeing		627
7	Minor Course 8	PCAR407T	Advanced Research Methodology and Statistics	2	628
8	Minor Course 9	PCCI408T	Culture and Indigenous Psychology	3	629

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	PCPP108L	Introduction to Psychological Practicum I	3	630
2	S E Course 2	PCPP109L	Introduction to Psychological Practicum II	3	630
3	S E Course 3	PCPP210L	Introduction to Psychological Practicum III	3	631

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	PCN107I	Internship	4	633
4	Internship	PCIN209I	Internship	4	633
5	Internship	PCIN310I	Internship	2	634

RESEARCH PROJECTS /DISSERTATIONS

BA PSYCHOLOGY (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	PCDI409P	Research Project Phase I	6	635
8	Research Project/Dissertation	PCDI410P	Research Project Phase II	6	635
BA PSYCHOLOGY (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	PCDI411P	Dissertation I	18	635
8	Research Project/Dissertation	PCDI412P	Dissertation II	20	635

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF PUBLIC ADMINISTRATION

PROGRAMME: BACHELOR OF ARTS (BA) in PUBLIC ADMINISTRATION (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	PAIP100T	Introduction to Public Administration	4	639
2	Major Course 2	PAAT101T	Administrative Theory	4	640
3	Major Course 3	PAIA200T	Indian Administration	4	640
3	Major Course 4	PAPP201T	Public Policy and Governance	4	641
4	Major Course 5	PADA202T	Development Administration	5	642
4	Major Course 6	PACP203T	Comparative Public Administration	5	643
4	Major Course 7	PAAE204T	Administrative Ethics in Governance	4	643
5	Major Course 8	PAAL300T	Administrative Law	5	644
5	Major Course 9	PAEG301T	Environmental Governance	5	645
5	Major Course 10	PAGO302T	E-Governance	4	645
6	Major Course 11	PARL303T	Rural Local Governance	4	646
6	Major Course 12	PAUL304T	Urban Local Governance	4	647
6	Major Course 13	PASW305T	Social and Welfare administration	4	648
6	Major Course 14	PARW306P	Excursion / survey, and report writing	4	648
7	Major Course 15	PAFA400T	Public Financial Administration	5	648
7	Major Course 16	PAPA401T	Public Personnel Administration	5	649
8	Major Course 17	PAEP402T	Engage policy and Governance	5	650
8	Major Course 18	PAGA403T	Governance & Administration in South East Asia	5	651

MINOR COURSES (HUMAN RIGHTS –HR/INTERNATIONAL RELATIONS -IR/PUBLIC POLICY-PP/ HISTORY-HI)

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	PAHR102T	Introduction to Human Rights (HR) / Introduction to International Relations (IR)	4	654
		PAII103T			656
2	Minor Course 2	PAPA104T	Environmental Policy and Administration (HR) / Policy Making – Structures and Processes (PP) / Historiography, Early Civilizations, Ancient to Medieval Indian History (HI)	4	654
		PASP105T			660
		PAHI108T			665
3	Minor Course 3	PARI205T	Human Rights in India (HR)/ Emerging Trends in International Relations (IR)/ Modern Indian History	4	655
		PAET206T			657
		PAMH210T			666
4	Minor Course 4	PARC207T	Refugees and International Conflicts (HR/IR) / Public Policy Implementation (PP) / World History	4	657
		PAIC208T			661
		PAWH211T			668
5	Minor Course 5	PAFP307T	Foreign Policy of India (IR)/ Policy Education, Impact and Evaluation (PP)	4	658
		PAIE308T			661
6	Minor Course 6	PASP309T	Statistics for Public Administration Research (HR,IR & PP) / Public Policy in India (PP)	4	662
		PAPP310T			663
7	Minor Course 7	PAHT404T	Human Trafficking in India	3	664
7	Minor Course 8	PARM405T	Research Methodology	2	665
8	Minor Course 9	PACG406T	China and Global System (IR)	3	659
		PAIC407T	Institutions & complexities in Public Policy Process (PP)	3	663

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	PAOH106L	Office, Home Management and Secretarial practice	3	670
2	S E Course 2	PACO107L	Corporate Communication	3	670
3	S E Course 3	PAES209L	Ethics & Self Awareness	3	671

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	PAIN109I	Internship	4	672
4	Internship	PAIN212I	Internship	4	672
5	Internship	PAIN311I	Internship	2	672

RESEARCH PROJECTS /DISSERTATIONS

BA PUBLIC ADMINISTRATION (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	PCDI409P	Research Project Phase I	6	673
8	Research Project/Dissertation	PCDI410P	Research Project Phase II	6	673
BA PUBLIC ADMINISTRATION (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	PCDI411P	Dissertation I	18	673
8	Research Project/Dissertation	PCDI412P	Dissertation II	20	674

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF PHILOSOPHY

PROGRAMME: BACHELOR OF ARTS (BA) in PHILOSOPHY (Honours) Minors in English and Psychology

MAJOR COURSES

Semester	Category	Course Code		Credits	Page No
1	Major Course 1	PYAM100T	Ancient & Medieval Philosophy	4	677
2	Major Course 2	PYVU103T	Vedic & Upanishadic Philosophy	4	678
3	Major Course 3	PYSI200T	Systems of Indian Philosophy	4	679
3	Major Course 4	PYMW201T	Modern Western Philosophy	4	680
4	Major Course 5	PYCS202T	Classical and Symbolic Logic	5	681
4	Major Course 6	PYWP203T	Contemporary Western Philosophy	5	682
4	Major Course 7	PYPB204T	Philosophy of Being	4	683
5	Major Course 8	PYPK300T	Philosophy of Knowledge	5	684
5	Major Course 9	PYGR301T	Philosophy of God and Religion	5	685
5	Major Course 10	PYPM302T	Postmodernism	4	686
6	Major Course 11	PYHP304T	Philosophy of the Human Person and Mind	4	687
6	Major Course 12	PYSN305T	Philosophy of Science and Nature	4	688
6	Major Course 13	PYHS306T	Heterodox Systems of India	4	689
6	Major Course 14	PYFR307P	Project work based on Field Research	4	690
7	Major Course 15	PYET400T	Ethics	5	692
7	Major Course 16	PYVP401T	Vedantic Philosophy	5	693
8	Major Course 17	PYCI404T	Contemporary Indian Philosophy	5	694
8	Major Course 18	PYPB405T	The Philosophy of the Bhagvad Gita	5	695

MINOR COURSES (IN ENGLISH AND PSYCHOLOGY)

Semester	Category	Course Code		Credits	Page No
1	Minor Course 1	EGGE106T	General English I	4	697
2	Minor Course 2	PCGP100T	General Psychology	4	698
3	Minor Course 3	EGGE207T	General English II	4	699
4	Minor Course 4	PCDP200T	Developmental Psychology	4	700
5	Minor Course 5	EGAE309T	Alternative English I	4	701
6	Minor Course 6	PCPP300T	Theories of Personality and Positive Psychology	4	702
7	Minor Course 7	EGAE407T	Alternative English II	3	703
7	Minor Course 8	PYRM402T	Research Methodology	2	704
8	Minor Course 9	PCPS400T	Social Psychology	3	705

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code		Credits	Page No
1	S E Course 1	PYMT102L	Basics in Motor Mechanics/Tailoring and Plumbing	3	707
2	S E Course 2	PYOA104L	Basics in Office Automation	3	707
3	S E Course 3	PYBE205L	Basics in Electrical and Electronics	3	708

INTERNSHIPS (Conducted after 4th Semester and evaluated in 5th Semester)

Semester	Category	Course Code	Course Name	Credits	Page No

5	Internship	PYIN303L	Teaching in Schools	2	709

RESEARCH PROJECT/DISSERTATION

BA Philosophy (Honours)					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	PYDI403P	Dissertation Based on Themes in Philosophy or Psychology	6	710
8	Research Project/Dissertation	PYDI406P	Comprehensive Evaluation of Dissertation and Philosophy (Viva-Voce)	6	711

SCHOOL OF PROFESSIONAL STUDIES

DEPARTMENT OF HOSPITALITY AND HOTEL ADMINISTRATION

PROGRAMME: BACHELOR OF SCIENCE (BSC) in HOSPITALITY AND HOTEL ADMINISTRATION (Honours/Honours with Research)

MAJOR COURSES

Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
1	Major Course 1	HAFB100T	Introduction to food & beverage service	2	716
		HAFB101L	Introduction to food & beverage service Practical	2	717
2	Major Course 2	HARM102T	Restaurant Ethics & Menu planning	2	718
		HARM103L	Restaurant Ethics & Menu planning Practical	2	719
3	Major Course 3	HADB200T	In room dinning & beverages	2	720
		HADB201L	In room dinning & beverages Practical	2	721
3	Major Course 4	HAIG202T	Indian Gastronomy	2	721
		HAIG203L	Indian Gastronomy Practical	2	722
4	Major Course 5	HABO204T	Bar operation & outlet management	3	724
		HABO205L	Bar operation & outlet management Practical	2	725
4	Major Course 6	HAQF206T	Quantity food production	3	725
		HAQF207L	Quantity food production Practical	2	726
4	Major Course 7	HAFO208T	Front office management	2	727
		HAFO209L	Front office management Practical	2	728
5	Major Course 8	HARP300T	Restaurant planning & management	3	729
		HARP301L	Restaurant planning & management Practical	2	730
5	Major Course 9	HAGC302T	Garde manger & confectionary	3	730
		HAGC303L	Garde manger & confectionary Practical	2	731
5	Major Course 10	HARB304T	Revenue management & Budgeting	2	732
		HARB305L	Revenue management & Budgeting Practical	2	733
6	Major Course 11	HAPR306L	Training & Development (Food and Beverage)	4	733
6	Major Course 12	HALB307L	Training & Development (Gastronomy)	4	734
6	Major Course 13	HAIT308L	Training & Development (Room Division)	4	735
6	Major Course 14	HAPR309P	Training Report Presentation	4	736
7	Major Course 15	HAGT400T	Modern trends in gastronomy - I	3	737
		HAGT401L	Modern trends in gastronomy - I Practical	2	738
			OR		
		HAFO402T	Modern trends in Front office - I	3	739
		HAFO403L	Modern trends in Front office - I Practical	2	740
7	Major Course 16	HAFS404T	Modern trends in Food & beverage service – I	3	740
		HAFS405L	Modern trends in Food & beverage service – I Practical	2	741
			OR		
		HAHK406T	Modern trends in Housekeeping – I	3	742
		HAHK407L	Modern trends in Housekeeping – I Practical	2	743

8	Major Course 17	HAGY408T	Modern trends in gastronomy - II	3	743
		HAGY409L	Modern trends in gastronomy - II Practical	2	744
			OR		
		HAFR410T	Modern trends in Front office - II	3	745
		HAFR411L	Modern trends in Front office - II Practical	2	746
8	Major Course 18	HABS412T	Modern trends in Food & beverage service – II	3	747
		HABS413T	Modern trends in Food & beverage service – II Practical	2	748
			OR		
		HAHG414T	Modern trends in Housekeeping – II	3	748
		HAHG415T	Modern trends in Housekeeping – II Practical	2	749

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	HAGH104T	Basics of Gastronomy & Hygiene Practices	2	751
		HAGH105L	Basics of Gastronomy & Hygiene Practices Practical	2	752
2	Minor Course 2	HACB106T	Culinary & Baking skills	2	753
		HACB107L	Culinary & Baking skills Practical	2	754
3	Minor Course 3	HARS210T	Room reports & surface cleaning	2	755
		HARS211L	Room reports & surface cleaning Practical	2	756
4	Minor Course 4	HASB212T	Housekeeping supervision & budgeting	2	756
		HASB213L	Housekeeping supervision & budgeting Practical	2	757
5	Minor Course 5	HAHM310T	Advanced housekeeping management	2	758
		HAHN311L	Advanced housekeeping management Practical	2	759
6	Minor Course 6	HANE3012T	Eco-Gastronomy: North East Indian regions	2	759
		HANE3013L	Eco-Gastronomy: North East Indian regions Practical	4	760
7	Minor Course 7	HABT408T	Basics of Tourism	3	761
7	Minor Course 8	HARM409T	Research Methodology	2	762
8	Minor Course 9	HAOB410T	Organizational Behaviour	3	763

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	HAIR108L	Introduction to room division	3	765
2	S E Course 2	HAFA109L	Functional areas & cleaning agents	3	766
3	S E Course 3	HAIM214L	Introduction to marketing	3	768

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	HABV110I	Basic Vocational Training	4	769
4	Internship	HASV215I	Specialization Vocational Training	4	770

RESEARCH PROJECT /DISSERTATION

BSC HOSPITALITY AND HOTEL ADMINISTRATION (Honours) with Research					
Semester	**Category**	**Course Code**	**Course Name**	**Credits**	**Page No**
7	Research Project/Dissertation	HADI411P	Dissertation I	18	770
8	Research Project/Dissertation	HADI412P	Dissertation II	20	770

DETAILED SYLLABUS
ABILITY ENHANCEMENT COURSES

AECE100T/AECE200T: COMMUNICATIVE ENGLISH I
(2 credits – 30 hours) (L-T-P: 2-0-0)
Objective: The objective of this course is to equip the learners with the basic skills of effective communication in English language in all real life contexts, with area to enable fluency and clarity.

Course Outcomes
The course is intensely practice oriented and it specifically attempts to:
CO1: *Familiarize* the students with the basic tools of oral communication.
CO2: *Teach* the students to use grammar in meaningful contexts.
CO3: *Enable* the students to communicate in English confidently.

Module I: Essential grammar of English: An Introduction (10 hours)
Parts of speech; Basic sentence structures; Articles; Prepositions; Person and number; Tenses and their uses; Subject–verb agreement; Vocabulary building; Common idioms and phrases

Module II: Basic tools of oral communication in English (4 hours)
a. Syllables, stress–pattern and intonation
b. Consonants, vowels and diphthongs
c. Differences between spoken and written English

Module III: Functional English: Situational Conversation Practice (7 hours)
a. At the post office, bank, hotel
b. At the doctors', at the chemists, in the library c) at the market, Tailors', at the garage
c. In the kitchen, with a close friend, Ata wedding
d. Greetings, small talk, congratulations, condolences, offers, invitations

Module IV: Functional English: Structural Conversation Practice (6 hours)
Telephone conversation, Interviewing a film star; At a travel agent's, An interview; Buying, Hiring a taxi, buying a motorcycle; Agreement, disagreement; Hypothetical conditions, likelihood; Public speaking: Speeches of great men; Interjection, exclamation, emotion emphasis; Expressions of hope, disappointment, surprise, concern, worry; Willingness, wish, intention; Commands, requests, advice, promise, threat.

Module V: Non-Detailed Study: Reading and comprehension (3hours) Short stories and poems
a. The Blind Dog – R K Narayan
b. The Gift of the Magi- O Henry
c. The End of the Party-Graham Greene
d. Civility is all that Counts - SJ Duncan
e. The Herb Seller- Yengkhom Indira
f. Nothing Gold Can Stay- Robert Frost
g. Night of the Scorpion - Nissim Ezekiel

Suggested Readings
1. Leech, Geoffrey and Jan Svartvik, A Communicative Grammar of English, Third edition, Pearson Education, 2002.
2. Sasikumar, V and Dhamija, P.V, Spoken English, Tata McGraw Hill, New Delhi.
3. Taylor, Grant, English Conversation Practice, Tata McGraw Hill, 1975.
4. Dixon, Robert J., Everyday Dialogues in English, Prentice Hall India, 2006.
5. Apte, Madhabi, A Course in English Communication, Prentice Hall India, 2007.
6. Seely, John, The Oxford Guide to Writing and Speaking, Oxford.
7. Plathottam, George, Public Speaking: Resource Book for Effective Communication, Don Bosco Publications, Guwahati, 2007.
8. An Anthology of Short Stories prepared by Department of Humanities and Social Sciences, Assam Don Bosco University, for private circulation, 2014.

Mapping of COs with the syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	
CO2	M	M	H	H	
CO3	L	L	H	H	H

AECE101T/ AECE201T: COMMUNICATIVE ENGLISH II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Outcomes

CO1 : *Equip* students with the competence of different forms of communications
CO2 : *Develop* the study skills and communication skills necessary in formal and non- formal situations.
CO3 : *Prepare* them to face interviews and group discussions

Module I: Basics of Business Communication (6 hours)

Effective communications—benefits, methods, barriers, flow Speaking, listening, non-verbal, telephonic communications
Use of English language in business—grammatical terms, subject-verb agreement, punctuation, some basic grammatical rules

Module II: Business Letters (5 hours)

a. Introduction—layout, structure, categories of business letter
b. Rules of good writing
c. Recruitment correspondence—application, CV, interview, offer, acceptance, etc.
d. Technical report writing

Module III: Telecommunication (3 hours)

a. Fax and e-mail
b. Internet, intranet, extranet

Module IV: Internal communication (5 hours)

a. Memos- structure, tone
b. Reports- formal, informal
c. Proposals
d. Meetings, minutes, agenda

Module V: Persuasive communication (4 hours)

a. Circulars, sales letters
b. Publicity materials- Public relations, news release, newsletters
c. Notice, advertisements, leaflets

Module VI: Visual and oral communications (4 hours)

a. Forms and questionnaires
b. Visual presentation—methods, charts, diagrams
c. Writing summaries
d. Oral presentation—reading and giving speech

Module VII: Non-Detailed Study: Reading and comprehension (3 hours) Short stories and poems

a. Engine Trouble – R K Narayan
b. The Mouse – H H Munro
c. The Rocking - Horse Winner – DH Lawrence
d. Travel the Road – Mamang Dai
e. Haflong Hills – Kallol Choudhury
f. Self-Portrait – A.K. Ramanujan
g. The Solitary Reaper – William Wordsworth

Suggested Readings

1. Taylor Shirely, Communication for Business: A Practical Approach, Fourth edition, Pearson Education, 2005.
2. Rutherford, Andrea J., Basic Communication Skills for Technology, Pearson Education, 2001.
3. Mitra, Barun K, Effective Technical Communication, OUP, 2006.
4. Sen, Leena, Communication Skills, Prentice Hall India, 2007.
5. Brian, M.H. Robinson, et. al., Communicative Competence in Business English, Orient Longman, 1988.
6. Kaul, Asha, Effective Technical Communication, Prentice Hall, 2006.
7. The Oxford Anthology of Writings from North-East India(Fiction) edited by Tilottoma Misra, OUP, 2011

Mapping COs with the syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO1	H	H	H	H	H	H	H
CO2	H	H	H	H	H		
CO3		H				H	

AECH100T/AECH200T: COMMUNICATIVE HINDI I
(2 credits – 30 hours) (L-T-P: 2-0-0)

Course outcomes
On completion of this course successfully, students will be able to:
CO 1: Grasp the basic script of Devnagari for communicative usage (remembering)
CO 2: Learn the vocabulary, grammar and sentence formation for day to day communication in Hindi (understanding)
CO 3: Use the vocabulary, idiom and proverbs in communicative Hindi writing (applying)
CO 4: Understand Hindi used in common public places & offices as National Language (applying)

Module I: Introduction to Hindi language and pronunciation
a. Introduction to evolution of Hindi as National language of connectivity
b. Introduction to Hindi alphabet (Devanagri script) - vowels and consonants with their pronunciation
c. Basic greetings and expressions
✓ हिंदी भाषा का राष्ट्रीय भाषा के रूप में उत्थान: परिचयात्मक विश्लेषण
✓ हिंदी बारह खड़ी (देवनागरी लिपि) का ज्ञान- स्वर , व्यंजन एवं उनका उच्चारण
✓ सामान्य सम्बोधन एवं उद्बोधन ज्ञान

Module II: Vocabulary building and basic sentence formation
a. Vocabulary building for daily use;
b. Basic sentence formation using simple verbs and nouns
c. Introduction to daily inter personal communications / asking questions/ daily use conversations
✓ दैनिक प्रयोग की शब्दावली एवं शब्दकोष का ज्ञान
✓ संज्ञा एवं क्रिया के उपयोग से सामान्य वाक्यों की संरचना
✓ दैनिक उपयोगी सम्बोधन , स्व-सम्बोधन , प्रश्न इत्यादि पूछना एवं सामान्य बोलचाल सम्बन्धी ज्ञान

Module III: Basic level conversational practice and grammar
a. Introduction to Hindi grammar: noun, pronoun, adjective, verb, adverb
b. Sentence formation using different tenses: present, past, future
c. Use of prepositions and conjunctions in sentences
d. Role-play exercises for different situations: shopping, ordering food, asking for directions, etc.
e. Group discussion and conversation practice for grammar , sentence formation and effective communication in Hindi
✓ हिंदी व्याकरण - संज्ञा , सर्वनाम , विशेषण , क्रिया , क्रिया - विशेषण इत्यादि
✓ विभिन्न काल सन्दर्भ में वाक्य संरचना,-वर्तमान, भविष्य एवं भूत काल
✓ संबंध सूचक अव्यय/पूर्वसर्ग शब्द एवं समुच्चयबोधक/संयोजक शब्द - वाक्य संरचना में उनका उपयोग
✓ अभिनय- नाटक /वार्तालाप गतिविधि / नाट्य रचना के माध्यम से विभिन्न दैनिक परिस्थितियों के वार्तालाप का ज्ञान - दैनिक खान-पान सम्बन्धी, खरीददारी सम्बन्धी, पता-ठिकाना /दिशा सम्बन्धी इत्यादि
✓ सामूहिक परिचर्चा एवं वार्तालाप के माध्यम से व्याकरण के उपयोग, वाक्य संरचना एवं प्रभावी वार्तालाप का ज्ञान तथा अभ्यास

Module IV: Intermediate level vocabulary and grammar
a. Vocabulary building for intermediate level topics: travel, health, environment, etc.
b. Intermediate level sentence formation: complex sentences, conditional sentences, etc.
c. Idioms & proverbs and their usage in communication
✓ माध्यमिक स्तर के वार्तालाप हेतु शब्दावली निर्माण जैसे यात्रा, स्वास्थ्य , वातावरण इत्यादि क्षेत्रों में उपयोगी शब्दावली का ज्ञान
✓ माध्यमिक स्तर के वार्तालाप हेतु वाक्य संरचना का ज्ञान : संयुक्त वाक्य, उपबंध वाची वाक्य इत्यादि
✓ दैनिक वार्तालाप तथा उपयोग में आने वाली कहावतों एवं मुहावरों का ज्ञान

Module V: Advanced level conversation and writing practice
a. Advanced conversation practice on different professional topics;
b. Writing practice: Paragraph writing , message writing ,letter writing, essay writing, etc.
✓ विभिन्न कार्यकारी क्षेत्रों से सम्बंधित उच्च स्तररीय वार्तालाप का ज्ञान एवं अभ्यास
✓ लेखन अभ्यास : पात्र लेखन, सन्देश , निबंध, अनुच्छेद / वाक्यखण्ड लेखन इत्यादि

Suggested Readings
1. Richard Delacy, Sudha Joshi (2009),Elementary Hindi: Learn to Communicate in Everyday Situations -Tuttle Publishing (a work book -e-book with MP4 video)
2. Sunita Narain Mathur, Madhumita Mehrotra (2017) ,Hindi for Beginners: A Guide to Conversational Hindi (Audio Disc Included), Tuttle Publishing
3. Surendra Kumar Gambhir (2003), Communicative Hindi for Beginners: Cultural Appropriateness, Vocabulary, Grammatical Accuracy Google book

4. DRISHTI IAS BLOG(2023), Hindi Language: Its Journey So Far, https://www.drishtiias.com/blog/hindi-language-its-journey-so-far
5. Britannica blog(nd), Hindi language- history, variety, grammar and vocabulary, https://www.britannica.com/topic/Hindi-language

Mapping of COs

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M			
CO 2	L	M	H		
CO 3				H	M
CO 4			M	M	H

AECH101T/ AECH201T: COMMUNICATIVE HINDI II
(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Outcomes
On completion of this course successfully, students will be able to:
CO 1: Conceptualize vocabulary used in professional sectors (remembering)
CO 2: Apply advance level grammatical concepts in communicative usage (applying)
CO 3: Understand the cultural and regional influences on communicative Hindi (understanding)
CO 4: Effectively use Hindi in public, professional and social platforms

Module I: Advanced vocabulary building
a. Review of concepts: Review of basic level Hindi vocabulary ,pronunciation and sentence formation
b. Review of intermediate level vocabulary ,conversation and grammar
c. Vocabulary building for advanced topics: politics, economics, technology, etc.
d. Understanding and usage of synonyms, antonyms, and homonyms words
✓ सामान्य हिंदी ज्ञान एवं अवधारणा की समीक्षा: शब्द कोष , उच्चारण , वाक्य संरचना इत्यादि
✓ माध्यमिक स्तर के वार्तालाप हेतु शब्दावली , वार्तालाप व्याकरण एवं इत्यादि की समीक्षा
✓ उच्च स्तररीय वार्तालाप हेतु शब्दकोष निर्माण जैसे राजनीति , अर्थशास्त्र , विज्ञानं व् तकनीकी आदि क्षेत्रों में उपयोगी शब्दावली
✓ समानार्थी, विरुद्धार्थी एवं सामनाम शब्दों का ज्ञान एवं उपयोग

Module II: Advanced grammar concepts
a. Advanced sentence formation: passive voice, direct and indirect speech, etc.
b. Use of conjunctions, interjections, and transitional words
c. Figures of speech (Alankar) and their effective usage in communicative Hindi
✓ उच्च स्तररीय वाक्य संरचना: कर्तृवाच्य और कर्मवाच्य , प्रत्यक्ष कथन और अप्रत्यक्ष कथन इत्यादि
✓ संयोजक , विस्मयादिबोधक, संक्रामी शब्दों का उपयोग
✓ अलंकारों का ज्ञान एवं प्रभावशाली वार्तालाप में उनका प्रयोग

Module III: Conversational practice and Writing practice
a. Role-play exercises for advanced situations: negotiating, debating, expressing opinions, etc. Group discussion and conversation practice
b. Writing practice for advanced topics: newspaper articles, book/magazine articles ,reports, etc.; rhetorical usage in Hindi writing
✓ अभिनय- नाटक /वार्तालाप गतिविधि / नाट्य रचना के माध्यम से उच्च स्तररीय परिस्थितियों के वार्तालाप का ज्ञान: वाद विवाद -, सामूहिक परिचर्चा, व्यक्तिगत अभिव्यक्ति एवं वार्तालाप अभ्यास
✓ लेखन अभ्यास: आलेख पत्र समाचार , पुस्तकीय आलेख , प्रतिवेदन इत्यादि, उच्च स्तररीय लेखन कार्य में आलंकारिक/ शब्दाडंबरपूर्ण भाषा का उपयोग

Module IV: Cultural and social influences on communication
a. Analytical understanding of Cultural and social aspects of communication in Hindi-speaking regions
b. Major communication styles : across generations , cultures and regions
c. Major Hindi Dialects of different regions of India
✓ विभिन्न हिंदी भाषी क्षेत्र एवं वार्तालाप संबद्धित सामाजिक एवं सांस्कृतिक दृष्टिकोण एवं विश्लेषण
✓ विभिन्न वार्तालाप पद्धतियां : सांस्कृतिक , क्षेत्रीय एवं पीढ़ी दर पीढ़ी परिवर्तन के सन्दर्भ में
✓ विभिन्न भारतीय क्षेत्रों की प्रमुख हिंदी उपभाषाएँ एवं बोलियां

Module V: Professional communication and specialized communication

a. Communication in professional contexts :Vocabulary building for professional use ,Writing emails , letters and memos in Hindi
b. Communication used in core business sectors for specific purposes: tourism, healthcare, education, etc.
c. Vocabulary building and sentence formation for specialized professional communication
d. Role-play exercises for specialized communication scenarios viz. institutional, administrative, professional, legal, corporate and business communications etc.

- ✓ व्यावसायिक वार्तालाप सन्दर्भ : व्यावसायिक वार्तालाप हेतु शब्दकोष का ज्ञान, इ- मेल/ विपत्र, व्यावसायिक पत्र , ज्ञापन आदि
- ✓ प्रमुख व्यावसायिक क्षेत्रों जैसे भ्रमण , स्वास्थ्य , शिक्षा इत्यादि क्षेत्रों में उपयोग में आने वाली शब्दावली का ज्ञान
- ✓ व्यावसायिक वार्तालाप /सूचनाओं के आदानप्रदान- में उपयोगी शब्दावली , वाक्य संरचना एवं शब्दकोष का ज्ञान
- ✓ अभिनय- नाटक /वार्तालाप गतिविधि / नाट्य रचना के माध्यम से विशिष्ट/विशेषीकृत परिस्थितियों के वार्तालाप का ज्ञान जैसे व्यावसायिक, प्रबंधकीय, संस्थागत, व्यापारिक, संगठित / निगमि' व्यापार सम्बन्धी एवं कानूनी वार्तालाप

Module VI: Use of Hindi in digital communication

a. Opportunities and Usage of Hindi language in social media and digital communication
b. Writing online content, public contents and professional contents in Hindi through in class activities.

- ✓ सामाजिक संचार माध्यम/ सोशल मीडिया, अंकीय माध्यम/ डिजिटल मिडिया में हिंदी भाषा का प्रयोग एवं संभावनाएं
- ✓ सीधा संचार संपर्क/ आन लाइन के सन्दर्भ में प्रारूप लेखन/कंटेंट राइटिंग ,सार्वजनिक लेखन, व्यावसायिक लेखन इत्यादि का ज्ञान एवं अभ्यास

Suggested Readings

1. Soorya prasad Dixit (2012) ,Sanchar Bhasha –Hindi, Lokbharti Prakashan
2. Hindi-B- Rachna Sagar(2019), Rachna Sagar publication
3. Omkar N.Koul (2008),Modern Hindi Grammar, Donwoody Press
4. Richard Delacy, Sudha Joshi (2009), Elementary Hindi: Learn to Communicate in Everyday Situations -Tuttle Publishing (a work book -e-book with MP4 video)
5. Sunita Narain Mathur, Madhumita Mehrotra (2017) ,Hindi for Beginners: A Guide to Conversational Hindi (Audio Disc Included), Tuttle Publishing
6. Surendra Kumar Gambhir (2003), Communicative Hindi for Beginners: Cultural Appropriateness, Vocabulary, Grammatical Accuracy Google book
7. DRISHTI IAS BLOG (2023), Hindi Language: Its Journey So Far, https://www.drishtiias.com/blog/hindi-language-its-journey-so-far
8. Britannica blog (nd), Hindi language- history, variety, grammar and vocabulary, https://www.britannica.com/topic/Hindi-language

Mapping of COs

COs	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	L	M	H			
CO 2	L	M	H			
CO 3				H	L	
CO 4			M		H	H

AECA100T/AECA200T: COMMUNICATIVE ASSAMESE I
(L-T-P: 2-0-0) (2 Credits: 30 hours)

Course Objectives

To give basic idea about the Assamese Language alphabets, wordings and also to make them learn about sentence formation, tense and writing skills of Assamese

Course Outcomes

CO 1: Understand the basic concept of Assamese language.
CO 2: Remembering the conversational language.
CO 3: Analyse the reading skills of Assamese
CO 4: Apply the writing skills in daily life activities

Module I: Introduction to Assamese language and pronunciation (8 Hours)

a. History and geography of Assam
b. Introduction to Assamese alphabet and pronunciation of vowels and consonants
c. Basic greetings and expressions
d. Module II: Vocabulary building and basic sentence formation (8 Hours)
e. Vocabulary building for daily use

f. Basic sentence formation using simple verbs and nouns
g. Introducing oneself and asking questions

Module III: Grammar Basics and Conversational Practice (6 Hours)
a. Introduction to Assamese grammar: noun, pronoun, adjective, verb, adverb
b. Sentence formation using different tenses: present, past, future
c. Use of prepositions and conjunctions
d. Role-play exercises for different situations: shopping, ordering food, asking for directions, etc.
e. Group discussion and conversation practice

Module IV: Intermediate level vocabulary and basic writing practice (8 Hours)
a. Vocabulary building for intermediate level topics: travel, health, environment, etc.
b. Intermediate level sentence formation: complex sentences, conditional sentences, etc.
c. Use of idioms and proverbs,
d. Advanced conversation practice on different topics
e. Writing practice: letter writing, essay writing, etc.
f. Project Phase-I : Group discussion, project identification
g. Case study along with group discussion.

Suggested Readings

১) অসমীয়া ভাষাৰ উদ্ভৱ আৰু আৰম্ভনি- ই-বিচোৰ্জ।
২) যোগাযোগমূলক অসমীয়া ভাষা - লিখক ডঃ হেমন্ত শর্মা।
৩) অসমীয়া বর্ণমালা আৰু যুক্তাক্ষৰ-
৪) অসমীয়া ব্যাকৰণ লিখক সত্যনাথ বৰা।
৫) অসমীয়া কুঁহিপাঠ - কুবেৰ পাব্লিকেচন।
৬) অকনিৰ হাঁহি- কুবেৰ পাব্লিকেচন, শ্রী বাবুল শর্মা।

AECA101T/AECA201T: COMMUNICATIVE ASSAMESE II
(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objectives
The objectives of this course is to provide Advance Writing Skill in Assamese Language, knowledge of Assamese grammar, Conversational practice, Cultural and Social Communication, Advance Grammar Concepts and finally to provide professional communication in Assamese.

Course Outcomes
CO 1: Understand the Advanced vocabulary buildings.
CO 2: Explain the Advance sentence formation in Assamese language.
CO 3: Evaluate the importance of Assamese culture professional communication.

Module I: Advanced vocabulary building (6 Hours)
a. Review of basic Assamese pronunciation and sentence formation
b. Review of intermediate level vocabulary and grammar
c. Vocabulary building for advanced topics: politics, economics, technology. etc.
d. Use of synonyms, antonyms, and homonyms

Module II: Advanced grammar concepts (8 hours)
a. Advanced sentence formation: passive voice, direct and indirect speech, etc.
b. Use of conjunctions, interjections, and transitional words

Module III: Conversational practice and Writing practice (8 Hours)
a. Role-play exercises for advanced situations: negotiating, debating, expressing opinions, etc.
b. Group discussion and conversation practice
c. Writing practice for advanced topics: newspaper articles, reports, etc.
d. Use of rhetorical devices in writing

Module IV: Cultural and social communication (8 hours)
a. Cultural and social aspects of communication in Assam

b. Differences in communication styles across generations and regions
c. Professional communication and specialized communication
d. Communication in professional contexts
e. Vocabulary building for professional use
f. Writing emails and memos in Assamese
g. Communication for specific purposes: tourism, healthcare, education, etc.
h. Vocabulary building and sentence formation for specialized communication Role-play exercises for specialized communication scenarios

Suggested Readings

১) নতুন আৰ্হি- অসমীয়া ব্যাকৰণ আৰু ৰচনা ৫ ম, ৬ ষ্ঠ আৰু ৭ ম শ্ৰেণী, - দীনেশ্বৰ নাথ, ঐনয়ন পাব্লিক প্ৰকাশন।
২) পাঠশালাৰ- ব্যাকৰণ আৰু ৰচনা তৃতীয় আৰু চতুৰ্থ শ্ৰেণীৰ বাবে অসম বুক- দিপেন

AEFR100T/AEFR200T: FRENCH BEGINNER LEVEL I

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course objective

French Beginner level I is a course of 30 learning hours designed to help learners to acquire basic speaking, listening, writing and reading skills in French. The course introduces pronunciation, common vocabulary and basic grammar to learners with no previous knowledge of French language. This knowledge prepares students to effectively communicate in French on topics related to everyday situations. Students practice listening and speaking in real-life situations, learn to read short and practical texts in French, and gain an insight into francophone cultures. By the end of the session, learners are expected to be able to engage in some general, everyday types of conversation.

Course Outcomes

On completion of this course, students will be able to:
CO1: Recall, name and identify the vocabulary and phrases related to who, when, where andother key question words, explain and interpret their meanings and select appropiate response. (Remembering, analyzing, evaluating)
CO2: Use the vocabulary and sentence structures learned to converse and discuss on a range of topics related to everyday situations. (Understanding, applying)
CO3: Demonstrate a basic understanding of francophone countries' cultures, describe and summarize basic cultural values. (Applying, understanding, evaluating)
CO4: Analyse cultural differences and choose appropriate ways to interact with speakersfrom Francophone countries. (Analysing, evaluating)
CO5: Design and compose meaningful situational dialogues and perform them; invent skits byusing the language skills learned. (Creating)

Module I: Introduction to French phonetics and pronunciation drills (8 hours)

a) Phonetic alphabet
b) Vowels, semi-vowels and consonnants
c) Silent letters
d) Pronunciation rules

Module II: Everyday common phrases and basic sentence structures (16 hours)

a) Greeting
b) Self-introduction (nationality, profession, age, family)
c) Making requests
d) Talking about one's likes and dislikes
e) Making invitation
f) Describing a personnel

Module III: Introduction to Francophone cultures (6 hours)

a) French and its speakers
b) Pop culture: music, movies, TV, dramas
c) Lifestyles

Suggested Readings

1. *Amical A1*, CLE International, Paris, 2011

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3
CO1	M	H	
CO2		H	
CO3			H
CO4			H
CO5		H	

AEFR101T/AEFR201T: FRENCH BEGINNER LEVEL II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course objective

French Beginner level II is a course of 30 learning hours designed to help learners having completed French Beginner Level 1 to acquire more advanced language skills in French language. These skills prepare students to effectively communicate in French on topics related to various daily situations. Students enhance listening and speaking abilities in real-life situations, learn to read and write practical texts in French, and gain deeper understanding of francophone cultures. By the end of the session, learners are expected to be able to engage in a variety of simple daily conversations, read and write short paragraphs in French.

Course Outcomes

On completion of this course, students will be able to:

CO1: Recall, name and identify the vocabulary and phrases related to who, when, where and other key question words, explain and interpret their meanings and select appropriate response. (Remembering, analyzing, evaluating)

CO2: Use the vocabulary and sentence structures learned to converse and discuss on a range of topics related to everyday situations. (Understanding, applying)

CO3: Demonstrate a deeper understanding of francophone countries' cultures, describe and summarize basic cultural values. (Applying, understanding, evaluating)

CO4: Analyse cultural differences and choose appropriate ways to interact with speakers from Francophone countries. (Analysing, evaluating)

CO5: Design and compose meaningful situational dialogues and perform them; invent skits by using the language skills learned. (Creating)

Module I: Pronunciation drills (8 hours)

a) Liaison and enchaînement
b) Sound discrimination
c) Distinction of grammatical gender
d) Elision

Module II: Daily conversation and grammatical structures (16 hours)

a) Shopping
b) Expressing wishes and needs
c) Asking and giving direction
d) Telling time
e) Describing intention in near-future tense
f) Making an appointment

Module III: Introduction to Francophone cultures (6 hours)

a) Tourism
b) Arts and literature
c) Lifestyles

Suggested Readings

1. *Amical A1*, CLE International, Paris, 2011

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3
CO1	M	H	
CO2	M	H	

CO3			H
CO4			H
CO5	M	H	

AEGR100T/AEGR200T: Introduction to German Language I

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objectives:

The course aims at covering the basics of German language. It also covers a few basic grammar topics and an application of grammar in day-to-day life that is in reading, writing, listening, and speaking. On the completion of the first semester, one can understand and use familiar, everyday expressions and very simple sentences, can introduce him/her and others as well as ask others about themselves – e.g., where they live, who they know and what they own – and can respond to questions of this nature.

Course Outcomes

Students will be able to acquire a working knowledge in basic German

Course Contents:

	Topic	Grammar
1	Greetings	Personal pronouns and verbs in the present tense
2	Introduce yourself/countries/occupations/Family	Artikel: der/die/das
3	The alphabet and the numbers	Verbs
4	Languages and countries	The negation
5	People and hobbies	Expression of time (am, um, von..bis)
6	In the city	Possessive Artikel
7	Food and drink and in the restaurant	Nominative and Accusative sentences, verbs and prepositions
8	Time and season	

Suggested Reading

Netzwerk Deutsch als Fremdsprache A1, Textbook + Workbook by Stephanie Dengler

AEGR101T/AEGR201T: INTRODUCTION TO GERMAN LANGUAGE II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objectives

The course aims at covering the basics of German language. It also covers a few basic grammar topics and an application of grammar in day-to-day life that is in reading, writing, listening, and speaking. On the completion of the first semester, one can understand and use familiar, everyday expressions and very simple sentences, can introduce him/her and others as well as ask others about themselves – e.g., where they live, who they know and what they own – and can respond to questions of this nature.

Course Outcomes

Students will be able to acquire a working knowledge in basic German

Course Contents

	Topic	Grammar
1	Daily schedule and arranging appointments	Dative sentences, verbs, prepositions
2	In the office, different jobs, and leisure activity	Sentence connectives: conjunctions (und, oder, aber)
3	On the computer and emails	The group of nouns
4	Living and the home furnishings	Pronouns
5	Clothes and the shopping	Adjectives
6	Health and body parts	Modal Verbs
7	Holiday, travel, and city tour	Past Tense

Suggested Reading

Netzwerk Deutsch als Fremdsprache A1, Textbook + Workbook by Stephanie Dengler

INTRODUCTORY MULTI DISCIPLINARY COURSES

BOBI111T: BIOLOGY (2-1-0)
(3 Credits: 45 Hours) (L-T-P: 2-1-0)

Course Outcomes

1. Recall the biological observations of 18th Century that lead to major discoveries? (Remembering)
2. Compare the two, three, four and five kingdom classifications. Highlight the criteria for classification (Understanding)
3. Apply thermodynamic principles to biological systems. (Applying)
4. Analyze biological processes at the reductionist level. (Analyzing)
5. Examine DNA as a genetic material in the molecular basis of information transfer (Evaluating)

Module 1: Introduction (4 hours)

Importance of Biology: Fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft; Aspect of biology as an independent scientific discipline. History of Biology: Biological observations of the 18th Century; Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor.

Module 2: Classification (5 hours)

Classification and its criteria: Morphological, Biochemical and Ecological; Hierarchy of Classifications, based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eukaryotes. (c) energy and Carbon utilization - Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e)Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life; Organism from different based on classification for the study :1. E.coli, 2. S.cerevisiae, 3. D. Melanogaster, 4.C. elegance, 5. A. Thaliana, 6. M. Musculus

Module 3: Genetics and Information Transfer (13 hours)

a) Mendel's laws: Law of segregation and Law of independent assortment, Dominance, Recessiveness; Allele, Gene mapping, Gene interaction, Epistasis; Meiosis and Mitosis in heredity; Gene – mapping; Genetic disorders in humans; complementation in human genetics.

b) DNA as a genetic material; Structure of DNA- single stranded, double stranded and nucleosomes; Genetic code- Salient features; Gene - complementation and recombination.

Module 4: Biomolecules and Enzymes (14 hours)

a) Biomolecules of life: Micromolecules and Macromolecules- sugars, starch and cellulose; Amino acids and proteins; Nucleotides and DNA/RNA; Two carbon units and lipids. Structure of proteins: Primary, Secondary, tertiary and Quaternary; Proteins as enzymes, transporters, receptors and structural elements.

b) Enzyme classification. Mechanism of enzyme action of any two enzyme. Enzyme kinetics and kinetic parameters; RNA catalysis.

Module 5: Metabolism (5 hours)

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Key and its relation to standard free energy.

Spontaneity. ATP as an energy currency; Glycolysis and Krebs cycle; Photosynthesis; Energy yielding and energy consuming reactions. Energy charge

Module 6: Microbiology (4 hours)

Unicellular organisms; Species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of unicellular organisms. Sterilization and media compositions. Growth kinetics.

Suggested Readings

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calendar, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	M			

CO 2	H	H	M		H	
CO 3					M	
CO 4		M		M	H	H
CO 5		M	H	H		

CMBO108T: BUSINESS ORGANISATION AND COMMERCIAL PRACTICES

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objectives:

The objective of this course is to provide basic knowledge of concepts, principles, tools and techniques of business organisations and fundamentals of marketing.

Course Outcomes:

On successful completion of the course, the Students will demonstrate:

CO 1: An understanding of the nature, objectives and social responsibilities of business
CO 2: An ability to describe the different forms of organisations
CO 3: An understanding of the basic concepts of management of organizations
CO 4: An understanding of fundamentals of marketing.
CO 5: An understanding of recent developments in marketing

Module I: Introduction to Business (10 hours)

Business: Meaning, Nature, Scope and Social responsibility of Business, Objectives, Essentials of successful business; Functional areas of business. Concept of Business Organisation

Module II: Forms of Business Organization (10 hours)

Sole proprietorship: Definitions, Features, Merits and Demerits. Partnership: Definitions, partnership deed, Features, Merits and Dmerits. Joint Stock Company: Definitions, Features, Merits and Demerits.Co-operatives: Definitions, Features, Merits and Demerits.

Module III: Management of Organizations (10 hours)

Management- Meaning, Definitions, Difference between Management and Administration, Levels of Management, Objectives of Management, Functions of management- planning, organizing, staffing, directing, coordinating, controlling, Principles of Management.

Module IV: Fundamentals of Marketing (15)

Introduction to Marketing, Evolution of Marketing, Meaning and Definitions, Objectives, Importance and Functions of Marketing, Traditional Marketing Concept vs Modern Marketing Concept. Marketing V/S Selling, Marketing Myopia, Approaches to Marketing. Marketing of Services - Meaning, Definition, Features. Marketing Environment - Meaning, Environmental Scanning, Benefits of Environmental Scanning, Components of Marketing Environment; Recent developments in marketing: Social Marketing, Online Marketing, Direct Marketing, Services Marketing, Green Marketing, Relationship Marketing, Rural marketing

Mapping of COs with Syllabus

COs	Module I	Module II	Module III	Module IV
CO1	M			
CO2		H	L	
CO3			H	M
CO4			M	L

Suggested Readings

1. C B. Guptha - Business Organisation and Management, Sultan Chand & Sons.
2. Dr. S. C. Saxena - Business Administration & Management, Sahitya Bhawan.
3. M. C. Shukla - Business Organisation and Management. S Chand & Company Pvt. Ltd.
4. S.A Sherlekar - Business Organization, Himalaya Publishing House.
5. Y.K. Bhushan. Fundamentals of Business Organisation and Management, Sultan Chand & Sons.
6. R.K. Sharma, Business Organisation & Management Kalyani Publishers
7. Dr. I.M. Sahai, Dr.PadmakarAsthana,' Business Organisation & Administration', SahityaBhawan Publications Agra.
8. Kotler, Philip; Keller, Kevin Lane; Koshy, Abraham, and MithileshwarJha, Marketing Management: A South Asian Perspective, Pearson Education.
9. McCarthy, E. Jerome; Cannon, Joseph P., and William D. Perrault, Jr., Basic Marketing: A Managerial Approach, McGraw Hills.

CMAC109T: ACCOUNTANCY

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective:

To provide basic knowledge on introduction, principles and practices of accounting, accounting cycle, techniques used in accounting, Accounting Equation; Preparing journal entries, ledger accounts; Trial Balance and students' skills in preparing Financial Statements and interpreting financial statements.

Course Outcomes:

CO 1: Understanding accounting concepts, types, rules, principles and the importance of accounting information to the users.

CO 2: Recording of business transactions using the double-entry accounting, different types of transactions and preparation of ledger accounts and trial balance.

CO 3: Explain the process of preparing financial statements

CO 4: Analyse financial statements to evaluate the financial performance

Module 1: Introduction: (15 hours)

Accounting: Meaning, objectives, types, concepts; accounting information and its need to different stakeholders; Accounting Equation: Components, double entry system.

Module 2: Recording of Transactions: (10 hours)

Journal: meaning, types and preparation of journal entry; special purpose books, ledger, trial balance and adjustment entries.

Module 3: Accounting Standard (10 hours)

Generally Accepted Accounting Principles (GAAP): Meaning and its uses; International Financial Reporting Standards (IFRS): Concepts and its importance; Introduction to Accounting standard, Ind-AS

Module 4: Financial Statement: (10 hours)

Financial statement: its concepts, importance; income statement, position statement, statement of cash flow, interpretation of financial statements.

Suggested Readings

1. Mike Piper, Accounting Made Simple, Simple Subjects, LLC
2. CA Dr KM Bansal and Dr Ritu Gupta, Basic Accounting, Taxxman Publication, edition 2022
3. CA Dr. P C Tulsian, Tushar & CA Bharat Tulsian, Accountancy S Chand CA Intermediate Tulsian's
4. S. Virender, Accounting Made Easy

COs mapping to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M			
CO2		H	L	
CO3			H	M
CO4			M	L

CMBI110T: BANKING AND INSURANCE

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective:

To provide an introduction to the banking and insurance industry in India, its history, structure, and functions. To learn about the regulatory framework governing the industry, different types of financial products and services, and the impact of technology on banking and insurance services

Course outcomes:

CO 1: Remembering the concepts of banking and insurance industry in India

CO 2: Understanding the nature, types, functions, products and services of banking industry in India

CO 3: Understanding the nature, types, functions, products and services of insurance industry in India

CO 4: Apply the banking products and insurance products

CO 5: Anlayse the best banking and insurance products and services in practice

Module 1: Introduction (12 hours)

Banking Industry in India: History and evolutions, structure and functions, banking system in India, Types of banks, banking regulation act, principles of banking, nationalization of banking in India, Regulatory body of Banking Industry in India, non-banking institutions

Module 2: Banking Products and services (13 hours)
Deposits: Deposits and Advances, Deposit Mobilization, Classification and Nature of Deposit Accounts, Advances, Lending Practice, Types of Advances. Investment Management: Nature of Bank Investment, Liquidity and Profitability, services: debit card, credit card, NEFT, RTGS, Demand Draft, IMPS. Locker, overdrafts, E-banking services: Internet banking, mobile banking, UPI, core banking services, bankasurrance, ECS, Nastro, Vastro, Mirror, Loro

Module 3: Insurance Industry in India (10 hours)
Introduction: origin, meaning, concepts, importance, principles, features and types of insurance services in India; Regulatory framework

Module 4: Insurance Products and Services (10 hours)
Life insurance products: concepts, key features, types of life insurance products; Non- Life insurance products: concepts, key features, importance, types of non-life insurance products.

Suggested Readings
1. J Sethi & N Bhatia, Elements of Banking & Insurance, PHI Publishers
2. P Agarwal, Banking & Insurance, Himalayan Publication
3. M.Y. Khan, Indian Financial System, McGraw Hill Education.
4. I.M. Pandey, Principles and Practice of Banking, Macmillan Publishers India
5. Banking Regulation Act & quot; by Taxmann, Taxmann Publications Pvt Ltd.
6. AK. Mishra, Indian Banking: Operations and Practices & quot, Oxford University
7. M. N. Mishra, Insurance: Principles and Practice & quot, S. Chand & Company Ltd.
8. Benjamin Graham, The Intelligent Investor & quot, HarperCollins Publishers
9. Ravi Subramanian, The Bankster & quot; Rupa Publications, India

COs mapping to Syllabus:

COs	Module I	Module II	Module III	Module IV
CO1	M			
CO2		H	L	
CO3			H	M
CO4			M	L
CO5		M		H

MTFB107T: FUNDAMENTALS OF BUSINESS, MANAGEMENT AND ECONOMICS

(3 Credits: 45 hours) (L-T-P: 4-0-0)

Objective:
The objective of this course is to develop an understanding of the Principles and processes of business, management and economics.

Course/Learning Outcomes
At the end of the course students will be able to:
CO1: define the concept and purpose of business and state its importance (Remembering)
CO2: explain the dimensions of business environment (Understanding)
CO3: construct the nature and significance of management (Applying)
CO4: classify the principles of management (Analysing)
CO5: evaluate the various principles of economics (Evaluating)

Module I: Nature and Purpose of Business (10 Hours)
Introduction; Types of human activities; concept and characteristics of business as an economic activity; objectives of business; role of profit in business; classification of business activities; sources of business finance; industry: meaning and types; business risks; role of consumer organizations and NGOs.

Module II: Business Environment (10 Hours)
Business Environment – meaning and importance. Dimensions of Business Environment – Economic, Social, Technological, Political, and Legal. Economic Environment in India; Impact of Government Policy Changes on Business and Industry, with special reference to the adoption of the policies of liberalization privatization, and globalization

Module III: Nature and Significance of Management (5 Hours)
Understanding the concept of management; meaning of effectiveness and efficiency; objectives of management; importance of management; nature of management as a science, art and profession; roles of top, middle and lower levels of management;

Module IV: Principles of Management (6 Hours)
Concept and significance: management; Taylor's scientific management: principles and techniques; Fayol's principles of management; comparison of the contributions of Taylor and Fayol

Module V: Principles of Economics (14 Hours)
Introduction to microeconomics; Consumer's equilibrium and demand; producer behaviour and supply; Forms of market and price determination under perfect competition with simple applications; Introductory macroeconomics; national income and related aggregates; money and banking; determination of income and employment; government budget and the economy; balance of payments

Suggested Readings

1. Joseph L. Massie: Essentials of Management .PHI, New Delhi; 2015
2. Harold Koontz, Heinz Weihrich: Management. Tata McGraw Hill Pub. Co., Delhi; 2015
3. Amitai Etzioni: Modern Organizations. PHI, New Delhi; 2021
4. Jones, Gareth R. and Jennifer M. George: Contemporary Management. Tata McGraw Hill
5. Charles Hill, W.L. and Steven L.McShane: Principles of Management. Tata McGraw Hill
6. Semuel C. Certo: Modern Management. Prentice Hall, New Jersey

E Resources

1. https://www.youtube.com/watch?v=znpp0UNIV2E&list=PLvUEqaF6qJICVyZcpmKn5OvflFSgwk2kW
2. https://www.youtube.com/watch?v=I6-QB-EIdsE&list=PLJtJvO3aaWe16eg-L7sJ1Ww3021CWlJU9

Mapping of COs with Syllabus

COs	Module-1	Module-2	Module 3	Module 4
CO 1	H	M		
CO 2		H	M	
CO 3			H	M

MTIE108T: INDIAN ECONOMY

(3 Credits – 45 Hours) (L-T-P: 4-0-0)

Objective:
This course seeks to enable the student to grasp the major economic problems in India and their solution.

Course/Learning Outcomes
At the end of the course students will be able to:
CO 1: Define the features of the Indian Economy. (Remembering)
CO 2: Illustrate the policy regimes of the Indian Economy. (Understanding)
CO 3: Identify the growth, development and structural changes of the Indian economy over the years. (Applying)
CO 4: Compare the sectoral trends – growth, performance and issues. (Analysing)

Module I: Basic Issues in Economic Development (5 Hours)
Concept and Measures of Development and Underdevelopment; Human Development

Module II: Basic Features of the Indian Economy at Independence (5 Hours)
Composition of national income and occupational structure, the agrarian scene and industrial structure

Module III: Policy Regimes (8 Hours)
a. The evolution of planning and import substituting industrialization.
b. Economic Reforms since 1991.
c. Monetary and Fiscal policies with their implications on economy

Module IV: Growth, Development and Structural Change (12 Hours)
a. The experience of Growth, Development and Structural Change in different phases of growth and policy regimes across sectors and regions.
b. The Institutional Framework: Patterns of assets ownership in agriculture and industry; Policies for restructuring agrarian relations and for regulating concentration of economic power;
c. Changes in policy perspectives on the role of institutional framework after 1991.
d. Growth and Distribution; Unemployment and Poverty; Human Development; Environmental concerns.
e. Demographic Constraints: Interaction between population change and economic development.

Module V: Sectoral Trends and Issues (15 Hours)

a. *Agriculture Sector:* Agrarian growth and performance in different phases of policy regimes i.e. pre green revolution and the two phases of green revolution; Factors influencing productivity and growth; the role of technology and institutions; price policy, the public distribution system and food security.

b. *Industry and Services Sector:* Phases of Industrialisation – the rate and pattern of industrial growth across alternative policy regimes; Public sector – its role, performance and reforms; The small-scale sector; Role of Foreign capital.

c. *Financial Sector*: Structure, Performance and Reforms. Foreign Trade and balance of Payments: Structural Changes and Performance of India's Foreign Trade and Balance of Payments; Trade Policy Debate; Export policies and performance; Macro Economic Stabilisation and Structural Adjustment; India and the WTO, Role of FDI, Capital account convertibility,

Suggested Readings

1. Mishra and Puri, *Indian Economy*, Himalaya PUblishing House
2. IC Dhingra, *Indian Economics*, Sultan Chand & Sons
3. Gaurav Dutt and KPM Sundarum, *Indian Economy*, S. Chand & Company.
4. Bhagwati, J. and Desai, P. *India: Planning for industrialization*, OUP, Ch 2.
5. Patnaik, Prabhat. *Some Indian Debates on Planning*. T. J. Byres (ed.). The Indian Economy: Major Debates since Independence, OUP.
6. Ahluwalia, Montek *S. State-level Performance under Economic Reforms in India* in A. O. Krueger. (ed.). Economic Policy Reforms and the Indian Economy, The University of Chicago Press.
7. Dreze, Jean and Amartya Sen. *Economic Development and Social Opportunity*. Ch. 2. OUP.
8. Khanna, Sushil. *Financial Reforms and Industrial Sector in India*. Economic and Political Weekly. Vol. 34. No. 45.
9. Uma Kapila (ed), "*Indian Economy since Independence",* Relevant articles.
10. Rangarajan, C. and N. Jadhav. *Issues in Financial Sector Reform*. Bimal Jalan. (ed). *The Indian Economy*. Oxford University Press, New Delhi.

E Resources

1. https://www.youtube.com/watch?v=T8tTUVk_fAE&list=PLpuxPG4TUOR619ThKfb5zMit6fWMbHvIt
2. https://www.youtube.com/watch?v=pEHTuyGxAfY

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		H	H		
CO 3				H	
CO 4					H

MTEI109T: EMOTIONAL INTELLIGENCE

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Objective:

To acquaint the students with the knowledge of emotional intelligence and its importance to personal and professional success

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Acquaint with the knowledge of emotional intelligence and its importance to personal and professional success. (Knowledge)

CO 2: Recognize four domains of Emotional Intelligence (Analyse)

CO 3: Employ the emotions for better decision making (Applying)

Module I: Concept of Emotional Intelligence (10 Hours)

a. Emotion- Meaning, characteristics of emotion, components of emotion-cognitive component, physiological component, Behavioral component.

b. Types of emotions, exposing the myths about emotion, physiological or bodily changes accompanying emotions, how emotions affect our thinking and actions.

c. Development of emotions and emotional maturity, Emotional Intelligence – concept, history, measurement of EI - Bar-On Emotional Quotient Inventory, emotional competency inventory, Emotional and social competency inventory, Mayer-Salovey-Caruso Emotional Intelligence Test, self-rated emotional intelligence scale.

Module II: Intrapersonal Awareness (10 Hours)

a. Working with EI - EI can be enhanced or developed, models of EI: Ability models, Trait models, Mixed model, development of EI

b. Emotional Self Awareness – Introduction, Meaning and Definition, Emotional Self-awareness and Success, development of emotional self-awareness

c. Accurate self-assessment-meaning and definition, Introduction, accurate self-assessment and success
d. Self-confidence –Introduction, need and importance of self-confidence in one's life.

Module III: Intrapersonal Management (15 Hours)

a. Emotional self-control-meaning and definition, emotional self-control and success
b. Developing or improving the ability of emotional self-control: stage1- identification or awareness about the parent emotional state, stage2- determining underlying causes responsible for the present emotional state, stage3-adopting measures for getting control of the emotional state
c. Stress Tolerance: Stress - Meaning and definition, Factors responsible for inducing stress, Development of stress Tolerance
d. Assertiveness, Self –actualization and Optimism- concept, meaning and importance

Module IV: Interpersonal and Intrapersonal Awareness (10 Hours)

a. Interpersonal Awareness Introduction, awareness about others-meaning and definition, awareness about others and success, personal life, professional life, development of awareness about others, empathy and reality testing.
b. Interpersonal Management - Managing Interpersonal Relationships, Flexibility, Flexibility and success
c. Problem Solving – meaning, scientific method of problem solving, development of problem-solving ability.

Suggested Readings

1. Daniel Goleman (1996) Emotional Intelligence. Why it can matter more than IQ. Bantam Doubleday Dell Publishing Group.
2. Daniel Goleman (2000) Working with Emotional Intelligence. Bantam Doubleday Dell Publishing Group
3. Liz Wilson, Stephen Neale & Lisa Spencer-Arnell (2012). Emotional Intelligence Coaching. Kogan Page India Private Limited.
4. Gupta S.K. (1980), Guidance and Counselling in Indian Education, New Delhi: NCERT

Mapping of COs to syllabus

COs	Module I	Module II	Module III	Module IV
CO1	H	M	M	
CO2		H		M
CO3			H	M

MABM109T: BASIC MATHEMATICS

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

COURSE OUTCOMES:

At the end of this course students will be able to

CO 1: Demonstrate fundamental arithmetic and mathematical concepts and their applications. (Understanding).
CO 2: Utilize various methods of computing in real life problems. (Applying).
CO 3: Develop the analytical skill and the problem-solving ability. (Creating)

Module I: (9 hours)

Sets and their operations, Cartesian Products, Relation, Equivalence Relation, Functions, types of Function, Principles of Mathematical Induction, The Division algorithm, prime numers,Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module II: (12 hours)

Algebra of matrices- Determinants- properties of determinants, Adjoint of a Matrix, Inverse of a matrix, Applications of Matrices. System of linear equations and solutions, matrix Method and Cremer's Rule

Module III: (12 hours)

Mathematical functions, graphs, Concepts of limit, Fundamental theorems of limits, computation of limits, continuity of a function.

Differentiation: Meaning and geometrical interpretation; Standard derivatives; Second and higher order derivatives Applications of differentiation: Optimization of functions; Maxima and Minima involving second or higher order derivatives, L'Hospital Rule.

Module IV: (12 hours)

Probability: Random experiments, sample space, events. Definitions of Probability, computation of probability, Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.

Ratio and proportions, partnership, time and work, time and distance, Average, permutation and combination, surds and indices, simple and compound interest. algebraic equations and solutions.

Suggested Readings

1. Mathematics for business and Social Sciences. Mizrahi Sullivan. Wiley and Sons.
2. Applied Mathematics. Budnick, P., McGraw Hill Education.
3. Differential Calculus, Shanti Narayan, S.Chand and Company, 1998.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	H	H	M	M
CO 3	M	H	H	M

MABM111T: BASIC MATHEMATICS I

(3 Credits – 45 Hours) (L-T-P: 3-0-0)

Objective(s): The primary objective of this course is to introduce students to key mathematical concepts that will enhance their mathematical maturity. By engaging with these concepts, students will develop a stronger ability to understand and construct mathematical arguments effective.

Learning Outcomes:

At the end of this course students will be able to

CO1: Demonstrate fundamental knowledge on the basic aspects of statistical reasoning and drawing conclusions (Understanding).

CO2: Utilize various mathematical tools in decision making problems (Applying).

CO3: Develop the analytical skill and the problem-solving ability. (Creating)

Module I: (13 hours)

Euclid's division lemma, Fundamental Theorem of Arithmetic, LCM & HCM, Problems on L.C.M and H.C.F, Simple Equations, Quadratic Equations, Graphs of Linear Equations, Ratio and Proportion, Percentages, Profit & Loss, Square roots, Triangles, circles, and Quadrilaterals, Trigonometric ratio, Regular Polygons, Partnership Business.

Module II: (17 hours)

Puzzles, Verbal Reasoning, Logical Reasoning, Data Sufficiency, Non-Verbal Reasoning, Data Interpretation, Analytical Reasoning, Time and Distance, Problems on Trains, Time and Work Partnership, Boats and Streams, Simple Interest, Areas, Averages.

Module III: (15 hours)

Pipes and Cisterns, Compound Interest, Volumes, Profit and Loss, Odd Man Out, Races and Games, Numbers and Ages, Mixtures and Allegations, Indices and Surds, Mensuration, Permutations and Combinations, Basic Probability and Statistics, Simplification and Approximation.

Suggested Readings

1. R.V. Praveen, Quantitate Attitude and Reasoning, 7th Edition, PHI 2013.
2. Dinesh Khattar, The Pearson Guide to Objective Arithmetic for Competitive Examinations, Pearson 2nd Edition 2008.
3. Mathematics for business and Social Sciences. Mizrahi Sullivan. Wiley and Sons.
4. Applied Mathematics. Budnick, P., McGraw Hill Education.
5. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, S. Chand and Sons, 11th Ed 2002.
6. A.M. Goon, M.K. Gupta and B. Dasgupta, Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata, 2002.
7. https://ncert.nic.in/textbook.php?kemh1=0-16
8. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMT5201.pdf
9. https://www.selfstudys.com/books/ncert-notes/english/class-11th/maths/chapter-1-sets/141556
10. https://www.vmi.edu/media/content-assets/documents/academics/appliedmath/Fundamentals-of-Matrix-Algebra-3rd-Edition.pdf
11. https://youtube.com/playlist?list=PLlGLQn89mIYeJlsnivXW89RyFQBqO2zt7&feature=shared
12. https://nerdsjobportal.com/mathematics-for-competitive-exams/
13. https://nerdsjobportal.com/average/
14. https://nerdsjobportal.com/percentage/

Mapping of COS to Syllabus

	Module I	Module II	Module III
CO1	H	M	H
CO2	M	H	H
CO3	M	H	H

MABM112T: BASIC MATHEMATICS II

(3 Credits – 45 Hours)(L-T-P: 3-0-0)

Objective(s): The primary objective of this course is to introduce students to key mathematical concepts that will enhance their mathematical maturity. By engaging with these concepts, students will develop a stronger ability to understand and construct mathematical arguments effective.

Learning Outcomes: At the end of this course students will be able to

CO1: Demonstrate fundamental knowledge on the basic aspects of coordinate geometry (Understanding).
CO2: Utilize various mathematical tools in decision making problems (Applying).
CO3: Develop the analytical skill and the problem-solving ability. (Creating).
CO4: Learn basic mathematical tools to solve real life problems. (Evaluation)

Module I: (10 hours)

Rectangular coordinate system, distance and section formulae, equation of straight lines, slope of a line and angle between two lines, various forms of equations of a line: parallel to axis, point-slope form, slope-intercept form, two-point form, intercept form and normal form, Second degree homogenous equations representing straight lines and angle between them.

Module II: (12 hours)

Real number system, Rational and Irrational numbers, Numbers, Division algorithm, Divisibility test, Test of prime numbers, prime factorizations, HCF and LCM, Closure property of reals, Complex numbers, equality of complex numbers, operations on complex numbers, modulus and amplitude of a complex number, polar form of a complex number.

Module III: (12 hours)

Percentage, Average, Discount, Profit & loss; Problems based on Age, Time, speed & distance, Time & work, clock & calendar, Partnership, Ratio & Proportions, Simple Interest and Compound Interest, Effective rate of interest, Present value, net present value and future value, Annuities, Calculating value of Regular Annuity, Pipes and Cisterns, Mixture and Allegation, Boats and Streams, Races and Games.

Module IV: (11 hours)

Probability and Statistics: Random experiments, sample space, events**,** exhaustive events, mutually exclusive events. Definitions of Probability, computation of probability, Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications. Measures of Dispersion: Range, Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode and their properties, variance and standard deviation of ungrouped/grouped data.

Suggested Readings

1. Mathematics for business and Social Sciences. Mizrahi Sullivan. Wiley and Sons.
2. Applied Mathematics. Budnick, P., McGraw Hill Education.
3. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, S. Chand and Sons, 11th Ed 2002.
4. Dinesh Khattar, The Pearson Guide to Objective Arithmetic for Competitive Examinations, Pearson 2nd Edition 2008.
5. R.V. Praveen, Quantitate Attitude and Reasoning, 7th Edition, PHI 2013.
6. A.M. Goon, M.K. Gupta and B. Dasgupta, Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata, 2002.
7. Irwin Miller Marylees Miller, John E. Freund's Mathematical Statistics with Applications, 8th Edition, Pearson 2014.
8. Complex trigonometry by Aziz, Nisar and Zargar.
9. Coordinate geometry by Shanti Narayan.
10. https://www.esaral.com/class-10-maths-ncert-book-pdf/
11. https://byjus.com/maths/coordinate-geometry/
12. https://www.cuemath.com/geometry/coordinate-geometry/
13. https://byjus.com/maths/probability-and-statistics/

Mapping of COS to Syllabus

	ModuleI	ModuleII	ModuleIII	ModuleIV
CO1	H	M	M	H
CO2	H	H	M	H
CO3	M	H	H	H
CO4		H	H	H

MABM212T: BASIC MATHEMATICS III

(3 Credits – 45 Hours) (L-T-P: 3-0-0)

Objective(s): The primary objective of this course is to introduce students to key mathematical concepts that will enhance their mathematical maturity. By engaging with these concepts, students will develop a stronger ability to understand and construct mathematical arguments effective.

Course/Learning Outcomes: At the end of this course students will be able to

CO1: Demonstrate fundamental arithmetic and mathematical concepts and their applications. (Understanding)
CO2: Solve problems related to matrices and calculus with their basic concepts. (Analysing)
CO3: Utilize various methods of computing in real life problems. (Applying).
CO4: Develop the analytical skill and the problem-solving ability. (Creating)

Module I: (11 hours)
Introduction to set theory: Sets and their representations, Types of sets, Subsets and subsets of a set of real numbers, especially intervals (with notations), Power set, Finite set, Infinite set, Countable and Uncountable sets and their examples, Venn diagrams, Basic operations, D'-Morgans laws.

Module II: (11hours)
Ordered pairs, Cartesian product of sets, number of elements in the Cartesian product of two finite sets, Relations, domain, co-domain and range of a relation, types of relations, Function as a special type of relation, types of function, operations on functions.

Module III: (10 hours)
Mathematical functions, graphs, Concepts of limit, Fundamental theorems of limits, computation of limits, continuity of a function. Differentiation: Meaning and geometrical interpretation; Standard derivatives; Second and higher order derivatives Applications of differentiation: Optimization of functions; Maxima and Minima involving second or higher order derivatives, L'Hospital Rule.

Module IV: (13 hours)
Matrices, Types of matrices, order, equality, types of matrices, Operations on matrices, transpose of a matrix, symmetric and skew symmetric matrices. Determinants- properties of determinants, minors, co-factors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. System of linear equations, consistency, inconsistency and solutions of system of linear equations, Method and Cremer's Rule

Suggested Readings

1. Mathematics for business and Social Sciences. Mizrahi Sullivan. Wiley and Sons.
2. Set theory Schaum's series.
3. Applied Mathematics. Budnick, P., McGraw Hill Education.
4. https://www.esaral.com/class-10-maths-ncert-book-pdf/
5. https://ocw.mit.edu/ans7870/resources/Strang/Edited/Calculus/Calculus.pdf
6. https://www.esaral.com/class-10-maths-ncert-book-pdf/
7. Differential Calculus, Shanti Narayan, S.Chand and Company, 1998.
8. https://ocw.mit.edu/ans7870/resources/Strang/Edited/Calculus/Calculus.pdf

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M	M	M
CO2	M	H	M	H
CO3	M	H	H	M
CO4		M	H	H

CAOP108T: OFFICE PRODUCTIVITY TOOLS

(3 Credit, 45 hours) (L-T-P: 1-1-1)

Objective:

This course will make the learners capable of handling all day-to-day office related work. The course will make the students to confidently write professional documents, do all analysis related works and present their outcome as well as any related matters in a professional way.

Course Outcomes:

After learning this course, the students will be able to:

1. Define the concepts of worksheet and workbook. (Remembering)
2. Explain the procedure of opening, closing and saving of workbooks. Outlining the technique of creating and saving of documents. (Understanding)
3. Making use of word processing for creating and saving of document. (Applying)
4. Appraising of PowerPoint in making the presentation. (Evaluating)

Module I: Spreadsheet Fundamentals

Introduction: Understanding the concept of spreadsheets and their relevance in business, Overview of popular spreadsheet software (e.g., Microsoft Excel, Google Sheets, etc.), Concept of worksheets and workbooks, creating, opening, closing and saving workbooks, Navigating the spreadsheet interface. Entering and formatting data, including numbers, text, and dates, using basic formulas and functions for calculations, Sorting and filtering data, Introduction to charts and graphs for data visualization, performing more advanced calculations using functions like SUMIF, COUNTIF, etc., Creating meaningful charts and graphs, Formatting techniques for improved visualization, Exporting and integrating spreadsheet data into presentations.

Module II: Essential Business Documentation

Introduction: Introduction to word processing software (e.g., Microsoft Word, Google Docs), Creating and saving your document, Formatting text, paragraphs, and pages; Working with fonts, styles, and alignment, working with paragraph formatting techniques using indents, tabs, alignment, spacing, bullets and numbering and creating borders; Page setup and sections: Setting page margins, orientation, headers and footers, endnotes and footnotes, creating section breaks and page borders; Working with tables: Creating tables, modifying table layout and design, inserting graphics in a table; Creating professional documents: reports, memos, letters, etc., Mail merge

Module III: Corporate Presentation

Introduction: Overview of presentation software (e.g., Microsoft PowerPoint, Google Slides); Creating a new presentation using a design template, creating and managing slides, using content placeholders, creating graphs, tables, diagrams, organization charts, inserting clip art and images, previewing presentation in slide show, understanding master views, using title master, slide master, handout master and notes master, working with headers and footers, using hyperlinks. Animation and multimedia: Using and applying animation schemes, custom animation, understanding sound file formats and video types, adding music, sound and video clips. Final presentation: Applying transition to slides, using hidden slides. using custom shows, using on screen pen and adding and accessing notes during a presentation.

Suggested Readings

1. Rajaraman, V. Introduction to Information Technology, Second Edition.PHI.
2. Sinha, Pradeep K. and PreetiSinh , Foundation of Computing, First Edition.BPB Publication.
3. http://www.bpbonline.com/foundation-of-computing.html ISBN-10: 8176566636
4. Rajaraman, V. Analysis and design of information Systems. Third Edition, PHI.
5. Sadagopan, S. Management Information Systems. Second Edition, PHI.
6. LibreOffice Team, Getting Started with LibreOffice, Shroff Publication, ISBN (13) 9789351107903

E Resources

1. Learn LibreOffice now, start using the FREE suite: Impress,Udemy
2. Learn LibreOffice now, start using the FREE suite: Calc, Udemy
3. Learn LibreOffice now, start using the FREE suite: Writer, Udemy
4. LibreOffice Base for Beginners, Udemy

Evaluation

1. **Theory is of 1 Credit - 15 Hours (5 Hours for each of the 3 Modules):**
   - **Assessment:** The theory component will be assessed through written exams.
   - **Evaluation:** Class Test 1 and Class Test 2 [10 Marks] , End-Semester Exam [30 Marks]
2. **Tutorial (1 Credit - Self-Learning):**
   - **Assessment:** Students will complete watching the e-learning platforms such as the Spoken Tutorial courses.
   - **Evaluation:** Individual Assignment [10 Marks]
3. **Practical is of 1 Credit - 30 Hours (10 Hours for each of the 3 Modules):**
   - **Assessment:** Practical sessions will be evaluated through laboratory assignments and exams.
   - **Evaluation:** Class Test 1 and Class Test 2 [10 Marks] , End-Semester Exam [30 Marks]

Additionally, like other courses, there will be **non-formal evaluation** of 5 marks and **attendance percentage evaluation** out of 5 marks.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1	L	L	L
CO2	M	H	H
CO3	H	H	M
CO4		M	M

CAPY109T: PYTHON FOR BUSINESS ANALYTICS

(3 Credits – 45 Hours) (L-T-P: 1-2-0)

Objective

This course will introduce the students to relevant modules of Python programming which is an extremely versatile open source programming language for statistics, management, data science and business analysis. The course is designed to build up opportunities to understand the data analysis for business studies.

COURSE/LEARNING OUTCOMES (CO)

1. Explain the definition and usage of python programming for data analysis and problem solving (Remembering).
2. Understand why it is necessary to evaluate the data set through data visualization (Understanding).
3. Apply the knowledge and skills acquired during the course to write and test the python program for addressing day to day problem statement on data set. (Applying).
4. Know what type of analysis and chart to adopt for efficient assessment of problem solving. (Analyzing/Creating).

Module I (12 hours)

Basic Syntax, data type, variables, operator, list, tuples, set, dictionaries, statements-If, if else, else if, loops, functions, dates, maths

Module II (13 hours)

Creating/reading csv, excel Files, file operations, Numpy, Panda, SciPy, Matplotlib, Statistics methods, String operations with variable.

Module III (20 hours)

Data visualization for business dataset, Pie chart, bar chart, box plot, histogram, line graphs, scatter plot, Normal distribution, Binomial distribution, classification, Time series analysis, T-Test, Chi-square test, Train/Test, Confusion Matrix, perform statistical analysis using Python

Suggested Readings

1. Reema Thareja, “Python Programming using problem solving approach”, Oxford University press, 2017. ISBN-13: 978-0199480173
2. Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
4. Wesley J Chun, “Core Python Applications Programming”, 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.

Mapping of Cos to syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	M	H
CO 2		M	H
CO 3	M	M	H
CO 4	L	H	H

PSNN106T: NANOSCIENCE AND NANOTECHNOLOGY (3-0-0)

Course Outcomes

CO 1: Recognize basic concepts of nano science and underlying principles of nanomaterials. (Remembering)
CO 2: Build knowledge on fabrication processes of nano materials and devices in the nanoscale. (Understanding)
CO 3: Assess nano materials and devices in the nanoscale using various characterization tools. (Applying)
CO 4: Analyze nanomaterials for applications in various technologies (Analysis)

Module I: Basics of Nanotechnology (8 hours)

Importance of Nanotechnology, History of Nanotechnology, Properties of Nanomaterials, Difference between Bulk and Nanomaterial, Molecular building blocks for nanostructure systems, Forces between atoms and molecules, Size effects, Fraction of Surface Atoms, Surface Energy and Surface Stress.

Module II: Physics of nanomaterials (10 hours)

Atomic scale structure of nanomaterials; Concept of quantum confinement: 0D, 1D and 2D nanostructures; Schrodinger equation- Infinite potential well, Core-shell quantum dots. Electronic and optical characteristic properties of quantum dots; Nanophotonics, Plasmonics – plasmons and surface plasmons, SPR.

Module III: Synthesis/fabrication techniques of nanomaterials (12 hours)
Top down approach, Lithography – electron beam and ion beam techniques, Etching – wet and dry etching, Bottom up approach - Solvent based and template based synthesis, other important synthesis methods like CVD, PVD etc.; Doping, Nucleation, Growth and Stability of colloidal nanoparticles, concept of self- assembly.

Module IV: Characterization methods (8 hours)
Optical Microscopy, Transmission electron microscopy (TEM), Scanning electron microscopy (SEM), Atomic force microscopy (AFM)

Module V: Applications (7 hours)
Different application of Nanotechnology, Micro and Nano electromechanical systems

Suggested Readings

1. Introduction to nanoscience, G. L. Hornyak, J. Dutta and H. F. Tibbals, A. Rao, CRC Press.
2. Introduction to nanotechnology, G. L. Hornyak, J. Dutta, H. F. Tibbals and A. Rao, CRC Press.
3. Introduction to Nanotechnology, C. P. Poole, Jr. and Frank J. Owens, Wiley India Pvt. Ltd.
4. Nanotechnology: Principles & Practices, S. K. Kulkarni, Capital Publishing Company.
5. Introduction to Nanoscience and Technology, K. K. Chattopadhyay and A. N. Banerjee, PHI Learning Private Limited.
6. Nanotechnology, Richard Booker and Earl Boysen, John Wiley and Sons.
7. Nanoparticle Technology Handbook, M. Hosokawa, K. Nogi and M. Naita, T. Yokoyama, Elsevier.
8. Springer Handbook of Nanotechnology, Bharat Bhushan, Springer-Verlag.

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	H			
CO 2			H		
CO 3				H	
CO 4					H

PSRS107T: RADIATION AND SAFETY MEASUREMENTS

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

COURSE OUTCOMES

CO 1: Solve problems using basic concept of Atomic and Nuclear Physics. (Analysis)
CO 2: Explain the theories of interaction of radiation with matter. (Understanding)
CO 3: Explain the working principles and functioning of radiation detection devices.(Understanding)
CO 4: Analyse the various issues with Radiation Safety Management. (Analysis)

Module I: Basics of Atomic and Nuclear Physics (7 hours)
Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half-life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

Module II: Interaction of Radiation with Matter (7 hours)
Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, Interaction of Photons - Photo- electric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, Interaction of Charged Particles: Heavy charged particles - Beth- Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung), Interaction of Neutrons- Collision, slowing down and Moderation.

Module III: Radiation Detection and Monitoring Devices (8 hours)
Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, mrads, rads, gy, rem, mrem, SV and mSV. absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC). Radiation detection: Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters (MWPC) and Geiger Muller Counter), Scintillation Detectors (Inorganic and Organic Scintillators), Solid States Detectors and Neutron Detectors, Thermo luminescent Dosimetry.

Module IV: Radiation Safety Management (8 hours)
Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Elementary idea of dosimetry. Nuclear waste and disposal management. Brief idea about Accelerator driven Sub- critical system (ADS) for waste management. management.

Suggested Readings

1. Nuclear and Particle Physics, W. E. Burcham and M. Jobes, Longman
2. Radiation detection and measurements, G. F. Knoll
3. Thermoluninescense Dosimetry, A. F. Mcknlay, Adam Hilger Ltd.
4. Fundamental Physics of Radiology, W. J. Meredith and J. B. Massey, John Wright and Sons
5. Fundamentals of Radiation Dosimetry, J. R. Greening, Adam Hilger Ltd
6. Practical Applications of Radioactivity and Nuclear Radiations, G. C. Lowentaland P. L. Airey, Cambridge University Press.
7. An Introduction to Radiation Protection, A. Martin and S. A. Harbisor, John Willey & Sons, Inc.
8. NCRP, ICRP, ICRU, IAEA, AERB Publications.
9. Medical Radiation Physics, W. R. Hendee, Year Book – Medical Publishers Inc.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2		H		
CO 3			H	
CO 4				H

PSAA212T: ASTROPHYSICS AND ASTRONOMY

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

COURSE OUTCOMES
CO1: Explain Celestial coordinates and planetary motion (understanding)
CO2: Describe stellar evolution (Understanding)
CO3: Explain the expansion of the universe (Understanding)

Module I: Planets and Solar System (13 hours)
Celestial coordinates- different systems, timekeeping (sidereal vs synodic period); Planetary motions; Light & Energy – Telescopes and observatory (For different range of wavelengths) - Optics - Detectors; Planets: Formation of Solar System - planet types - planet atmospheres - extrasolar planets;

Module II: Stellar Parameters and their Evolution (12 hours)
Stars: Measuring stellar characteristics (temperature, distance, luminosity, mass, size) - HR diagram - stellar structure (equilibrium, nuclear reactions, energy transport) - stellar evolution; Use of software to observe the night sky.

Module III: Basic Cosmology (20 hours)
Galaxies: Our Milky Way - Galactic structure - Galactic rotation - Galaxy types - Galaxy formation;Cosmology: Expansion of the Universe - redshifts - supernovae - the Big Bang - history of the Universe - fate of the Universe.

Suggested Readings

1. BW Carroll & DA Ostlie, An Introduction to Modern Astrophysics, Latest Edition, Addison-Wesley.
2. Frank Shu, The Physical Universe, Latest Edition, University Science Books
3. Martin Harwit, Astrophysical Concepts, Latest Edition, Springer.
4. T. Padmanabhan, Invitation to Astrophysics, Latest Edition, World Scientific Publishing Co.
5. T. Padmanabhan, Theoretical Astrophysics vols 1-3, Latest Edition, Cambridge University Press.
6. Malcolm Longair, High Energy Astrophysics, vols 1-2, Latest Edition, Cambridge University Press.
7. Sparke and Gallaghar, Galaxies in the Universe: An Introduction, Latest Edition, Cambridge University Press.
8. Dina Prialnik: An Introduction to the Theory of Stellar Structure and Evolution, Latest Edition, Cambridge University Press.

	Module I	Module II	Module III

CO 1	H		
CO 2		H	
CO 3			H

BOBC116T: BIODIVERSITY CONSERVATION

(3 credits-45 hours) (L-T-P:3-0-0)

Course Outcomes:

At the end of this course, student will be able to:

CO1: Interpret biodiversity and illustrate the different levels and values of biodiversity (Understanding)

CO2: Identify the different categories and threats to biodiversity (Applying)

CO3: Recognize the various strategies needed and laws of biodiversity conservation (Understanding)

Module I: Biodiversity and Its Importance (15 hours)

Concept of biodiversity; Patterns of biodiversity; species, genes, and ecosystems biodiversity; Scale of biodiversity: alpha, beta and gamma diversity; Measuring biodiversity; Values of biodiversity: Instrumental and intrinsic values; Biodiversity services

Module II: Threats to Biodiversity (15 hours)

Types of extinctions; Sixth extinction; Extinction processes; Rate of extinction; Vulnerability of species to extinction; IUCN threat categories; Red data book; Threats: human impacts on biodiversity, Climate change interactions; Threats to biodiversity in India and world

Module III: Maintaining Biodiversity and Biodiversity Acts (15 hours)

Global biodiversity; Biodiversity of India; Strategies for biodiversity conservation, *ex-situ* and *in-situ* conservation; Protecting ecosystems; Managing ecosystems; Managing populations; Social approaches to conservation; Biodiversity acts; International conventions and protocols related to biodiversity; Indian initiatives in biodiversity conservations

Suggested Readings

1. Singh, J.S., Singh, S.P., & Gupta, S. (2014). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
2. Sharma PD. Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition
3. Krishnamurthy, K.V. (2003). Textbook of Biodiversity. Science Publishers, Inc., Enfield, NH, USA
4. Krishnamurthy, K.V. (2018). An Advanced Textbook on Biodiversity: Principles and Practice. Oxford & IBH Publishing Co Pvt. Ltd

Mapping of CO to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H	M	M
CO2		H	M
CO3		M	H

BOGN117T: GARDENING AND NURSERY MANAGEMENT

(3 credit-45 hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO1: Learn basic and scientific knowledge on Gardening and nursery raising techniques for producing quality planting materials (Knowledge)

CO2: Understand the basic knowledge about tools, and equipment used in nursery for plant production (Understanding)

CO3: Develop the required skill for proper management of commercial nursery (Apply)

Module I: Introduction of Garden and Nursery (15 Hours)

Garden and Nursery: definition, types, objectives and objectives; Nursery trade in India, Scope for commercial nursery. Different types of ornamental / flowering plants, some popular ornamental plant species plant material and designs

Module II: Garden and Nursery management (15 Hours)

Planning and lay out/structures of commercial nursery, plant materials, skills, tools and equipment required in gardens and nursery development and management. Manuring, watering, management of pests and diseases and harvesting.

Module III: Propagation methods (15 Hours)

Seed Propagation – procedure of seed propagation; Vegetative propagation-propagation by cuttings; Propagation by layering, propagation by budding, propagation by grafting, propagation by specialized vegetative structures, propagation by Tubers, Rhizomes; Propagation by specialized organs/structures-tubers, rhizomes, suckers

Suggested Readings

1. Bose T.K. & Mukherjee, D. 1972. Gardening In India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K. 1989. Plant Propagation, Wile Eastern Ltd., Bangalore, Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H	M	M
CO2	M	H	M
CO3	L	M	H

BOEB118T: ECONOMIC BOTANY

(2 credits-30 hours) (L-T-P:2-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO1: Recall the concept of origin of crops, and evolution of new crops (Remembering)

CO2: Perceive the ideas of different economically useful crops and their products processing (Understanding)

Module I: Cereals (6 Hours)

Wheat and rice- Origin, morphology and uses

Module II: Legumes (4 Hours)

General account with special reference to Gram and soybean

Module III: Spices (6 Hours)

General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses).

Module IV: Beverages (4 Hours)

Tea (morphology, processing, uses)

Module V: Oils and Fats (4 Hours)

General description with special reference to groundnut

Module VI: Fibre Yielding Plants (4 Hours)

General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Module VII: Drug-yielding plants (2 Hours)

Therapeutic drugs with special reference to *Cinchona* and *Papaver*

Suggested Readings

1. Kochhar, S.L. (2011) Economic Botany in the Tropics, 4th edition, MacMillan Publishers India Ltd., New Delhi
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	M	L	L	M	M	M
CO2	H	H	H	H	H	H	H

BOEB119L: ECONOMIC BOTANY LAB

(1 Credit- 30 Hours) (L-T-P:0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO1: Recall the basic knowledge about economically important plants (Remembering)

Practical:

Expt.1. Study of economically important plants: Wheat, rice, Gram, Soybean, Black pepper, Clove, Tea, Cotton, Groundnut, Cinchona, Papaver through specimens, sections and microchemical tests.

Mapping of COs to Syllabus

Course Outcomes	Expt. I
CO1	H

ZGNC110T: NUTRITION FOR COMMUNITY HEALTH

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s): *The impart the knowledge of Community Nutrition actions is to adequate lifestyles related to food consumption patterns in order to improve the quality of life and contribute to health promotion of the population in the community*

Course Outcomes

CO 1: Understand the causes and consequences of nutrition problems in the society (Remembering and understanding).

CO 2: To understand and be familiar with various approaches of nutrition and health (Understanding).

CO 3: Apply the components of health and the role of nutrition. (Applying)

CO 4: Evaluate Develop ability to evaluate fitness and well-being through nutrition. (Analyzing)

Module-I: Food, Nutrition and Health: 8 Hours

Definition of Community Health; Introduction, Food and its Functions, Meaning of Nutrition and Nutrients: Action, Interaction and Balance, Handling of Food and Nutrients by the Body, Social, Psychological and Economic Aspects of Nutrition, The Concept of Health: Physical Health, Mental Health, Social Health and Spiritual Health; Meaning of Nutritional Status; Interrelationship between Nutrition and Health

Module-II: The Macronutrients: 9 Hours

Carbohydrates, Protein, Lipids and Water. Importance of Macronutrients for Health.

Module-III: The Micronutrients: 9 Hours

Minerals: Minerals Required In Larger Amounts, Minerals Required in Smaller; Vitamins: Fat-soluble Vitamins, Water-soluble Vitamins, Importance of Vitamins and Minerals.

Module-IV: Planning Balanced Diets: 9 Hours

Concept of a Balanced Diet, Use of Recommended Dietary Intakes in Planning Balanced Diets, Guidelines for Planning Balanced Diets

Module-V: Malnutrition: 3 Hours

Concept of Malnutrition, Diseases related to Malnutrition.

Module-VI: Food Safety: 4 Hours

Food Contamination, Food Adulteration, Simple Tests to Detect Adulteration, Food Laws- Food Standards, Certification and Quality Control, Agencies Involved in Consumer Protection

Module-VII: Food Supplements: 3 Hours

Definition of Food Supplements, Nutritional Gap, Benefits of Food supplements, Common food supplements

Suggested Readings

1. Nutrition for Community; Shri Chakradhar Publication Pvt. Ltd.
2. Fundamentals of Food and Nutrition, by Tejmeet Rekhi and Heena Yadav, Elite Publishing Houser)
3. Text Book of Community Nutrition, by Suryatapa Das, Academic Publishers

Mapping of COs to Syllabus

	M-I	M-II	M-III	M -IV	M-V	M-VI	M-VII
CO 1	M			M			H
CO 2	H	H	H	H	H	H	
CO 3	L				L	L	
CO 4	H				H		

ZGIB112T: INTRODUCTION TO BIOLOGY OF INSECTA

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Outcomes

CO 1: To demonstrate the concepts of insect biology including basic systematics of insects and interpret the behavioural aspects of social insects. (Understanding)
CO 2: Illustrate the role of insects as vectors and pests. (Understanding)
CO 3: Develop an understanding of insect plant interactions. (Understanding)
CO 4: Acquire knowledge regarding morphology of insects and physiology of insect body systems. (Understanding)

Module I: Introduction (2 Hours)
General Features of Insects Distribution and Success of Insects on the Earth

Module II: Insect Taxonomy (5 Hours)
Basis of insect classification; Classification of insects up to orders

Module III: General Morphology of Insects (8 Hours)
External Features; Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits Thorax: Wings and wing articulation, Types of Legs adapted to diverse habitat, Abdominal appendages and genitalia

Module IV: Physiology of Insects (20 Hours)
Structure and physiology of Insect body systems - Integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductive, and nervous system Sensory receptors Growth and metamorphosis

Module V: Insect Society (2 Hours)
Group of social insects and their social life Social organization and social behaviour (w.r.t. any one example)

Module VI: Insect Plant Interaction (3 Hours)
Theory of coevolution, role of allelochemicals in host plant mediation Host-plant selection by phytophagous insects, Insects as plant pests

Module VII: Insects as Vectors (5 Hours)
Insects as mechanical and Biological vectors, Brief discussion on houseflies and mosquitoes as important insect vectors

Suggested Readings

1. A general text book of entomology, Imms , A. D., Chapman & Hall, UK
2. The Insects: Structure and function, Chapman, R. F., Cambridge University Press, UK
3. Principles of Insect Morphology, Snodgrass, R. E., Cornell Univ. Press, USA
4. Introduction to the study of insects, Borror, D. J., Triplehorn, C. A., and Johnson, N. F., M Saunders College Publication, USA
5. The Insect Societies, Wilson, E. O., Harward Univ. Press, UK
6. Host Selection by Phytophagous insects, Bernays, E. A., and Chapman, R. F., Chapman andHall, New York, USA
7. Physiological system in Insects, Klowden, M. J., Academic Press, USA
8. The Insects, An outline of Entomology, Gullan, P. J. , and Cranston, P. S., Wiley Blackwell,UK
9. Insect Physiology and Biochemistry, Nation, J. L., CRC Press, USA

Mapping of COs to Syllabus

CO	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	M	H	M				
CO2						H	H
CO3					H	M	
CO4	E	E	E	H	M	E	

ZGVB113T: PUBLIC HEALTH AND VECTOR BORN DISEASES

(3 Credits: 45 Hours) (L-T-P:3-0-0)
Objective(s): *To impart a comprehensive overview of vectors, the diseases they transmit and their distribution*.

Course Outcomes

CO 1: Understand the individual components of vector-borne disease transmission. (Remembering and understanding).
CO 2: To understand and evaluate vector-borne pathogen control measures (Understanding).
CO 3: Explain the ecological components of vector-borne disease transmission (Analyzing)
CO 4: Demonstrate how vector biology is integral to our public health history. (Applying)

Module-I: Introduction to Public Health: 5 Hours
Definition of Public Health, Public Health vs Medical Care, The Sciences of Public Health, Core Disciplines within Public Health, Functions of Public Health, Public Health Infrastructure in India, Public Health in India: An overview.

Module-II: Introduction to Vector Born Diseases: 3 Hours
Concept of Vectors, Vector born diseases and Pathogens.

Module-III: Vector Born Diseases caused by Mosquitoes: 13Hours
Chikungunya, Dengue, Zika fever, Yellow fever, Filariasis, Malaria, West Nile fever, Japanese Encephalities- Causative vectors and Pathogens; Transmission, Symtoms, Control and Prevention.

Module-IV: Vector Born Diseases caused by Flies: 10 Hours
Leishmaniasis, African Trypanosomiasis, Onchocerciasis (river blindness) - Causative Vectors and Pathogens; Transmission, Symtoms, Control and Prevention.

Module-V: Vector Born Diseases caused by Ticks and Mites: 14 Hours
Lyme Disease, Anaplasmosis, Babesiosis, Ehrlichiosis, Borrelia miyamotoi Disease, Borrelia mayonii Disease, Scabies and Trombiculosis- Causative vectors and Pathogens; Transmission, Symptoms, Control and Prevention.

Suggested Readings

1. Sougata Ghosh: Textbook of Medical Parasitology, Jaypee Brothers Medical Publishers (P) Ltd
2. Venkitaraman: Economic Zoology, Sudarsana Publishers
3. Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers
4. Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.
5. Ananthakrishnan, T. N. and K.G. Shivaramakrishnan. Ecological entomology: Insect life in odd environment. Scientific Pub.: India
6. David, B. V and T.N. Ananthakrishnan. General and Applied Entomology. 2nd Edition. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi
7. Fenemore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)
8. Packer, B. Aquaponics System: A Practical Guide to Building and Maintaining Your Own BackyardAquaponics

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M			E
CO2		E		
CO3	M			M
CO4			E	

EGDH107T: DIGITAL HUMANITIES

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Outcomes

CO 1: *Define* the key concepts in Digital Humanities (Remembering)
CO 2: *Apply* the use of key tools and applications of digital technologies pertinent to Digital Humanities. (Applying)
CO 3: *Examine* critically existing digital platforms based on features that can be used for data creation, curation and analysis within different fields such as literature, history, arts, and music. (Analyzing)

Module I: Digital Society and Humanities (5 hours)
Digital Society - Concepts
The humanities: transitions -Oral, text-based practices, Post Humanism

Module II: Introduction to Digital Humanities (5 hours)
The Evolution of Digital Humanities
Digital Humanities -Meaning, definitions and nature, Features and principles

Module III: Digital Libraries and Archiving (15 hours)
Digital Libraries-Types
Archiving-Tools and techniques
Open Data-Need and application

Module IV: Computing and Human Technology Interaction (20 hours)

Practice:

- Basic digital tools used to document data (such as PDF creators, audio-video tools and social media), in storage systems (shared drive, blogs, drop box, and websites)

Practice:

- -visual display various intersections of disciplines that Digital Humanities encompasses
- -developing skills for interactive interfaces on a digital platform (Practical application)
- -Scientific communication (online publishing, e-correspondence)

Suggested Readings

1. Adolphs, Svenja and Dawn Knight, editors. *The Routledge Handbook of English Language and Digital Humanities.* Delhi: Routledge, 2020.
2. Berry, David M., and Anders Fagerjord. *Digital Humanities: Knowledge and Critique in a Digital Age.* John Wiley & Sons, 2017.
3. Bulkun, Mestrovic Deyrup & Mary. *Transformative Digital Humanities: Challenges and Opportunities*. Delhi: Routledge, 2020
4. Crompton, Constance, Richard J. Lane, and Ray Siemens, eds. *Doing Digital Humanities: Practice, Training, Research*. Taylor & Francis, 2016.
5. Dobson, James E. Critical Digital Humanities: *The Search for a Methodology*. Chicago: University Illinois of Press, 2019.
6. Gairola, Roopika Risam and Rahul K. *South Asian Digital Humanities: Postcolonial Mediations Across Technology's Cultural Canon.* Delhi: Routledge, 2020.
7. Gold, Matthew, editor. *Debates in the Digital Humanities*. Minneapolis: University of Minnesota Press, 2012.
8. Karla, Maya Doddd & Nidhi. *Exploring Digital Humanities in India Pedagogies, Practices, and Institutional Possibilities*. Delhi: Routledge India, 2020.
9. Rosenzweig, Roy and Dan Cohen. *Digital History: A Guide to Gathering, Preserving, and Presenting the Past on the Web*. Pennsylvania: University of Pennsylvania Press, 2005.
10. Sabharwal, Arjun. *Digital curation in the Digital Humanities: Preserving and Promoting Archival and Special Collections.* Chandos Publishing, 2015.
11. Schnapp, Jeffrey. *Digital Humanities.* Cambridge: MIT Press, 2021.
12. Schreibman, Susan and Ray Siemens, editors. *A Companion to Digital Literary Studies.* New Jersey: Blackwell Publishing, 2008.
13. Terras, Melissa, Julianne Nyhan, and Edward Vanhoutte, eds. *Defining Digital Humanities: A Reader.* Routledge, 2016.
14. Warwick, Claire, Melissa Terras, and Julianne Nyhan, eds. *Digital Humanities in Practice.* Facet Publishing, 2012.

Mapping of COs to Syllabus:

COs	Module 1	Module 2	Module 3	Module 4
CO1	H	H		
CO2		H	H	
CO3			H	H

MCCJ108T: BASICS OF COMMUNICATION AND JOURNALISM

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Outcomes

CO 1: Define the concept, meaning and functions of communication and news (Remembering)
CO 2: Classify different types of news media (Understanding)
CO 3: Apply the concepts and techniques of journalism in news reporting (Applying)
CO 4: Analyse ethical issues in journalism (Analysing)
CO 5: Explain the roles and responsibilities of media persons (Evaluating)
CO 6: Elaborate, produce and edit new stories (Creating)

Module 1: Introduction to Communication (20 Hours)

Definition of Communication, nature and process of human communication, functions of communication, Forms of Communication, Levels and elements of Communication, Mass Communication and its process, Communication barriers, Normative Theories of the Press, Communication ethics, Media in Democracy, Media and the Public Sphere.

Module 2: Understanding News (15 Hours)

Understanding Journalism, types of journalism, Meaning, definition, nature of News, News process: from the event to the reader, Hard and Soft news, basic components of a news story, Attribution, embargo, verification, balance and fairness, brevity, dateline, credit line, by-line.

Module 3: Understanding the structure, construction of news and writing formats (20 Hours)
Organising a news story, 5W's and 1H, Inverted pyramid, Criteria for newsworthiness, principles of news selection, use of archives, sources of news, Language and principles of writing, types of journalistic writing.

Suggested Readings

1. An Introduction to Journalism, Carole Flemming and Emma Hemingway, 2006, Vistaar Publications
2. Journalism Ethics: A Casebook of Professional Conduct for News Media, Fred Brown, 2011,
3. Modern Journalism and news writing, Sativa Chadda, Sativa, 1998, Popular Prakashan, Bombay
4. News writing and reporting for today's media, Itule D. Bruce and Anderson A. Douglas, 2000, McGraw Hill Publication
5. Mass Media in a Changing World, George Rodman, 2007, McGraw Hill Publication
6. Srivastava, M.V. The Journalistic Hand Book. Sterling Publishers
7. The Newspaper's Handbook, Richard Keeble, 2006, Routledge Publication
8. Writing Tools: 50 Essential Strategies for every writer, Peter Roy Clark, 2006, Little Brown

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2	M	M		
CO3		H	H	
CO4		M	M	H
CO5		H	H	M
CO6		H	H	

MCFC109T: FASHION COMMUNICATION

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Outcomes

CO 1: Define fashion communication (Remembering)
CO 2: Understanding fashion communication technology (Understanding)
CO 3: Apply the key technologies used in promoting and distributing content for the online platform (Applying)
CO 4: Create media contents for video and promotion (Creating)

Module 1: Introduction to Communication and Design (15 Hours)
Introduction to the Global Fashion & Textile Industry, Communication Concepts & Processes, Introduction to Pattern Making, Communication Skills, Fashion styling personal development.

Module 2: Fashion Communication and technology (15 Hours)
Elements of Design, Fashion Journalism, Fashion Photography, Fashion Marketing & Merchandising, Fashion Promotion, Graphic Design for Fashion. Illustrator in fashion editing.

Module 3: Publicity and promotion techniques (15 Hours)
Creative advertising & media planning, publicity programme process, promotion and advertising in digital platform, Fashion public relation, Computer Applications in Fashion industry, Portfolio design.

Suggested Exercise
Create visuals, sound and text messages for mobile media, produce audio-video PSAs, Mobile News Report for different beats, Editing on Mobile Apps.

Suggested Readings:

1. Mobile Journalism. Al Jazeera Media Training and Development Centre, Maccise, Diana Larrea and Mara, Monstaser, E-book
2. Multimedia sound and video, Lozano, Jose, Pearson
3. Magic in the Air: Mobile Communication and the transformation of social life, Katz, James E, Routledge
4. Mobile Communications, Second Edition, Jochen Schiller, 2014, Pearson Education
5. Practising Convergence Journalism. An Introduction to Cross-media storytelling, Kolody, Janet, Routledge
6. Smartphone Video Storytelling 1st Edition, Kindle Edition, Robb Montgomery, 2018, Routledge

Suggested Readings

1. The Fashion Designer Survival Guide: Mary Gehlhar(2008), third edition.
2. The End of Fashion: Teri Agins(2000)
3. The Beautiful Fall: Alicia Drake((1970)
4. The Little Dictionary of Fashion: Christian Dior, 'A Guide To Dress Sense For Every men and Woman'
5. Fashion Design Essentials: Jay Calderin '100 Principles of Fashion Design'
6. The Fundamentals of Digital Fashion Marketing: Clare Harris

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H		
CO2	H	H	
CO3		H	H
CO4		H	H

PCCP108T: COMMUNITY PSYCHOLOGY

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Outcomes

CO 1: Comprehend and discuss the concepts, approaches, models and strategies of community development (Understanding)

CO 2: Ability to apply knowledge and skills acquired in community psychology to address issues of human diversity, social justice, inclusion and community mental health (Applying)

CO 3: Ability to assess various concerns in a community and apply models and approaches for community development (Evaluating)

CO 4: Designing an intervention plan for community development and empowerment. (Creating)

Module 1: Introduction to Community Psychology (10 hours)

Definition of community psychology; types of communities; models

Module 2: Core values (12 hours)

Individual and family wellness; sense of community; respect for human diversity; social justice; empowerment and citizen participation; collaboration and community strengths

Module 3: Health promotion (11 hours)

Process of community organization for health promotion, importance, Community program for: child and maternal health, physical challenged and old age in the Indian context.

Module 4: Interventions (12 hours)

Community development and empowerment; case studies in Indian context.

Suggested Readings

1. Banerjee, A., Banerji, R., Duflo, E., Glenneske, R., & Khenani, S. (2006). Can Information Campaign start local participation and improve outcomes- A study of primary education in Uttar Pradesh, India, World Bank Policy Research, Working Paper No.3967
2. Kloos B. Hill, J Thomas, Wandersman A, Elias M.J. & Dalton J.H. (2012). Community Psychology: Linking Individuals and Communities, Wadsworth Cengage Learning.
3. McKenzie, J. F. Pinger, R. R. & Kotecki, J. E. (2005). An introduction to community health. United States: Jones and Bartlett Publishers.
4. Misra, G. (Ed). (2010) Psychology in India. Indian Council of Social Science Research. Dorling Kindersley (India) Pvt Ltd. Pearson Education.
5. Poland, B. D., Green, L.W. & Rootman, I. (2000) Setting for Health Promotion: Linking Theory and Practice, Sage Publication, New Delhi

Mapping of CO's to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	H	M	M
CO-2			H	H
CO-3		M	H	
CO-4			M	H

PCHW109T: PSYCHOLOGY OF HEALTH AND WELLBEING

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Outcomes

- Identifying and learning the importance of inner strength and human values which could help in maintenance of holistic health and gain insights into positive aspects of work. (Understanding)
- Interpreting variety of health enhancing factors, and their application in illness management. (Applying)
- Estimate the approximate health hazards and recommend the health enhancing behaviours. (Evaluating)
- Developing awareness about the various health hazards and suitable ways of dealing with such risks effectively at the community level. (Creating)

Module 1: Illness, Health and Wellbeing (12 hours)
Continuum and Models of health and illness- Bio-Medical, Biopsychosocial, holistic health; health and wellbeing

Module 2: Stress and Coping (11 hours)
Nature and sources of stress; Effects of stress on physical and mental health; Coping and stress management

Module 3: Health Management (12 hours)
Health-enhancing behaviours; Health compromising behaviours; Health Protective behaviours; Illness Management

Module 4: Promoting Human strengths and life enhancement (10 hours)
Classification of human strengths and virtues; cultivating inner strengths: Hope and optimism; Gainful Employment and Me/We Balance

Suggested Readings

1. Taylor, S. E. (2012). Health Psychology (8th Edition). New York: McGraw Hill.
2. Ghosh, M. (2015). Health Psychology-Concepts in Health and Well-being. New Delhi: Dorling Kindersley (India) Pvt. Ltd.
3. DiMatteo, M.R. & Martin, L.R.(2002). Health psychology.New Delhi: Pearson.
4. Forshaw, M. (2003).Advanced Psychology: Health Psychology. London: Hodder and Stoughton.
5. Forshaw, M. (2003). Advanced Psychology: Health Psychology. London: Hodder and Stoughton.
6. Hick, J.W. (2005).Fifty signs of Mental Health. A Guide To Understanding Mental Health. Yale University Press.
7. Snyder, C.R., & Lopez, S.J. (2007). Positive Psychology: The scientific and practical explorations of human strengths.Thousand Oaks, CA: Sage.
8. Carr, A. (2004). Positive Psychology: The science of happiness and human strength.UK: Routledge.
9. Dalal, A.K & Misra, G. (2006). Psychology of Health and Well-Being: Some Emerging Perspectives, Psychological Studies, 2(2-3)
10. Dharmshaktu, N.S (2018). Holistic Health and Wellbeing: How to Achieve it, Journal of Preventive, Curative and Community Medicine, 4(2-3).

Mapping of COs to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	M	M	
CO-2	H	H		
CO-3	M		M	H
CO-4			H	H

PCPM110T: PSYCHOLOGY AND MEDIA

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course outcomes

CO 1: Outline the effect of the media on underlying psychological processes and mechanisms (Understanding)
CO 2: Determine the impact of psychological processes on advertising and promotional activities (Applying)
CO 3: Analyse the influence of media on the perception and understanding of individuals (Analysing)
CO 4: Adapt approaches to media which would benefit the development of a health society (Creating)

Module 1: Media and User (10 hours)
Understanding mass media; Issues in Media psychology: Construction of reality, media and culture, Media and ethics, regulation.

Module 2: Media and advertising (10 hours)
Developing an effective advertising programme /media promotions/ campaign for social marketing. Case studies in the Indian context.

Module 3: Audio-Visual media (TV and movies) and Print media (15 hours)
Nature and their impact; Developmental issues: fantasy Vs reality, socialization, stereotyping, violence, and cybercrime. Case studies in the Indian context.

Module 4: Interactive and emerging technologies (10 hours)
Virtual social media, interactive media, gaming, issues of internet addiction. Case studies in the Indian context.

Suggested Readings

1. Dill, K.E. (2009). How Fantasy becomes Reality Seeing Through Media Influence.New York: Oxford University Press.
2. Giles, D. (2003). Media Psychology. New Jersey: Lawrence Erlbaum Associates Publishers.
3. Haugtvedt, C. P., Herr, P. M., & Kardes, F. R. (Eds.). (2008). Handbook of Consumer Psychology. NY: Psychology Press.
4. Jansson-Boyd, C. V. (2010). Consumer Psychology. England: Open University Press.
5. Wanke, M. (Ed.). (2009). Social Psychology of Consumer Behaviour. NY: Taylor & Francis Group.
6. Kirsh, S.J. (2006). Children Adolescents and Media Violence. New York: Sage.
7. Montgomery, K.C. (2007) Generation Digital. MIT Press.

Mapping of CO's to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H			
CO-2	M		H	
CO-3		H		
CO-4			H	H

ENMB107T: MONEY AND BANKING

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Objective
This course is designed to understand the importance of money and banking in various economics. It aims to provide an introduction to understand the concept of money, theories of money supply and money demand and working of monetary policy. It provides an insight into the banking system.

Course Outcomes

CO 1: Interpret the components of a financial system with respect to real economy linkages and financial market participants (Understanding)
CO 2: Identify the impact of central bank monetary policy on financial systems and the overall economy. (Applying)
CO 3: Analyze the development of financial markets and securities in response to market participant requirements. (Analyzing)
CO 4: Evaluate the different financial intermediation and risk management services that financial institutions provide and the need for governmental regulation. (Evaluating)

Module I: Money and Functions of Money (10 hours)
Concept of Money; Functions of Money; Theories of Demand for Money; Type of Money – M1, M2, M3, M4 ; Money multiplier theory.

Module II: Financial Institutions, Markets, Instruments and Financial Innovations (11 hours)
Meaning, types and role of Financial Markets and Institutions; Money and Capital Markets, their characteristics and functions; call money market, treasury bill market, commercial bill market including commercial paper and certificates of deposits; primary and secondary market for securities.

Module III: Interest Rates (10 hours)
Determination of Interest Rate; Sources of Interest Rate Differentials; Types of Interest Rate – Compound and Simple Interest Rate; Theories of Term Structure of Interest Rates; Interest Rates in India

Module IV: Banking System and Monetary policy (14 hours)
Indian Banking System; Banking Sector Reforms; Functions of Commercial Banks, Credit Creation System of Commercial Bank; The Evolution of Commercial Banks, Regional Rural Bank in India; NABARD; Functions and Goals of Central banks; Instruments of Monetary Control – Quantitative Control; Repo Rate; Reverse Repo Rate; CRR; SLR; Qualitative Control; Margin Requirements; Credit Rationing; Regulation of Consumer Credit; Moral Suasion; Publicity and Publication; Monetary Management in an Open Economy; Current Monetary Policy of India

Suggested Readings

1. F. S. Mishkin & S. G. Eakins, Financial Markets and Institutions, Pearson Education, 6th edition, 2009.
2. F. J. Fabozzi, F. Modigliani, F. J. Jones, M. G. Ferri, Foundations of Financial Markets and Institutions, Pearson Education, 3rd edition, 2009.
3. L. M. Bhole & J. Mahakud, Financial Institutions and Markets, Tata McGraw Hill, 5th edition, 2011.
4. M. Y. Khan, Indian Financial System, Tata McGraw Hill, 7th edition, 2011.
5. Various latest issues of R.B.I. Bulletins, Annual Reports, Reports on Currency and Finance and Reports of the Working Group, IMF Staff Papers.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2	H	M		H
CO3				
CO4		M	M	H

ENSM108T: INTRODUCTION TO STOCK MARKET

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Objective

This course will enhance the students with a comprehensive understanding of the workings of the stock market, including the market's structure, trading and settlement procedures, processes, and related components, as well as the regulations that govern the stock market and the emerging challenges it faces. This course's objective is to provide students with a comprehensive understanding of the workings of the stock market.

Course Outcomes

CO 1: Explain the Indian capital market and financial instruments. (Remembering & Understanding)
CO 2: Identify the different terms associated with the stock market in the action of buying and selling stocks. (Applying)
CO 3: Discuss stock market experience and learn to analyze risk and profitability. (Analyzing)
CO 4: Elaborate the possibility to evaluate and compare various financial securities and money market investment instruments. (Evaluating and Creating)

Module I: The Stock Market and its Operation (15 Hours)

Role and Structure of Money and Capital Market; Instruments of Capital Market – Share, Debentures, Equity and Bond; The Stock Market and its Operation; Stock Market Index – The BSE Sensex and the NSE Nifty; Role and working SEBI; Impact of SEBI on Capital Market in India; IDRA and its role in Financial Markets

Module II: Terminology of Stock Market (10 Hours)

Strike Price, Call Option, Put Option; Bull and Bear market; Beta, Delta, Bid, Blue chip stock; Board Lot, Odd Lot; Out of the Money (OTM), Stock split

Module III: Trading of Stock (20 Hours)

Recent development of stock exchange; Stock trading on BSE and NSE; Stock market trading mechanism; Online stock trading; OTC exchange; Commodity exchanges: evolution and history; overviews of derivatives in financial market, basic derivatives operation and trading; managing exchange rate, carbon markets, weather derivatives, ETFs – Purpose, Importance, types; risk management, commodity exposure, hedge accounting, currency futures

Suggested Readings

1. Bhole, L.M.(1999), Financial Institutions and Markets, Tata McGraw Hill Company Ltd., New Delhi
2. Johnson, H.J. (1993), Financial Institutions and Markets, McGraw Hill, New York.
3. KhanM.Y. (1996), Indian Financial Systems, Tata McGraw Hill, New Delhi
4. Robinson, R.I. and D. Wrightman (1981), Financial Markets, McGraw Hill, London.
5. Fenstermaker, J.V. (1969), Readings in Financial Markets & Institutions, Appleton, NewYork
6. Smith, P.F. (1978), Money and Financial Intermediation: The Theory and Structure of Financial System, Prentice Hall, Englewood-Cilffs, New Jersey

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1		M	
CO2	H		M
CO3		M	H

CO4	M		H

ENED110T: ENTREPRENEURSHIP DEVELOPMENT

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Outcomes

CO 1: Students will get the knowledge of the term Entrepreneurship, and the qualities required to become an Entrepreneur. (Understanding)

CO 2: Will be introduced to various theories of entrepreneur and their applicability in real life (Apply)

CO 3: Will be introduce to various sources of financial assistance available to promote entrepreneur (Evaluating)

CO 4: The students will get some idea of various legal protections for innovation and develop the skill of decision making. (Creating)

Module I Introduction (Hours 10)

Meaning and Importance, Evolution of term Entrepreneurship, Factors influencing entrepreneurship; Characteristics of an entrepreneur; Types of entrepreneur; Barriers to entrepreneurship

Module II Entrepreneurial Motivation (Hours 12)

Motivation meaning; Maslow's theory; Herjburg's theory; McGragor's Theory; Culture & Society; Risk taking behavior of entrepreneurs.

Module III Entrepreneurial Creativity (Hours 8)

Creativity and entrepreneurship and Stepsin Creativity; Innovation and inventions; Legal Protection of innovation Skills of an entrepreneur Decision making and Problem Solving

Module 4 Organization Assistance (Hours 15)

Industrial Park (Meaning, features, & examples); Special Economic Zone (Meaning, features & examples); Financial assistance by different agencies; MSME Act and Small Scale Industries; Environmental Clearance: National Small Industries Corporation (NSIC); Financial assistance to MSME; The Small Industries Development Bank of India (SIDBI); The State Small Industries Development Corporation (SSIDC) Export oriented units; Incentives and facilities to exports entrepreneurs; Export oriented zone; Export-Import Bank of India

Suggested Readings

1. Arya Kumar, Entrepreneurship, Pearson, Delhi.
2. Poornima MCH, Entrepreneurship Development –Small Business Enterprises, Pearson, Delhi
3. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
4. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press, Delhi
5. Anil Kumar, S., ET.al., Entrepreneurship Development, New Age International Publishers, New Delhi
6. Khanka, SS, Entrepreneurship Development, S. Chand, New Delhi
7. Peter F. Drucker, Innovation and Entrepreneurship
8. A. Sahay, M. S. Chhikara, New Vistas of Entrepreneurship: Challenges and Opportunities

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M	M	M	
CO2	H	M		M
CO3		M		H
CO4		H	H	M

CHFN115T: FOOD AND NUTRITION (3-0-0)

Course Outcomes

CO 1: Revisit the relationship between food, nutrition and health. (Remembering)

CO 2: Explain the importance of nutritional diets, deficiency and management during the life cycle. (Understanding)

CO 3: Apply the knowledge of food chemistry for career development. (Applying)

Module I: Food, nutrients and their needs (12 hours)

Basic idea of food, nutrition and health; functions of food, Nutritional Requirement during Infancy, maternal Childhood; Diet, Nutrition and Adolescence; Nutrition in the Elderly.

Module II: Nutritional constituents (10 hours)

Sources and functions of (a) Carbohydrates; (b) Amino acids and proteins; (c) Lipids (d) Mineral; (e) Vitamins: A, D, E, K.

Module III: Categories of food (10 hours)
Study of the following categories of food:
(a) Cereals; (b) Pulses; (c) Fruits and vegetables; (d) Milk and milk products; (e) Egg, meat, poultry and fish; (f) Fats and oils.

Module IV: Management of deficiencies/ Dietary goals (11 hours)
Causes, symptoms, treatments of certain important nutrient deficiencies, Food Preservation & Food Additives & Colorants, Social Health Issues – Smoking, Alcoholism, Drug
Addiction, AIDS and AIDS Control Programs.

Module V: Food perspectives (2 hours)
Career opportunity in food chemistry, food industry, Entrepreneur Development.

Suggested Readings
1. Essential of food chemistry, JAGAT BAHADUR K.C. and BASANTA KUMAR RAI, Electronic library, DMC/NAAST/CCT.
2. Food Chemistry, H.-D. Belitz · W. Grosch · P. Schieberle, 4th revised and extended ed., Springer.
3. Fundamentals of Foods, Nutrition and Diet Therapy, S. R. Mudambi and M. V. Rajagopal, New Age International.
4. Handbook of Food and Nutrition, M. Swaminathan,BAPPCO.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	H	H	
CO3			H		H

CHEE116T: ENERGY AND ENVIRONMENT (3-0-0)

Course Outcomes:
1. Recall the concept of fuel petroleum chemistry as energy sources (Remembering)
2. Application of medicinal chemistry in daily life (Applying)
3. Analysis of the cause of pollution and their preventive measurements. (Analysing)

Module I: Importance of chemistry in energy and technology (15 Hours)
Renewable and non-renewable source of energy, origin, composition and importance of petroleum, distillation and fractional distillation, refining of petroleum, Cracking and Reforming process, Applications of various fractions of crude oil, Petrol, Diesel, Kerosene, LPG, CNG, LNG, clean fuels, Octane number, Flash point, calorific value, knocking and anti-knocking properties of oil, use of hydrogen as fuel, sustainable energy source and future scope.

Module II: Pharmaceutical Chemistry (15 Hours)
Definition of drug, Classification of drug, mechanism of drug action, mode of action of various types of drugs, natural and synthetic drug, importance of traditional herbs as medicine and their comparison with synthetic drug, lethal dose and toxicity of drug, preliminary concept of antibiotic, antiviral, anti-HIV, anti-cancer and antimalarial drugs.

Module III: Environmental pollution and management (15 Hours)
Concept of pollution, causes of environmental pollution and their adverse effects, definition of air pollution, major air pollutants, their sources and influences, acid rain, photochemical smog, effects on organisms and on materials, water pollution major sources and impacts, eutrophication, water treatment processes, soil pollution, causes of soil pollution, soil salinity, sources of soil pollutants, major influences and remedial measures, radioactive pollution, Pollution Monitoring and Control, importance of waste management system, concept of reusability or recyclability in practical life for minimizing waste.

Suggested Readings:
1. Drugs and Pharmaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York.
2. Introduction to Industrial Chemistry, B.K. Sharma: Goel Publishing, Meerut (1998)
3. Environmental Chemistry, Manahan, S. E. 9th edn. (CRC Press, Boca Raton, 2010).
4. Environmental Chemistry, J. W. Moore & E. A. Moore. Academic Press, London (1976).

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H		
CO 3		H	

CO4			H

MDBM100T: BASICS IN MATHEMATICS
(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Course Objectives
The objective of this course is to acquaint the students with reasoning skills especially numeracy skills to wade through every area of life. As the goal of education is defined as teaching the three R's, namely, Reading, wRiting and aRithmetic, a student of philosophy is expected to possess basic knowledge in mathematical skills.

Course Outcomes
CO1: Defines the basic mathematical concepts (remembering)
CO2: Explains the basic mathematical operations (understanding)
CO3: Develops basic reasoning skills in mathematics (applying)
CO4: Solves the commonplace issues in commercial transactions (creating)

Module 1: Basic Arithmetic Skills I (10 hours)
Number system, arithmetical operations, numeral systems, KCF and LCM, Fractions, Decimals

Module 2: Basics in Arithmetic Skills II (15 hours)
Square roots, cube roots, exponents and powers, ratios and proportions, percentages, profit and loss, discount, simple and compound interest and measurements

Module 3: Basic Algebra (5 hours)
What is Algebra? Algebraic equations

Module 4: Basic Geometry (10 hours)
What is geometry? Circle, volume and surface areas of solids, angles and triangles, introduction to co-ordinate Geometry and graphs

Module 5: Basic Statistics (10 hours)
Data Interpretation: collection, mean, median, mode, range, etc.

Suggested Reading
1. Thatiush Daimari, Skilling in Maths, Guwahati: Commission for Formation, NEIRBC, 2023.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	H	H	H	H	H
CO3	M	M	M	M	M
CO4	H	H	H	H	H

MDBA101T: BASICS IN ACCOUNTING
(Credits: 3 Hours: 45) (L-T-P: 3-0-0)
Objectives
This multi-disciplinary course provides the students with hands-on training in various basic components of accounting, namely, heads of account, books of account, formation of societies and trusts, banking laws and practices and tally. It prepares the students to take up leadership and administrative roles in their future careers.

Course Outcomes
CO1: Explains the accounting concepts (understanding)
CO2: Simplifies the accounting procedures using the computer programme Tally (analysing)
CO3: Identifies the processes involved in the formation and management of societies and trusts (applying)
CO4: Appraises the banking laws and practices (evaluating)

Module 1: Concepts Explained (5 hours)

Module 2: Heads of Account and Books of Accounts (10 hours)

Module 3: Formation and Management of Societies/Trusts (10 hours)

Module 4: Banking Laws and Practices (10 hours)

Module 5: Tally in Accounting (10 hours)

Suggested Reading

1. Trevor D'Souza, Accounts, Finance and Law for Not-For-Profit and Religious Organisations, unpublished notes.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	M	H		M	H
CO3	M		H		
CO4				H	

MDGS200T: INTRODUCTION TO GENERAL SCIENCE

(Credits: 3 Hours: 45) (L-T-P: 3-0-0)

Objectives

The main objective of the study of General Science is to understand the functional role of nature and explain it in a complete form. It helps to provide knowledge of the laws of nature after verifying them through experiments. Since Science is one of the most important channels of knowledge, studying subjects like Physics, Chemistry & Biology is important for the general understanding of things around us.

Course Outcomes

CO1: Spells out a general understanding of things around us (remembering)
CO2: Explains the basic concepts in Science (understanding)
CO3: Examines basic topics in Biology, Chemistry and Physics (analysing)
CO4: Identifies the biological, chemical and physical characteristics of human beings, animals, plants and inorganic elements (applying)

Module 1: Biology (15 hours)

The science of life, classification of the animal kingdom, classification of the plant kingdom, cells, the composition of the human body, list of human diseases

Module 2: Chemistry (15 hours)

Matter and its states, atomic structure, molecule, the elements, radio-activity, minerals and ores, global warming: its causes and effects, greenhouse gas emission: its causes and effects

Module 3: Physics (15 hours)

Introduction, main branches of physics, the universe: galaxy, stars, sun and asteroids, light, motion and mechanics, electric current

Suggested Readings

1. Encyclopaedia of General Science, Arihant Experts.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H	H	H
CO3	H	H	H
CO4	H	H	H

DETAILED SYLLABUS

COMMON VALUE BASED COURSES

CBES101T: ENVIRONMENTAL STUDIES
(1 credit: 15 hours)

Course Outcomes:
CO 1: Recall the multidisciplinary nature of environmental studies. (Remembering)
CO 2: Explain ecological processes of natural resources. (Understanding)
CO 3: Categorize different types of natural resources. (Analysing)
CO 4: Evaluate the global scale of environmental pollution. (Evaluating)

Module I: The Multidisciplinary Nature of Environmental Studies (1 lectures)
Definition, scope and importance, need for public awareness.

Module II: Natural Resources (2 lectures)
a. Different types of natural resources and associated problems - forest resources, water resources, mineral resources, food resources, energy resources and land resources.
b. Conservation of natural resources.

Module III: Ecosystems (2 lectures)
a. Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, food chains, food webs.
b. Structure of following ecosystems - forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems.

Module IV: Biodiversity and Its Conservation (2 lectures)
Types of biodiversity – genetic, species and ecosystem, value of biodiversity, global biodiversity, India as a mega-diversity nation, threats to biodiversity, conservation of biodiversity - in-situ and ex-situ conservation.

Module V: Environmental Pollution (3 lectures)
a. Definition, causes, effects and control measures of - air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards and e-pollution.
b. Solid waste management.
c. Disaster management.

Module VI: Social Issues and the Environment (3 lectures)
a. From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, climate change, global warming, acid rain, ozone layer depletion.
b. Environment protection act.
c. Introduction to environmental impact assessment.

Module VII: Human Population and the Environment (2 lectures)
Population growth and sex ratio; Population explosion - family welfare programme; Environment and human health; HIV/AIDS; Role of information technology in environment and human health.

Suggested Readings
1. Textbook for Enviromental Studies, E. Bharucha, UGC, New Delhi.
2. Fundamentals of Environmental Studies, S. Somvanshi and R. Dhupper, S.K. Kataria and Sons Publisher.
3. Environmental Chemistry, A. K. De, New age publishers.
4. Environmental Studies, Third edition, J. P. Sharma, University Science Press.
5. Comprehensive Environmental Studies, K. G. Bhattacharyya and A. Sarma, Narosa Publishing House Pvt, Ltd.

E Resources
1. https://www.youtube.com/watch?v=zuSFs85kuJs&list=PLIC0i9IRboHb19v2dF0yuenG7xDOGJLeP
2. https://www.youtube.com/watch?v=tMwFNMfjFuU&list=PL8dPuuaLjXtOikZljhKAe28AkupJXnS2u

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H				H		H
CO 2		M	H				
CO 3				M		H	

CO 4							H

CBHY102T: HEALTH AND WELLNESS, YOGA EDUCATION, AND SPORTS AND FITNESS

(1 Credit: 15 hours)

Course Outcomes

CO 1: Explain the importance of healthy lifestyle (Understanding)
CO 2: Make use of Yoga, sports for health and fitness (Applying)

Module I: Health and Wellness (4 hours)

Meaning and importance of health and Wellness, components/dimensions of health and Wellness; Nutrition for health and wellness

Module II: Yoga (6 hours)

Introduction to Yoga, Asanas and Pranyamas

Module II: Sports and Fitness (5 hours)

Concept of Sports and fitness; Fitness activities for strength, Flexibility and Endurance; Indoor and Outdoor sports

Suggested Readings

1. Claude Bouchard, Steven N. Blair, William L. Haskell, 'Physical Activity and Health' , Human Kinetics, 2007
2. Emily Oddo,' Yoga: For Beginners', , White Flower Publishing, 2018
3. Marzia Fernandez, Emily Attached, Gino Mackesy, 'Mental Health Workbook', 2020.
4. Dr. A. K. Uppal , Dr. P. P. Ranganathan,' Fitness, Wellness and Nutrition', Friends Publications India. 2020
5. Fred Coalter, ' Sport for Development: What game are we playing?', Routledge. 2013

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		M
CO 2		H	M

CBDT103T: DIGITAL AND TECHNOLOGICAL SOLUTIONS

(1 credit: 15 hours)

Module I: Computer Fundamentals and Office automation (8 Hours)

Evolution of Computers and its applications, latest IT gadgets, basics of hardware and software, Operating Systems: types and functions, Office tools – Word Processor, Spreadsheets, Power Presentation, Introduction to graphic editing tools.

Module II: Communication Systems and Digital Solutions (4 Hours)

Types of Communication Systems model and principles, Types of transmission media, Internet concepts, Web browsers, search engines, Email, Social networking and Netiquettes.

Introduction & Evolution of Digital Systems, Role and Significance of Digital Technology, Overview of e-governance, E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges, Digital India & e-Governance: Initiatives, Infrastructure, Services and Empowerment, Digital Financial Tools: Unified Payment Interface (UPI), Unstructured Supplementary Service Data (USSD), Aadhaar Enabled Payment System (AEPS), Banking Cards, e-Wallets, Internet Banking, 5G Technology.

Module III: Cyber Security and Emerging Technologies (4 Hours)

Concepts of cyber security, Issues and challenges of cyber security, Classification of cyber-crimes, Introduction to IT Act 2000 and its amendments, Needs and best practices for the use of Social media.

Introduction to emerging technologies, Internet of Things (IoT), Big Data Analytics, Cloud Computing, Virtual reality, Artificial Intelligence, Block Chain technology, 3D Printing, Robotic Process automation.

Suggested Readings

1. Rajaraman V., Fundamentals of Computers, PHI Publications
2. Anita Goel, Computer Fundamentals, Pearson Publication New Delhi
3. Suresh Basandra, Computers Today A. Shinde, *Introduction to Cyber Security: Guide to the World of Cyber Security*, Notion Press, 2021
4. U Sharma, P Nand, J Chatterjee , V Jain, N Z Jhanjhi, R. Sujatha, *Cyber-Physical Systems: Foundations and Techniques*, Wiley, 2022.
5. U Sharma, P Astya, A Baliyan, S Krit,V Jain, M Z Khan, *Advancing Computational Intelligence Techniques for Security Systems Design*, CRC Press, 2021
6. Rich & Knight, Artificial Intelligence, TMG, 3 e/d

7. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontline" Schroff/O'Reilly
8. Khan, Jamil Y., and Mehmet R. Yuce, eds. *Internet of Things (IoT): systems and applications*. CRC Press, 2019.
9. Redwood, Ben, Filemon Schöffer, and Brian Garret. *The 3D printing handbook: technologies, design and applications*. 3D Hubs, 2017.
10. G. Nandi, R. K. Sharma, *Data Science Fundamentals and Practical Approaches,* BPB, 1st Edition, 2020

E Resources

Module I:

1. Evolution of Computers and its Applications: https://computerhistory.org/
2. Basics of Hardware and Software: Tutorial by Khan Academy
3. Hardware and Sotware: https://www.coursera.org/learn/computer-hardware
4. Operating Systems: Types and Functions: GeeksforGeeks Tutorial Website
5. Office Tools: Spoken Tutorial on Office Tools
6. GIMP Tutorials

Module II:

7. Internet Fundamentals and Digital Systems - Courses by GeeksforGeeks and Coursera

Module II:

8. IT Act 2000 – Website on IndiaKanoon
9. Social Media Best Practices – Website on Hootsuite
10. Cloud Computing – Resources by AWS
11. 3D Printing – Coursera Website

CBUI104T: UNDERSTANDING INDIA

Credit – 1 (0-0-1) – 15 Hours

Course Outcomes

CO 1: At the end of this course, students will be able to explain the social, cultural and religious diversity of India and its impact on Indian psyche.

CO 2: At the end of this course, students will be able to evaluate the political and economic system of India.

Module 1: India and its Diversity (18 hours)

- Overview of India's geography, diversity, demographics and development indicators
- A brief survey of India's history, highlighting key events, personalities and movements that shaped its identity and destiny
- An exploration of India's rich and varied cultural heritage, including its languages, religions, arts, literature and philosophy
- An overview of India's social structure, institutions, norms and values, with a focus on issues such as caste, gender, class and ethnicity

Module 2: Indian Political System (12 hours)

- A study of India's political system, institutions, parties and ideologies
- India's role in regional and global affairs
- A review of India's economic performance; the challenges and opportunities for growth;
- An overview of sectors such as agriculture, industry, services, and trade.
- A discussion of India's environmental problems & the solutions for sustainable development
- A discussion on India's journey towards a developed nation.

Suggested Readings

1. Thapar, R. (2015). The Penguin History of Early India: From the Origins to AD 1300. India: Penguin Books Limited.
2. Kosambi, D. D. (2022). The Culture and Civilization of Ancient India in Historical Outline. United Kingdom: Taylor & Francis.
3. Zimmer, H. R. (2020). Philosophies of India. United States: Princeton University Press.
4. Mohanty, M. (2004). Class, Caste, Gender. India: SAGE Publications.
5. Mitra, S. K. (2017). Politics in India: Structure, Process and Policy. United Kingdom: Taylor & Francis.
6. Kothari, R. (1970). Politics in India. India: Orient Longman.
7. Balasubramanyam, V. N. (2019). The Economy of India. United Kingdom: Taylor & Francis.
8. Fisher, M. H. (2018). An Environmental History of India: From Earliest Times to the Twenty-First Century. United Kingdom: Cambridge University Press.

STUDENT INDUCTION PROGRAM

USIP001: STUDENT INDUCTION PROGRAM
(P/NP)

The following list presents the topics covered in the Mandatory Student Induction Program conducted in the Assam Don Bosco University School of Technology:

1. Physical activity – Yoga and sports activity (indoor and outdoor)
2. Creative arts through Extra-curricular clubs e.g., music & singing, dance, drama, debating & quiz, art & craft, photography
3. Universal Human Values – group discussions on the following topics:
    a) Aspirations and family expectations
    b) Gratitude
    c) Competition and cooperation
    d) Competition and excellence
    e) Peer pressure
    f) Self-confidence
    g) Relationships in family
    h) Trust and respect
    i) Anger management
    j) Happiness and prosperity
    k) Dealing language barriers – tests on communication skill for future follow up.
    l) Sexual orientation / courting / sexual harassment
4. Literary exposure through Literary Club
5. Proficiency Modules – Psychological tests and orientation, introduction to Co-curricular clubs and innovations.
6. Lectures by eminent people – in-campus invited Guests and over SKYPE
7. Visit to local areas – visit to industry and institutions of repute
8. Familiarization to departments and common facilities
9. Mentoring system – introduction and assignment of mentors
10. Selection / election of Class Representatives for college association
11. Health check-up for all with documentation for future reference
12. Library Orientation, Introduction to ERP and e-Resources, filling up “Online anti-ragging affidavit” by all.

DEPARTMENT OF COMPUTER APPLICATIONS

PROGRAMME: BACHELOR OF COMPUTER APPLICATIONS (BCA)
DEGREE: BCA (HONOURS)/ BCA (HONOURS) WITH RESEARCH

VISION
Impart knowledge of Computer Applications to mould individuals into IT professionals, researchers, and entrepreneurs who are innovative, versatile and committed to society.

MISSION
- To prepare students for professional careers and higher studies by providing conducive teaching, learning, and research environment.
- To produce skilled individuals and entrepreneurs in emerging areas of technologies through academia-industry collaboration.
- To instill in individuals a sense of commitment to work for the betterment of society using technology.

PROGRAM OUTCOMES - BCA
PO 1: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO 2: Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media, and technology.
PO 3: Social Interaction: Elicit views of others, mediate disagreements, and help reach conclusions in group settings.
PO 4: Effective Citizenship: Demonstrate empathetic social concern and equity-centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO 5: Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO 6: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
PO 7: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes
PO 8: Innovation and Entrepreneurship: Identify a timely opportunity and use innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PROGRAM SPECIFIC OUTCOMES – BCA
PSO 1: Knowledge of Computing Systems: An ability to understand the principles and workings of computer systems.
PSO 2: Project Development Skills: An ability to understand the structure and development methodologies of software systems.
PSO 3: Software Development Skills: Familiarity and practical competence with a broad range of programming languages and open-source platforms.
PSO 4: Research Skills: Ability to enhance research skills by utilizing standard research-based tools for analysis, design, and implementation of techniques for resolving real-life and/or social problems.

LIST OF COURSES -BCA

1.1	CACL100T: Computer Programming in C Language (Theory)
1.2	CACL101L: Computer Programming in C Language (Lab)
1.3	CALE104T: Cyber Law and Ethics
1.4	Computer Fundamentals
2.1	CADS102T: Data Structures Using C (Theory)
2.2	CADS103L: Data Structures Using C (Lab)
2.3	CAET105T: E-commerce Technologies
2.4	Hardware and Server Maintenance
3.1	CAIJ200L: Introduction to Java Programming (Theory)
3.2	CAIJT201T: Introduction to Java Programming (Lab)
3.3	CALD202T: Digital Logic Design (Theory)
3.4	CALD203L: Digital Logic Design (Lab)
3.5	CAER210T: Enterprise Resource Planning

3.6	Multimedia and Graphics
4.1	CAOS204T: Operating System (Theory)
4.2	CAOS205L: Operating System (Lab)
4.3	CACA206T: Computer Organization and Architecture (Theory)
4.4	CACA207L: Computer Organization and Architecture (Lab)
4.5	CARD208T: Relational Database Management Systems (Theory)
4.6	CARD209L: Relational Database Management Systems (Lab)
4.7	CAWD211T: Basics of Web Designing (Theory)
4.8	CAWR212L: Basics of Web Designing (Lab)
5.1	CACN300T: Computer Network Fundamentals (Theory)
5.2	CACN301L: Computer Network Fundamentals (Lab)
5.3	CAWT302T: Web Technologies (Theory)
5.4	CAWT303L: Web Technologies (Lab)
5.5	CASE304T: Software Engineering (Theory)
5.6	CASE305L: Software Engineering (Lab)
5.7	CAPT310T: Basics of Python (Theory)
5.8	CAPT311L: Basics of Python (Lab)
5.9	Internship
6.1	CACC306T: Cloud Computing
6.2	CAAD307T: Android Application Development Fundamentals
6.3	CANS308T: Network Security
6.4	CAPW309P: Minor Project
6.5	CABS312T: Business Statistics
7.1 A	CAPM400T: Python and Machine Learning (Theory)
7.2 A	CAPM401L: Python and Machine Learning (Lab)
7.3 A	CADA402T: Design and Analysis of Algorithm (Theory)
7.4 A	CADA403L: Design and Analysis of Algorithm (Lab)
7.5 A	CAAI407T: Introduction to Artificial Intelligence
7.6 A	CARM408T: Research Methodology
7.7 A	Research Project/ Dissertation
7.1 B	CARM408T: Research Methodology
7.2 B	Dissertation Phase – I
8.1 A	CADS404T: Data Science (Theory)
8.2 A	CADS405L: Data Science (Lab)
8.3 A	CAOR406T: Operation Research
8.4 A	CADV409T : Data Visualization
8.5 A	Research Project/ Dissertation
8.1 B	Dissertation Phase – II

A: Honours, B: Honours with Research

POs and PSOs mapping

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
1.1	H							L		M	H	M
1.2	H							L		M	H	M
1.3	M							M	H	M	H	H
1.4		H					L		H			
2.1	H							L		M	M	
2.2	H							L		M	M	
2.3	M	H		L				M				
2.4							L	L				
3.1	H							L		M	H	M
3.2	H							L		M	H	M
3.3	M								H			
3.4	M								H			
3.5	L	M						H				

3.6	L	M					H	M	M	H	L	H
4.1	L								H	L	M	
4.2	L								H	L	M	
4.3	L								H	L		M
4.4	L								H	L		M
4.5	L							L		H	M	
4.6	L							L		H	M	
4.7		M		M				H		M	M	
4.8		M		M				H		M	M	
5.1	M				L	L	H	H	H	M		H
5.2		M	L		M	M	H	H	H	M	M	H
5.3		M		M				H		M	M	
5.4		M		M				H		M	M	
5.5	M				M	H	H	H	H	H	M	M
5.6	L				M	M	H	H	H	H	M	M
5.7	M							H		H	H	M
5.8	M							H		H	H	M
5.9	H	H					M	H	M	H	H	H
6.1	M								H	M	L	
6.2	M								H	H	H	
6.3	H				M		M		M	M	M	H
6.4	H	M	H	M	M	H	H	M	M	H	H	H
6.5	H							M	M		L	M
7.1 A	M							H		H	H	M
7.2 A	M							H		H	H	M
7.3 A	H									M		M
7.4 A	H									M		M
7.5 A	M					M	H	H	H	H	M	H
7.6 A	M	M	L	L	H							H
7.7 A	H	H	H	M	M	H	H	H	H	H	H	H
7.1 B												
7.2 B	H	H	M	M	M	H	H	H	H	H	M	H
8.1 A	H	L					L	M		H		H
8.2 A	H	L					L	M		H		H
8.3 A	M				L	H	H	H	M	H	H	M
8.4 A		M								M		M
8.5 A	H	H	H	M	M	H	H	H	H	H	H	H
8.1 B	H	H	M	M	M	H	H	H	H	H	M	H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	CACL100T	Computer Programming in C Language (Theory)	2
		CACL101L	Computer Programming in C Language (Lab)	2
2	Major Course 2	CADS102T	Data Structures Using C (Theory)	3
		CADS103L	Data Structures Using C (Lab)	1
3	Major Course 3	CAIJT200T	Introduction to Java Programming (Theory)	3
		CAIJ201L	Introduction to Java Programming (Lab)	1
3	Major Course 4	CALD202T	Digital Logic Design (Theory)	3
		CALD203L	Digital Logic Design (Lab)	1
4	Major Course 5	CAOS204T	Operating System (Theory)	3
		CAOS205L	Operating System (Lab)	2
4	Major Course 6	CACA206T	Computer Organization and Architecture (Theory)	3
		CACA207L	Computer Organization and Architecture (Lab)	2
4	Major Course 7	CARD208T	Relational Database Management Systems (Theory)	3
		CARD209L	Relational Database Management Systems (Lab)	1
5	Major Course 8	CACN300T	Computer Network Fundamentals (Theory)	3
		CACN301L	Computer Network Fundamentals (Lab)	2
5	Major Course 9	CAWT302T	Web Technologies (Theory)	3
		CAWT303L	Web Technologies (Lab)	2
5	Major Course 10	CASE304T	Software Engineering (Theory)	3
		CASE305L	Software Engineering (Lab)	1
6	Major Course 11	CACC306T	Cloud Computing	4
6	Major Course 12	CAAD307T	Android Application Development Fundamentals	4
6	Major Course 13	CANS308T	Network Security	4
6	Major Course 14	CAPW309P	Minor Project	4
7	Major Course 15	CAPM400T	Python and Machine Learning (Theory)	3
		CAPM401L	Python and Machine Learning (Lab)	2
7	Major Course 16	CADA402T	Design and Analysis of Algorithm (Theory)	3
		CADA403L	Design and Analysis of Algorithm (Lab)	2
8	Major Course 17	CADS404T	Data Science (Theory)	3
		CADS405L	Data Science (Lab)	2
8	Major Course 18	CAOR406T	Operation Research	5

CACL100T: COMPUTER PROGRAMMING IN C LANGUAGE

(2 credits – 30 hours) (L-T-P: 2-0-0)

Objective:

The objective of the course is to learn the concept of C programming language and to solve the problem statement using the C language.

COURSE / LEARNING OUTCOMES

At the end of this course, students will be able to:

CO 1: Define information based on the understanding of the concepts of C language's syntax, data types, control statements, functions, pointers, arrays, structures and pointers in C. (Understanding)

CO 2: Solve problems using standard algorithms, translate pseudo-codes into C programs, and implement them. (Applying)

CO 3: Evaluate the data structure, function, data types, and algorithms used for searching, sorting, solving problem instances, etc. in terms of correctness and computation cost. (Evaluating)

CO 4: Combine the various concepts and ideas learned in C to plan, propose, and develop a product. (Creating)

Module I: Introduction to Algorithms and Programming Languages (8 hours)

Introduction to structured programming and problem-solving methods: algorithms, key features of algorithms, flowcharts, pseudocode, generation of programming languages, structured programming languages.

Overview of C: introduction to C, basic structure of a C program, compiling and executing C programs, comments, characteristics of a good program, character set, identifiers, keywords, data types, constants, and variables, I/O statements, operators, and expressions, precedence and associativity of operators, type conversion, and typecasting.

Module II: Decision Control Statements, Loops and Functions (8 hours)
Decision Control Statements and Loops: Introduction to Decision Control Statements, Conditional Branching statements, while loop, do-while loop, for loops, Nested Loops, Break and Continue Statements
C Functions: Need for functions, function declaration and definition, user defined and library functions, passing parameters to function, return statement, scope of variables, storage classes, recursive functions.

Module III: Arrays, Strings and Pointers (8 hours)
Arrays and Strings: One-dimensional arrays, passing array to function, multidimensional arrays and their applications, character arrays and string operations.
Pointers: Introduction to pointers, pointer expressions, dynamic memory allocation.

Module IV: Structures and Unions (6 hours)
Structures and Unions: Declaration of structures and simple implementation of structures, unions, enumerated data types.

Suggested Readings
1. Thareja, R., Computer Fundamentals and Programming in C, Oxford University Press, New Delhi.
2. Gottfried, Byron S., Programming with C (Schaum's Outlines Series), Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Kernighan, B.W., and Ritchie, Dennis M., The C Programming Language, Prentice Hall Pvt. Ltd, New Jersey.

E Resources
1. NPTEL SWAYAM Course on- Introduction To Programming In C- By Prof. Satyadev Nandakumar, IIT Kanpur
2. NPTEL SWAYAM Course on- Problem-Solving Through Programming In C, By Prof. Anupam Basu, IIT Kharagpur
3. C Programming - Learn Computer Programming With C Language, Udemy

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	L	H	H	M
CO 3	H	H	M	M
CO 4		M	H	H

CACL101L: COMPUTER PROGRAMMING IN C LANGUAGE LAB

(2 credits – 30 hours) (L-T-P: 0-0-2)

Objective
The objective of the course is to learn how to solve problems using c programming language.

COURSE / LEARNING OUTCOMES
At the end of the Lab experiments students will be able to:
CO 1: Interpret information based on their understanding of the concepts of C language's syntax, data types, control statements, functions, pointers, arrays, structures and pointers in C. (Understanding)
CO 2: Solve problems using standard algorithms and translate pseudo-codes into C programs and implement them. (Applying)
CO 3: Apply their analytical skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. (Analysing)

List of experiments:
1. Introduction to OS: Linux/Unix, Vi editor, file handling, directory structures, creating and editing simple C programs.
2. C programming using variables, assignment and simple arithmetic expressions
3. If else
4. Switch-case statements
5. Break, continue
6. Loops
7. Single and multidimensional arrays
8. Functions and recursion
9. Pointers, address operator, declaring pointers and operations on pointers

Suggested Readings
1. Balagurusamy, E., Computer Fundamentals and C Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Kanetkar, Y., Let us C, BPB Publication, New Delhi

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX
CO 1	L	M	L	L	L	H	H	H	H
CO 2			L	L	L	H	M	H	H
CO 3	L	M	M	M	H	H	H	H	H

CADS102T: DATA STRUCTURES USING C

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of the course is to learn how to create data structures to represent a collection of similar data and solve problems using C language.

COURSE / LEARNING OUTCOMES

At the end of this course, students will be able to:

CO 1: Recall the basic C constructs and familiarize with basic C syntax, also define and outline the relationship between data and operations on these data using different data structures like arrays, linked list, stacks and queues, graphs and trees. (Remembering)

CO 2: Define C constructs for explaining and generalizing these data structures and choosing appropriate algorithms for efficient program design using C syntax. (Understanding)

CO 3: Compute and demonstrate these data structures and algorithms in different real world problem domain (Applying)

CO 4: Review the choice of data structure and algorithms based on the problem domain. (Evaluating).

Module I: Arrays and Lists (13 Hours)

Data Type, Abstract Data Type, Data Structure, Fundamental and Derived Data Types, Array as a data structure, Representation of arrays: single and multidimensional, Address calculation using column and row major ordering; insertion and deletion in arrays; use of arrays for matrix representation and manipulation (addition, multiplication).

Linked List as a data structure; operations on lists; singly linked list (with one or two external pointers), doubly linked list, circular list; use of linked lists for polynomial representation and manipulation (addition and multiplication), and sparse matrix representation and manipulation (inputting, adding, and displaying in matrix form).

Module II: Stacks and Queues (12 Hours)

Stacks and Queues as data structures; implementation of stacks and queues using arrays and linked lists; Circular Queue, Priority Queue; Application of stacks: Conversion of infix (containing arithmetic operators including exponential operator, and parenthesis) to postfix and prefix expressions; evaluation of postfix expression.

Module III: Trees and Graphs (10 Hours)

Binary Trees and General Trees, Representation of trees using linked lists, Binary tree traversal methods, recursive and non-recursive algorithms for traversal methods, Binary search trees (creation, insertion and deletion of a node), Height balanced (AVL) binary trees (construct and traverse an AVL tree), B-tree (construction and traversal of a B-tree of given order)

Introducing Graphs; Graph representation: Adjacency matrix, adjacency lists, incidence matrix; Traversal schemes: Depth first search, Breadth first search

Module IV: Searching and Sorting (10 Hours)

Linear and binary search, Indexed search; Hashing, Hash Functions (division method, mid square method, folding), Basic Sorting algorithms.

Suggested Readings

1. Lipschutz, S., Theory and Problems of Data Structures (International Edition), Schaum's Outline Series, New Delhi: Tata McGraw-Hill.
2. Kanetkar, Y. P., Data Structures Through C Language, New Delhi: BPB Publications.
3. Chattopadhyay, S.; D. G. Dastidar; M. Chattopdhyay, Data Structures Through C Language, New Delhi: BPB Publications.

E Resources

1. NPTEL SWAYAM Course on- Data Structure using C Programming, By Dr. Dipti Verma and Mr. Aditya Tiwari, Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)
2. Data Structures and Algorithms In C (DSA) by Udemy

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		

CO 2	M	H		
CO 3			H	M
CO 4		M	M	H

CADS103L: DATA STRUCTURES USING C Lab

(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Recall the basic C constructs and familiarize with basic C syntax, also define and outline the relationship between data and operations on these data using different data structures like arrays, linked list, stacks and queues, graphs and trees. (Remembering)

CO 2: Define C constructs for explaining and generalizing these data structures and choosing appropriate algorithms for efficient program design using C syntax. (Understanding)

CO 3: Compute and demonstrate these data structures and algorithms in different real world problem domain (Applying)

CO 4: Review the choice of data structure and algorithms based on the problem domain. (Evaluating).

Solution of problems on-

1. Arrays
2. Stacks and Stack Application, Queues
3. Linked Lists, Circular and Doubly Linked Lists
4. Binary Trees
5. Searching and data modification: Linear search, Binary search, Hashing
6. Sorting Techniques: Selection, Insertion, Bubble Sort.

Suggested Readings

1. Lipschutz, S., Theory and Problems of Data Structures (International Edition), Schaum's Outline Series, New Delhi: Tata McGraw-Hill.
2. Kanetkar, Y. P., Data Structures Through C Language, New Delhi: BPB Publications.
3. Chattopadhyay, S.; D. G. Dastidar; M. Chattopdhyay, Data Structures Through C Language, New Delhi: BPB Publications.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M			M	M
CO 2	M	H			H	H
CO 3	M		H	M		
CO 4		M	M	H	M	M

CAIJ200T: INTRODUCTION TO JAVA PROGRAMMING

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The course is designed to impart the knowledge and skill required to solve real-world problems using an object-oriented approach utilizing Java language constructs. This course covers the two main parts of Java i.e. Java Language and Java Library (JDK 5).

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Recall the knowledge of the structure and model of the Java programming language, (Remembering)

CO 2: Explain the use of Java programming language for various programming technologies (Understanding)

CO 3: Develop software in the Java programming language. (Applying)

CO 4: Analyse user requirements for software functionality required to decide whether the Java programming language can meet user requirements. (Analysing)

CO 5: Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (Evaluating)

CO 6: Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (Creating)

Module I: Java Fundamentals (16 hours)
Genesis, Java Philosophy, Java & Internet, Object-Oriented Programming features, Java Applet and Application, Java Environment and Java Development Kit (JDK) and Java Standard Library (JSL), Tokens, Expressions, Using Data Types, Declarations, Control Flow

Module II: Java Classes, Packages and Interfaces, Java Streams (14 hours)
1. Introduction, Classes, Working with Objects, Packages, Inheritance, Interfaces
2. Data Flow with Java Streams, Input Streams, Output Streams

Module III: Exception Handling in Java and Java threads (10 hours)
1. Introduction, Exception Methods, java.lang Exceptions
2. Introduction, Creating Threads, the Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads

Module IV: Java Applets (10 hours)
Introduction, Applet Examples, The java.applet.Applet Class, The Five Stages of an Applet's Life Cycle, Methods for Adding UI Components, Methods for Drawing and Event Handling

Module V: Java AWT (10 hours)
Introduction, Swing Component and Container classes, Layout managers (Flow Layout, Grid Layout, Border Layout), Handling events, Adapter classes, Anonymous inner classes, Swing GUI components :JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollBar, JScrollPane, JToolTip, JPanel, JFrame, introduction to database connectivity with JDBC.

Suggested Readings
1. Deitel, H. M.; P. J. Deitel, Java: How to Program, New Delhi: Prentice Hall India
2. Schildt, H., The Complete Reference Java 2, New Delhi: Tata McGrawHill
3. Moss, K., Java Servlets, New Delhi Tata McGraw-Hill
4. Russell, Java Programming for the absolute Beginner, New Delhi: Prentice-Hall India
5. Hanagan D., Java Examples in a Nutshell, New Delhi: O' Reilly

E Resources
1. Coursera course on Introduction to Java
2. Udemy Course on Java Programming for Complete Beginners

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	H	M			
CO 3		M	M	M	M
CO 4		M	M	M	M
CO 5		M	M	M	M
CO 6		M	M	M	M

CAIJ201L: Introduction to Java Programming Lab
(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES
At the end of the Lab experiments students will be able to:
CO 1: Identify classes, objects, members of a class and relationships among them needed for a specific problem.(Remembering/Evaluating)
CO 2: Write Java application programs using OOP principles and proper Program structuring. (Applying/Understanding)
CO 3: Demonstrate the concepts of polymorphism and inheritance .(Applying)
CO 4: Write Java programs to implement error handling techniques using exception handling.(Applying)
CO 5: Analyse the real world problems and solve using Java programming .(Analysing/ Applying)

List of Experiments
1. Java Fundamentals using Data Types, Declarations, Control Flow
2. Java Classes and Java Packages
3. Java Interfaces and Java Streams
4. Java Exception Handling
5. Java Threads

6. Java Applets
7. Java AWT

E-resource for learning

1. Java, www.spoken-tutorial.org

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H	H					
CO 2	M	M	M	M			
CO 3			M				
CO 4				H			
CO 5					M	M	M

CALD202T: DIGITAL LOGIC DESIGN

(3 credits–45 hours) (L-T-P) (2-1-0)

Objectives

This course covers the basic concepts of digital logic. The course includes the fundamental concepts of Boolean algebra and its application for circuit analysis, multilevel gates networks, flip-lops, counters logic devices and synchronous and asynchronous sequential logic and digital integrated circuits.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: To solve conversion among different number systems (Applying)

CO 2: Apply the knowledge of Boolean algebra, Karnaugh-map or tabulation method to minimise Boolean expressions. (Applying)

CO 3: Design and analyse a given combinational/ sequential circuit and determine the corresponding truth table/ state table. (Analysing)

Module I: Number Systems (6 Hours)

Binary, Octal, & Hexadecimal Number Systems and Their Conversions, Representation of Signed Numbers-Floating Point Number, Binary Arithmetic, Representation-of BCD-ASCII-Excess 3 -Gray Code —Error Detecting and Correcting Codes.

Module II: Boolean Algebra, Simplification of Boolean Functions (13 Hours)

Boolean Algebra: Various Boolean operations; Postulates, Theorems, Duality, Boolean functions, Canonical forms, Representation of Boolean expressions using truth tables, logic gates. Boolean expressions minimization using Karnaugh map, Realization of canonical forms from Karnaugh map, Don't Care Conditions - problems using Don't care conditions, benefit of using Don't care conditions. Tabulation method/Quine- Mc Kluskey method, prime implicants.

Module III: Combinational Logic and Sequential Logic (26 Hours)

Digital devices: Logic gates, wired-logic, 8 non-degenerate forms of NOR and NAND, multilevel NAND and NOR gats, buffer, 3-state buffer, high impedance state, Realization of other logic functions using NAND/NOR gates. Drawing logic diagrams for different types of Boolean expression derived from truth tables; A brief introduction to Combinational and sequential circuits. Difference between Combinational and sequential circuits; Arithmetic circuits: Half-adder, Full-adder, Binary Adder, Binary Parallel Adder, BCD Adder, Binary Adder-Subtractor, Half-subtractor, Binary Incrementer, carry propagation, look ahead carry, carry generator, magnitude comparator; Encoders, Decoders, Multiplexers, Demultiplexers

Flip-flops: Different types of flip-flops, Flip-flop excitation tables, characteristic equations, truth tables, Triggering of Flip-flops.

Registers: Registers (Register with Parallel Load), Shift registers

Counters: Asynchronous counters, Synchronous counters; Binary Counter with Par-allel Load, binary Ripple Counter, BCD ripple counter, synchronous binary counter, binary count-up-down counter, BCD synchronous counter.

Suggested Readings

1. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd., New Delhi, 1994
2. Thomas L. Floyd, Digital Fundamentals, Fifth Edition, Pearson Education, 2002
3. V. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996

E Resources

1. SWAYAM course on Digital System Design By Prof. Neeraj Goel, IIT Ropar
2. SWAYAM Course on Digital Circuits by Prof. Santanu Chattopadhyay, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III

CO 1	H		
CO 2		H	M
CO 3			H

CALD203L: DIGITAL LOGIC DESIGN LAB

(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES

At the end of the experiments students will be able to:

CO 1: Explain the working of the various logic gates. (Understanding)
CO 2: Experiment with different logic gates to solve any given problem. (Applying)
CO 3: Analyse a given logic circuit and point out errors in it. (Analysing)
CO 4: Evaluate the output of a logic circuit for given inputs. (Evaluating)

List of experiments-

1. *Study of the Truth tables of logic gates*
2. *Realization of half/full adder and half/full adder subtractor*
3. *Verify truth table of multiplexer and demultiplexer*
4. *Verify truth table of one bit and four bit comparators*
5. *Verify truth table of flip-flops*
6. *Simulation with VDHL*
7. *Adders*
8. *Subtractors*
9. *Logic gates*
10. *MUX and DEMUX*

Suggested Readings:

1. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd., New Delhi, 1994
2. Thomas L. Floyd, Digital Fundamentals, Fifth Edition, Pearson Education, 2002
3. V. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996

E Resources

1. SWAYAM course on Digital Logic and Circuits Simulations by Prof. Awadhesh Kumar, Banaras Hindu University

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M	M		
CO 3			M	M	H	H
CO 4			M	M	M	H

CAOS204T: OPERATING SYSTEMS

(3 Credits – 45 hours) (L-T-P: 2-1-0)

Objective

To provide the basic functionalities and services provided by an operating system. This subject provides an overview of process management, memory management, deadlock, file system, input-output systems and protection and security. It gives knowledge on existing common operating systems like UNIX, Linux and Windows.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Define the basic concepts of operating systems and terminology related to operating systems such as processes, threads, files, semaphores, IPC abstractions, shared memory regions. (Remembering)
CO 2: Analyze important algorithms such as Process scheduling and memory management algorithms. (Analysing)
CO 3: Categorize the operating system's resource management techniques, deadlock management techniques, memory management techniques. (Analysing)
CO 4: Discuss and examine the importance of File and I/O system management in operating systems. (Evaluating)

Module I: Introduction to Operating systems (5 Hours)

Definition of Operating Systems, Functions of Operating Systems, Types of Operating Systems: Batch, Multiprogrammed, Time sharing, Multi-Processor, Real-time and Distributed Operating Systems, Operating System Structures, Components and Services, System calls.

Module II: Process Management (10 Hours)
Process Concept-Definition, Process States, Process Control Block, Process Schedulers- Short term, Medium term and Long term schedulers, Scheduling Algorithms - Preemptive and Non-Preemptive, Co-operating process, Threads, Inter-process communication.

Module III: Process Synchronization and Deadlock (12 Hours)
Process Synchronization-the Critical Section Problem, Classical Problems of Synchronization, Semaphores. Deadlocks - Definition of a Deadlock, System model, Characterization, Deadlock Handling-Prevention, Avoidance, Detection and Recovery (Banker's Algorithms and Resource Request Algorithm

Module IV: Memory Management (10 Hours)
Memory Management- Logical and Physical Address Space, Address Mapping, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging. Virtual memory- Demand paging and its performance, Page replacement algorithms-FIFO and LRU, Thrashing.

Module V: File and I/O System Management (8 Hours)
File management (Systems, Secondary Storage Structure)-File Concepts, Access methods, Directory Structure, Protection and consistency, Recovery.
I/O System Management- Overview of I/O Systems, I/O Interface, Secondary Storage Structure-Disk Structure and Scheduling methods, Disk management, Swap – Space management.

Suggested Readings
1. Abraham Silberschatz and Peter Baer Galvin, "Operating System Concepts", 7th Edition, Pearson Education, 2002.
2. Tannenbaum," Modern Operating Systems", PHI
3. William Stallings, "Operating Systems", 6th Edition, Pearson Education, 2010.
4. Harvey M. Deitel, Operating Systems, Second Edition, Pearson Education Pvt. Ltd.
5. Mandik and Donovan, Operating Systems, Mcgraw Hill.

E Resources
1. NPTEL SWAYAM Course on- Introduction to Operating Systems, By Prof. Chester Rebeiro, IIT Madras
2. NPTEL SWAYAM Course on- Operating System Fundamentals, By Prof. Santanu Chattopadhyay, IIT Kharagpur
3. Operating System, Udemy

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	M
CO 2		H		H	
CO 3			H	H	
CO 4					H

CAOS205L: OPERATING SYSTEMS LAB

(2 CREDIT-30 Hours) (L-T-P) (0-0-2)

COURSE / LEARNING OUTCOMES
At the end of Introduction to Operating Systems Lab students will be able to:
CO 1: Experiment with *fork()* system call to create a new process.
CO 2: Infer the concepts related to shell programming and their significance. (Understanding)
CO 3: Experiment with various scheduling algorithms (FCFS, SJF and Round Robin). (Applying)
CO 4: Examine the results obtained from page replacement algorithms-(FIFO, LRU), and understand the underlying principles and working of space management concepts. (Analysing)

List of experiments-
1. Programs using fork system calls.
2. Shell programming.
3. Programs to simulate process scheduling- FCFS, SJF and Round Robin.
4. Programs to simulate page replacement algorithms-FIFO, LRU.
5. Programs to simulate free space management.

E-resource for learning:
Linux-Ubuntu, www.spoken-tutorial.org

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	H

CACA206T: COMPUTER ORGANIZATION AND ARCHITECTURE

(3 Credits – 45 hours) (L-T-P: 3-1-0)

Objective

This course aims to provide the student with the concepts and basic knowledge necessary to understand the organisation and architecture of computing systems.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Recognize and define the basic components and design of a computer, including CPU, memories, and input/output units. (Remembering)
CO 2: Identify and classify the major components of a CPU and discuss, review the operations intrinsic to it. (Understanding)
CO 3: Discover the parameters of performance improvement and use them in predicting the issues in instruction cycle. (Applying)
CO 4: Analyse the mapping techniques of different memory units; instruction sets interpret the different performance trade-offs between them. (Analysing)
CO 5: Summarize the concepts adhered to the principles and architectures of a digital computer system to design and develop new improvised systems. (Create)

Module I: Control Unit (10 Hours)

a. Major Components of a CPU; General Register Organization; Stack Organization (Register Stack, Memory Stack, Reverse Polish Notation); Characteristics of Complex Instruction Set Computer (CISC) and Reduced Instruction Set Computer(RISC)
b. Micro operations, Control Function, Role of Three-State Bus Buffers in Memory Transfers; Arithmetic Microoperations, Logic Microoperations, Shift Microoperations; Microprogrammed Control and Hardwired Control; Control Memory, Control Word, Microinstruction, Microprogram, Mapping of Instructions; Instruction Formats(Three- Address Instructions, Two-Address Instructions and Zero-Address Instructions); Addressing modes.

Module II: Parallel Processing and Multiprocessors (12 Hours)

a. Parallel Processing: Flynn's Classification of computers; Pipelining, Data Dependency,Handling of Branch Instructions, Delayed Load, Delayed Branch; Vector Processing, Supercomputers; Array Processors.
b. Multiprocessors: Tightly Coupled, Loosely Coupled;

Module III: Memory Organization (10 Hours)

Hardware Organization for Associative Memory; Mapping methods for Cache Memory (Associative Mapping, Direct Mapping, Set-Associative Mapping), Write Through, Write Back, Cache Initialization, Cache Coherence; Virtual Memory, Memory management hardware.

Module IV: Input-Output Organization (13 Hours)

Input Output Interface, I/O Bus, Memory Bus, Isolated I/O, Memory-Mapped I/O; Asynchronous Data Transfer, Strobe Control, Handshaking; Modes of Transfer- viz. Direct Memory Access, Programmed I/O, and Interrupt-Initiated I/O; Priority Interrupt (Daisy-Chain Priority, Parallel Priority Interrupt, Priority Encoder); Input-Output Processor; Serial Communication(Character-Oriented Protocol and Bit-Oriented Protocol).

Suggested Readings

1. M. Morris Mano, Computer System Architecture, Third Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
2. V. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996
3. William Stallings, Computer Organization and Architecture, Sixth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2002

E Resources

1. SWAYAM course on Computer Architecture and Organization by Prof. Indranil Sengupta, Prof. Kamalika Datta, IIT Kharagpur

2. SWAYAM course on Computer Architecture by Prof. Smruti Ranjan Sarangi, IIT Delhi

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	M		
CO 3		M	H	L	
CO 4			H	L	
CO 5					H
CO 6			H	H	L

CACA207L: COMPUTER ORGANISATION AND ARCHITECTURE LAB

(2 credits – 30 hours) (L-T-P: 0-0-2)

Objective

This course aims to provide the student with the concepts and basic knowledge necessary to develop the organization and architecture of computing systems.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO 1: Recall different OPcodes and syntax used in 8086 (Remembering).

CO 2: Illustrate the syntax of 8086 assembly language (Understanding).

CO 3: Choose the appropriate method to Categorize different types of OPcodes and write an 8086 assembly program (Evaluating).

Module 1

Dismantling and assembling a PC along with study of connections, ports, chipsets, SMPS etc.

Module 2

Assembly language programming using IA32(gcc), Introduction of gcc assembly programming, Verification of Instruction Set, Arithmetic operations

Module 3

Addition, Subtraction, Multiplication and Division of two 8-bit numbers.
Multi byte Addition and Subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.

Module 4

Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.
DOS/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

Suggested Readings

1. V. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996
2. William Stallings, Computer Organization and Architecture, Sixth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2002

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	H	H	M
CO 2	M	M	L	L
CO 3		H	H	H

CARD208T: RELATIONAL DATABASE MANAGEMENT SYSTEMS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objectives of this course are to give students an in-depth understanding of the relational model for establishing fundamental skills with SQL and the operation of an RDBMS. The course also provides concepts of data modeling, design, and management for solving real problems.

COURSE / LEARNING OUTCOMES:

At the end of this course, students will be able to:

CO 1: Define the terminologies and features related to database systems and also describe the main functions and benefits of each of the database systems. (Remembering)

CO 2: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database. (Understanding)

CO 3: Master sound design principles for the logical design of databases, including the E-R model, EER model, and schema diagrams. (Evaluating)

CO 4: Transform an information model into a relational database schema and use the various types of query languages to implement and use the schema using a DBMS. (Applying)

CO 5: Analyze the concepts used for transaction processing and also the issues and techniques related to concurrency and recovery management. (Analyzing)

Module I (10 hours)

a. Database System – Database, Database System, DBMS, Advantages of using the database system, Functionalities of the database, Data Independence, Data Abstraction

b. Data models - Entity Relationship (ER), Enhanced Entity Relationship (EER), Mapping ER Model to Relational data model, Hierarchical and Network data models, Object Oriented and Object-Relational Data Models

Module II (15 hours)

a. SQL Queries - Relation Query Languages, SQL data types, Data Definition Language (DDL) commands, Data Manipulation Language (DML) commands, Data Retrieval commands, Single-row and Group functions, Multi-table querying (Joins and Subqueries)

b. Query Languages - Relational Algebra, Tuple and Domain Relational Calculus, Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.

Module III (8 hours)

a. Normalization: Concepts of Normalization and Denormalization, First Normal Form, Second Normal Form, Third Normal Form, Fourth Normal Form, and Fifth Normal Form

b. Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Query Optimization Algorithms

Module IV (12 hours)

a. Storage Strategies: Indices, B-Trees, Hashing, Transaction processing: Recovery and Concurrency Control, Locking and Timestamp based Schedulers

b. Advanced topics: Web Databases, Distributed Databases, Data Warehouse, and Data Mining.

Suggested Readings

1. Ramez Elmasri and Shamkant B Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education
2. Abraham Silberschatz, Henry F Korth and S Sudarshan, Database System Concepts, 5th Edition, Mc-Graw Hill.
3. C.J. Date, Introduction to Database Systems, 8th ed., Pearson Education.
4. Bipin Desai, An Introduction to Database System, Galgotia Publication.

E Resources

1. SWAYAM Course on Database Management System by Prof. Partha Pratim Das, IIT Kharagpur
2. SWAYAM Course on Database Management Systems by Dr. K. Arul Deepa, Assistant Professor, Dr.K.Arul Deepa & Dr.P.Velvizhy, Asst. Professor Dept. of IST, Anna University, CEG, Chennai, Anna University, Chennai, Anna University

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2	L	M	H	
CO 3		M		H
CO 4			M	H
CO 5			H	M

CARD209L: RELATIONAL DATABASE MANAGEMENT SYSTEMS LAB

(1 credit – 15 hours) (L-T-P:0-0-1)

Objective

The objectives for this course are to give students an in-depth understanding of the relational model for establishing fundamental skills with SQL and the operation of an RDBMS. The course also provides concepts of data modelling, design and management for solving realistic problems.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Infer database language commands to create simple database
CO 2: Analyze the database using queries to retrieve records
CO 3: Applying PL/SQL for processing database

Module I: SQL Queries (10 hours)

SQL Queries: Data Definition Language (DDL) commands – CREATE, DROP, ALTER and RENAME; Data Manipulation Language (DML) commands – INSERT, UPDATE, and DELETE; Data Retrieval command – SELECT, Single-row Functions – String functions, Numeric Functions, Date-Time Functions, General Functions, Data Type Conversion Functions; Group functions -SUM, AVG, MIN, MAX, COUNT, Multi-table querying (Joins and Subqueries)

Module II: PL/SQL Programming (5 hours)

PL/SQL Programming: PL/SQL Block Structure – DECLARE, BEGIN, END, EXCEPTION, SQL Within PL/SQL, Loops and Decision making statements, Cursor Types – Implicit and Explicit cursors

Suggested Readings

1. Ramez Elmasri and Shamkant B Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education
2. Abraham Silberschatz, Henry F Korth and S Sudarshan, Database System Concepts, 5th Edition, Mc-Graw Hill.
3. C.J. Date, Introduction to Database Systems, 8th ed.,Pearson Education.
4. Bipin Desai, An introduction to Database System, Galgotia Publication.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	L
CO 3		H

CACN300T: COMPUTER NETWORK FUNDAMENTALS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to make the students understand basic terminologies of computer networks along with their types, mode of communication, models, transmission media, connecting devices. It also emphasizes to make the students aware about network security and basic conception of the World Wide Web.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Define the basic concepts of Computer Networks, its goals and network related terminologies. (Remembering)
CO 2: Explain the concepts of Analog and Digital signals, Electromagnetic spectrum and related concepts on various architecture used in computer networks. (Understanding)
CO 3: Experiment with various Networks concepts such as Types of networks, Topologies, Transmission media. (Applying)
CO 4: Comprehend Network Security Devices, Digital Signature and Internet Basics for designing the network with a suitable topology and network types. (Creating)

Module I (15 Hours)

Computer Network: Definition, Goals, Applications, Structure, Components, Topology, Types of Topology, Types of Networks (LAN, MAN, WAN, Internet), Broadcast and Point-To-Point Networks, Communications Types (Synchronous, Asynchronous), Modes of Communication, Topology, Client/Server architecture, Network Models, Design issues of the layer, Protocol Hierarchy, ISO-OSI Reference Model (Functions of each layer),Terminology, SAP, Connection Oriented and connectionless services, Peer Entities, TCP/IP model, Layers, Ports, Protocol Stack, Comparison of ISO-OSI and TCP/IP Model

Module II (15 Hours)

Transmission Media, Classes of Transmission Media, Guided Media: Coaxial Cable, Twisted Pair, Fiber Optics Cable, Connectors, Unguided Media (Wireless), Electromagnetic Spectrum for Wireless Communication, Propagation Methods (Ground, Sky, Lineof-Sight), Wireless Transmission, Radio Waves, Infrared, Microwave, Wireless LANs Architecture, MAC Sublayer, Frame Format,Frame Types, Bluetooth Architecture.

Module III (15 Hours)

Analog and Digital Signals, Data Encoding, Parallel and Serial Transmission, Network Connectivity Devices, Categories of Connectivity Devices, Passive and Active Hubs, Repeaters, Bridges, Switches (2-Layer Switch, 3-Layer Switch (Router)), Gateways, Network Interface Cards (NIC), Internetworking Principles, Network Security : Definition, Network Security Requirements and Attacks, Network Security Devices (firewalls, Proxy Server), Encryption and Digital Signatures, Internet Basics, Concept of Intranet and Extranet, Web Server, World Wide Web (WWW) Architecture, Web Documents, Search Engines, Internet Service Providers (ISP).

Suggested Readings

1. Andrew S. Tannenbaum, "Computer Networks", Tata McGraw-Hill Publishing Company Limited New Delhi.
2. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill Publishing Company Limited New Delhi.
3. William Stallings, "Data and Computer Communications", Pearson Education Asia.

E Resources

1. Udemy Course on Computer Network Fundamentals
2. Coursera course on Networking Fundamentals

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	L	M	M
CO 2		M	M
CO 3	L	L	L
CO 4	H		H

CACN301L: COMPUTER NETWORK FUNDAMENTALS LAB

(2 credits – 30 hours) (L-T-P: 0-0-2)

COURSE / LEARNING OUTCOMES

At the end of this course, students will be able to:

CO 1: Implement various commands and evaluate the significance of socket programming used in networking. (Understanding)

CO 2: Make client-server communication with optimum algorithm and topology. (Creating)

CO 3: Make a distinctive comparison of various routing algorithms to select the optimum network path for data transfer.(Analysing)

List of Experiments

1. Basic Networking Commands and troubleshooting.
2. Introduction and implementation of LAN Trainer for various topologies and protocols simulation.
3. Programs using TCP Sockets (like date and time server and client, echo server and client, file transfer, etc.)
4. Programs using UDP Sockets (like simple DNS, file transfer, etc.)
5. Program to implement Remote Command Execution.
6. Create HTTP socket for web page upload and download.
7. Perform a case study on the following routing algorithms to select the optimum network path for data transfer.
   a. Shortest path routing
   b. Flooding
   c. Distance vector

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	L	H	L	L	M	M	L
CO 2	L	H	M	M	H	M	L
CO 3			M	M			H

CAWT302T: WEB TECHNOLOGIES

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies.

COURSE / LEARNING OUTCOMES

On successful completion of the course students will be able to:

CO 1: Recall the various Internet related terminologies and examine the history and growth of Internet. (Remembering)
CO 2: Identify and differentiate the various services provided by the internet. (Understanding)
CO 3: Experiment with various mark-up languages and style sheets to design a static website. (Applying)
CO 4: Experiment with various scripting languages to design a dynamic website. (Applying)
CO 5: Develop and create a website using standard tools and technologies. (Creating)

Module I: Basic Internet-related Terms and Static Web Development (13 Hours)

Basics of Internet – History of Internet and WWW, W3C Recommendations, Internet Connectivity (Dial-up, Leased Line, DSL, WiFi, and VSAT); Requirements for Internet Connectivity; Search Engines, Various Internet Services; Web Portal; Different types of browsers (IE, Firefox, Chrome); URLs, Domain names

Static Web Development: Introduction to XHTML; HTML vs. XHTML, XHTML comments; Basic Tags-XHTML, HEAD, TITLE, BODY; Paragraph Tag, Horizontal Rule Tag, Headings Tags, Blockquote Tag, Lists, Linking, Images, Tables, FONT Tag, PRE, DIV and SPAN tags; other different formatting tags; Forms; Frames

Module II: CSS and XML (12 Hours)

Cascading Style Sheets: Types of Style Sheets-Inline, Embedded, and External; CSS Background properties, text and font properties, Use of CSS for positioning elements, Background, and Text flow, CSS Box Model, CSS Borders and Outlines, Style class and Pseudo-class

XML: Introduction to XML; Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Parser; Document Object Model; Extensible Stylesheet Language (XSL)

Module III: Website Design Considerations and JavaScript (12 Hours)

Website Design Considerations: Planning to design a website, sitemaps, top-down vs. bottom-up approach, Creating a Compatible website for different color depths, resolutions, and browser considerations)

DHTML: Introduction to DHTML and JavaScript, Data types, operators, variables, input and output statements, Built-in functions, Arrays, If statement, Switch statement, Looping statements, JavaScript Form Validation, Events in JavaScript.

Module IV: Web Servers and PHP (8 Hours)

1. Web servers: Need of a web server; System Architecture of a Web server; HTTP Request Types; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Various web servers- Microsoft IIS, Apache, NGINX, LAMP, WAMP
2. PHP: Introduction to PHP; PHP Data Types; Control Structures; Functions; Strings; Arrays

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

E Resources

1. Spoken Tutorial on HTML by Praveen S, IIT Bombay
2. Spoken Tutorial on CSS by Neha Solanki, IIT Bombay
3. Spoken Tutorial on JavaScript by Jayesh K Ramalingaiah
4. Spoken Tutorial on PHP by Kavita Kharad

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			L
CO 2	H			
CO 3	H	H		
CO 4			H	H
CO 5		L	L	H

CAWT303L: WEB TECHNOLOGIES LAB

(2 CREDIT - 30 HOURS)

Objective

The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies.

COURSE/LEARNING OUTCOMES

At the end of the experiments, students will be able to

CO 1: Experiment with various mark-up languages and style sheets to design a static web site (Applying)
CO 2: Develop and create a dynamic website using scripting languages. (Creating)
CO 3: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (Evaluating)

Module I: Static Web Designing (10 Hours)

Web Designing: Creating static websites involving various XHTML elements
Cascading Style Sheets: Designing web pages that use CSS for standard formatting

Module II: Dynamic Web Designing (5 Hours)

JavaScript: Designing websites that use JavaScript for creating interactive web pages
PHP: Designing websites that use PHP as server-side scripting language to connect and access the web server

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3	H	H

CASE304T: SOFTWARE ENGINEERING

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

To provide the ability to analyse a scenario and produce a problem statement. The learners will be able to produce a conceptual solution which includes sample prototypes, domain models, and user stories. The learners will be able to describe the attributes and activities involved in software development process models and testing.

COURSE/LEARNING OUTCOMES

At the end of this course, students will be able to:

CO 1: Relate and examine the life cycle models of software. (Remembering)
CO 2: Interpret and differentiate various software life cycle models(Understanding)
CO 3: Experiment with different software architectures and identify the best feasible one (Applying)
CO 4: Analyse and design the software requirement specification and formulate an effort estimation plan (Analysing)
CO 5: Develop and create various design diagrams and find solutions to problems. (Creating)

Module I (15 Hours)

Problems and solutions: Why software is developed. Problem and vision statements. Goals and objectives. Definitions and paradigms, A generic view of software engineering. Software development life cycle, Role of quality, metrics and measurement, The feasibility study, Software Requirement Analysis and Specifications, work breakdown structure (WBS), Problem Analysis, Creating software requirement specification document (SRS).

Module II (15 Hours)
Process Models: How software is built. The fundamental design concept for data, architectural and procedural designs, Conceptual solutions, Agile concept and User stories. Domain modeling with UML diagrams-Class diagram, Use cases etc, Object oriented design paradigm; Creation of technical design document, The relationship between design and implementation, Coding the procedural design, Good coding style and review of correctness and readability.

Module III (15 Hours)
Strategies of software testing. Types of testing, functional testing, validation and verifications, Test Case Design, Maintenance as part of software evaluation, techniques and procedures for maintenance, Introduction to configuration Management, The concept of CASE, green engineering.

Suggested Readings:
1. Sommerville, "Software Engineering", Addison Wesley.
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

E Resources
4. Udemy course on Complete Software Engineering Course : Build Better Software
5. NPTEL course on Software Engineering By Prof. Rajib Mall, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	L
CO 2		H	L
CO 3	H	M	L
CO 4		H	H
CO 5			H

CASE305L: SOFTWARE ENGINEERING LAB
(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES
At the end of the Lab experiments students will be able to:
CO 1: Implement the software engineering process to develop any software project and formulate an effort estimation plan. (Understanding)
CO 2: Apply software design patterns. (Applying)
CO 3: Maintain the software project by using maintenance plan. (Creating)

Module I (5 Hours)
Identifying the requirements from problem statements.
Estimation of project metrics. Modelling Data Flow Diagrams

Module II (3 Hours)
Development of User stories.
Identifying domain classes from the problem statements

Module III (7 Hours)
Modeling UML use case diagram & capturing use case scenarios
Class diagram, Activity diagram etc.
Designing test suite and testing.

Suggested Readings
1. Lab using IBM RSA tools
2. Virtual lab Weblink: http://vlabs.iitkgp.ernet.in/se/

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	L	H
CO 2	L	H	H
CO 3	H	L	H

CACC306T: CLOUD COMPUTING

(4 credits-60Hours) (L-T-P: 4-0-0)

Objective

This course is designed to enable students

- *To get acquaint with the latest computational model, i.e. cloud computing*
- *To understand the basic foundational elements of cloud computing*
- *To study details of Data storage in cloud, big data file handling and parallel computing basics*
- *To get familiarized with popular cloud platforms and applications*

COURSE / LEARNING OUTCOMES

On successful completion of the course students will be able to:

CO 1: Recall and identify the various cloud service models. (Remembering)
CO 2: Understand the basic concepts of Big Data and interpret using Hadoop. (Understanding).
CO 3: Identify and relate security issues with respect to cloud environment. (Applying)
CO 4: Analyse the Quality of Service rendered by various cloud service providers. (Analysis)

Module I: Introduction and Cloud Service Models (15 Hours)

Introduction to Cloud Computing, the Evolution of Cloud Computing, Hardware Evolution, Internet Software Evolution, Server Virtualization, Web Services Deliver from the Cloud, Communication-as-a-Service, Infrastructure-as-a-Service, Monitoring-as-a-Service, Platform-as-a-Service, Software-as-a-Service, Building Cloud Network on amazon web service as VPC.

Module II: Cloud data handling (18 Hours)

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, The Map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Map-reduce.

Module III: Security Issues (15 Hours)

Putting security on the spot with questions: Understanding Security Risks, Reducing Cloud Security Breaches, Vulnerability assessment tools, Cloud computing security architecture, Architectural considerations, general issues, Trusted cloud computing, Cloud computing security challenges, Virtualization security management, VM Security recommendations, Secure execution environments and communications in cloud.

Module IV: Quality of Service (QoS) in Cloud (12 Hours)

Issues in cloud computing, implementing real-time application over cloud platform, Issues in Inter cloud environments, Dependability, Dita migration, streaming in cloud, Quality of Service (QoS) monitoring in cloud computing environment, taking virtualization into cloud, develop an application on cloud platform and deploy.

Suggested Readings:

1. John W. Rittinghouse , "*Cloud Computing: Implementation, Management, and Security*", CRC Press
2. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "*Cloud Computing for Dummies*",Wiley India Edition
3. Gautam Shroff, "*Enterprise Cloud Computing*", Cambridge
4. Ronald Krutz and Russell Dean Vines, "*Cloud Security*", Wiley-India
5. Jeffrey Dean, Sanjay Ghemawat, "*MapReduce: Simplified Data Processing on Large Clusters*", OSDI'04: Sixth Symposium on Operating System Design and Implementation,San Francisco, CA, December, 2004.
6. Tim Malhar, S.Kumaraswammy, S.Latif,"*Cloud Security & Privacy*",SPD,O'REILLY
7. Antohy T Velte, et.al,"*Cloud Computing : A Practical Approach*", McGraw Hill,

E Resources

1. http://aws.amazon.com/
2. SWAYAM course on Cloud computing by Prof. Soumya Kanti Ghosh, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3			H	L
CO 4			M	H

CAAD307T: ANDROID APPLICATION DEVELOPMENT FUNDAMENTALS

(4 credits-60Hours) (L-T-P: 4-0-0)

Objective

This course is designed to enable students to get a complete understanding of the development of android applications. On completion of this course, students will be able to design, develop, debug and deploy various real-time applications.

COURSE / LEARNING OUTCOMES

CO 1: Interpret the android architecture and configure the development environment (Understanding)
CO 2: Design and build user defined app with different types of menus and views (Applying)
CO 3: Make use of AsyncTask for accomplishing different background task (Applying)
CO 4: Create SQlite database and use views to interact with the database and publishing of application.(Creating)

Module I: Get started (10 Hours)

Get started: Build your first app, Introduction to Android, Create Your First Android App, Layouts, Views and Resources, Text and Scrolling Views.Activities: Understanding Activities and Intents, the Activity Lifecycle and Managing State,Activities and Implicit Intents. Testing, debugging, and using support libraries: The Android Studio Debugger, Testing your App, The Android Support Library

Module II: User experience (13 Hours)

User interaction: User Input Controls, Menus, Screen Navigation, RecyclerView, Delightful user experience: Drawables, Styles, and Themes, Material Design, Providing Resources for Adaptive Layouts Testing your UI: Testing the User Interface

Module III: Working in the background (15 Hours)

Background Tasks: AsyncTask and AsyncTaskLoader, Connect to the Internet, Broadcast Receivers, Services, Triggering, scheduling and optimizing background tasks: Notifications, Scheduling Alarms, Transferring Data Efficiently

Module IV: All about data (22 Hours)

Preferences and Settings: Storing Data, Shared Preferences, App Settings b) Storing data using SQLite: SQLite Primer, SQLite Database, Sharing data with content providers: Share Data Through Content Providers d) Loading data using loaders: Loaders. Permissions, Performance and Security, Firebase and AdMob, Publish

Suggested Readings

1. Android Developer Fundamentals Course – E-book by the Google Developer Training team.
2. The practical workbook: Android Developer Fundamentals Course—Practical's E-book.
3. Slide decks & Videos of lectures for reference provided by Google.

E Resources

4. Udemy Course on Learn Android Application Development: A beginner course on Android Application development
5. Coursera Course on Introduction to Android Mobile Application Development

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3		H	H	
CO 4			M	H

CANS308T: NETWORK SECURITY

(4 credits – 60 hours) (L-T-P:4-0-0)

Objective

The objective of the course is to learn the network security attacks, system vulnerabilities and strategies that can be deployed to increase the efficiency of the network service.

COURSE / LEARNING OUTCOMES

CO 1: Recall and identify the different security attacks, requirements, mechanisms and services in the practical field. (Remembering)
CO 2: Recognize and summarize the core principles of cryptography and cryptanalysis available today, including symmetric and asymmetric encryption, hashing, and digital signatures. (Understanding)
CO 3: Identify and relate themselves with the different vulnerabilities, a system in a network can have. (Applying)
CO 4: Inference and predict the issues of securing computer and information systems. (Analyzing)

CO 5: Construct how malicious code functions, relate the vulnerabilities that make proliferation possible and rewrite methods and practices available for alleviation. (Creating)

Module 1 (18 hours)
Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

Module 2 (18 hours)
Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC, Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

Module 3 (12 hours)
Email privacy: Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Module 4 (12 hours)
Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats. Firewall Design principles, Trusted Systems, Intrusion Detection Systems, Ransomware and different types of Ransomware, Methodology of execution of Ransomware.

Suggested Readings

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech.
3. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.
4. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
5. Cryptography and network Security, Third edition, Stallings, PHI/Pearson
6. Principles of Information Security, Whitman, Cengage Learning.
7. Cryptography and Network Security, S.Bose , Pearson

E Resources
1. SWAYAM: Introduction to Cyber Security (IGNOU)o https://onlinecourses.swayam2.ac.in/nou24_cs13/preview
2. Cybrary - Free and paid courses on various aspects of network security. Cybrary Network Security
3. SANS Institute - Cybersecurity training and certification programs. SANS Institute
4. Kali Linux Documentation - Resources for using Kali Linux in network security. Kali Linux Documentation
5. OWASP - Resources and tools for improving web application security. OWASP
6. Coursera Network Security Courses - Various courses on network security fundamentals and advanced topics. Coursera Network Security
7. E-Book: Introduction to Cyber Security https://uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H	M	
CO 3	L	H	M	L
CO 4	L	M	H	M
CO 5		M	H	L

CAPW309P: MINOR PROJECT
(4 credits – 60 hours) (L-T-P: 0-0-4)

Objective
This course aims to provide the student with various practical knowledge on different problem specific system deployment techniques and analysis.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO 1: Recall different processes involved in software development life cycle (Remembering).
CO 2: Understanding the problem statement and related literature study (Understanding).
CO 3: Analyse end user requirements for identifying system functionality metrics and decide whether developed system can meet end user requirements. (Analysing)
CO 4: Choose an engineering approach to solving problems, starting from the acquired knowledge to visual interpretation. (Evaluating)
CO 5: Propose the use of certain technologies by implementing them in different programming languages to solve the problem statement (Creating).

Module 1

Feasibility study of the problem statement and solution, evaluation of existing system, finding the limitation of existing system

Module 2

Literature study, identification of software and hardware requirement, schedule feasibility, economic and operational feasibility, identification software development metrics

Module 3

Evaluate Design diagrams for solving the problem statement. Identify deployment strategy.

Module 4

Develop algorithms and implement those using programming languages. Resolve and implement the problem statement through proposed software model and system architecture.

Module 5

Prepare a report to highlight the problem statement, design diagram, technologies deployed, and references used to resolve end user's requirement.

Suggested Readings:

1. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
2. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	L	L	
CO 2	H	H			
CO 3	L	L	H	H	M
CO 4		L	H	H	L
CO 5			M	H	H

CAPM400T: PYTHON AND MACHINE LEARNING

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The course is intended to give the students an insight into python programming language and its application extended to machine learning techniques in different problems of applications.

COURSE/LEARNING OUTCOMES

At the end of the Python and Machine Learning Lab students will be able to:

1. Understand python basics, data types, flow controls, sequences and functions. (Remembering).
2. Understand the file operations, function programming, data handling using Python and its libraries. (Understanding).
3. Build machine learning programs for designing self-learning solutions to different problems in the real world. (Applying)
4. Experiment with different learning techniques & parameters and conclude the pros and cons of each with respect to different problem domains. (Analysing)

Module I (15 hours)

Introduction to python, Python basics: Data types and variables, data type conversions, command line argument, data input, Flow control: if, if_elif_else statement, while loop, for loop, break & continue, Python sequences: Range, String, List, Tuple, Dictionary, Set, Shallow and deep copy, Functions and modules: Function, Pass arguments, Arguments with default values and arbitrary arguments, local and global variables, returning single and multiple values from functions, python modules, import statement for importing modules.

Module II (15 hours)
File operations handling: Reading, writing, manipulations, Exception handling: try, except, finally, raise exception, user defined exception, Python class & objects: Constructors, creating objects, Destructors, Inheritance, Overriding, Overloading, Data hiding, Functional programming: Iterators, Generators, lambda construct, Comprehensions, Map reduce and filter. NumPy: selecting data using slicing, numerical processing with multidimensional array, 2D plotting with matplotlib Pandas: Loading from CSV and other structured formats, 1D and 2D data structures-Series and DataFrame, Normalizing data, dealing with missing data.

Module III (15 hours)
Introduction to Machine learning: Basic definition, types of learning, linear regression, Decision trees, Probability and Bayes learning, Instance Based Learning: K-Nearest Neighbours Algorithm, K-Means Algorithm, Artificial Neural Network (ANN).

Suggested Readings
1. Python Cookbook-by Alex Martelli, Anna Martelli Ravenscroft, and David Ascher
2. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
3. Introduction to Machine Learning Edition 2, by Ethem Alpaydin.

E Resources
1. Coursera course on IBM Machine Learning with Python.
2. Harvard University course on Machine Learning and AI with Python
3. W3Schools course on Machine Learning
4. Suggested web links: To be provided as and when required for a particular module/topic

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	
CO 2	M	H	
CO 3			H
CO 4			M

CAPM401L: PYTHON AND MACHINE LEARNING LAB
(2 Credits – 30 hours) (L-T-P: 0-0-2)

Objective
The course is intended to give students hands-on experience on Python and building machine learning systems using Python.

COURSE/LEARNING OUTCOMES
At the end of the Python and Machine Learning Lab students will be able to:
1. Understand Python basics, data types, flow controls, sequences and functions. (Remembering).
2. Understand the file operations, function programming, data handling using Python and its libraries. (Understanding).
3. Build machine learning programs for designing self-learning solutions to different problems in the real world. (Applying)
4. Experiment with different learning techniques & parameters and conclude the pros and cons of each with respect to different problem domains. (Analysing)

List of Experiments
1. Installation of PyCharm and Jupyter. Making the Machine learning environment ready.
2. Practice of loops, iterators, string operations, file handling and classes in Python.
3. Use of Numpy and Pandas for data reading and preprocessing - standard dataset as an example.
4. Writing program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
6. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set. You can use Java/Python ML library classes/API
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

Suggested Readings

1. Python Cookbook-by Alex Martelli, Anna Martelli Ravenscroft, and David Ascher
2. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
3. Introduction to Machine Learning Edition 2, by Ethem Alpaydin.
4. Suggested web links: To be provided as and when required for a particular module/topic.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1	H	H	H					
CO 2	M	H	H					
CO 3				H	H	H	H	H
CO 4					H		H	

CADA402T: DESIGN AND ANALYSIS OF ALGORITHM

(3 Credits – 45 hours) (L-T-P: 2-1-0)

Objective

To create analytical skills, to enable the students to design algorithms for various applications and to Analyse the algorithms with the objective to introduce mathematical aspects, design and analysis of algorithms.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Define algorithms, importance of analysis of an algorithm and their asymptotic bounds and relate the different types of problem and their solutions. (Remembering)
2. Explain different design strategies such as brute force, divide and conquer, dynamic programming, greedy and backtracking used for the design of algorithms. (Understanding)
3. Compare and analyse different design strategies of algorithms. (Analysing)
4. Assess various algorithms in terms of correctness, computation cost and memory space used. (Evaluating)

Module I (11 hours)

1. Basic Concepts of Algorithms: Introduction, Notion of Algorithm, Fundamentals of Algorithmic Solving, Important Problem types, Fundamentals of the Analysis Framework – Asymptotic Notations and Basic Efficiency Classes.
2. Mathematical Aspects and Analysis of Algorithms: Mathematical Analysis of Non- recursive Algorithm, Mathematical Analysis of Recursive Algorithm.

Module II (12 hours)

Analysis of Sorting and Searching Algorithms: Brute Force – Selection Sort and Bubble Sort – Sequential Search and Brute-force string matching – Divide and conquer – Merge sort – Quick Sort – Binary Search – Binary tree- Traversal and Related Properties – Decrease and Conquer – Insertion Sort.

Module III (12 hours)

Algorithmic Techniques: Transform and conquer – Presorting – Heaps and Heap sort – Dynamic Programming – Strassen's Algorithm, Warshall's and Floyd's Algorithm – Optimal Binary Search trees – Greedy Techniques – Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman trees.

Module IV (10 hours)

NP-Complete Problems: The classes P and NP, Languages and problems, NP-completeness of the satisfiability problem. Algorithm Design Methods: Backtracking – n-Queen's Problem – Hamiltonian Circuit problem – Knapsack problem – Traveling salesman problem.

Suggested Readings

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI.
2. A.V.Aho, J.E. Hopcroft and J.D.Ullman, The Design and Analysis Of Computer Algorithms, Pearson Education.
3. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Education.
4. Sara Baase and Allen Van Gelder, Computer Algorithms - Introduction to Design and Analysis, Pearson Education.

E Resources

1. NPTEL Swayam Course on: Design and analysis of algorithms, By Prof. Madhavan Mukund, Chennai Mathematical Institute
2. Design and Analysis of Algorithms, Udemy

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		
CO 3		M	H	H
CO 4			M	M

CADA403L: DESIGN AND ANALYSIS OF ALGORITHMS LAB

(2 Credits – 30 hours) (L-T-P: 0-0-2)

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Define algorithms, importance of analysis of an algorithm and their asymptotic bounds and relate the different types of problem and their solutions. (Remembering)
2. Explain different design strategies such as brute force, divide and conquer, dynamic programming, greedy and backtracking used for the design of algorithms. (Understanding)
3. Compare and analyse different design strategies. (Analysing)
4. Assess various algorithms in terms of correctness, computation cost and memory space used. (Evaluating)

List of experiments-

1. Prove that Bubble sort algorithm has time complexity (n2) by showing the graph notation.
2. Implement the Dynamic programming technique and Analyse the algorithm showing the graph notation.
3. Implement the Greedy programming technique and Analyse the algorithm showing the graph notation.
4. Implement the Divide and Conquer technique and Analyse the algorithm showing the graph notation.
5. Design a small file compressor and decompressor by using Huffman coding technique

Suggested Readings

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI.
2. A.V.Aho, J.E. Hopcroft and J.D.Ullman, The Design and Analysis Of Computer Algorithms, Pearson Education.
3. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Education.
4. Sara Baase and Allen Van Gelder, Computer Algorithms - Introduction to Design and Analysis, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M	H			
CO 3		M	H	H	M
CO 4	M		M	M	H

CADS404T: DATA SCIENCE

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to introduce to the students the fundamental concepts, tools and techniques needed for dealing with various facets of Data Science practice. Being a data scientist mainly requires an integrated skill set such as mathematics, statistics, machine learning, databases, deep learning, along with other branches of computer science. This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset.

COURSE / LEARNING OUTCOMES

At the end of this course, students will demonstrate the ability to

1. Understand the basic concepts and technologies related to Data Science. (Understanding)
2. Interpret data findings effectively to any audience, orally, visually, and in written formats. (Understanding)
3. Obtain, clean/process, and transform data and analyze the transformed data using an ethically responsible approach (Applying and Analyzing)
4. Apply statistical analysis, machine learning and/or deep learning tools and methodologies to solve data science tasks. (Remembering)
5. Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges (Creating)

Module I: Introduction to Data Science, Preprocessing, and Data Visualization (12 Hours)

Introduction to Data Science and Data Preprocessing: Why Learn Data Science, Data Analytics Life Cycle, Types of Data Analysis, Introduction to Data Preprocessing, Data Types and Forms, Possible Data Error Types, Various Data Preprocessing Operations.

Data Plotting and Visualization: Introduction to Data Visualization, Basic Data Visualization Tools - Histograms, Bar Charts, Scatter Plots, Line Charts, Pie Charts, Box Plots, Bubble Plots, Heat Map; Advanced Data Visualization Tools - Wordclouds, Waffle Charts, Choropleth Map

Module II: Machine Learning and Deep Learning (20 Hours)

Machine Learning for Data Science: Overview of Machine Learning, Types of Machine Learning, Regression Methods (linear and logistic), KNN Classification, K-means Clustering

Deep Learning for Data Science: Introduction to TensorFlow, Pytorch, Deep Learning Primitives, Activation Functions, Artificial Neural Network, Convolutional Neural Network

Module III: Statistical Data Analysis and Business Analytics (13 Hours)

Statistical Data Analysis: Role of Statistics in Data Science, Kinds of Statistics, Descriptive Statistics (Measures of Frequency, Central Tendency, Dispersion, and Position), z-Test, Probability Theory

Business Analytics: An Overview of Business Analytics, The Business Analytics Life Cycle, Basic Tools Used in Business Analytics, Customer Analytics, and Employee Analytics

Suggested Readings

1. G. Nandi, R. K. Sharma, ***Data Science Fundamentals and Practical Approaches,*** BPB, 1st Edition, 2020.
2. Silberschatz, H. F. Korth, S Sudarshan, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, *1st Edition, Dreamtech, 2016*
3. C. Neil, R. Schutt, ***Doing Data Science: Straight Talk from the Frontline,*** O'Reilly, 1st Edition, 2019

E Resources

1. NPTEL Swayam Course on Python for Data Science, by Prof. Ragunathan Rengasamy, IIT Madras
2. NPTEL Swayam Course on Data Science for Engineers, Prof. Shankar Narasimhan and Prof. Ragunathan Rengasamy, IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	H	L	L
CO 3	H	L	L
CO 4		H	H
CO 5			H

CADS405L: DATA SCIENCE LAB

(2 credits – 30 hours) (L-T-P: 0-0-2)

Objective

The objective of this course is to make the students learn to extract valuable information for use in strategic decision making, product development, trend analysis, and forecasting. Through the practical approaches, quantitative modeling and data analysis techniques can be applied to find the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques. This course will thoroughly introduce students to the rapidly growing field of Data Science and equip them with some of its basic principles and tools for data analysis and decision making.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Apply data visualisation for presenting the output after an in-depth analysis of the given problem
2. Utilise data preprocessing techniques to prepare data for further analysis.
3. Apply standard machine learning and deep learning algorithms to solve real-life problems

Module I: Introduction to Data Preprocessing, and Data Visualization (15 Hours)

Data Preprocessing Operations using Python - Data Cleaning, Data Integration, Data Transformation, Data Reduction, and Data Discretization

Data Plotting and Visualization – Plotting Basic Data Visualization Tools - Histograms, Bar Charts, Scatter Plots, Line Charts, Pie Charts, Box Plots, Bubble Plots, Heat Map; Advanced Data Visualization Tools - Wordclouds, Waffle Charts, Choropleth Map

Module II: Statistical Data Analysis, Machine Learning and Deep Learning (25 Hours)

Statistical Data Analysis using Python: Applying Descriptive Statistics (Measures of Frequency, Central Tendency, Dispersion, and Position), z-Test, Bayesian Probability

Machine Learning and Deep Learning using Python: Applying linear and logistic regression, KNN Classification, K-means Clustering, Artificial Neural Network, Convolutional Neural Network

Suggested Readings

1. G. Nandi, R. K. Sharma, Data Science Fundamentals and Practical Approaches, BPB, 1st Edition, 2020.
2. Silberschatz, H. F. Korth, S Sudarshan, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, 1st Edition, Dreamtech, 2016
3. C. Neil, R. Schutt, Doing Data Science: Straight Talk from the Frontline**,** O'Reilly, 1st Edition, 2019.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	L
CO 2	H	
CO 3		H

CAOR406T: OPERATIONS RESEARCH

(5 credits - 75 hours) (L-T-P: 5-0-0)

Objective

Operations Research can be described as a scientific approach to the solution of problems in the management of complex systems. In a rapidly changing environment, an understanding is sought which will facilitate the choice and the implementation of more effective solutions which, typically, may involve complex interactions among people, materials and money.

Module I: Introduction to Linear Programming (20 hours)

Introduction to linear programming - formulation, graphical method, Simplex method and its applications, initial feasible solution, optimality test, Big M method and Two-Phase method.

Module II: Special topics in Linear Programming (19 hours)

Duality in linear programming, the dual simplex method, the revised simplex method, sensitivity analysis of linear programming, Goal programming, and Integer programming.

Module III: The Transportation Model and The Assignment Model (18 hours)

a. Formulation and solution of Transportation Model, North-west Corner method, Vogel's approximation method, stepping stone method, modified distribution method, degeneracy in Transportation problem, least me transportation problems,
b. Mathematical representation and solution of assignment model, Hungarian method.

Module IV: Sequencing Problem, Replacement Analysis and Queueing Model (18 hours)

Assumptions in sequencing problem, processing of n jobs through one machine, two machines and three machines, processing of two jobs through m machines. Replacement of items whose maintenance and repair cost increase with me, i) ignoring changes in the value of money, ii) value of money changes with me; replacement of items that fail suddenly. Introduction to Queueing Model.

Suggested Readings

1. C. Mohan, "Optimization Techniques" New Age
2. D. S. Hira and P.K. Gupta, "Operations Research" S. Chand
3. J.K. Sarma"Operations Research "Macmillan
4. Taha " Operation Research an introduction" Pearson
5. Billey Gillet "Operations Research" PHI
6. N.G Nair "Operations Research" Dhanpat Rai Publication
7. Pablo Pedvegal "Introduction to Optimisation" New Age.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	L	H	H	M
CO 3	H	H	M	M

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	CALE104T	Cyber Law and Ethics	4
2	Minor Course 2	CAET105T	E-Commerce Technology	4
3	Minor Course 3	CAER210T	Enterprise Resource Planning	4
4	Minor Course 4	CAWD211T	Basics of Web Designing	4
5	Minor Course 5	CAPT310T	Basics of Python	2
		CAPT311L	Basics of Python Lab	4
6	Minor Course 6	CABS312T	Business Statistics	4
7	Minor Course 7	CAAI407T	Introduction to Artificial Intelligence	3
7	Minor Course 8	CARM408T	Research Methodology	2
8	Minor Course 9	CADV409T	Data Visualization	3

CALE104T: CYBER LAW AND ETHICS

(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective

The course aims to learn about the different cyber threats, law and ethics that are associated with cyberspace.

COURSE/LEARNING OUTCOMES:

At the end of the course, students will be able to:

CO 1: Identify knowledge related to the constitution and its legal issues in cyberspace. (Remembering)

CO 2: Explain the different cybercrimes, and the related cyber laws. (Understanding)

CO 3: Demonstrate the different perspectives of professional ethics and responsibilities of engineers. (Understand)

CO 4: Illustrate the concepts behind Cyber Torts, Intellectual Property Rights and describe the concepts in connection to dispute resolution in cyberspace. (Analyzing)

Module I (14 Hours)

Constitutional & Human Rights Issues in Cyberspace Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet, Right to Privacy, Right to Data Protection, Cyber Crimes & Legal Framework Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud Cyber terrorism, Cyber Defamation.

Module II (18 Hours)

Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies, Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering

Module III (14 Hours)

Cyber Torts Cyber Defamation, Different Types of Civil Wrongs under the IT Act 2000, Intellectual Property Issues in Cyber Space Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

Module IV (14 Hours)

Dispute Resolution in Cyberspace, Concept of Jurisdiction, Indian Context of Jurisdiction, and IT Act, 2000. International Law and Jurisdictional Issues in Cyberspace, Dispute Resolutions.

Suggested Readings

1. Engineering Ethics M. Govindarajan, S. Natarajan, V. S. Senthilkumar Prentice –Hall, 2004
2. Constitution of India, Professional Ethics and Human Rights Shubham Singles, Charles E. Haries, and et al Cengage Learning India 2018
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi.
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute.
5. Jonthan Rosenoer, Cyber Law, Springer, New York.
6. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York.

E Resources

1. SWAYAM Course on Cyber Laws by Vishal Goyal Punjabi University - Patiala

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	M	M	M
CO 2	L	H	H	M
CO 3	L	H	M	M
CO 4		M	H	M

CAET105T: E-COMMERCE TECHNOLOGY

(4 CREDITS- 60 HOURS) (L-T-P: 4-0-0)

Objectives

To enable the student to become familiar with the mechanism for conducting business transactions through electronic means, buildup knowledge on electronic business, online marketing and make the students to devise marketing strategies for concerns engaged in ecommerce and understand the current status of e-business.

COURSE/LEARNING OUTCOMES:

After learning this course, the students will be able to:

CO 1: Interpret the basic concepts and technologies used in the field of E-Commerce. (Remembering)
CO 2: Explain the different regulatory provisions relating to E-Commerce. (Understanding)
CO 3: Develop processes of developing and implementing information systems. (Applying)
CO 4: Define the ethical, social, and security issues of information systems. (Analysing)
CO 5: Evaluate the various online business transactions (Evaluating)

Module I: Introduction (12 Hours)

E – Commerce: Meaning, definition, features, functions of E-Commerce, Scope, Benefits and limitations of E-Commerce – The Internet and India – E-commerce opportunities and challenges for IndustriesTechnology used in E-commerce: The dynamics of world wide web and internet (meaning, evolution and features); Designing, building and launching e-commerce website (A systematic approach involving decisions regarding selection of hardware, software, outsourcing vs. in-house development of a website)

Module II: Electronic Data Interchange (12 Hours)

Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI, EDI Agreements, EDI Security, Business Model, E-business Models Based on the Relationship of Transaction Parties: Business-to-Consumer (B2C), Business to-Business (B2B), Consumer-to-Consumer (C2C), Consumer-to-Business (C2B), E-business Models Based on the Relationship of Transaction Types: Brokerage Model, Aggregator Model, Implementation, Legal Framework for E-Commerce: E-Commerce Legal Framework, Rights and Obligations in the World of E-commerce , Copyrights , Defamation, Privacy, Contracts, Taxation, Signing a contract Electronically ,Domain name and Registration.

Module III: E-payment System (12 Hours)

E-payment Systems: Digital payment Requirements, Digital Token-based E-payment systems, Benefits to Buyers , Benefits to Sellers, Credit card as E-payment system, Mobile payments, smart card cash payment system, Micropayment system, E- Cash, Risk and e-Payment Systems, Designing e-Payment Systems, E-Retailing, E services.

E-Finance: Areas of Financing, E-Banking, Traditional Banking Vs. E-Banking, Operations in E-Banking, E-Trading, Stock Market trading, Importance and advantages of E-Trading.

Module IV: Security and Encryption: (12 Hours)

E-commerce security environment: dimension, definition and scope of e- security, security threats in the E-commerce environment, technology solutions, business procedures, and public laws , Threats in Computer Systems: Virus, Cyber Crime, Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server.

Module V: IT Act 2000 and Cyber Crimes (12 Hours)

IT Act 2000: Definitions, Digital signature, Electronic governance, Attribution, acknowledgement and dispatch of electronic records, Regulation of certifying authorities, Digital signatures certificates, Duties of subscribers, Penalties and adjudication, Appellate Tribunal, Offences and Cyber-crimes

Suggested Readings

1. Joseph P. T., E - Commerce – An Indian Perspective
2. Kenneth C. Laudon and Carlo GuercioTraver, E-Commerce,Pearson Education.
3. David Whiteley, E-commerce:Strategy,TechnologyandApplications,McGrawHill Education
4. Bharat Bhaskar, Electronic Commerce: Framework, Technology and Application, 4thEd., McGraw Hill Education
5. Joseph P T, E-Commerce: An Indian Perspective, PHILearning
6. Bajaj K K and Debjani Nag, E-commerce, McGraw HillEducation
7. Chhabra T N, E-Commerce, Dhanpat Rai Co.
8. Madan Sushila, E-Commerce, Taxmann

E Resources

1. Udemy Course on Mastering E-commerce: The Ultimate Course
2. Swayam course on E-Business By Prof. Mamata Jenamani, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			M
CO2	M	H			
CO3		M	H		M
CO4			M	H	
CO5			H	M	M

CAER210T: ENTERPRISE RESOURCE PLANNING

(4 CREDITS – 60 HOURS) (L-T-P: 4-0-0)

Objective

To help the student understand the conceptual elements of ERP and its theory and implementation. This is especially poignant in view of large number of organizations implementing ERP applications in recent years. The student will appreciate the impact that ERP brings into the daily operations of firms with respect to their productivity, integration, communication, etc.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Recall the conceptual elements of ERP. (Remembering)
CO 2: Demonstrate the Influence of ERP in Large Organizations. (Understanding)
CO 3: Identify the impact of ERP into the daily operations of firms with respect to their productivity, integration, communication etc. (Applying)
CO 4: Analyse the practical side of ERP implementation with different vendors. (Analysing)
CO 5: Discuss and evaluate the best practices of ERP with various case studies and real time examples. (Creating, Evaluating)

Module I: ERP Basics (15 hours)

Evolution and structure of ERP, ERP concepts, growth of the ERP market, conceptual model of ERP, 2-tier and 3-tier architecture, elements in ERP architecture, advantages/benefits of ERP, overview of an enterprise, integrated management information, business modelling, integrated data model ERP and related technologies: Business Process Reengineering (BPR), Management Information Systems (MIS), Decision Support Systems (DSS), Data Warehousing, Data Mining, Online Analytical Processing (OLAP), Supply Chain Management.

Module II: ERP Modules (10 hours)

Item types in ERP, Manufacturing, distribution and Financial requirements, item control module in ERP, Finance module, Manufacturing and Production Planning module, Sales and Distribution module, Plant Maintenance module, Quality Management module, Materials Management module, Capital Requirement Planning module, Purchase Control module, Human Resources modules; concept of Bill of materials, concept of formula management.

Module III: Profiling ERP Vendors (10 hours)

SAP AG: R/3 –, overview of R/3 system, R/3 modules, R/3 and the internet BAAN: Baan ERP modules, Baan ERP Tools
Oracle: Oracle modules – Financials, Human Resources, Projects, Manufacturing, Supply chain.
PeopleSoft: Accounting and control, Treasury Management, Performance Management, Sales and Logistics, Procurement.

Module IV: ERP Implementation Lifecycle (10 hours)

Elements of implementation methodology, Pre-evaluation Screening, Package evaluation, project planning phase, Gap Analysis, Business Process Re-engineering, configuration, Implementation team training, testing, product migration and support,

Problems in ERP implementation, cost of ERP.

Module V Best Practices in ERP (15hours)
Concept of Best Practices, concept of Customer Order Decoupling Point(CODP), Demand Management – Sales and Operations Planning, ERP scenario in India, future directions in ERP. Case studies should also be introduced to highlight situations where ERP projects are implemented, and the success stories/benefits/difficulties of these implementations.

Suggested Readings
1. O'Leary, Daniel E, Enterprise Resource Planning Systems: systems, life cycle, electronic commerce and risk, Cambridge University Press.
2. Alexis Leon, Enterprise Resource Planning, 14th reprint, Tata McGraw Hill, New Delhi 2005
3. Rahul V Altekar, Enterprise Resource Planning (Theory and Practice), Prentice Hall India, New Delhi 2004
4. Alexis Leon, ERP Demystified, Tata McGraw Hill Pub. Co. Ltd, 2000
5. Kent Sandoe, Enterprise Integration, John Wiley and Sons
6. Garg and Venkitakrishnan, Enterprise Resource Planning: Concepts and Practice, 2nd edition, Prentice Hall India
7. Garg and Venkitakrishnan, ERPWARE: ERP Implementation Framework, Prentice Hall India

E Resources
1. Oracle course on Oracle Fusion Cloud Enterprise Resource Planning Training and Certification
2. Udemy course on SAP ERP Fundamentals

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			M
CO 2		H	M		
CO 3		M	H		M
CO 4			M	H	
CO 5				M	H

CAWD211T: BASICS OF WEB DESIGNING

(3 Credit – 45 Hours) (L-T-P: 3-0-0)

Objective
The objective of the course is to familiarize the students with a discussion on Internet and its growth. It also provides the students a study on the basic services provided by the Internet. A familiarization on the markup languages and scripting language are also being discussed to make the student competent to design websites.

COURSE/LEARNING OUTCOMES
On successful completion of the course students will be able to:
CO 1: Recall the various Internet related terminologies and examine the history and growth of Internet. (Remembering)
CO 2: Identify and differentiate the various services provided by the internet. (Understanding)
CO 3: Experiment with various mark-up languages and style sheets to design a static website. (Applying)
CO 4: Experiment with various scripting languages to design a dynamic website. (Applying)
CO 5: Develop and create a website using standard tools and technologies. (Creating)

Module I: Basics of Internet and XHTML (15 Hours)
Basics of Internet: History of the Internet and the World Wide Web; W3C; Levels of Internet Connectivity; Requirements for Internet Connectivity; Search Engines, Various Internet Services, Web Portal; Different types of browsers; URLs, Domain names, HTTP and URL
XHTML: Basic HTML Tags – html, head, title, body, paragraph, headings, horizontal, break, image, table, lists, links, and forms. Introduction to XHTML; HTML vs. XHTML, XHTML comments;

Module II: Cascading Style Sheets and JavaScript (18 Hours)
Cascading Style Sheets: Types of Style Sheets - Inline, Embedded, and External; CSS Text properties, font properties, and Background properties; CSS Borders and Outlines, CSS Box Model, Style class and Pseudo-class
JavaScript: Client-side scripting, Introduction to JavaScript, Simple JavaScript code, JavaScript variables, functions, conditions and loops

Module III: Website Design Considerations and Web Servers (12 Hours)
Website Design Considerations: Planning to design a website, use of sitemaps, Creating a compatible website for different color depths, resolutions, and browser considerations, validating a website

Web servers: Need of a web server; System Architecture of a Web server; HTTP Request Types; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Various web servers- Microsoft IIS, Apache, NGINX, LAMP, WAMP, MAMP, XAMPP

Suggested Readings

1. Steven Holzner,"HTML Black Book", Dremtech Press
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications: Concepts and Real-World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson
5. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

E Resources

1. Spoken Tutorial on HTML by Praveen S, IIT Bombay
2. Spoken Tutorial on CSS by Neha Solanki, IIT Bombay
3. Spoken Tutorial on JavaScript by Jayesh K Ramalingaiah

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
1	H		
2	H		
3	H	H	
4		H	
5	M	L	H

CAWR212L: BASICS OF WEB DESIGNING LAB

(1 Credit - 15 Hours) (L-T-P: 0-0-1)

Objective

The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies.

COURSE/LEARNING OUTCOMES

At the end of the experiments, students will be able to

CO 1: Experiment with various mark-up languages and style sheets to design a static web site (Applying)
CO 2: Develop and create a dynamic website using scripting language. (Creating)
CO 3: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (Evaluating)

Module I: Static Web Designing (10 Hours)

Web Designing: Creating static websites involving various XHTML elements.
Using Style Sheets: Designing web pages that use CSS for standard formatting

Module II: Dynamic Web Designing (5 Hours)

JavaScript: Designing websites that use JavaScript for creating interactive web pages

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
1	H	
2		H
3	H	M

CAPT310T: BASICS OF PYTHON

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective:

The objective of the course is to provide learners with a solid foundation in the fundamentals of the Python programming language. The course aims to equip students with the knowledge and skills necessary to write simple Python programs and understand the core concepts and principles of Python programming.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Learn the syntax, semantics and OOP concepts of Python Programming Language.
CO 2: Comprehend the flow control logic in Python
CO 3: Use Python functions to facilitate code reuse and manipulate strings.
CO 4: Illustrate the process of exception handling, structuring the data using lists, tuples and dictionaries.

Module I: Introduction to Python (8 hours)

What is Python? and history of Python, Unique features of Python, Install Python and Environment Setup, Python Identifiers, Keywords and Indentation, Comments and document interlude in Python, Command line arguments, Getting User Input, Python Data Types, variables

Module II: Control Statements (8 hours)

if-else, if-elif-else, while loop, for loop, break, continue, assert, pass, return
List, Ranges & Tuples in Python
Lists in Python, Understanding Iterators, Generators, Comprehensions and Lambda Expressions, Generators and Yield, Next and Ranges, Understanding and using Ranges, Ordered Sets with tuples
Python Dictionaries and Sets
Introduction to the section, Python Dictionaries, More on Dictionaries, Sets, Python Sets Examples

Module III: Input and Output in Python (8 hours)

Reading and writing text files, writing Text Files, appending to Files and Challenge, Writing Binary Files Manually, Using Pickle to Write Binary Files
Python built in function, Python user defined functions, Python packages functions, Defining and calling Function, The anonymous Functions, Loops and statement in Python, Python Modules & Packages

Module IV: OOP concept in Python (6 hours)

Overview of OOP, The self-variable, Constructor, Namespaces, Creating Classes and Objects, Inheritance, Types of Methods, Instance Methods, Static Methods, Class Methods, Accessing attributes, Built-In Class Attributes, Destroying Objects, Abstract classes and Interfaces, Abstract Methods and Abstract class, Interface in Python, Abstract classes and Interfaces

Suggested Readings

1. Reema Thareja, “Python Programming using problem solving approach”, Oxford University press, 2017. ISBN-13: 978-0199480173
2. Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
4. Wesley J Chun, “Core Python Applications Programming”, 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.

E Resources

1. Coursera course on Introduction to Python Fundamentals
2. Udemy course on Extensive Python Fundamentals in 4 Weeks

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
1	L	H	H	H
2		H	H	H
3	L	M	M	H
4	H		H	H

CAPT311L: BASICS OF PYTHON LAB

(2 Credits- 30 Hours) (L-T-P: 0-0-2)

Objective

The objective of the course is to provide learners with a solid foundation in the practical knowledge of Python programming language. The course aims to equip students with the knowledge and skills necessary to write simple Python programs and understand the core concepts and principles of Python programming.

COURSE / LEARNING OUTCOMES

At the end of the lab experiments, students will be able to learn

CO 1: Writing programs in python, Understanding the basic structure of Python programming.
CO 2: Understanding the built – in libraries
CO 3: Implementing the concepts of OOPs in Python

Lists of experiments:

1. if-else, if-elif-else, while loop, for loop, break, continue, assert, pass, return
2. List, Ranges & Tuples in Python
3. Python Dictionaries and Sets
4. Reading and writing text files, writing Text Files, appending to Files and Challenge, Writing Binary Files Manually, Using Pickle to Write Binary Files
5. Constructor, Namespaces, Creating Classes and Objects

Suggested Readings

1. Reema Thareja, "Python Programming using problem solving approach", Oxford University press, 2017. ISBN-13: 978-0199480173
2. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO2		L	H	H	M
CO 3	M	M	M	H	H

CABS312T: BUSINESS STATISTICS

(4 Credit – 60 Hours) (L-T-P: 2-0-0)

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Recall the key terminology, concepts tools and techniques used in business statistical analysis (Remembering)
CO 2: Understand the use of Graph Theory, Probability and Time-series analysis for management decisions. (Understanding)
CO 3: Apply differential and inferential statistics to solve problems related to statistical analysis (Applying)
CO 4: Apply coorelation and regression analysis to solve problems related to statistical analysis (Applying)

Objective: *The objective of this course is to familiarize the students with basic concepts of Statistics in Business and an in-depth learning of the various statistical techniques. The aim of this course is to impart knowledge to students to improve their logical reasoning ability and interpretation of various business results. The course makes an effort to acquaint the students with the emerging issues in business, trade, and commerce regarding analyzing business facts.*

Module I: Introduction to Statistics, Frequency Distribution, and Graphs (12 Hours)

Introduction to Statistics: Statistics as a Subject of Study, Information and Data, Census data vs. Sample data, Methods of statistical data collection, Statistical Variables: Qualitative and Quantitative

Frequency Distribution and Graphs: Frequency, Stem and Leaf Display, Frequency Distributions, Data Grouping - Discrete and Continuous, Introduction to Graphs, Graph for Qualitative variables, Graph for Quantitative variables, Various types of graphs and diagrams: pictographs, bar diagram, scatter diagram, histogram, pie chart, frequency curve and frequency polygon

Module II: Descriptive and Inferential Statistics (18 Hours)

Descriptive Statistics: Measures of Central Tendency (Median, Mode, Arithmetic Mean, Geometric Mean, Harmonic Mean), Measures of Dispersion, Range, Co-efficient of Range, Quartiles, Inter-Quartile Range and Quartile Deviation, Standard Deviation, Skewness and Kurtosis; Co-efficient of Skewness: Karl Pearson's Coefficient
Inferential Statistics: Hypothesis Testing, Parametric vs. Non-Parametric tests, Parametric Tests (z-test, t-test, Chi-Square test, and F-test)

Module III: Correlation and Regression Analysis (15 Hours)
Correlation Analysis: Introduction to Correlation, Karl Pearson's product moment Co-efficient of Correlation, Positive, negative and zero correlation, Correlation through Scatter diagrams, Interpretation of Correlation Co-efficient, Simple and Multiple Correlation;
Regression Analysis: Regression and the criterion for the Line of Best Fit, Linear Regression, Logistic Regression, Polynomial Regression

Module IV: Probability and Probability Distributions (15 Hours)
Probability and Probability Distributions: Sample space and Events, Simple and Compound Events, Probability and Probability distributions: Normal Distribution, Binomial and Poisson Distribution
Time-Series Analysis: Definition, Overview of Time-Series Analysis, Components of Time-Series, Time-Series Forecasting Models using Stochastic Models (AR, MA, ARMA and ARIMA)

Suggested Readings
1. Sharma, Japuji K. *Business statistics*. Pearson Education India, 2012.
2. Bajpai, Naval. *Business statistics*. Pearson Education India, 2009.
3. Siegel, Andrew F. *Practical business statistics*. Academic Press, 2016.

E Resources
1. NPTEL course on Business Statistics
2. Study.com course on Business 212: Business Statistics

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
1	H	L		
2	H			H
3		H		
4			H	

CAAI407T: INTRODUCTION TO ARTIFICIAL INTELLIGENCE (L-T-P: 3-0-0)

(3 credits- 45 hours) (L-T-P: 3-0-0)
Objective
The course aims to familiarise the students with concepts of Artificial Intelligence, search techniques and knowledge representation issues. This course also aims to equip the students with knowledge of fuzzy logic and its uses for artificial intelligence, game playing and natural language processing.

COURSE / LEARNING OUTCOMES
At the end of the lab experiments, students will be able to learn
CO 1: Define artificial intelligence and the different techniques of artificial intelligence. (Remembering)
CO 2: Understand the components of AI agents and different problem-solving techniques, various applications of AI techniques in intelligent agents, expert systems, and artificial neural networks. (Understanding)
CO 3: Apply basic principles of AI in solutions that require problem-solving, inference, perception, knowledge representation, and learning. (Applying)
CO 4: Analyze and examine the different approaches to Knowledge Representation, reasoning, problem-solving etc. (Analyzing)

Module I (15 Hours)
What is AI (Artificial Intelligence)? : The foundation of AI problems, the history of AI, the underlying Assumption, and AI techniques Intelligent Agents: Agents and Environments, nature of environments, the structure of Agents Problem-solving Agents, State Space Search & Heuristic Search Techniques, Local Search and Optimization, Adversarial Search, Constrained Satisfaction Problem.

Module II (12 Hours)
Knowledge Representation and Reasoning Issues: Representations and Mappings, Approaches to Knowledge Representation. Using Predicate Logic: Representation of Simple Facts in Logic, Representing Instance and Isa Relationships, Computable

Functions and Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning. Symbolic Reasoning Under Uncertainty: Statistical Reasoning: Probability and Bayes' Theorem.

Module III (10 Hours)
Learning in AI: Supervised, Unsupervised, Linear regression and classification, Decision Trees, Ensemble Learning.

Module IV (8 Hours)
Recent Advances in AI: Neural Network, Fuzzy Sets and Theory, Expert Systems. Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse And Pragmatic Processing.

Suggested Readings
1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

E Resources
1. Harvard University course on Machine Learning and AI with Python
2. Simplilearn course on Professional Certificate Program In Generative AI And Machine Learning

Mapping of COs to Modules

	Module I	**Module II**	**Module III**	**Module IV**
CO1	H	M	L	L
CO2	L	H	M	M
CO3		M	H	L
CO4		M	H	H

CARM408T: RESEARCH METHODOLOGY

(2 credits- 30 hours) (L-T-P: 2-0-0)

Objective
This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights into solving a relevant problem.

COURSE/LEARNING OUTCOMES
At the end of the course students will be able to:
CO 1: Define and tell why research and its methodology are important. (Remembering)
CO 2: Explain the use of methodology in understanding the process of research. (Understanding)
CO 3: Identify the sources of data and apply various data collecting and sampling techniques. (Applying)
CO 4: Justify the use of data preprocessing techniques before analysing data. (Evaluating)
CO 5: Apply statistical analysis to classify, analyse and draw inferences from data. (Analysing/Applying)

Module I: Introduction to Research (15 Hours)
Concept and nature, objectives, criteria of a good research, types of research; features of a good research design; research problem: definition, Components, selection and formulation of research problem; preparation and presentation of research proposal; types of data, methods of data collection; sampling process; methods of sampling; determination of sample size; Report Writing: Essentials of report writing, report format

Module II: Processing and Analysis of Data (15 Hours)
Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

Suggested Readings
1. Kothari C.R , Research Methodology: Methods and Techniques, New Age International,
2. Srivastava, S. C. : Foundation of Social Research and Economics Techniques, Himalaya Publishing House, 1990.
3. Sharma H.D. and Mukherji S. P: Research Methods in Economics and Business, New York: The Macmillan Company, 1992.
4. Saunders M , Philip Lewis and Adrian Thornhill, Research Methodology for business students, Pearson Education
5. Michael V.P, Research Methodology in Management, Himalaya Publishing House

E Resources

1. NPTEL Swayam Course on Research Methodology by Prof. E. Prasad, IIT Madras
2. NPTEL Swayam Course on Research Methodology by Prof. Soumitro Banerjee, IISER Kolkata

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	
CO2	H	
CO3	H	L
CO4		H
CO5	L	H

CADV409T: DATA VISUALIZATION

(3 Credits – 45 hours) (L-T-P: 3-1-0)

Objectives:

- Develop skills to both design and visualizations.
- Understand visualization for correlation analysis, distribution analysis and multivariate analysis.
- Understand the components involved in visualization design.
- Understand the type of data impacts the type of visualization.

COURSE/LEARNING OUTCOMES

On successful completion of the course students will be able to:

CO 1: Develop familiarity with the design process to develop visualization methods and visualization systems. (Remembering)
CO 2: Understand the fundamental design principles and different types of data visualization. (Understanding)
CO 3: Apply existing visualization tools and techniques to analyze basic datasets. (Applying)
CO 4: Design and develop various data visualization methods for a given problem. (Creating)

Module I (10 hours)

Visual Perception and Cognition, visual representation of data, Coordinate Systems and Axes, Gestalt principles, information overloads, Tufte's Principles, Data visualization: Introduction, Types of data visualization, Data for visualization, Aesthetics and Types of data, Applications of Data Science technologies for visualization.

Module II (10 hours)

Basic Plotting - Line plot, Bar plot, Pie Chart, Scatter Plot, Histogram, Stacked Bar Charts, Sub Plots, Matplotlib, Searborn, Plotly, Seaborn Styles. Applied Visualizations - Box plot, Density Plot, Area Chart, Heat map, Tree map, Graph Networks. Interactive Visualizations and Animation - Dynamic charts, Dynamic maps, Animation types- 2D, 3D, Motion Animation, Animation Principles, Altair Package, Statistical Visualizations.

Module III (13 hours)

Distribution analysis, describing distributions, distribution patterns, distribution displays, distribution analysis best practices, correlation analysis, describing correlations, correlation patterns, correlation displays, correlation analysis techniques and best practices, multivariate analysis, multivariate patterns, multivariate displays, multivariate analysis techniques and best practices.

Module IV (12 hours)

Information dashboard, Introduction, Types of Dashboard, dashboard designing, Design Issues and assessment of needs – Considerations for designing dashboard-visual perception, Best practices in Dashboard design. Case Study: Creating a dashboard using Excel.

Time Series Data Visualization - Individual time series data, multiple time series data. Visualizing Trends – Smoothing, Showing Trends with a defined functional form, detrending and time series data decomposition.

Suggested Readings

1. Cole Nussbaumer Knaflic, Storytelling with Data: A Data Visualization Guide for Business Professionals, Wiley, 2015
2. Claus O. Wilke, Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, O'Reilly, 2019
3. Edward R. Tufte, The Visual Display of Quantitative Information, Graphics Press, 2001.
4. D. Kusleika, Data Visualization with Excel Dashboards, Wiley 2021.

E Resources

1. Udemy Course on Mastering Data Visualization: Theory and Foundations
2. Coursera Course on Data Visualization with Python

Mapping of COs to Modules

	Module I	Module II	Module III	Module IV
CO 1	H	M		M
CO 2	M	H		
CO 3		M	H	
CO 4		H	M	H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	CACF106L	Computer Fundamentals	3
2	S E Course 2	CAHS213L	Hardware and Server Maintenance	3
3	S E Course 3	CAMG313L	Multimedia and Graphics	3

CACF106L: COMPUTER FUNDAMENTALS

(3 credits – 90 hours) (L-T-P:0-0-3)

After completing the course successfully, the students will be able to:

CO 1: Demonstrate working with Unix files, folders, applications and operations. (Understanding)

CO 2: Write SQL queries to handle single or multi-table queries and other complex queries. (Creating)

CO 3: Apply explorative analysis techniques. (Applying)

CO 4: Evaluate the data visualisation outcomes (Evaluating)

Module I: Introduction to the Unix Operating System

Unix kernel, file system, Directories, Navigating the file system, Filename wildcard characters, Manipulating files and directories, Overview of the vi editor, Basic functions, Searching and Replacing text, Searching for text with grep, Linking files, File Permissions and Access Control, Monitoring and killing process, wc, find, cut, sort command, Condition and loop Execution, User and Group management

Module II: SQL Operations Basic

Introduction to DBMS, Basic SQL Commands, Data Definition Language, Data ManipulationLanguage, SQL SELECT Statement, business analysis using SQL, math operation, joins, union, SQL built-in functions

Module III: Data Visualization using Spreadsheet

Introduction to data visualization, bar charts, clustered bar charts, dot plots, connected dot plots, pictograms, proportional shape charts, bubble charts, radar charts, polar charts, Range chart, Box-and-whisker plots, scatter plots, histograms, pie chart, waffle chart, stacked bar chart, back-to-back bar chart, all relevant 2-D/3-D charts, sample analysis.

Suggested Reading

1. Yashwant Kanetkar, UNIX Shell Programming, BPB Publications
2. Mansoor, I.T. Tools and Applications, Pragya Publications, Matura
3. Allen G. Taylor, SQL All-in-One for Dummies, Wiley

Mapping of CO to Syllabus

	Module I	Module II	Module III
CO1	H	L	L
CO2		H	
CO3	L	H	M
CO4			H

CAHS213L: HARDWARE AND SERVER MAINTENANCE

(3 credits – 45 hours) (L-T-P: 0-1-2)

COURSE/LEARNING OUTCOMES:

CO 1: To understand the different components of computer hardware and their functions.

CO 2: To be able to identify and explain the various types of servers and their uses and to appreciate the importance of hardware and server maintenance in ensuring the smooth operation of computer systems.

CO 3: To learn basic hardware components and be able to install and configure operating systems on servers and monitor the performance of servers and tune them for optimal performance.
CO 4: To understand data backup and disaster recovery procedures and implement them effectively and learn about server virtualization, cloud computing, and high availability.

Module I: Introduction to Hardware and Server Maintenance: (5 hours)
Overview of computer hardware components, Types of servers and their uses, Importance of hardware and server maintenance

Module II: Basic Computer Hardware Components: (10 hours)
Processor and memory, Motherboard and BIOS, Power supply and cooling, Hard drives and solid-state drives, Input/Output (I/O) devices

Module III: Servers: (15 hours)
Web servers, Database servers, File servers, Mail servers, Virtual servers.
Operating system installation and configuration, Network configuration, Security updates and patches, Performance monitoring and tuning, Data backup and disaster recovery

Module IV: Advanced Topics in Hardware and Server Maintenance (20 hours)
Server virtualization, Cloud computing, High availability and redundancy, Storage area networks (SAN), Network-attached storage (NAS) Documentation and asset management, Preventive maintenance, Disaster planning and recovery, Compliance and regulatory requirements

Module V: Practical, Case Studies and Hands-On Labs (10 hours)
- Hands-on experience with hardware and server maintenance tasks
- Case studies of real-world hardware and server maintenance scenarios
- Independent research on a topic related to hardware and server maintenance
- Presentation of findings and recommendations

Suggested Readings
1. "Computer Organization and Design: The Hardware/Software Interface" by David A. Patterson and John L. Hennessy
2. "Operating System Concepts" by Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne
3. "Essential System Administration: Tools and Techniques for Linux and Unix Administration" by AEleen Frisch
4. "Windows Server 2019 Inside Out" by Orin Thomas and J.C. Mackin
5. "Linux Server Hacks: 100 Industrial-Strength Tips and Tools" by Nicholas D. Wells
6. "Data Center Fundamentals" by José Manuel Moreno Pérez and Jorge Bañuelos García
7. "Storage Networking Fundamentals: An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems" by Marc Farley
8. "Virtualization: A Beginner's Guide" by Sander van Vugt
9. "The Cloud Adoption Playbook: Proven Strategies for Transforming Your Organization with the Cloud" by Ryan O'Hara
10. "Disaster Recovery Planning: Preparing for the Unthinkable" by Jon William Toigo.

E Resources
1. Udemy: Computer Hardware, Operating System and Networking
2. CompTIA - Training and certifications for hardware and server maintenance.
3. TechTarget - Articles and guides on server maintenance and hardware troubleshooting.
4. Cisco Networking Academy - Courses on server management and IT infrastructure.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	H			
CO 2	M	M	M	M	
CO 3			M		M
CO 4					H

CAMG313L: MULTIMEDIA AND GRAPHICS

(3 Credits – 45 Hours) (L-T-P:0-0-3)

Objective
This course will introduce the students to relevant modules of multimedia and graphics using technical education tools. The course is designed to build up opportunities to understand graphic design, illustration, image manipulation, video editing, and

visual effects and experiment with the creativity and conceptualizing ability designing trends as solutions for representation of different aspects of social interaction.

COURSE/LEARNING OUTCOMES

CO 1: List the feature of multimedia tools for representation of design aspects (Remembering)
CO 2: Explain the technique for multimedia design for content development. (Understanding)
CO 3: Experiment with different editing process to solve problem statement. (Applying)
CO 4: Design prototype to represent any real-life scenario using multimedia techniques. (Creating)

Module I (15 hours):

Text, Font, Faces, animating Text, hyper text, sound – MIDI, audio editing, digitization of sound, audio filtering

Module II (15 hours):

Modelling , Lighting & Texturing, Character Rigging, Movie Merchandising, Video Editing & Compositing,

Module III (15 hours):

Portfolio Developments, Matte Painting, GNU Image Manipulation Program (GIMP)

Suggested Reading:

1. Fazreil Amreen, Instant GIMP Starter, PACKT Publishing
2. Jan Smith,Roman JoosGIMP for Absolute Beginners, Apress

E Resources

1. Web Link https://www.gimp.org/tutorials/
2. Coursera course on Interactive Computer Graphics
3. NPTEL course on Computer Graphics By Prof. Samit Bhattacharya, IIT Guwahati
4. NPTEL course on Introduction to Multimedia Systems and Processing, Prof. Somnath Sengupta, IIT Kharagpur

Mapping of Cos to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	L	
CO 2	H	M	
CO 3	H	H	H
CO 4	H	H	H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	CAIN107I	Internship	4
4	Internship	CAIN213I	Internship	4
5	Internship	CAIN314I	Internship	2

CAIN107I/ CAIN108I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 hours)

CAIN314I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours)

Objectives

The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in classroom courses to real-life industry work situations. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills.

COURSE/ LEARNING OUTCOMES

At the end of the internship, students will be able to:
CO 1: Relate theory and practical with real life examples. (Remembering)
CO 2: Explain the technical processes involved in the industry. (Understanding)
CO 3: Identify the importance of learning the computer technology. (Applying)
CO 4: Analyse application of computer technology into the practical field. (Analysing)
CO 5: Discuss the actual technological advancements in the industry. (Creating)

GUIDELINES:

The students should follow the following instruction and guidelines during the course of the internship:

- The internship should be for a minimum duration of 80 hours which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.
- The students have to undergo the internship during the Summer/Winter Break.
- The students can undergo an internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to computer technology.
- After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department.
- There would be a Seminar Presentation (PPT) and Viva-Voce Examination based on which the students would be evaluated for the internship. The Internship report would also be a part of the evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise the following:

a. Recommendation Letter from the Department.
b. Completion Certificate from the Organisation where the student has worked as an intern.
c. Internship Diary as per the prescribed format.
d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.

The Contents of the Report must include:

a. Introduction.
b. Objectives of the Internship.
c. About the Organisation (Sector, Activities, Operations).
d. Description of the work.
e. Learning Outcomes.

The Assessment for the internship must have the following components:

- Internship Report: 20 Marks
- Internship Diary: 20 Marks
- Seminar Presentation: 30 Marks
- Viva-Voce Examination: 30 Mark

RESEARCH PROJECT/DISSERTATION

BCA (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	CADI410P	Dissertation Phase I	6
8	Research Project/Dissertation	CADI411P	Dissertation Phase II	6
BCA (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	CADI412P	Dissertation Phase I	18
8	Research Project/Dissertation	CADI413P	Dissertation Phase II	20

BCA (Honours)

CADI410P: DISSERTATION-I

(6 credits – 180 hours) (L-T-P: 0-0-6)

Objective

This course aims to provide the student with various practical and research based knowledge on different problem specific statement, system deployment techniques and analysis.

COURSE / LEARNING OUTCOMES

At the end of the research project students will be able to:

1. Recall different process involved in software development life cycle (Remembering).
2. Understanding the research problem statement and related literature study (Understanding).
3. Analyse end user requirements for identifying system functionality metrics and decide whether developed system can solve the research problem. (Analysing)
4. Choose an engineering approach to solving problems, starting from the acquired knowledge to visual interpretation. (Evaluating)
5. Propose the use of certain technologies by implementing them in different programming languages to solve the research problem statement (Creating).

Module I: (12 hours)
Research methodology and types, Identification of research problem statement, finding the limitation of existing system

Module II: (12 hours)
Literature study, Identification of software and hardware requirement, schedule feasibility, economic and operational feasibility, identification software development metrics, Identification of development platform, planning for experimental arrangement

Module III: (8 hours)
Prepare Design diagrams/flowchart etc. (as applicable), Identify deployment strategy, identify probable outcome and observation.

Module IV: (15 hours)
Resolve and Implement the problem statement through proposed software model and system architecture.
Write a paper based on overall evaluation and findings during case studies / research project activities.

Module V: (13 hours)
Prepare a report to highlight the problem statement, design diagram, technologies deployed and references used to resolve end users requirement.
Submit a research paper for participation in national/international conferences for a peer review by external editorial committee.

Suggested Readings:
1. Kothari, C. and Garg, G., *Research methodology Methods and Techniques*., NEW AGE International Publishers
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	L	L	
CO 2	H	H			
CO 3	L	L	H	H	M
CO 4		L	H	H	L
CO 5			M	H	H

CADI411P: DISSERTATION-II
(6 credits – 180 hours) (L-T-P: 0-0-6)

Objective
This course aims to provide the student with various practical and research-based knowledge on different problem-specific statements, system deployment techniques, and analysis.

COURSE / LEARNING OUTCOMES
At the end of the research project, students will be able to:
1. Understanding the research problem statement and related literature study (Understanding).
2. Analyse end-user requirements for identifying system functionality metrics and decide whether the developed system can solve the research problem. (Analysing)
3. Choose an engineering approach to solving problems, starting from the acquired knowledge to visual interpretation. (Evaluating)
4. Solve problems using standard algorithms along with the presentation of probable findings and recommendations (Applying)
5. Propose the use of certain technologies by implementing them in different programming languages to solve the research problem statement (Creating).

Module I: (12 hours)
Research methodology and types, Identification of problem statement, literature study for a solution, evaluation of the existing system, finding the limitation of the existing system

Module II: (12 hours)
Comparative Literature review on recent trends for research problem solving, identification of software and hardware requirement, schedule feasibility, economic and operational feasibility, identification of software development metrics, Identification of development platform, and planning for experimental arrangement

Module III: (8 hours)
Prepare Design diagrams/flowcharts etc. (as applicable), design test cases, develop a test bed for solving the problem statement, Identify deployment strategy, and identify probable outcomes and observation.

Module IV: (15 hours)
Develop algorithms and implement using programming languages.
Resolve and Implement the problem statement through proposed software model and system architecture.
Write a paper based on overall evaluation and findings during case studies / research project activities.

Module V: (13 hours)
Prepare a report to highlight the problem statement, design diagram, technologies deployed and references used to resolve end users requirement.
Submit a research paper for participation in conference/books/letter/journal for a peer review by external editorial committee.

Suggested Readings
1. Kothari, C. and Garg, G., *Research methodology Methods and Techniques*., NEW AGE International Publishers
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			
CO 2	L	L	H	H	M
CO 3		L	H	H	L
CO 4			H	H	M
CO 5			M	H	H

BCA (Honours) with Research

CADI412P: DISSERTATION- I
(18 Credits -540 Hours) (L-T-P: 0-0-18)

Objective
During this phase, the student will start a research project applying the knowledge acquired during the first two semesters and incorporating the recent trends in the chosen area. It should include phases of analyses and design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department during the semester.

COURSE / LEARNING OUTCOMES:
At the end of the research work, students will be able to-
1. Plan and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic relevant to environment and society. (Applying)
2. Systematically identify relevant theory and concepts, relate these to appropriate methodologies and evidence, apply appropriate techniques and draw appropriate conclusions. (Applying and understanding)
3. Systematically analyse and critically evaluate the relevant information sources. (Analysing and evaluating)
4. Formulate a methodology for the problem statement. (Creation).

Module I: Introduction (30 Hours)
Formulation of the problem statement, research question.

Module II: Literature Review(60 Hours)
Literature review, study of the existing systems and their limitations, and comparative study.

Module III: Requirement Analysis and Feasibility Study (60 Hours)
Requirement analysis: Identification of software and hardware requirement, Feasibility study: schedule feasibility, economic and operational feasibility, identification software development metrics, Identification of the development platform, planning for experimental arrangements

Module IV: Design, Dataset Preparation and Methodology Design (60 hours)
Data collection: Dataset collection, dataset description, dataset preprocessing
Prepare Design diagrams/flowchart etc. (as applicable), Identify the deployment strategy, the probable outcome, and the observation. Design a methodology for the given problem statement.

Module V: Documentation (60)
Project report, presentation
Submit a research paper for participation in national/international conferences or journals (peer reviewed) for peer review by an external editorial committee.

Suggested Readings:
1. Kothari, C. and Garg, G., *Research methodology Methods and Techniques*., NEW AGE International Publishers
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			H
CO 2		H	H		M
CO 3				H	M
CO 4				H	M

CADI413P: DISSERTATION- II

(20 Credits -600 Hours) (L-T-P: 0-0-20)

Objective
During this phase, the student will carry forward and complete the work that they started in Phase I. It is expected that the student will publish at least one research paper in a well-known journal to augment their work during this phase. Published papers will carry extra weight during evaluation. The mode and components of evaluation and the weights attached to them shall be published by the Department at the beginning of the semester.

COURSE / LEARNING OUTCOMES:
At the end of the research work, students will be able to-
1. Apply the algorithm formulated in Phase I for model implementation(Application).
2. Compare the results with the existing system to identify its accuracy (Analysis)
3. Evaluate and summarize the outcome which is expected from the research (Evaluating).
4. Create an outcome based on the methodology implemented (Creation)

Module I: Implementation (80 hours)
Implement the proposed methodology using a suitable platform and tools.

Module II: Comparative Analysis (80 hours)
Detailed analysis of the standard techniques applied for decision making.

Module III: Training, Testing and Performance evaluation (60 hours)
Train and test the designed model with the prepared dataset.
Apply evaluation metrics to analyze performance and the accuracy of results.

Module IV: Documentation (80 hours)
Project report, presentation
Submit a research paper for participation in national/international conferences for peer review by external editorial committee.

Suggested Readings:
1. Kothari, C. and Garg, G., *Research methodology Methods and Techniques*., NEW AGE International Publishers
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		H	H	
CO 3			H	H
CO 4				H

DEPARTMENT OF MANAGEMENT

PROGRAMME: BACHELOR OF BUSINESS ADMINISTRATION

DEGREE: BBA (HONOURS)/ BBA (HONOURS) WITH RESEARCH

VISION:

The BBA curriculum strives to grow into a significant position in Management education to create graduates in the fied of business and management to become future business leaders, entrepreneurs who are socially responsible professionals capable of adapting into the dynamic corporate world having a globally acceptable vision.

MISSION:

- To focus on imparting the highest quality education with a strong foundation of management concepts for students to excl and enhance their skills.
- To develop a strong industry-academia interface for project based learning, internships and placements
- To create academic excellence at par with International standards in order to make the students accepted worldwide as managers.

Programme Outcomes (PO)

On successfully completing the program the student will be able to:

PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Ethical and responsible citizen:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them. : Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO 6: **Leadership,** Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Programme Specific Outcomes (PSO)

On the successful completion of B.B.A., the students will be able to:

PSO 1: **Knowledge of Marketing, HR, Finance and Aviation management**: Comprehend the various concepts, processes and significance; to develop an insight and analytical abilities and also to develop the ability to provide solutions for effective decision making in practical business problems

PSO 2: **Development of managerial skills:** To provide an opportunity for gaining practical understanding of the workplace and develop various leadership and interpersonal skills through internship training and also to make the students industry ready and to enhance critical thinking skills in understanding business challenges related to global business.

PSO 3: **Entrepreneurship development skills:** To promote entrepreneurial skills by understanding the fundamentals of new business ventures.

Mapping of Courses with POs/PSOs

Course Names	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	PSO 3
1.1	H	M	M	M	L	M	M	H	M
1.2	M	L	L	L	L	L	M	M	M
1.3	M	L	L	L		L	L	L	M
1.4	L	H	M	L		L		L	
1.5	L	L		L	L	L	L	L	H
1.6	L		L	H	H				
1.7	L		L	H		L			
2.1	L	L		L		L	H	M	
2.2	L	L		L		L	M	H	

2.3	L			L	H	L		L	L
2.4	L	H	L			L	M		
2.5	L	L	L	M		L		H	
2.6	L	M	L	L		M		H	
2.7			H	M	L	M			
3.1	L	L		L		M	H	H	
3.2	L	L		L		M	H	H	
3.3	M	L	L	L					
3.4	M	M	M	M		L		M	
3.5		H	M			L			
3.6	L	L	M			M	M	M	
4.1	H			L		L	M	M	L
4.2	H				H	L		M	M
4.3	H			L		L	M	M	L
4.4	M			L	H	L	M	M	L
4.5	L			L		M	M	L	
4.6	L	L		L		M	M	L	
4.7	L		L			L	L	L	
4.8		H				L		L	
5.1	M			L	M	L		M	
5.2	M	M	L	L		L	H	M	
5.3		L		H		M		L	
5.4	L	L				M	L	L	
5.5	M	L	L	L		M	H	H	L
5.6	L	L	L	H		L		L	
5.7	L			L		L	L	L	
6.1	M			L	M	L		M	
6.2	H			L		L	M	M	L
6.3			L	H		L			
6.4	L	L	L	M		L	M	L	
6.5	M	L		L		M	H	H	L
6.6	M					M	M	M	
6.7	M	L		L	L	M	M		
6.8	L					L	M	M	
7.1 (BBA Hons)	L					M	L	H	L
7.2 (BBA Hons)	L					M	L	H	L
7.3 A (BBA Hons)	M	L				L	L	L	
7.3 B (BBA Hons)	L					L	L	L	
7.4 (BBA Hons)	H					M	M	M	
7.5 (BBA Hons)	H	L		L		M	M	M	
7.1 (BBA Res)	H	L				L	M	L	
7.2 (BBA Res)	H	L	L	M		L	M	L	
8.1 (BBA Hons)	M	L	M	L	M	L	L	L	
8.2 (BBA Hons)	M			L		M	L	L	
8.3 (BBA Hons)	L			M		L		M	
8.4 (BBA Hons)	H	L	L	M		L	M	L	
8.1 (BBA Res)	H	L	L	M		L	M	L	

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	MTMP100T	Management Process, Principles and Practices	4
2	Major Course 2	MTHB101T	Fundamentals of Human Resources Management & Organisation Behaviour	4
3	Major Course 3	MTMM200T	Marketing Management	4
3	Major Course 4	MTAI201T	Introduction to Aviation Industry	4
4	Major Course 5	MTFM202T	Fundamentals of Financial Management	5
4	Major Course 6	MTCB203T	Consumer Behaviour	5
4	Major Course 7	MTMD204T	Business Mathematics and Statistics for Decision Making	4
5	Major Course 8	MTME300T	Managerial Economics	5
5	Major Course 9	MTEG301T	Business Ethics and Corporate Governance	5
5	Major Course 10	MTPO302T	Production and Operations Management	4
6	Major Course 11	MTPM303T	Business Policy and Strategic Management	4
6	Major Course 12	MTFI304T	Financial Markets and Institutions	4
6	Major Course 13	MTCL305T	Corporate and Business Law	4
6	Major Course 14	MTMP306P	Minor Project - 1	4
7	Major Course 15	MTCF400T	Corporate Finance	5
7	Major Course 16	MTSC401T	Supply Chain Management	5
8	Major Course 17	MTSM402T	Services Marketing	5
8	Major Course 18	MTCR403T	Corporate Restructuring	5

MTMP100T: MANAGEMENT PROCESS, PRINCIPLES AND PRACTICES
(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s)
The objective of this course is to develop an understanding of the Principles and processes of management covering the basic management functions and challenges in the emerging perspective.

Course/Learning Outcomes
At the end of the course students will be able to:
CO 1: Define the meaning of MPP. (Remembering)
CO 2: Explain the theory of planning and control. (Understanding)
CO 3: Determine the organisational process. (Applying)

Module I: Introduction to MPP (15 Hours)
Introduction: Concept, Nature, Process and Significance of Management; Managerial Roles (Mintzberg); Development of Management Thought- Classical, Neo -classical, Behavioural and Management Science Approach, System and Contingency Approaches.

Module II: Planning & Control (15 Hours)
Planning and Control: Concept, Process and Types; Planning Tools- Forecasting and Scheduling; Decision -making concept and process; Bounded rationality; Management by objectives; Corporate Planning- Environment analysis and Diagnosis

Module III: Organising (15 Hours)
Organising: Concept, nature, process and significance; Authority and Responsibility relationships Delegation, Decentralisation; Departmentation basis and formats (Project and Matrix); Formal and Informal Organisation; Changing patterns in Organisation structures in the Knowledge economy. Directing-Motivating and Leading People at work.

Module IV: Communication and Decision Making (15 Hours)
Role of communication; Communication media and technology, communication networks - formal vs. informal; barriers to effective communication; communication skills; persuasion in communication; active listening; participative decision making techniques; group vs. the individual; the decision making process

Suggested Readings
1. Joseph L. Massie :Essentials of Management .PHI, New Delhi; 2015

2. James F.Stoner: Management. Pearsons Education, Delhi ; 2020
3. Harold Koontz, Heinz Weihrich: Management. Tata McGraw Hill Pub. Co., Delhi; 2015
4. Amitai Etzioni: Modern Organizations. PHI, New Delhi; 2021
5. Jones, Gareth R. and Jennifer M. George: Contemporary Management. Tata McGraw Hill
6. Charles Hill, W.L. and Steven L. McShane: Principles of Management. Tata McGraw Hill

E Resources

1. https://www.youtube.com/watch?v=q6LMjurECZM
2. https://www.youtube.com/watch?v=GZ2dmbDmB5I

Mapping of COs with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M

MTHB101T: FUNDAMENTALS OF HUMAN RESOURCES MANAGEMENT & ORGANISATION BEHAVIOUR

(Credits: 4- 60 hours) (L-T-P: 4-0-0)

Objective(s)

The objective of this paper is to provide the students an insight into the various fundamental concepts of human resource management and organizational behaviour and its relation to other activities in an organization

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Define the nature and scope of HRM and OB and its significance (Remembering)
CO 2: Describe the importance of HRM and the procurement functions (Understanding)
CO 3: Explain the cognitive processes and dynamics of organizational behavior (Applying)
CO 4: Analyse the concepts of perception, learning and motivation (Analyzing)
CO 5: Evaluate the change and organisational development and stress management (Evaluating)

Module I: Importance of Human Resource Management (12 Hours)

Meaning, Nature and Scope, Functions and Role of HR Manager; Advisory and service function to other department; HRM function planning; objectives and policies, organizing the HRM department

Module II: Procurement and Development Functions: (12 Hours)

Job Analysis, Job description, job specification, staffing functions: recruitment, selection, interview, training, placement and induction

Module III: Introduction to the basics of Organisation Behaviour (12 Hours)

Nature and scope of OB, Challenges and opportunities for OB, Organization Goals, Models of OB, Impact of Global and Cultural diversity on Organisation Behaviour

Module IV: Cognitive processes of organizational behavior (12 Hours)

Concept, Personality, Perception and its role in individual decision making, Learning, Motivation: Hierarchy of needs theory, Theory X and Y, Motivation Hygiene theory, Vroom's expectancy theory.

Module V: Behavior Dynamics (12 Hours)

Interpersonal behavior, Communication, Leadership: Its Theories and prevailing leadership styles in Indian Organizations. Group Behavior: Definition and classification of Groups, Types of Group Structures, Group decision making, Teams Vs Groups

Suggested Readings

1. Robbins, Judge, and Vohra (2013); Organizational Behavior; Prentice Hall Inc.; 15th Edition.
2. Fred, Luthans (2005); Organisational Behavior; UK: McGraw Hill; 10th Edition.
3. G, Moorhead & Griffith. (2007). Organizational Behavior. Houghton Muffin Co.
4. Harold Koontz & Heinz Weihrich, Essentials of Human Resource Management, Tata Mc Graw Hill.
5. Stoner, Freeman, Gilbert Jr., Human Resource Management, Prentice Hall.

E Resources

1. https://www.youtube.com/watch?v=bI9RZjF-538
2. https://www.youtube.com/watch?v=MnvWxZhsvKA&list=PLdinyWzDfipOaYB_oPdWBDHqQwFBtyfGk

Mapping of COs with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M
CO4				M	
CO5					M

MTMM200T: MARKETING MANAGEMENT

(Credits: 4 - 60 hours) (L-T-P: 4-0-0)

Objective(s)

The Objective of the course is to introduce the students to the domain of marketing and to its practical applications.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Enumerate the fundamentals of marketing management. (Understanding)
CO 2: Assess the marketing environment. (Analyse)
CO 3: Analysing market segmentation. (Analysis)
CO 4: Examine pricing strategy and distribution channels. (Analysis)
CO 5: Importance of communication in marketing (Creating)

Module I: Fundamentals of Marketing (8 Hours)

Conceptual Framework of Marketing, Core Concepts of Marketing, Marketing Philosophies, Marketing Myopia, Marketing Practices developed over 21st Century; Different Contexts of Marketing Applications.

Module II: Marketing Environment (10 Hours)

Analysis of marketing environment: Macro and Micro components and their impact on marketing decisions, Macro & Micro environment of Marketing – Industry & Competitor analysis, Developing strategies.

Module III: Market Segmentation and Product Overview (13 Hours)

Consumer buying Model, Market segmentation, Targeting and Positioning, Market and Marketing research and Marketing Information System, Marketing Mix, Product mix strategies, : Product and service concept, Product Lines- Length, Breadth & depth, Product life cycle, New product Development, Brand concept, Brand Equity.

Module IV: Pricing and Distribution Strategies (14 Hours)

Pricing strategies, Price setting, Price determination. Channels of distribution: Types, Designing Distribution Channels, Managing Conflicts and Controls in Channels, Retailing, and Wholesaling, E-Retailing.

Module V: Marketing Communication Mix (15 Hours)

Marketing Communication, Integrated Marketing Communication, Promotional Mix Components- Advertising Vs Promotion, Advertising Vs Publicity, Sales Promotion, Public Relations, Personal Selling and Direct Marketing, Digital Marketing Emerging issues in marketing, Ethical issues, Green marketing, Consumerism, CSR in marketing, Payment related issues in the cashless era.

Suggested Readings

1. Kotler, P., Keller, K., Koshy, L., & Jha, M: Marketing Management: A South Asian Perspective. Pearson Education, New Delhi; 2019.
2. Saxena, R: Marketing Management. Tata McGraw Hill, New Delhi; 2015.
3. Stanton: Fundamentals of Marketing, McGraw Hill; 2020.
4. S. Jayachandran: Marketing Management, Tata McGraw Hill; 2015.
5. Ramaswamy, V. S., & Namakumari, S: Marketing Management: Global Perspective Indian Context. Laxmi Narayan Publication, New Delhi; 2014.

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3			H		
CO4				H	
CO5					M

MTAI201T: INTRODUCTION TO AVIATION INDUSTRY

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s)

The Objective of the course is to introduce the students to the domain of Aviation Industry and its different facets.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: demonstration of aviation industry (Understanding)
CO2: assessing the essentials of Aviation industry. (Evaluating)
CO3: assessing the organisational structure of aviation industry (Evaluating)
CO4: categorise the airport services. (Analysis)
CO5: evaluating the safety and security (Evaluating

Module I: Introduction (10 Hours)

Airline Industry – Scope, Types. Scheduled and Non-Scheduled Flights; Air Cargo Transport – Economic and Social impact; Regulatory Bodies; Key Performance indicators

Module II: Fundamentals of Aviation Industry (12 Hours)

Airline Profitability, Main Industry, Characteristics of Passenger airlines, Service Industry – Characteristics

Module III: Organisational Structure (12 Hours)

Airline Alliances, Development of commercial airlines, Deregulation – Impact of Deregulated Airline industry, Organizational Structure, Types of Airline Personnel, Flight crew and Cabin Crew Training, Organizational Culture**.**

Module IV: Airport and services (12 Hours)

Airports – Personnel, Processing Passengers and Freight, Airport Security, Air Navigation Services, Air Traffic Control, Airplanes – Manufacturers – Types of Aircraft

Module V: Safety and Security (14 Hours)

Air Safety and Security, Role of Regulatory Agencies, Airside Safety, Culture of Safety, Issues in Air safety, Accident and Incident Investigation, Future of Airline Industry

Suggested Readings

1. Andreas Wald, Sven Grossand Hanns Christian Wirtz, Introduction to Aviation Management, published by Routledge
2. Dr Richard Shevell, Fundamentals of Aviation and Aerospace, published by CRC Press in 2018
3. National Research Council, Aviation and the Role of Government, published by National Acaemies Press in 1998
4. Bijan Vasign, Ken Flemming and Thomas Tacker, Introduction to Airport EconmicsL From Theory to Applications, published by Routledge in 2015

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L	M		L	
CO 2	L	L			
CO 3			M	M	M
CO 4			H		
CO 5					H

MTFM202T: FUNDAMENTALS OF FINANCIAL MANAGEMENT

(5 credits- 75 hours) (L-T-P: 5-0-0)

Objective(s)

This course aims to provide students with an understanding of fundamental concepts of business finance.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Explain the objectives & scope of financial management in context of business (Remembering)
CO 2: Explain various aspects of financial environment (Understanding)
CO 3: Apply the concept of time value of money (Applying)
CO 4: Evaluate investment opportunities using the capital budgeting process (Evaluating)

Module I: Introduction (15 Hours)
Meaning of finance; Basic areas of finance; Finance functions; Finance in the organization structure of a firm; Forms of business organizations; Goals of financial management; relationship with other functions; Career in finance.

Module II: Financial Environment: Markets, Institutions, Interest Rates and Taxes (20 Hours)
Financial markets: concept and types; Financial Institutions: concept, role in funds transfer, and types; Interest rates: level of Interest rate, determinants of market interest rates, the term structure of interest rate and yield curve: Taxes: corporate tax, marginal tax and average tax.

Module III: Time Value of Money (20 Hours)
Future Value: Single period, multiple period; Present Value: single period and multiple period; Future Value and Present value for multiple cash flows; Present value of an annuity; Future value of an annuity; Perpetuities: present value; Effective annual rate.

Module IV: Capital Investment Decisions (20 Hours)
Concept of investment decisions; Generating investment project proposal; Process of Capital budgeting decision; Classification of capital projects; Project cash flows; Incremental cash flows, sunk costs, opportunity costs, net working capital, financing costs and other issues; Net present value, payback method, internal rate of return.

Suggested Readings
1. Financial Management and Policy, James C.Van Horne and Sanjay Dhamija, Pearson Education.
2. Principles of Financial Management, Levy H. and M. Sarnat, Pearson Education.
3. Fundamentals of Financial Management, Brigham and Houston, Cengage Learning.
4. Basic Financial Management, Khan and Jain, McGraw Hill Education
5. Fundamentals of Financial Management, Prasanna Chandra, McGraw Hill Education
6. Financial Management-text and Problems, Singh, J.K, DhanapatiRai and Company , Delhi
7. Fundamentals of Financial Management, Rustagi, R.P, Taxmann Publications Pvt. Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

MTCB203T: CONSUMER BEHAVIOUR

(5 credits- 75 hours) (L-T-P: 5-0-0)

Objective(s)
The objective of the course is to make the students understand the different concepts of consumer behavior, role of social and cultural settings on consumer behavior and consumer buying process.

Course/ Learning Outcomes:
At the end of this course students will be able to:
CO 1: Define the consumer behaviour. (Remembering)
CO 2: Explain the models of consumer decision process. (Understanding)
CO 3: Apply the factors influencing consumer behavior in developing marketing strategies, identify purchase decision and post purchase behaviour in varied marketing situations (Applying)
CO 4: Analyse market segmentation and segmentation of consumer markets, (Analysing)
CO 5: Assess the positioning strategies on buying behaviour. (Evaluating)

Module I: Contemporary Dimensions of Consumer Behaviour (15 Hours)
Consumer Behaviour, Consumer Decision-Making, Models of Consumer Decision –Making, Types of Consumer Buying Behaviour, Factors influencing Consumer Behaviour, Market Segmentation, Segmentation of Consumer markets, Positioning, Differentiation and Marketing Mix, Marketing Research; Consumer Research Process, Types of Research Methods.

Module II: Implications Social and Cultural Settings on Consumer Behaviour (15 Hours)
Influence of culture and Subculture on Consumer Behaviour, Influence of Social Class on Consumer Behaviour, Social Stratification and Marketing Strategy, Group Influence on Consumer Behaviour, Household and Family Influence on Consumer Behaviour, Socialisation of family Members, Family Purchasing Decision-Making and Consumption Related Roles, family Life Cycle.

Module III: Consumer Buying Process (15 Hours)
Stages of Consumer Buying Process, Purchase Decision and Post Purchase Behaviour, Traditional and Contemporary Models of Consumer Behaviour; Case study

Module IV: Advertising as a communication process (20 Hours)

a) Advertising as a tool of communication; Meaning, nature and importance of advertising; Types of advertising; Advertising objectives. Audience analysis; Setting of advertising budget: Determinants and major methods.
b) Major media types-their characteristics, internet as an advertising media, merits and demerits; Factors influencing media choice; media selection, media scheduling, Advertising through the Internet-media devices

Module V: Evaluating communication and sales effects (10 Hours)
Evaluating communication and sales effects; Pre- and Post-testing techniques

Suggested Readings

1. Blackwell, Roger D, Paul W Miniard and James F Engel, Consumer Behaviour, Thomson Learning Inc.,2002.
2. Duhan S.N., GarimaSahni N.K. , Consumer Behaviour, 1st edition, 2016, Kalyani Publishers
3. Loudon, David l., and Albert J. Della Bitta, Consumer Behaviour, Tata McGraw Hill, New Delhi
4. Schiffman, Leon G., and Leslie kanuk, Consumer Behaviour, Prentice Hall, New Delhi
5. Schiffman, Kanuk L L., S Ramesh Kumar, Consumer Behaviour, 10th edition, Pearson
6. Dheeraj Sinha, Consumer India Inside the Indian Mind and Wallet, 2011, Jain Book Depot

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H		M	L	
CO 2		M			
CO 3			L	H	
CO 4		H			M

MTMD204T: BUSINESS MATHEMATICS & STATISTICS FOR DECISION MAKING

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objective(s)
The objective of this course is to familiarize students with the applications of mathematics and statistical techniques in business decision-making

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Apply matrices in business and economic models (Applying)
CO 2: Illustrate the use of differentiation in business and economic models. (Applying)
CO 3: Identify the methods of calculating interest rates (Applying)
CO 4: Summarize data sets using descriptive statistics (Understanding)
CO 5: Analyse the relationship between two variables (Analysing)
CO 6: Determine the trend and seasonality in time series data (Evaluating)

Part – A: Business Mathematics

Module I: Matrices (7 Hours)
Definition of a matrix. Types of matrices; Algebra of matrices. Calculation of values of determinants up to third order; Adjoint of a matrix; Finding inverse of a matrix through ad joint; Applications of matrices to solution of simple business and economic problems

Module II: Differential Calculus (13 Hours)
Mathematical functions and their types – linear, quadratic, polynomial; Concepts of limit and continuity of a function; Concept of differentiation; Rules of differentiation – simple standard forms. Applications of differentiation – elasticity of demand and supply; Maxima and Minima of functions (involving second or third order derivatives) relating to cost, revenue and profit.

Module III: Basic Mathematics of Finance (5 Hours)
Simple and compound interest Rates of interest – nominal, effective and continuous – their interrelationships; Compounding and discounting of a sum using different types of rates

Part – B: Business Statistics

Module IV: Uni-variate Analysis (15 Hours)

Measures of Central Tendency including arithmetic mean, geometric mean and harmonic mean: properties and applications; mode and median. Partition values - quartiles, deciles, and percentiles. Measures of Variation: absolute and relative. Range, quartile deviation and mean deviation; Variance and Standard deviation: calculation and properties.

Module V: Bi-variate Analysis (10 Hours)
Simple Linear Correlation Analysis: Meaning, and measurement. Karl Pearson's co-efficient and Spearman's rank correlation Simple Linear Regression Analysis: Regression equations and estimation. Relationship between
Co-relation and regression coefficients

Module VI: Time-based Data: Index Numbers and Time-Series Analysis (10 Hours)
Meaning and uses of index numbers; Construction of index numbers: Aggregative and average of relatives – simple and weighted, Tests of adequacy of index numbers, Construction of consumer price indices. Components of time series; additive and multiplicative models; Trend analysis: Finding trend by moving average method and Fitting of linear trend line using principle of least squares.

Suggested Readings
1. Mizrahi and John Sullivan. Mathematics for Business and Social Sciences. Wiley and Sons.
2. Budnick, P. Applied Mathematics. McGraw Hill Publishing Co.
3. N. D. Vohra, Business Mathematics and Statistics, McGraw Hill Education (India) Pvt Ltd
4. J.K. Thukral, Mathematics for Business Studies, Mayur Publications
5. J. K. Singh, Business Mathematics, Himalaya Publishing House.
6. J. K. Sharma, Business Statistics, Pearson Education.
7. S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.
8. S.P. Gupta and Archana Gupta, Elementary Statistics, Sultan Chand and Sons, New Delhi.
9. Richard Levin and David S. Rubin, Statistics for Management, Prentice Hall of India, New Delhi.
10. M.R. Spiegel, Theory and Problems of Statistics, Schaum's Outlines Series, McGraw Hill Publishing Co.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H				
CO 3			H			
CO 4				H		
CO 5					H	
CO 6						H

MTME300T: MANAGERIAL ECONOMICS

(5 credits-75 Hours) (L-T-P: 5-0-0)

Objective(s)
The purpose of this course is to apply micro economic concepts and techniques in evaluating business decisions taken by firms. The emphasis is on explaining how tools of standard price theory can be employed to formulate a decision problem, evaluate alternative courses of action and finally choose among alternatives. Simple geometry and basic concepts of mathematics will be used in the course of teaching.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain the mechanics of supply and demand in allocating goods and services and resources (Remembering)
CO 2: Illustrate how changes in demand and supply affect markets (Understanding)
CO 3: Apply the choices made by a rational consumer (Applying)
CO 4: Interpret the relationships between production and costs (Evaluating)
CO 5: Discuss key characteristics and consequences of different forms of markets (Creating)

Module I (20 Hours)
Demand, Supply and Market equilibrium: individual demand, market demand, individual supply, market supply, market equilibrium; Elasticity of demand and supply : Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, elasticity of supply;
Theory of consumer behavior : cardinal utility theory, ordinal utility theory(indifference curves, budget line, consumer choice, price effect, substitution effect, income effect for normal, inferior and giffen goods), revealed preference theory.

Module II (15 Hours)
Producer and optimal production choice: optimizing behavior in short run(geometry of product curves, law of diminishing

marginal productivity, three stages of production), optimizing behavior in long run (isoquants, iso-cost line, optimal combination of resources) Costs and scale : traditional theory of cost (short run and long run, geometry of cost curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.

Module III (20 Hours)
Theory of firm and market organization : perfect competition (basic features, short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of changes in demand, cost and imposition of taxes) ; monopoly (basic features, short run equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination; monopolistic competition (basic features, demand and cost, short run equilibrium, long run equilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma

Module IV (20 Hours)
Factor Market: demand for a factor by a firm under marginal productivity theory (perfect competition in the product market, monopoly in the product market), market demand for a factor, supply of labour, market supply of labour, factor market equilibrium.

Suggested Readings
1. Dominick Salvatore (2009). Principles of Microeconomics (5th ed.) Oxford University Press
2. Lipsey and Chrystal. (2008). Economics. (11th ed.) Oxford University Press
3. Koutosyannis (1979). Modern Micro Economics. Palgrave Macmillan
4. Pindyck, Rubinfeld and Mehta. (2009). Micro Economics. (7th ed.). Pearson.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		H		
CO 3			H	
CO 4				H
CO 5	H			M

MTEG301T: BUSINESS ETHICS AND CORPORATE GOVERNANCE

(Credits: 5-75 hours) (L-T-P: 5-0-0)

Objective(s)
The objective of this paper is to make the students aware about the importance of ethics in the business, practices of good governance to encourage moral imagination and heightening sensitivity towards the ethical dimension of managerial problems.

Course/Learning Outcomes
At the end of this course the students will be able to:
CO 1: Define Business Ethics and best practices of business ethics (Remembering)
CO 2: Explain the various Corporate Social Responsibilities (Understanding)
CO 3: Plan the need and importance of corporate and professional responsibility (Applying)
CO 4: Analyse the corporate governance frameworks (Analyzing)

Module I: Business Ethics (15 Hours)
Business ethics: Introduction, Meaning of ethics, Types of business, ethical issues, why ethical problems occur in business, Ethical dilemmas and principles in business,
Case Study: Personal companies like Tata related to Ethics in Business in Indian context

Module II: Corporate Governance (20 Hours)
Corporate governance: concept, need to improve corporate governance standards, Features of good governance, Corporate governance abuses, Role played by regulators to improve corporate governance. Different Approaches to Corporate Governance, Leadership and Corporate Governance, Rights and Privileges of shareholders; Investor's Problem and protection; Board of Directors; Role, Duties and Responsibilities of Auditors, Bank and Corporate Governance.
Case Study: International experience- UK scenario (Cadbury committee; US scenario(Tread way commission, Blue ribbon committee); Indian experience- imperatives, CII code of best practices, Kumar Mangalam Birla, Narayan Murthy committee report.

Module III: Moral issues in business (20 Hours)
Moral issues in business: Importance of moral issues and reasoning, Principles of moral reasoning, Quality of work life, implications of moral issues in different functional areas of business like finance, HR and marketing.

Whistle blowing: Kinds of Whistle blowing, Marketing truth and advertising: Marketing, Advertising, Truth and advertising, Allocation of moral responsibility in advertising Trade secrets, corporate disclosure, insider trading: Trade secrets, corporate disclosure, insider trading Accounting, finance Affirmative action, Ethics and Environment

Module IV: Corporate Social Responsibility (20 Hours)
Corporate Social Responsibility: Meaning, Evolution of Corporate Social Responsibility, Limits of Corporate Social Responsibility, Voluntary Responsibility Vs. Legal requirements, Profit maximization vs. social Responsibility, Socially Responsive Management: Strategies of response, formulating socially responsive strategies, Implementing social responsiveness, Financial incentives for social responsibility, Role of self regulation in discharge of social responsibility.
Case studies on Indian companies like Tata, Godrej etc related to Corporate Social Responsibility

Suggested Readings
1. Crane. A., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Taxmann Publishing House.
2. Manuel G Velasquez. Business Ethics: Concept and Cases
3. William H. Shaw, Business Ethics: A Textbook with Cases
4. Tom L. Beauchamp and Norman E. Bowie, Ethical Theory and Business
5. Jill Solomon, Corporate Governance and Accountability
6. R. I. Tricker, Corporate Governance: Principles, Policies, and Practices

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	L
CO 2		M		H
CO 3		M	L	H
CO 4		H		L

MTPO302T: PRODUCTION AND OPERATIONS MANAGEMENT

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective(s)
This course aims at acquainting the students with the functions of production and operations management and basic issues and tools of managing production and operation functions of an organization. The course also intends to provide the students a system theoretic view on project management and helps develop an understanding on why today's organizations are cultivating a formal project management process to gain competitive advantage.

COURSE/LEARNING OUTCOMES
At the end of this course students will be able to:
CO 1: Define a production system. (Remembering)
CO 2: Explain the tools and techniques to measure work study, motion study. (Understanding)
CO 3: Demonstrate the procedure for product development and design. (Applying)
CO 4: Compute project completion time and Analyse and evaluate project risk management techniques. (Evaluating)

Module I: Introduction and Work Study (15 Hours)
Introduction to Production and operations management- Meaning and scope, subdivisions of work study Method/Motion, study and work measurement

Module II: Plant Location and layout (15 Hours)
a) Objectives, Locational factors, Economics of plant location
b) Meaning, objectives and types of plant layout and their relevance to mass, batch and job- order production systems.
c) Systematic Layout Planning (SLP) procedure

Module III: Product design and Development and PPC (15 Hours)
a) Meaning of product, Product life cycle (PLC) and Product mix
b) Decisions to be taken during product development and design
c) Procedure for product development and design
d) Value of a product – its meaning, Value Analysis (VA) – its objectives, procedure and example, Simplification and Standardization.
e) Meaning and Objectives of PPC, Effects of types of production

Module IV: Project Management (15 Hours)
a) Project management framework, Project management processes, Cost and Time management, Project integration

management, Project risk management, Project Quality management, Project communication management.

Suggested Readings

1. Adam, Ebert, Production and Operations Management, PHI.
2. R. Panneerselvam, Production and Operations Management, PHI.
3. K. Aswathappa & K. Shridhara Bhat, Production and Operations Management, Himalaya Publishing

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	L
CO 2		M		H
CO 3		M	L	H
CO 4		H		L

MTPM303T: BUSINESS POLICY & STRATEGIC MANAGEMENT

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course is designed to enhance knowledge on business policy and strategy adopted for managing the business. It will help a student to get broad exposure to understand the business policy and strategic management adopted by different business for their smooth running and facing the competition.

Course/Learning Outcomes

At the end of the course students will be able to:
CO1: develop an understanding of underlying concepts, tools, frameworks, issues and challenges (Remembering)
CO2: achieve development of an understanding of the increasing competition (Understanding)
CO3**:** explain the different circumstances & situations arising from ever changing strategic situation (Analysisng)

Module I: Introduction to Business Strategy and Formulation (15 Hours)

Introduction & Concept of Strategy, Corporate Policy as a field of study, Nature. Importance, purpose and objective of business policy, Chief Executive job, roles and responsibilities of board of Directors, An overview of strategic management, its nature and process, Formulation of strategy, Environment, environment scanning, environment appraisal, Identifying corporate competence & resource.

Module II: Introduction to Strategic Management (15 Hours)

Corporate Strategy, Persona1 and Ethical Values, Business ethics, Industry structure, Reconciling divergent values, Modification of values, moral components of corporate strategy, community considerations and corporate social responsibility (CSR) .

Module III: Strategic Management Process (15 Hours)

Corporate portfolio analysis, competitor & SWOT analysis, strategic audit & choice, strategic plan, routes to sustainable competitive advantage (SCA)

Module IV: Strategic Planning and Implementation (15 Hours)

Strategy Implementation, Structural implementation, organisational design and change, behavioural implementation, leadership, corporate culture. corporate politics and use of power, functional implementation - financial, marketing. Operation personnel (HR) policies and their integration, strategic evaluation and control

Suggested Readings

1. Wheelen, Thomas L , Hunger, J David & Rangarajan, Krish (2001) Concepts in Strategic Management & Business Policy, Pearson Education.
2. David, Fred R (2005), Strategic Management Concepts & Cases, PHI.
3. Kazmi, A. (2000); Business Policy, McGraw Hill.
4. Pearce, John A , Robinson, Richard B , Mital, Amita (2005) , 10th Edition., Strategic Management – Formulation, Implementation & Control, McGraw Hill.

Mapping of COs with Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2		H		
CO 3			H	H

MTFI304T: FINANCIAL MARKETS AND INSTITUTIONS

(4 credits – 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The objective of this paper is to introduce students to the different aspects and components of financial Institutions and financial markets and also to introduce them with the emerging application of technologies in the system. The study of the course will enable them to take rational decisions in the growing financial environment.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Describe the Indian banking system (Understanding)
CO 2: Explain the role of regulatory bodies in regulating the system (Understanding)
CO 3: Analyze the operative system of financial markets in India (Analyzing)
CO 4: Evaluate the types of debt instruments and their characteristics. (Evaluating)
CO 5: Elaborate the links between the theories of financial markets (Creating)

Module I: Structure of Indian Financial System (12 Hours)

An overview of the Indian financial system, financial sector reforms: context, need and objectives; major reforms in the last decade; competition; deregulation; capital requirements; issues in financial reforms and restructuring; future agenda of reforms; Regulation of Banks, NBFCs &FIs, Salient provisions of banking regulation act and RBI Act; Role of RBI as a central banker; Products offered by Banks and FIs: Retail banking and corporate banking products. Universal Banking: need, importance, trends and RBI guidelines.

Module II: Emerging Technologies in Indian Financial System (12 Hours)

Core banking solution (CBS); RTGS, IMPS and internet banking, mobile banking, NBFCs and its types; comparison between Banks and NBFCs; payment bankers such as PayTM, Google Pay etc

Module III: Introduction to Financial Markets in India (12 Hours)

Role and Importance of Financial Markets, Financial Markets: Money Market; Capital Market; Factors affecting Financial Markets, Linkages Between Economy and Financial Markets, Debt Market- role and functions of these markets, Issue of Corporate Securities: Public Issue through Prospectus, Rights Issue, On- Line IPO, Book Building of Shares, Disinvestment of PSU, Employees Stock Options, Preferential Issue of Shares,

Module IV: Secondary Market in India (12 Hours)

Introduction to Stock Markets, Regional and Modern Stock Exchanges, International Stock Exchanges, Comparison between NSE and BSE, Raising of funds in International Markets; Indian Stock Indices and their construction, Factors influencing the movement of stock markets, indicators of maturity of stock markets, Major Instruments traded in stock markets, Myths attached to Investing in Stock Markets. Trading of securities on a stock exchange; Selection of broker, capital and margin requirements of a broker, DEMAT System

Module V: Money Markets & Debt Markets in India (12 Hours)

Money Market: Meaning, role and participants in money markets, Segments of money markets, money market instruments. Role of STCI and DFHI in money market, Debt Market: Introduction and meaning, Market for Government/Debt Securities in India, Secondary market for government/debt securities, over subscription and devolvement of Government Securities, Government securities issued by State Governments, Municipal Bonds, Corporate Bonds vs. Government Bonds

Suggested Readings

1. Khan, MY.(2010).Financial Services(5th ed.).Mc Graw Hill Higher Education.
2. Bharati V. Pathak, Indian Financial System, Pearson
3. Shahani, Rakesh(2011). Financial Markets in India : A Research Initiative. Anamica Publications
4. Goel, Sandeep.(2012).Financial services. PHI.
5. Gurusamy, S.(2010).Financial Services. TMH.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M			L	
CO 3		H	H		
CO 4			H	M	M
CO 5				H	

MTCL305T: CORPORATE AND BUSINESS LAW

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s)

The objective of this paper is to introduce students to the different aspects of Corporate and Business Law. To introduce them with the relevance and applications of the different laws

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: define what a company is and how it is formed. (Remembering)
CO 2: explain the concepts related to the essential documents of companies (Understanding)
CO 3: explain the knowledge regarding administration of a company (Applying)
CO 4: Identify the legal provisions in the partnership business and its Act. (Analysing)

Module I: Introduction (12 Hours)

Introduction of Companies Act, 2013, meaning and characteristics of a company; types of companies including one person company, small company, and dormant company; association not for profit; illegal association; lifting of corporate veil; Registration and Incorporation of company, on-line filing of documents, promoters, their legal position ,pre-incorporation contract; on-line registration of a company, Tribunal courts like NCLT, NCLAT etc

Module II: Documents of Companies (12 Hours)

Memorandum of association, Doctrine of ultra vires, Articles of association, Doctrine of constructive notice and indoor management, prospector-shelf and red herring prospectus, misstatement in prospectus, book-building; issue, allotment and forfeiture of share, transmission of shares, buyback and provisions regarding buyback; issue of bonus shares.

Module III: Administration and Management of Company (12 Hours)

Classification of directors, women directors, independent director, small shareholder's director; disqualifications, director identity number (DIN); appointment; Legal positions, powers and duties; removal of directors; Key managerial personnel, managing director, manager;

Meetings: Meetings of shareholders and board of directors; Types of meetings, Convening and conduct of meetings, Requisites of a valid meeting, postal ballot, meeting through video conferencing, e-voting.

Committees of Board of Directors- Audit Committee, Nomination and Remuneration Committee, Stakeholders Relationship Committee, Corporate Social Responsibility Committee

Module IV: The Indian Contract Act, 1872 (12 Hours)

1. Proposal- its communication, acceptance and revocation; Agreement vis-à-vis contract, void agreement & voidable contract
2. Consideration – essential elements, exception to rule- No consideration no contract; privity of contract and consideration
3. Capacity to contract; free consent – coercion, undue influence, misrepresentation, fraud; Mistake – of fact and of law
4. Legality of object – agreements opposed to public policy and in restraint of marriage, trade & legal proceedings; Contingent contracts
5. Performance of contract–liability of joint promisor; Consequences of breach of contract–liquidated damages and penalty
6. Quasi contract; Indemnity guarantee–surety's liability
7. Bailment–Duties and liabilities of bailor and bailee, bailment of pledges;
8. Agency–types of agency, agents duty to principal and vice-versa, ratification and revocation of agent's authority

Module V: The Partnership Act, 1932 (12 Hours)

a) Nature of Partnership; Relation of partners-inter se; Relation of partners to third parties; Incoming and outgoing partners
b) Dissolution of Firm; Registration of Firms-effect of non-registration

Suggested Readings

1. Chadha, Reena& Chadha, Sumant; Corporate Laws, Scholar Publishing House, New Delhi
2. Kuchhal, M.C &Kuchhal, Vivek, Business Law, Vikas Publishing House
3. Kapoor, N.D; Business Law; Sultan Chand & Sons, New Delhi.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2	L	H		
CO 3		L	H	
CO 4				L
CO 5				H

MTMP306P: MINOR PROJECT – 1

(4 Credits – 120 hours)

Objective(s)

The objective of the minor project-1 is to give students an idea of research. In which they need to undertake a field survey for collecting data. Further they need to analyse the data and present a report on the topic in which they have conducted research. The evaluation will be done on the basis of the project report, presentation and viva-voce examination.

Guidelines Related To Project:

The entire project will be carried out in one phase in the particular semester

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the different types of research project. (Remembering)
CO 2: Explain the various steps of designing research project (Understanding)
CO 3: Build questionnaire and schedules (Applying)
CO 4: Assess the data for analysis (Analyzing)
CO 5: Appraise the findings in the report (Evaluating)
CO 6: Design a research project report (Creating)

Module I: Contents of the Report

Introduction
Brief Review of Literature
Research Methodology
Data Analysis and Interpretation
Findings, suggestions and conclusion

MTCF400T: CORPORATE FINANCE

(5 Credits - 75 hours) (L-T-P: 5-0-0)

Objective(s)

To acquaint students with the techniques of financial management and their applications for business decision making.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the strategic objectives of the organisation for finance function. (Remembering)
CO 2: Explain the different sources of corporate finance (Understanding)
CO 3: Interpret the impact of risk and cost of capital impact on investment appraisal. (Applying)
CO 4: Analyze the factors impacting the cost of capital (Analyzing)
CO 5: Evaluate a corporation’s capital structure (Evaluating)

Module I: Nature of Financial Management (20 Hours)

Nature of Financial Management: Finance and related disciplines; Scope of Financial Management; Profit Maximization, Wealth Maximization - Traditional and Modern Approach; Functions of finance – Finance Decision, Investment Decision, Dividend Decision; Objectives of Financial Management; Organisation of finance function; Concept of Time Value of Money, present value, future value, and annuity.

Module II: Long -term investment decisions (20 Hours)

Long -term investment decisions: Capital Budgeting - Principles and Techniques; Nature and meaning of capital budgeting; Estimation of relevant cash flows and terminal value; Evaluation techniques - Accounting Rate of Return, Net Present Value, Internal Rate of Return & MIRR.

Concept and Measurement of Cost of Capital: Explicit and Implicit costs; Measurement of cost of capital; Cost of debt; Cost of perpetual debt; Cost of Equity Share; Cost of Preference Share; Cost of Retained Earning; Computation of overall cost of capital based on Historical and Market weights

Module III: Capital Structures (20 Hours)

Capital Structures: Approaches to Capital Structure Theories - Net Income approach, Net Operating Income approach, Modigliani-Miller (MM) approach,

Dividend Policy Decision - Dividend and Capital; The irrelevance of dividends: General, MM hypothesis; Relevance of dividends: Walter's model, Gordon's model;

Leverage Analysis: Operating and Financial Leverage; EBIT-EPS analysis; Combined leverage.

Module IV: Working Capital Management (15 Hours)
Working Capital Management: Management of Cash - Preparation of Cash Budgets (Receipts and Payment Method only); Cash management technique (Lock box, concentration banking), Receivables Management – Objectives; Credit Policy, Cash Discount, Debtors Outstanding and Ageing Analysis; Costs - Collection Cost, Capital Cost, Default Cost, Delinquency Cost, Inventory Management (Very Briefly) - ABC Analysis; Minimum Level; Maximum Level; Reorder Level; Safety Stock; EOQ (Basic Model), Determination of Working Capital.

Suggested Readings
1. Berk & DeMarzo, Fundamentals of Corporate Finance, Prentice Hall.
2. M.Y. Khan & P.K. Jain , Financial Management, Tata McGraw Hill Publishing Co. Ltd.
3. Rustogi , Financial Management
4. I.M. Pandey , Financial Management
5. L.J. Gitman & C.J. Zutter, Managerial Finance
6. R.A. Brealey, S.C. Myers, F. Allen& P. Mohanty, Principles of Corporate Finance

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		L	M	
CO 3		M	H	
CO 4		M	H	
CO 5				H

MTSC401T: SUPPLY CHAIN MANAGEMENT
(5 credits – 75 Hours) (L-T-P: 5-0-0)

Objective(s)
The objective of this paper is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for an international firm.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define the process of supply chain management. (Remembering)
CO 2: Demonstrate operational purchasing methods and techniques on supplier management (Understanding)
CO 3: Explain the strategic importance of logistics elements (Understanding)
CO 4: Apply sales and operations planning, MRP and lean manufacturing concepts. (Applying)
CO 5: Analyse creation of new value in supply chain for customers & society. (Analysing)

Module I: Basic Framework (15 Hours)
Concept of supply chain management (SCM); SCM and trade Logistics; Business view of SCM; Push and pull of SCM; Decision phases; Impellers and drivers in SCM Process views of SCM, planning and operations; Supply chain modeling; Role of Relationship marketing in SCM; managing relationships with suppliers and customers; Designing strategic distribution network; Factors influencing distribution network.

Module II: Supply Chain and Information Management Systems (15 Hours)
Purchasing Process- Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle; Supplier selection and evaluation; Vendor development; Importance of information management; Distribution and sharing of information; Information Technology as a platform for effective and efficient supply chain management

Module III: Logistic System (10 Hours)
Concept, objectives and scope of logistics; System elements; Inbound and Outbound logistics. Reverse inventory, Value added role of logistics, Logistics interface with manufacturer and marketing, Packing, Marking, Just in time concept; Third party logistic outsourcing–challenges and future directions

Module IV: Transportation (20 Hours)
Importance of effective transportation system; Service choices and their characteristics; inter- modal services; Transport cost characteristics and rate fixation; Carrier selection determinants and decision; Structure of Shipping: World seaborne trade; international shipping - characteristics and structure ;Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Charter, party agreement; Development in sea transportation-Unitization, containerization, inter and multimodal transport; CFC and ICD; Indian shipping – growth, policy and problems; Ports and port trust; International Air transport: International set up for air transport: Freight rates; India's exports and imports by air – Problems and prospects; Carriage of

Goods by sea, sea and combined transport.

Module V: Warehousing and Inventory Management (15 Hours)
Warehousing And Marketing Strategy; Objectives and functions of warehousing; Warehouse Strategies; Material handling equipment and material mobility Warehousing evaluation and requirements
Inventory management-inventory categories, EOQ, LT, ICC; Inventory levels; Material planning and sourcing of procurement; Methods of cost reduction.

Suggested Readings

1. Ballau, R.H., Business Logistics Management, Prentice Hall, Englewood Cliffs.
2. Bes, J., Chartering Practices.
3. Bes, J., Dictionary of Shipping and chartering Practices.
4. Christopher, M., Logistics and Supply Chain Management, Prentice Hall.
5. ICAO Journal, New York., various issues
6. Indian Shipping and Transport, Mumbai, Various issues.
7. Murphy, Paul R. and Donald F. Wood, Contemporary Logistics, Prentice Hall.
8. Marks, Daniel, Shipping Cartels.
9. Shapiro, R., Logistics Strategy: Cases and Concepts, West Publishing, St. Paul.
10. Coughlan, A., Anderson, E. and Louis W. Stern, Marketing Channels, Prentice Hall.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L				
CO 2		M			
CO 3			M		
CO 4		M		H	
CO 5	M		H		H

MTSM402T: SERVICES MARKETING

(Credits: 5- 75 Hours) (L-T-P: 5-0-0)

Objective(s)
The objective of this course is to make the students know the service concept, its evolution and growth. To make the students understand Marketing Mix in service marketing and its effective management and to know the service marketing techniques applied in various sectors.

Course/Learning Outcomes
At the end of this course students will be able to:
CO1: relate the importance of service economy and Services characteristic. (Remembering)
CO2: explain the concept of Service Marketing Mix (Understanding)
CO3: identify the various service deliver gap and developing appropriate solutions (Applying)
CO4: analyse the reasons for service failure (Analysing)

Module I: Introduction to Service Economy (15 Hours)
Emergence of the service economy, Concept and nature of Service, Difference between goods and services, Service marketing Mix, Service Management Trinity

Module II: Service Consumer Behaviour (20 Hours)
Understanding the Service Customer as a Decision Maker, service purchase and risk association, Service Evaluation process, The Service Consumer Decision Process, and The Decision-making Process in the Service Sector, Components of Customer Expectations, Service Satisfaction, Service Quality Dimensions

Module III: Service Delivery Process (20 Hours)
Managing Service Encounters, Common Encounter Situations, Managing Service Encounters for Satisfactory Outcomes, Service Failure, Service Recovery, Process of Service Recovery, Customer Retention and Benefits

Module IV: Delivering Quality Service (20 Hours)
Causes of Service delivery failure – Quality Gaps. The Customer Expectations *versus* Perceived Service gap. Factors and Techniques to Resolve this Gap. Customer Relationship Management. Gaps in Services – quality standards, Factors and Solutions – The Service Performance Gap – Key Factors and Strategies for Closing the Gap. External Communication to the Customers – the Promise *versus* Delivery Gap – Developing Appropriate and Effective Communication about Service Quality

Suggested Readings

1. Service Marketing, C. Bhattacharjee, Excel Books
2. Service Marketing, R. Nargundkar, Tata McGraw Hill
3. Service Marketing the Indian Perspective, R Shakeran R, Excel Books
4. The Essence of Service Marketing, M.P. Newton, A Payne, PHI
5. Service Marketing - The Indian Context R. Srinivasan, PHI

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M	M	
CO4				H	H

MTCR403T: CORPORATE RESTRUCTURING

(Credits: 5- 75 Hours) (L-T-P: 5-0-0)

Objective(s)

To familiarize the students with various concept and technique that can help in effective corporate structuring in business. Focus will be on the practical application of the concepts learnt.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the concept and function of joint venture (Remembering)
CO 2: Explain the theories of merger and acquisition (Understanding)
CO 3: Identify takeover and its types (Applying)
CO 4: Discover the various techniques of valuation of firms during merger (Analyzing)
CO 5: Assess the impact of merger on shareholders and different stakeholders (Evaluating)

Module I: Joint Ventures: (15 Hours)

Joint Ventures: Concept & Meaning of Joint Ventures, Need & Types of Joint Ventures, Structures & Problems faced in Joint Ventures, some relevant case study of successful and failed joined ventures.

Module II: Mergers and Acquisitions (20 Hours)

Mergers and Acquisitions: Introduction to mergers, types of mergers, theories of mergers & acquisitions, merger strategy - growth, synergy, operating synergy, financial synergy, diversification; Cross-border mergers and acquisitions, issues and challenges in cross border M&A. Handling cross-culture and taxations issues in cross-border M&A. Analysis of Post-Merger Performance. Demerger, types of demergers, reverse merger, buyback of shares, leverage buy-out strategy, Takeover and its types, takeover strategy, takeover bids, legal framework for mergers and acquisitions, leverages and buyouts; Hostile tender offers and various anti-takeover strategies.

Module III: Mergers and Acquisitions (20 Hours)

Deal Valuation and Evaluation: Factors affecting valuation basics, methods of valuation, cash flow approaches, economic value added (EVA), sensitivity analysis, and valuation under takeover regulation, valuation for slump sale, cost-benefit analysis, and swap ratio determination.

Module IV: Post-Merger Evaluation (20 Hours)

Post-Merger Evaluation: Financial Evaluation of Mergers & Acquisitions, Impact on shareholders' Wealth; Methods of payment and financing options in mergers & acquisitions, financing decision, Merger, Acquisition and Competition law 2002, SEBI (Securities & Exchange Board of India) Takeover Code 2011 and criteria for negotiating friendly takeover.

Suggested Readings

1. Sundarsanam (2006); Creating Value from Mergers and Acquisitions, (1st ed.) Pearson Education
2. Ramanujan. S. (1999); Mergers: The New Dimensions for Corporate Restructuring, McGraw Hill
3. Narayankar, Ravi, (2013): Merger and Acquisitions Corporate Restructuring, Strategy and Practices, (2nded.). International Book House Pvt. Ltd.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		L		
CO 3			H	
CO 4			H	
CO5				H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	MTBO102T	Business Organisation	4	
2	Minor Course 2	MTMF103T	Management Fundamentals	4	
3	Minor Course 3	MTBI205T	Banking and Insurance	4	
4	Minor Course 4	MTFT206T/ MTCM207T/ MTIM208T/ MTAO209T	Fundamentals of Investment / Compensation Management/ International Marketing / Airport Operations	4	
5	Minor Course 5	MTSH307T/ MTPF308T/ MTMR309T/ MTGH310T	Strategic HRM/ Personal Financial Planning / Marketing Research/ Ground Handling Services at Airport	4	
6	Minor Course 6	MTIR311T/ MTIP312T/ MTDM313T/ MTAC314T	Management of Industrial Relations/ Investment Analysis and Portfolio Management/ Digital Marketing / Air Cargo Operations	4	
7	Minor Course 7	MTBE404T/ MTAR405T	Business Environment / Airport Resource Planning and Services Management	3	
7	Minor Course 8	MTRM406T	Research Methodology	2	
8	Minor Course 9	MTIB407T	International Business	3	

MTBO102T: BUSINESS ORGANIZATION
(4 credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)
To familiarize students with the basics of business, the different forms of organisations, the process and the basic concepts and functions of management

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain the nature, objectives and social responsibilities of business (Remembering)
CO 2: Describe the different forms of organisations (Understanding)
CO 3: Understand the process and the basic concepts of management (Understanding)
CO 4: Describe the different functions of management (Applying)
CO 5: Explain the different types of business (Evaluating)

Module I: Introduction to Business (10 Hours)
Meaning, Nature, Scope and Social responsibility of Business, Objectives, Essentials of successful business; Functional areas of business; Concept of Business Organisation

Module II: Forms of Business Organization (15 Hours)
Sole proprietorship: Definitions, Features, Merits and Demerits. Partnership: Definitions, partnership deed, Features, Merits and Demerits. Joint Stock Company: Definitions, Features, Merits and Demerits. Co-operatives: Definitions, Features, Merits and Demerits

Module III: Public Enterprises and Public Private Partnerships (15 Hours)
Departmental Undertaking: Definitions, Features, Merits and Demerits. Public Corporations: Definitions, Features, Merits and Demerits. Government Companies: Definitions, Features, Merits and Demerits. PPP Model: characteristics, different models of PPP, its success factors, some examples of PPP model from Indian context.

Module IV: Business Combinations (10 Hours)
Meaning Definitions, Causes, Types, Forms, merits and demerits of Business Combinations, Recent Trends in Business Combinations

Module V: Management of Organizations (10 Hours)
Management- Meaning, Definitions, Difference between Management and Administration, Levels of Management, Objectives of Management, Functions of management- planning, organizing, staffing, directing, coordinating, controlling, Principles of Management.

Suggested Readings

1. C B. Gupta - Business Organisation and Management, Sultan Chand & Sons.
2. Dr. S. C. Saxena - Business Administration & Management, Sahitya Bhawan

E Resources

1. https://www.youtube.com/watch?v=BarcVAOT_fs&list=PL9Cd7H8NFRQxDwlEOu_MBT5AUoysg4NgF
2. https://www.youtube.com/watch?v=Ewzhw63biOU&list=PL47Z0ywCYIyykGNxHpB6_LN5MvTO8hPGD

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		H		
CO 3			H	
CO 4				H
CO 5				H

MTMF103T: MANAGEMENT FUNDAMENTALS

(4 Credits: - 60 hours) (L-T-P: 4-0-0)

Objective(s)

The objective for this course to provide an understanding of the task and functions of management and to acquaint the participants with the developments in concept. Theories and practices in the overall field of management.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the nature and significance of Management (Remembering)
CO 2: Explain the nature and significance of planning (Understanding)
CO 3: Describe the staffing functions and explain the significance of communication (Applying)

Module I: Nature and significance of Management (15 Hours)

Nature of management; significance of management; Approaches of management, Contributions of Taylor, Fayol and Barnard, Functions of a Manager, Social responsibility of Managers, Values in management.

Module II: The Nature of significance of Planning (15 Hours)

Nature of Planning, significance of planning, objectives, steps of planning, decision making as key step in planning; process and techniques of decision making; organisation: nature and significance; approaches, departmentation, line and staff relationships; delegation and decentralisation

Module III: Staffing functions (15 Hours)

Nature and significance of staffing functions; selection, interview, training, appraisal and development of managers; directing: Issues in managing human factors, motivation, nature and significance

Module IV: Communication (15 Hours)

Definition and Significance of Communication, Its process, barriers of communication, building effective communication system. Controlling: definition and elements; Control techniques, Coordination, determinants of an effective control system, Managerial Effectiveness.

Suggested Readings

1. Joseph L. Massie :Essentials of Management .PHI, New Delhi; 2015
2. James F.Stoner: Management. Pearsons Education, Delhi; 2020
3. Harold Koontz, Heinz Weihrich: Management. Tata McGraw Hill Pub. Co., Delhi; 2015
4. Amitai Etzioni: Modern Organizations. PHI, New Delhi; 2021
5. Jones, Gareth R. and Jennifer M. George: Contemporary Management. Tata McGraw Hill
6. Charles Hill, W.L. and Steven L.McShane: Principles of Management. Tata McGraw Hill

E Resources

1. https://www.youtube.com/watch?v=I6-QB-EIdsE&list=PLJtJvO3aaWe16eg-L7sJ1Ww3021CWlJU9
2. https://www.youtube.com/watch?v=q6LMjurECZM

Mapping of COs with Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		H			
CO 3			H	M	M

MTBI205T: BANKING AND INSURANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course is designed to provide students with the necessary skills and knowledge in the context of the functioning of banking and insurance.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the basic principles of banking and insurance. (Remembering)
CO 2: Relate the various services provided by banks. (Understanding)
CO 3: Apply the concept of Internet Banking in day-to-day transactions. (Applying)
CO 4: Examine the situations to relate the risk and insurance. (Analysing)

Module I: Introduction (10 Hours)

Origin of banking: definition, banker and customer relationship, General and special types of customers, Types of deposits, Origin and growth of commercial banks in India. Financial Services offered by banks, changing role of commercial banks, types of banks.

Module II: Cheque and Paying Banker (10 Hours)

Crossing and endorsement - meaning, definitions, types and rules of crossing. Duties, Statutory protection in due course, collecting bankers: duties, statutory protection for holderin due course, Concept of negligence.

Module III: Banking Lending (6 Hours)

Principles of sound lending, secured vs. unsecured advances, types of advances, Advances against various securities.

Module IV: Internet Banking (10 Hours)

Meaning, Benefits, Home banking, Mobile banking, Virtual banking, E-payments, ATM Card/ iometric card, Debit/Credit card, Smart card, NEFT, RTGS, ECS (credit/debit), E-money, electronic purse, Digital cash.

Module V: Insurance (9 Hours)

Basic concept of risk, Types of business risk, Assessment and transfer, Basic principles of utmost good faith, Indemnity, Economic function, Proximate cause, Subrogation and contribution, Types of insurance: Life and Non-life, Re-insurance, Risk and return relationship, Need for coordination. Power, functions, and Role of IRDA, Online Insurance

Suggested Readings

1. Agarwal, O.P., Banking and Insurance, Himalaya Publishing House
2. Satyadevi, C., Financial Services Banking and Insurance, S. Chand
3. Suneja, H.R., Practical and Law of Banking, Himalaya Publishing House
4. Chabra, T.N., Elements of Banking Law, Dhanpat Rai and Sons
5. Arthur C. And C. William Jr., Risk Management and Insurance, McGraw Hill
6. Saxena, G.S. Legal Aspects of Banking Operations, Sultan Chand, and Sons
7. Varshney, P.N., Banking Law and Practice, Sultan Chand, and Sons
8. Jyotsna Sethi and Nishwan Bhatia, Elements of Banking and Insurance, PHI Learning

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4				M	H

MTFT206T: FUNDAMENTALS OF INVESTMENT

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective(s)

This course aims to provide students with an understanding of fundamental concepts of business finance and investment.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the objectives & scope of financial management in context of business (Remembering)
CO 2: Apply the concept of time value of money (Applying)
CO 3: Evaluate investment opportunities using the capital budgeting process (Evaluating)
CO 4: Explain Indian securities market including the derivatives market (Understanding)
CO 5: Evaluate mutual funds as an investing avenue. (Evaluating)

Module I: Introduction (10 Hours)

Meaning of investment; Basic areas of investment; Investment functions; Forms of business organizations; Goals of investment management; concept of returns and Interest rates: level of Interest rate, determinants of market interest rates

Module II: Time Value of Money (10 Hours)

Future Value: Single period, multiple period; Present Value: single period and multiple period; Future Value and Present value for multiple cash flows; Present value of an annuity; Future value of an annuity

Module III: Capital Investment Decisions (10 Hours)

Concept of investment decisions; Generating investment project proposal; Process of Capital budgeting decision;; Net present value, payback method, internal rate of return.

Module IV: Basics of Investing (20 Hours)

Basics of Investment & Investment Environment. Risk and Return, Instruments of Investment -Equity shares, Preference shares, Bonds and Debentures. Indian Security Markets - Primary Markets (IPO, FPO, Private placement, Offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE, NSE, MSEI. Security Market Indices: Nifty & Sensex.

Module V: Investing in Mutual Funds (10 Hours)

Concept and background on Mutual Funds: Advantages, Disadvantages of investing in Mutual Funds, Types of Mutual funds: Open ended, close ended, equity, debt, hybrid, money market and entry load vs. exit load funds. Factors affecting choice of mutual funds. CRISIL mutual fund ranking and its usage, calculation and use of Net Asset Value

Suggested Readings

1. Principles of Financial Management, Levy H. and M. Sarnat, Pearson Education.
2. Fundamentals of Financial Management, Brigham and Houston, Cengage Learning.
3. Basic Financial Management, Khan and Jain, McGraw Hill Education
4. Fundamentals of Financial Management, Prasanna Chandra, McGraw Hill Education
5. Financial Management-text and Problems, Singh, J.K, DhanapatiRai and Company , Delhi
6. Fundamentals of Financial Management, Rustagi, R.P, Taxmann Publications Pvt.Ltd.
7. Singh J K , Singh Amit Kumar, Investing in Stock Markets, A K Publications, Delhi.
8. Tripathi, Vanita and Pawar, Neeti (2019), Investing in Stock Market, Taxmann Publications

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M				
CO 2		M			
CO 3			M		
CO 4				H	H

MTCM207T: COMPENSATION MANAGEMENT

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The course aims to clarify the principles and basic concepts of compensation management in organizations, including the role of human resources management in dealing with employees, and methods used to provide compensation.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Define Compensation Management (Remembering)
CO 2: Explain the principles and importance of compensation management. (understanding)

CO 3: Develop and design compensation system. (Applying)
CO 4: Analyze the present trends in calculation of incentives and other pay systems. (Analyzing)

Module I: Introduction to Compensation Management (15 Hours)
Definition of Compensation Management - objectives of compensation – Principles of Compensation Management – Importance of Compensation Management - Types of wages. Exploring and defining the compensation context – Intrinsic compensation - Extrinsic compensation -- Compensation Trends in India. - The 3-P compensation concept

Module II: Compensation Planning & Bases of Compensation (15 Hours)
Compensation Planning: Level, Structure and Systems Decision – Factors influencing compensation level planning: internal factors and external factors.
Traditional Bases for Pay-Seniority and Longevity Pay Merit Pay- Performance Appraisal- Methods- Biases -Strengthening the Pay for Performance Link- Possible Limitations of Merit Pay

Module III: Incentive Pay & Other Pay Systems (15 Hours)
Exploring Incentive Pay- Contrasting Incentive Pay with Traditional Pay.
Individual Incentives- Types of Individual Incentives- Advantages and Disadvantages
Group Incentives- Types of Group Incentives- Advantages and Disadvantages
Companywide Incentives- Types- Designing Incentive Pay Programmes
Person Focused Pay- Competency Based Pay, Pay for Knowledge and Skill Based Pay, Team based pay- Concepts.

Module IV: Designing Compensation System (15 Hours)
Building internally consistent Compensation System - Creating Internal Equity through Job Analysis and Job Valuation
Building Market Competitive Compensation System – compensation surveys - Integrating Internal Job Structures with External Market; Building Pay Structures that Recognise Individual Contribution: Constructing pay structure.
Pay structure variations – Broad banding- two tier pay structure.

Suggested Readings
1. Tapomoy Deb, Compensation Management text & cases, Excel Publication, 2014.
2. Joseph J. Martocchio, Strategic Compensation- A Human Resource Management Approach- Pearson Education, 2012, 3rd Ed.
3. Dipak Kumar Bhattacharya, Compensation Management, Oxford University Press, 2014.
4. Richard.I. Henderson: Compensation Management in A Knowledge Based World - Prentice-Hall, 2012, 9th Ed.
5. Milkovich & NewMan, Compensation, Tata McGraw –Hill, New Delhi, 2015.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		M		
CO 3			M	
CO4				H

MTIM208T: INTERNATIONAL MARKETING

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)
To familiarize the students with the concept and issues of international marketing and enable them to be able to analyse the foreign market environment and develop international marketing strategies for a business firm.

Course/ Learning Outcomes
At the end of this course, students will be able to:
CO 1: Define international marketing (Remembering)
CO 2: Explain International Product Planning and Pricing decisions (Understanding)
CO 3: Identify the traditional to modern channel structures, Intermediaries (Applying)
CO 4: Analyse the international distribution decisions in terms of issues and planning (Analysing)
CO 5: Evaluate the different aspects of international promotional strategies (Evaluating)

Module I: Introduction: Introduction to International Business (14 Hours)
An overview; International marketing management process, International marketing information system. International Marketing Environment: Influence of physical, economic, socio - cultural, political and legal environments on international marketing decisions; International marketing information system. International Market Segmentation, Selection and Positioning; International market entry strategies – Exporting, licensing, contract manufacturing, joint venture, setting -up of

wholly owned subsidiaries abroad.

Module II: International Product Planning and Pricing decisions (14 Hours)
Major Product decisions-product design, labeling, packaging, branding and product support services; Product standardization vs. adaptation; Managing product line; International trade product life cycle; New product development. Pricing decisions for International Markets: Factors affecting international price determination; International pricing process and policies; Delivery terms and currency for export price quotations; Transfer
pricing; Counter trade as a pricing tool- types and problems of counter trading.

Module III: International Distribution Decisions (12 Hours)
Distribution channel- from traditional to modern channel structures, Intermediaries for international marketstheir roles and functions; Alternative middlemen choices, Factors affecting choice of channels; Locating, selecting and motivating channel members; International distribution logistics- Issues and Planning.

Module IV: International Promotion Strategies (12 Hours)
Communications across countries-complexities and issues; Country -of-origin effect; Sales promotions in international markets, trade fairs and exhibitions, International public relations, International Advertising decisions, Personal selling and sales management; Developing international promotion campaign.

Module V: Emerging trends in International Marketing (8 Hours)
International Marketing through Internet; Ecological concerns and international marketing ethics.

Suggested Readings
1. Cateora, Philip R, Grahm John L and Prashant Salwan, International Marketing, Tata Mc Graw Hill
2. Czinkota, Michael R. and Illka A. Ronkainon, International Marketing, Cengage Learning
3. International Marketing, P K Vasudeva, 4th edition, 2010, Excel Books , New Delhi.
4. Jain, Subash C., International Marketing, South-Western.
5. Keegan, Warran J and Mark C Green, Global Marketing, Pearson
6. Kotabe, Masaaki and Kristiaan Helsen, Global Marketing Management, John Wiley and Sons.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		M			
CO 3			H		
CO 4				M	L

MTAO209T: AIRPORT OPERATIONS

(4 credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)
The course objective of Airport Operation in Bachelor of Business Administration (BBA) is to provide Students' with an understanding of the various aspects of airport operations, including airport management, airport security, and airport marketing

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain the basic concepts of airport operations (Remembering)
CO 2: Explain airline navigation systems (Understanding)
CO 3: Analyze the process of airport safety and security (Analyzing)
CO 4: Critically judge the various aspects of Airport Planning and Services (Evaluating)

Module I: Introduction (15 Hours)
Airport Definition – Aerodrome and Airport, ICAO set-up and functions, Aerodrome Data and Physical characteristics, Declared Distances, Obstacle Limitation Surfaces.

Module 2: Airline Navigation (15 Hours)
Navigational Aids; Runway, Taxiway and Apron; Airfield Lighting; Visual Aids, Category of ILS (Instrument Landing System), Air Traffic Services and aeronautical communication (RT phraseology); Aeronautical Information Publication, NOTAM, Meteorological Report and Forecast, Facilitation (ICAO Annex – 9).

Module 3: Airport Safety and Security (15 Hours)

Security – Safeguarding civil aviation; Safe transportation of dangerous goods; Basic Safety Concept at Airport; Hazards; Safety Risk Assessment; SMS framework; Phased approach of SMS implementation.

Module 4: Airport Planning and Services (15 Hours)
Airport Planning (Master planning); Set-up of an international airport; Terminal Management; Airfield Management; Airport Operations Control Centre; Landside Management; Immigration and Customs Procedure; APHO Services; Ramp Handling Services; Cargo Operations; Commercial Management; Airport's economic performance; National Civil Aviation Policy (2016).

Suggested Readings
1. Airport Operations, Third Edition by Norman Ashford, Pierre Coutu, and John Beasley - Publisher: McGraw Hill Education, Year: 2014
2. Airport Planning and Management, Sixth Edition by Alexander T. Wells and Seth B. Young - Publisher: McGraw Hill Education, Year: 2017
3. Airport Systems: Planning, Design, and Management, Third Edition by Richard de Neufville and Amedeo Odoni - Publisher: McGraw Hill Education, Year: 2012
4. Introduction to Air Transport Economics: From Theory to Applications, Second Edition by Bijan Vasigh, Ken Fleming, and Thomas Tacker - Publisher: Routledge, Year: 2015.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2		M		
CO3			M	
CO4				H

MTSH307T: STRATEGIC HUMAN RESOURCE MANAGEMENT

(4 Credits - 60 hours) (L-T-P: 4-0-0)

Objective(s)
The objective of this course is to develop within the students the understanding of the student with relevant concepts, roles and challenges related to strategic human resource management practices in the workplace and design the requisite skills to be competent contributors in the organization's strategic decision-making process and make them competent to for various managerial and administrative positions in different organizations.

Course/ Learning Outcomes
At the end of this course students will be able to:
CO 1: Define the hierarchy of strategy, classify between traditional HR and strategic HR. (Remembering)
CO 2: Demonstrate the aims of strategic HRM (Understanding)
CO 3: Analyse the concept of HR strategies, explain the approaches of developing HR strategies (Analysing)
CO 4: Examine the strategic role of the HR director, determine the strategic role of the HR specialists (Analysing)
CO 5: Evaluate the various approaches to motivation (Creating)

Module I: Introduction to Strategic Human Resource Management (12 Hours)
Introduction, Strategy, Hierarchy of Strategy, Corporate Level Strategy, Business Level Strategy, Functional Level Strategy, Strategic HRM, Emergence of Strategic Human Resource Management (SHRM), The Evolutionary Stages of Strategic HRM, Difference Between Traditional HR and Strategic HR, Case study

Module II: Concepts of Strategic Human Resource Management (12 Hours)
Introduction, Trends in Strategic Human Resource Management, HR Practitioners Role, Human Resource as Competitive Advantage, Aims of Strategic HRM, Approaches to Strategic HRM, Formulation of HR Strategies, The Classical Sequential Approach, The Empirical Need-based Approach, Achieving Strategic Fit, Problems in Achieving Strategic Fit, Benefits of Strategic HRM, Barriers to Strategic HRM, Case study

Module III: Human Resource Strategies and its Implementation (12 Hours)
Introduction, HR Strategies, Types of HR Strategies, Overarching Strategies, Specific HR Strategies, Criteria for an Effective HR Strategy, Developing HR Strategies, Methodology for Formulating HR Strategies, Setting Out the Strategy, conducting a Strategic Review, Implementing HR Strategies Barriers to the Implementation of HR Strategies, Overcoming the Barriers, Case study

Module IV: Roles in Strategic Human Resource Management (12 Hours)

The Strategic Role of Top Management, The Strategic Role of Front-line Management, The Strategic Role of the HR Director, The Strategic Role of the HR Specialists, The New Mandate for HR, The Specific Strategic Roles of HR, Business Partner, The Innovation Role, The Change Manager Role, The Implementer Role, Case study

Module V: Challenges in Strategic Human Resource Management (12 Hours)
Introduction, The Challenges of Workplace Diversity, The Management of Workplace Diversity, Managing Diverse Workforce in an Organisation, Planning a Mentoring Program, Organising Talents Strategically, Retention Strategy, Talent Management Strategy and its components, Approaches to Human Resource Planning, Managing Executive Information Systems, Challenges for HR Managers, HRM Strategic Challenges, Case study

Suggested Readings
1. Sharma A, Khandekar A, Strategic Human Resource Management – An Indian Perspective, SAGE Publications
2. Schuler, R. S., & Jackson, S. E., 2009, Strategic Human Resource Management.2nd ed., Wiley-India
3. Sharma, A and Khandekar, A., 2006, Strategic Human Resource Management: an Indian perspective.1st ed., Response Books

MTPF308T: PERSONAL FINANCIAL PLANNING

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective(s)
The course aims to familiarize learners with different aspects of personal financial planning like savings, investment, taxation, insurance, and retirement planning and to develop the necessary knowledge and skills for effective financial planning.

Course/ Learning Outcomes
At the end of this course students will be able to:
CO 1: Define the meaning and the relevance of financial planning. (Remembering)
CO 2: Understand the concept of investment planning and its methods. (Understanding)
CO 3: Examine the scope and ways of personal tax planning. (Applying)
CO 4: Analyse insurance planning and its relevance. (Analysing)
CO 5: Develop insight into retirement planning and its relevance.(Evaluating)

Module I: Introduction to Financial Planning (12 Hours)
Financial goals, steps in financial planning, budgeting incomes and payments, time value of money. Introduction to savings, benefits of savings, management of spending & financial discipline, Setting alerts and maintaining sufficient funds for fixed commitments

Module II: Investment Planning (12 Hours)
Process and objectives of investment, concept and measurement of return & risk for various asset classes, measurement of portfolio risk and return, diversification & portfolio formation. Gold bond; Real estate; Investment in greenfield and brownfield Projects; Investment in fixed income instruments, financial derivatives & commodity market in India. Mutual fund schemes; International investment avenues. Currency derivatives and digital currency

Module III: Personal Tax Planning (12 Hours)
Tax structure in India for personal taxation, Scope of personal tax planning, exemptions and deductions available to individuals under different heads of income and gross total income. Comparison of benefits - Special provision u/s 115 BAC vis-à-vis General provisions of the Income-tax Act, 1961, tax avoidance versus tax evasion

Module IV: Insurance Planning (12 Hours)
Need for insurance. Life insurance, health insurance, property insurance, credit life insurance and professional liability insurance

Module V: Retirement Benefits Planning (12 Hours)
Retirement planning goals, process of retirement planning, Pension plans available in India, Reverse mortgage, Estate planning.

Suggested Readings
1. Deb Tapomoy, Strategic Approach to Human Resource Management Concept, Tools and Application, Atlantic Publishers & Distributors Pvt Ltd.
2. Nayantara Padhi, Strategic Human Resources Management: Theory and Practice, Atlantic Publishers and Distributors Pvt. Ltd; 1 edition
3. Mello Jeffrey A., Strategic Management of Human Resources, Cengage Learning, 3rd edition

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	L	L	L
CO 2	L	H			
CO 3			H		
CO 4		M		H	
CO 5	M		H		H

MTMR309T: MARKETING RESEARCH

(4 Credits- 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define marketing research (Remembering)
CO 2: Explain sample and sampling design (Understanding)
CO 3: Identify various data collecting methods and tools (Applying)
CO 4: Analyse data hypothesis and testing procedures (Analyzing)

Module I: Introduction of Marketing Research (15 Hours)

Define Marketing Research, Aims and Objectives of Marketing Research. Applications of Marketing Research, Marketing Information System, Evaluation and Control of Marketing Research, Value of Information in Decision Making, Steps in Marketing Research. Research Design: Formulating the Research Problem, Choice of Research Design, Types of Research Design, Sources of Experimental Errors.

Module II: Sample and Sampling Design (15 Hours)

Some basic terms, Advantages and Limitation of Sampling, Sampling process, Types of Sampling, Types of Sample Designs, Determining the Sample Size, Sampling Distribution of the Mean. Scaling Techniques: The concept of Attitude, Difficulty of Attitude Measurement, Types of Scales, Applications of Scaling in Marketing Research.

Module III: Data Collection (15 Hours)

Secondary Data, Sources of Secondary Data, Primary Data, Collection of Primary Data, Methods of Data Collection- Observation, Questionnaire, Designing of Questionnaire. Data Processing and Tabulation: Editing, Coding and Tabulation.

Module IV: Data Analysis (15 Hours)

Testing of Hypothesis, Measurement of Central Tendency, Dispersion, Univariate Analysis, Multiple Regression, Factor Analysis, Cluster Analysis, Multidimensional Scaling, Conjoint Analysis; Interpretation and Report Writing, Types of Research Reports

Suggested Readings

1. Satyabhushan D., Malhotra NK., (2015) Marketing Research: An Applied Orientation,7th Edition, Pearson publisher.
2. Bajpai N., (2011) Business Research Methods: Pearson publisher.
3. Cooper & Schindler (2015) Business Research Methods,12th Edition, Mcgraw-Hill.
4. Green, Tull&Albaum (2010) Research for Marketing Decisions,5th Edition, PHI Pvt. Ltd, New Delhi.
5. Leveine, Khrehbiel& Berenson (2013) Business Statistics,6th Edition, Pearson Education.
6. Luck D. & Rubin D. (2006) Marketing Research, 7th edition, PHI, New Delhi

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M		M	
CO3			H		
CO4			M	M	H

MTGH310T: GROUND HANDLING SERVICES AT AIRPORT

(4 credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The paper is to demonstrate conceptual understanding of the scope of Ground Handling Operations in aviation industry and also to analyze the challenges faced by Ground Handling companies while providing services to the clients. The paper also focuses on understanding the work culture of Ground Handling organizations and analyze regulatory framework prevalent in the industry.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the fundamentals of ground handling (Remembering)
CO 2: Understand the fundamentals of passenger handling. (Understanding)
CO 3: Apply the baggage handling procedure (Applying)
CO 4: Analyse the cargo handling procedure. (Analysing)
CO 5: Describe the ramp handling procedure (Evaluating)

Module I: Ground Handling overview (15 Hours)

Meaning and importance - IATA SAFETY AUDIT for GROUND OPERATIONS (ISAGO) – Airport Operations Control Centre – Role of Turn-Around Coordinator – Ground Handling Equipment.

Module II: Passenger Handling (15 Hours)

Check In and security – Transfer and Transit Passenger handling – Special Category of Passengers – Passenger Embarkation/Disembarkation – Role of Human Factors

Module III: Baggage handling procedures (10 Hours)

Baggage types – World Tracer – Dangerous Goods in Baggage, Checking of baggages.

Module IV: Cargo and Mail handling procedures (10 Hours)

Special cargo – Dangerous Goods – Aircrafts Holds, Load Control Procedures – Process flow – Aircraft Weight & Balance Principles – Centralized Load Control.

Module V: Ramp handling procedures (10 Hours)

Aircraft Loading/Unloading – Interior and exterior cleaning – Regulatory authorities – MOCA, BCAS, DGCA

Suggested Readings

1. "Ground Handling: Theory and Practice" by Konstantinos Zografos and Theodoros Kostouros, published by Routledge in 2016
2. "Airport Ground Handling" by Alexandre G. de Barros and Paulo Roberto de Oliveira, published by CRC Press in 2015
3. Michael J Kroes, William A Watkins, Frank J. Delp and Walter J. Boyne, “Aviation Ground Handling” published By McGraw – Hill Education in 2004

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4				H	
CO5					M
CO6					M

MTIR311T: MANAGEMENT OF INDUSTRIAL RELATIONS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The course focuses on acquainting students with concepts of Industrial Relations and various legislations related to Labour Welfare and Industrial laws.

Course/Learning Outcomes

At the end of this course students will be able to :

CO 1: Define the conceptual knowledge on industrial relations (Remembering)
CO 2: Explain the extent to which the workers can participate in management (Understanding)
CO 3: Apply the mechanism for resolving industrial disputes (Applying)
CO 4: Analyse the provision for payment of wages (Analysing)

CO 5: Discuss the legal framework of factories act (Evaluating)

Module I: Concept of Industrial Relations (15 Hours)
Aspects of industrial relations, conflict and cooperation, parties in industrial relations, workers employers and government, trade unions, objectives process, prerequisites of collective bargaining.

Module II: Workers Participation in Management (10 Hours)
Levels & Mode of participation, Works Committee, Joint Management councils, Worker Director, Grievance Procedure, QC.

Module III: Trade Union Act 1926 (15 Hours)
Immunity granted to Registered Trade Unions, Recognition of Trade Unions. The Industrial Employment (Standing Orders) Act 1946, scope, coverage, certification process, modification, interpretation, and enforcement. The Industrial Disputes Act 1947, forum for settlement of disputes.

Module IV: Payment of Wages Act (10 Hours)
Salient features, coverage of employees and employers, rules and benefits relating to The Payment of Wages Act 1936, The Payment of Gratuity Act 1972, The Minimum Wages Act 1948, The Payment of Bonus Act 1965.

Module V: The Factories Act 1948 (10 Hours)
Definition, approval, licensing and registration, health and welfare measures , employment of women and young persons, leave with wages and weekly holidays.

Suggested Readings
1. C.B.Mamoria, Mamoria & Gankar, Dynamics of Industrial Relations, Himalaya Publishing House Pvt Ltd, 13th Edition, 2014
2. C.S. Venkat Rathnam, Industrial Relations, Oxford University Press, New Delhi, 2012.
3. Arun Monappa, Industrial Relations, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
4. T N Chhabra, Industrial Relations and Labour Laws, Dhanpat Rai Publishing House, Edition 5th, 2013 2. S C Srivastava, Industrial Relations and Labour Laws, Vikas Publishing House.2012

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H	M		
CO3		H	H	L	
CO4				H	
CO5					H

MTIP312T: INVESTMENT ANALYSIS & PORTFOLIO MANAGEMENT

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)
To learn the basics of investing and decide where to invest with less risk.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define the investment environment, different types of investment vehicles (Remembering)
CO 2: Explain the logic of investment process (Understanding)
CO 3: Apply the quantitative methods for investment decision making (Applying)
CO 4: Analyse the portfolio theory and the process of investment portfolio formation (Analysing)
CO 5: Analyze relevance of stocks and bonds for the investments (Analysing)

Module I: Basics of risk and return (15 Hours)
Concept of returns, application of standard deviation, coefficient of variation, beta, alpha. Bonds: present value of a bond, yield to maturity, yield to call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve and theories regarding shape of yield curve. Unsystematic risk and non-risk factors that influence yields. Duration and modified duration, immunization of a bond portfolio. Fundamental analysis, Economic analysis, Expected direction of movement of stock prices with macroeconomic variables in the Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOT analysis, financial analysis of an industry

Module II: Share valuation (15 Hours)
Dividend discount models- no growth, constant growth, two stage growth model, multiple stages; Relative valuation models using P/E ratio, book value to market value. Technical analysis: meaning, assumptions, difference between technical and fundamental analysis; Price indicators- Dow theory, advances and declines, new highs and lows. Volume indicators- Dow

Theory, small investor volumes. Other indicators- futures, institutional activity, Trends analysis: line chart, bar chart, candle chart, point & figure chart. Patterns: head & shoulders, triangle, rectangle, flag, cup & saucer, double topped, double bottomed, Indicators: moving averages. Efficient market hypothesis; Concept of efficiency: Random walk.

Module III: Portfolio analysis (15 Hours)
Portfolio risk and return, Markowitz portfolio model: risk and return for 2 and 3 asset portfolios, concept of efficient frontier & optimum portfolio. Market Model: concept of beta systematic and unsystematic risk. Investor risk and return preferences: Indifference curves and the efficient frontier, Portfolio management services: Passive – Index funds, systematic investment plans. Active – market timing, style investing.

Module IV: Capital Asset Pricing Model (CAPM) (15 Hours)
Efficient frontier with a combination of risky and risk-free assets. Assumptions of single period classical CAPM model. Characteristic line, Capital Market Line, Security market Line. Expected return, required return, overvalued and undervalued assets. Mutual Funds: Introduction, calculation of Net Asset Value (NAV) of a Fund, classification of mutual fund schemes by structure and objective, advantages and disadvantages of investing through mutual funds. Performance Evaluation using Sharpe's Treynor's and Jensen's measures .

Suggested Readings
1. Security Analysis & Portfolio Management, Fischer, D.E. & Jordan, R.J ; Pearson Education.
2. Investment Analysis and Portfolio Management, Prasanna Chandra, Tata Mcgraw Hill Education Private Limited

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3	M	H	H	L
CO4		M	H	H
CO5		L	M	H

MTDM313T: DIGITAL MARKETING

(4 credits - 60 hours) (L-T-P: 4-0-0)

Objective(s)
After studying this course, the students will be able to learn about the different knowledge and skills needed for effective digital marketing in the corporate sectors and entrepreneurial ventures.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define the fundamentals of website marketing. (Remembering)
CO 2: Explain the fundamentals of search engine technology (Understanding)
CO 3: Interpret the various types of social media marketing. (Applying)
CO 4: Analyze the models of digital marketing (Analyzing)
CO 5: Evaluate the web analytics and social media analytics (Evaluating)

Module I: Introduction to Digital Marketing (10 Hours)
Introduction to Digital Marketing, Fundamentals of Website Marketing, Search Engine Marketing, Social Media Marketing, Key Concepts and Important Terminologies, Fundamentals of Metrics and its importance in digital marketing, Fundamentals of Programmatic Advertisement and Performance Marketing, Traditional marketing vs Digital Marketing

Module II: Search Engine Optimization (15 Hours)
Introduction to SEO, Fundamentals of Search Engine Technology, Overview of Search Engine Upgrades, Fundamentals of Google Search, Basics of Google Ads, Keyword Research, On-page and Off-page optimization, Core Elements of Optimization, Understanding Backlinks and Value Network, Organic and Paid Optimization and Techniques of Optimization

Module III: Social Media Marketing (10 Hours)
Introduction Social Media Marketing, Understanding Platforms; types and categories, Relevance in Marketing, Platform Selection, Performance Marketing, Social Media Mentions and Spread, Social Media Sentiment, Lead Generation, Creating a sales funnel.

Module IV: Models of Digital Marketing (10 Hours)
Communication Model (10-C), 7P's of Marketing for content development, AIDA, Framework for targeting and positioning, BOS framework for Channel Development, Integrated Marketing Communication for Efficiencies.

Module V: Web and Social Media Analytics (15 Hours)
Fundamentals of Web Analytics and Social Media Analytics, Understanding Analytical Dimensions, Preparation of Analytical Plan, Identification of Core Metrics and KPIs, Formulation of Metrics, Interpretation of Platform Inbuilt Dashboards (Facebook, Instagram etc and Google Analytics) Channels and Content Development. Designing a website (non-programming), Designing a Social Media Page, Merger of Accounts, Understanding Content, Classification of Content, Content Marketing Channels, Post Strategies, Target Identification

Suggested Readings

1. Ahuja V. Digital Marketing, Oxford University Press.
2. Dodson, I. (2016). The Art of Digital Marketing: The Definitive Guide to Creating Strategic,
3. Targeted, and Measurable Online Campaigns (1st ed.). Hoboken, New Jersey Wiley.
4. Kelsey, T., & Springerlink (Online Service. (2017). Introduction to Social Media Marketing : A Guide for Absolute Beginners. Apress.
5. Reza Zafarani, Mohammad Ali Abbasi, & Huan Liu. (2014). Social media mining: an introduction. Cambridge University Press.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			M	M	H
CO 4				M	
CO 5					M

MTAC314T: AIR CARGO OPERATIONS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)
This course provides air cargo operations overview and freight forwarders perspective about the air cargo industry. This course cargo operations would focus on the business, operations and regulatory fundamentals. It will explore how the air cargo industry is changing and how to identify opportunities to become more successful as a manager in your company. The purpose of this course is to enlighten the students about various cargo handling process and system which are prevalent in business industry.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define air freight and cargo (Remembering)
CO 2: Demonstrate the cargo terms and glossary. (Understanding)
CO 3: Identify the various the airport documentation (Applying)
CO 4: Categorize the cargo weight, packing etc. (Analysis)
CO 5: Evaluate the cargo laws (Evaluating)

Module I: Air Freight Forwarder (15 Hours)
The Air Freight Forwarder, The Airlines, Geography, The Governing Bodies, Cargo Requiring Special Handling, Aircrafts & ULDs, International Time calculators

Module II: Glossary of cargo terms (10 Hours)
Glossary of cargo terms, Aircraft type: Holds and Compartments.

Module III: Introduction, classification of dangerous goods (15 Hours)
Introduction, classification, limitation, identification, packing, documentation, unitization, handling, acceptance, and the carriage of dangerous goods

Module IV: General cargo, special cargo (10 Hours)
General cargo, special cargo, weight & dimension, packing, marking, labeling, handling label, coding and decoding, all types of cargo requiring special handling

Module V: Introduction, principles and rules governing liability (10 Hours)
Introduction, principles and rules governing liability, the liability of freight forwarder, carriage of Goods by Sea, the Hague rules, Hamburg rules, Warsaw convention, Montreal convention.

Suggested Readings

1. Bhalla, A. S. B., Vankar, A. A., &Zala, L. B. Runway Pavement Design of a proposed Airport with the use of FAARFIELD Software.
2. Hanlon, J. P. (2000). Strategic Airport Planning, Robert E. Caves and Geoffrey D. Gosling, Pergamon, Oxford, 1999, ISBN 0 08 042764 2, 451
3. Jarach, D. (2017). Airport marketing: Strategies to cope with the new millennium environment. Routledge

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4				H	
CO5				M	M

MTBE404T: BUSINESS ENVIRONMENT

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective(s)

To apply relevant knowledge, skills and exercise professional judgement in understanding the macro environment in which a business organisation operates. The course would also make the students capable of analysing and understanding policies of the government implemented from time to time and assess their impact on business

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define economic systems in depth (Remembering)
CO 2: Explain how an entity operates in a business environment (Understanding)
CO 3: Identify the role of Public and Private sector in the business environment (Applying)
CO 4: Examine the trade environment in details (Analysing)

Module I: Business Environment (6 Hours)

Concept, Components and importance; Indian Business Environment; Cultural, social, political, technological, economic and legal environment; scanning techniques of environmental forecasting; SWOT- Internal environment -their impact on policy formulation.

Module II: Economic trends (6 Hours)

Economic reforms in India –Liberalization, privatization and globalization; Competitive Strength of Indian industry; Impact of liberalization policy on different sectors; Foreign Investments policy in India.

Module III: Multinational Corporations (6 Hours)

Multinational corporations and their participation in India; strategies of multinational corporations; competitive strengths policies and performance

Module IV: Business Ethics and Social Responsibilities (6 Hours)

Business ethics and social responsibilities; relationship between business and society; Corporate power social accountability; Ethical issues and values in business; Corporate Social policies - issues and challenges; Ecological and environmental issues

Module IV: Economic Development of North Eastern Region (6 Hours)

Special package for economic development of the north eastern region; DONER and its role in economic development, infrastructure and industry; Brief study of the tea industry, paper industry, food processing industry, silk industry and bell metal industry; tourism industry of Assam

Suggested Readings

1. Wheelen, Concepts of Strategic Management and Business policy, Pearson Education, New Delhi.
2. Islam Swabera & Kharkongor; Business Environment, Taxman's Publication, New Delhi.
3. Misra S.K., Puri V.K.; Indian Economy, Himalaya Publishing House, Mumbai.
4. Deepashree, Indian Economy, Tata McGraw Hill, New Delhi.
5. Dutta Rnddar and Sundaram KPM , S. Chand & Co. Ltd., New Delhi.
6. Agarwal A.N., Indian Economy, New Delhi.
7. Kazhmi Azhar, Business Policy
8. Gupta, Liberalisation - its impact on Indian Economy, Macmillan.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	L	L	L		
CO 2	M		H		
CO 3		M		H	
CO 4	L				M

MTAR405T: AIRPORT RESOURCE PLANNING & SERVICES MANAGEMENT

(3 Credits -45 hours) (L-T-P: 3-0-0)

Objective(s)

The main objective of Airport Planning & Management course is to help the students to acquire and develop skill to take rational decisions in the process of planning costly airport infrastructure. The paper also familiarizes the students in understanding on various customer handling standard operating procedures. This will be helpful to increase and develop skill of independent thinking and decision making.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define airport and airport operations (Remembering)
CO 2: Explain the airspace and air traffic control. (Understanding)
CO 3: Develop the airport system planning (Applying)
CO 4: Analyse the airport customer services. (Analysis)
CO 5: Evaluate the branding strategies (Evaluating)

Module I: Airport and Airport Systems (10 Hours)

Introduction of airport and airport system - National Plan of Integrated Airport system - Rules govern airport system- Organizations that influence airport regulatory policies - Profiles of regulatory bodies of airport - Organization and administration, The components of the airport - The airfield - Components of an airport - The airfield coastal & geotechnical survey - NAVAIDS on the airfield - Weather reporting facilities - Security infrastructure.

Module II: Airspace and air traffic Control (8 Hours)

Brief history of ATC - Present day ATC management & operating infrastructure - Basics of ATC - Current & future enhancement to ATC - Airport terminal and ground access - Historical development of airport terminals - Components of airport terminal - Airport ground access.

Module III: Airport system planning Airport master plan (10 Hours)

Forecasting - Facilities Requirement - Design alternatives - Financial plans - Land use planning - Environmental planning - Airport capacities and delays - Defining capacity - Factors affecting capacity & delay - Estimating capacity - Illustrating capacity with a time space diagram - FAAA approximation chart - Simulation models.

Module IV: Customer service (8 Hours)

Introduction, concept of customer service, objectives of customer service, role of customer service representative, objectives of customer services. Dealing with various complaints, reasons and causes of complaints

Module V: Branding Strategies (9 Hours)

Branding strategies with customer services at airports: marketing ambience of airport, role of service and social media in customer service, performance and quality of service offered.

Suggested Readings

1. Khanna, S. K., & Arora, M. G. (1971). Airport Planning and Design. Mom Chand.
2. Freathy, P. (2003). Managing airports: an international perspective: Anne Graham.
3. Butterworth-Heinemann, Oxford, 2001, pp. 240, ISBN 075064823.
4. Wensveen, J. G. (2016). Air transportation: A management perspective. Routledge
5. Sudhir, A. (2007). Introduction to tourism and hospitality industry. Tata McGraw-Hill.
6. Bazargan, M. (2016). Airline operations and scheduling. Routledge

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4				H	
CO5					M

MTRM406T: RESEARCH METHODOLOGY

(2 Credits - 30 Hours) (L-T-P: 2-0-0)

Objective(s)

This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the various kinds of research, objectives of doing research (Remembering)
CO 2: Apply the basic knowledge on qualitative research techniques (Understanding)
CO 3: Analyze of data analysis-and hypothesis testing procedures (Analysing)

Module I: Introduction (6 Hours)

Meaning of Research, Objectives of Research, Types of Research, Research Process, Research Problem formulation; Research Design: Features of a good research design; Different Research Designs; Measurement in Research; Data types; Sources of Error

Module II: Measurement and Scaling (8 Hours)

Primary Level of Measurement- Nominal, Ordinal, Interval, Ratio, Comparative and Non-competitive Scaling Techniques, Questionnaire Design, Sampling Process, Sampling Techniques-Probability and Non-Probability Sampling, Sample Size Decision.

Module III: Data Collection (10 Hours)

Primary & Secondary Data; Survey Method of Data Collection, Classification of Observation Method; Fieldwork and Data Preparation. Hypothesis: Null Hypothesis & Alternative Hypothesis; Type-I & Type-II Errors; Hypothesis Testing: Z-Test, T-Test, ANOVA, Concepts of Multivariate Techniques.

Module IV: Research Report (6 Hours)

Meaning, Types and Layout of Research Report; Steps in Report Writing, Tabular & Graphical Presentation of Data, Citations, Bibliography and Annexure in Report, Avoid Plagiarism; Use of Statistical Software to Analysis the Data.

Suggested Readings

1. Satyabhushan D., Malhotra NK., (2015) Marketing Research: An Applied Orientation,7th Edition, Pearson publisher.
2. Bajpai N., (2011) Business Research Methods: Pearson publisher.
3. Cooper & Schindler (2015) Business Research Methods,12th Edition, Mcgraw-Hill.
4. Green, Tull & Albaum (2010) Research for Marketing Decisions,5th Edition, PHI Pvt. Ltd, New Delhi.
5. Leveine , Khrehbiel & Berenson (2013) Business Statistics,6th Edition, Pearson Education.
6. Luck D. & Rubin D. (2006) Marketing Research, 7th edition, PHI, New Delhi

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			H	M	M

MTIB407T: INTERNATIONAL BUSINESS

(Credits-3 - 45 hours) (L-T-P: 3-0-0)

Objective(s)

This course provides an overview of the environment, concepts, and basic differences involved in international business.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Describe the foundation of international business.
CO 2: Describe international organizations and multinational corporations.
CO 3: Define forms of foreign involvement.
CO 4: Evaluate various international trade theories.

Module I: Introduction to Global Business (10 Hours)

Global Business: Scope, Global Linkages today; Culture and Global Business: Elements of culture, Training Challenge; Global Trade and Investment Theory: Mercantilism, Classical Trade Theory, Factor Proportion Theory, International Trade and Product cycle theory, Theory of International Investments; Structure of Indian Foreign Trade: Composition & direction; EXIM Bank; Exit

Policy of India; Regulation and Promotion of Foreign Trade.

Module II: Global Financial Markets (10 Hours)
Foreign exchange markets; Fixed and Floating Foreign exchange rates; Significant monetary events; Exchange rates, interest rates and economic policy; Economic Integration; Government Trade Policies.

Module III: Global Business Environment (15 Hours)
Private International Law; Public International Law; Risk to Global Business; Doctrine of Sovereign Immunity; Doctrine of Eminent Domain; Labour Law Differences; Theoretical foundations of International Business; Balance of Payments; International Liquidity; International Economic; Accounting and Tax differences; Multinational Corporations; Foreign Direct Investment.

Module IV: International Finance (10 Hours)
Financing exports and imports; International Capital and Cash Management; Capital Structure: International Dimensions; International Capital Markets; International Banking and Security Markets; IMF; World Bank; IFC; ITA; ADB; WTO.

Suggested Readings

1. Joshi Rakesh Mohan: International Business, Oxford University Press.
2. Cherunilam F: International Business: Text and Cases, PHI Learning.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2		H		
CO 3			H	M
CO 4	H			

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	MTED104L	Entrepreneurship Development	3
2	S E Course 2	MTOM105L	Office Organization and Management	3
3	S E Course 3	MTRM210L	Retail Management	3

MTED104L: ENTREPRENEURSHIP DEVELOPMENT

(3 Credits - 45 Hours) (L-T-P: 4-0-0)

Objective(s):

The purpose of the paper is to orient the learner toward entrepreneurship as a career option and creative thinking and behavior.

Course/ Learning Outcomes

At the end of the course students will be able to:

CO 1: Define the concept of entrepreneur. (Remembering)
CO 2: Classify different types of entrepreneurs and entrepreneurial ventures. (Understanding)
CO 3: Describe the dimensions of entrepreneurial orientation. (Applying)
CO 4: Identify strengths, weaknesses of oneself. (Analysing)

Module I: Introduction (8 hours)

Meaning, elements, determinants and importance of entrepreneurship and creative behavior; Entrepreneurship and creative response to the society' problems and at work; Dimensions of entrepreneurship: intrapreneurship, technopreneurship, cultural entrepreneurship, international entrepreneurship, netpreneurship, ecopreneurship, and social entrepreneurship

Module II: Entrepreneurship and Micro, Small and Medium Enterprises (8 hours)

Concept of business groups and role of business houses and family business in India; The contemporary role models in Indian business: their values, business philosophy & behavioural orientations; Conflict in family business and its resolution

Module III: Sustainability of Entrepreneurship (8 hours)

Public and private system of stimulation, support and sustainability of entrepreneurship. Requirement, availability and access to finance, marketing assistance, technology, and industrial accommodation, Role of Industries/entrepreneur's association and self-help groups, The concept, role and functions of business incubators, angel investors, venture capital and private equity fund

Module IV: Sources of business ideas and tests of feasibility (12 hours).

Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation, planning & control; preparation of project report (various aspects of the project report such as size of investment, nature of product, market potential may be covered); Project submission/ presentation and appraisal thereof by external agencies, such as financial/non-financial institutions

Module V: Mobilising Resources (9 hours).

Mobilising resources for start-up. Accommodation and utilities; Preliminary contracts with the vendors, suppliers, bankers, principal customers; Contract management: Basic start-up problems

Suggested Readings

1. Kuratkoand Rao, Entrepreneurship: A South Asian Perspective, Cengage Learning.
2. Hisrich R, Peters M, Dean Shepherd, Entrepreneurship, McGraw Hill Education
3. Desai, Vasant. Dynamics of Entrepreneurial Development and Management. Mumbai, Himalaya Publishing House.
4. Dollinger, Mare J. Entrepreneurship: Strategies and Resources. Illinois, Irwin.
5. David H. Entrepreneurship: New Venture Creation. Prentice-Hall of India ,NewDelhi.
6. Singh, Nagendra P. Emerging Trends in Entrepreneurship Development. New Delhi: ASEED.
7. Khanka S S, Entrepreneurial Development, S. Chand &Co, Delhi.

E Resources

1. https://www.youtube.com/watch?v=rA4uKIy5gO0&list=PLsh2FvSr3n7fQlIDbfKutmSL26TsWitGQ
2. https://www.youtube.com/watch?v=DiKduSs7o34

Mapping of COs with Syllabus

Course Outcomes	Module-1	Module-2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	M
CO4			H	L

MTOM105L: OFFICE ORGANIZATION AND MANAGEMENT

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective(s)

The course aims to establish the importance of office organisation and management and its role in the workplaces. It also prepares the students to acquire basic knowledge and skills necessary for different tasks and aspects in different industries

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the basic knowledge of office organisation and management (Remembering)
CO 2: Demonstrate skills in effective office organisation (Understanding)
CO 3: Organise and to maintain the office records (Applying)
CO 4: Ability the different types of digital records. (Analysing)
CO 5: Appraise the different types of organisation structures (Evaluating)

Module I: Fundamentals of Office Management (10 Hours)

Introduction: Meaning, importance and functions of modern office Modern Office Organisation: Meaning; Steps in office organisation; Principles of Office organisation, Organisation structure types, Nature of office services: Types of services in a modern office, decentralisation and centralisation of office services, Office management: Meaning, Elements and major processes of Office management Office Manager: Functions and qualifications of Office manager

Module II: Administrative Arrangement and Facilities (8 Hours)

Office Accommodation and its Importance: Location of Office, Choice of Location: Urban vs Suburban, Factors to be Considered in Selecting the Site, Securing Office Space, Office Lay-out: Objectives of Office Lay-out, Types of offices: Open Office and Private Office- advantages and disadvantages.

Module III: Office Environment (10 Hours)

Meaning and Components of Office Environment Interior Decoration: Colour Conditioning, Floor Coverings, Furnishings, Furniture and Fixtures: Types of Furniture, Choice between Wooden and Steel Furniture, Principles Governing Selection of Furniture Lighting and Ventilation, Noise: Internal Noise, External Noise , Cleanliness, Sanitation and Health Safety and Security;

Module IV: Introduction to Records & Filing System (8 Hours)

Importance of Records, types of office records, Records Management: Meaning, Principles of Record Keeping, Functions of Records; Management Filing: Elements of Filing and Filing Functions, Objectives and Importance of Filing, Advantages of Filing, Essentials of a Good Filing System, Classification of Files. Filing Methods: Horizontal and vertical Filing. Office manual: contents, Importance, types of office manuals. Indexing: Meaning, importance, advantages and essentials of good indexing, Retention and disposal of files: Meaning and benefits of record retention, need for disposal of files, life-cycle stages of files.

Module V: Office Mechanisation and Data Processing (9 Hours)

Meaning, Importance and Objectives of Office Mechanisation, Advantages and disadvantages of Office Mechanisation, Factors Determining Office Mechanisation Kinds of Office Machines: Duplicating Machines and Photocopying Machines, Distinction between Data and Information, Importance of Data and Information, Classification of Data, Classification of Information, Data Collection Methods- Primary and secondary data collection methods Data processing using computers: Computer Applications in Office Management, Advantages and Limitations of Computerisation

Suggested Readings

1. S.P Arora, Office Organisation and Management, Vikas Publishing House Pvt Ltd
2. M.E Thakuram Rao, Office organisation and Management, Atlantic
3. Judith Read, Mary Lea Ginn, Record Management, 10th Edition, Cengage Learning.

E Resources

1. https://www.youtube.com/watch?v=8iwOCXkImmI
2. https://www.youtube.com/watch?v=QE6TBuGbScA&list=PL7c2_MFoYT-4Wa-ajZ71x4gZt2aZ_Wrbi

Mapping of COs with Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4			H	H	
CO5				M	M

MTRM210L: RETAIL MANAGEMENT

(Credits: 3- 45 hours) (L-T-P: 3-0-0)

Objective(s)

The course aims to establish the importance of retail management. It also prepares the students to acquire basic knowledge and skills necessary for different tasks and aspects of retail management.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: List the types and forms of Retail business. (Understanding)
CO 2: Examine Consumer Behavior in various environment. (Applying)
CO 3: Analyze various Retail operations and evaluate them. (Analysing)
CO 4: Determine the retail marketing mix. (Knowledge)
CO 5: Application of IT in retail sector (Applying)

Module I: Introduction to Retail Business (8 Hours)

Definition – functions of retailing - types of retailing – forms of retail business ownership. Retail theories – Wheel of Retailing – Retail life cycle. Retail business in India: Influencing factors – present Indian retail scenario.

Module II: Consumer Behaviour in Retail Business (10 Hours)

Buying decision process and its implication on retailing – Influence of group and individual factors, Customer shopping behaviour, Customer service and customer satisfaction.

Module III: Retail Operations (12 Hours)

Factors influencing location of Store - Market area analysis – Trade area analysis – Rating Plan method - Site evaluation. Retail Operations: Stores Layout and visual merchandising, Stores designing, Space planning, Inventory management, Merchandise Management, Category Management.

Module IV: Retail Marketing Mix (8 Hours)

Introduction -Product: Decisions related to selection of goods (Merchandise Management revisited) – Decisions related to delivery of service. Pricing: Influencing factors – approaches to pricing Place : Supply channel – SCM principles – Retail logistics – Promotion : Setting objectives – communication effects - promotional mix.

Module V: Information Technology in Retailing (7 Hours)

Non store retailing (e-retailing) - The impact of Information Technology in retailing - Integrated systems and networking – EDI – Bar coding – Electronic article surveillance – Electronic shelf labels – customer database management system.

Suggested Readings

1. Suja Nair; Retail Management, HPH
2. Karthic – Retail Management, HPH
3. S.K. Poddar& others – Retail Management, VBH.
4. R.S Tiwari ; Retail Management, HPH

Mapping of COs with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H		
CO4				H	
CO5					H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	MTIN106I	Internship	4
4	Internship	MTIN211I	Internship	4
5	Internship	MTIN315I	Internship	2

MTIN106I/MTIN211I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits- 120 Hours) (L-T-P: 0-0-4)

Objective(s)

The students are required to undergo an internship in work related to Commerce and Management during the semester break at the end of fourth Semester or fifth Semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Identify career alternatives prior to graduation. (Understanding)
CO 2: Translate theory into practice. (Applying)
CO 3: Improve work habits and attitudes towards job success in workplace (Creating)

INTRODUCTION

The field of Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the BBA programme the students are made acquainted with the various facets of General Management, Marketing, HR and Finance functions. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

1. The internship should be for a minimum duration of **three weeks for 120 hours** which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.
2. The students have to undergo the internship at the end of 1st Year or 2nd Year if they choose to leave the programme . Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student
3. The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management.
4. After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department. e. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise of the following:

a. Recommendation Letter from the Department.
b. Completion Certificate from the Organisation where the student has worked as intern.
c. Internship Diary as per the prescribed format.
d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.
e. The Contents of the Report must include:
    I. Introduction.
    II. Objectives of the Internship.

III. About the Organisation (Sector, Activities, Operations).
IV. Description of the work.

The Assessment for the internship must have the following components:

a. Internship Report: 20 marks
b. Internship Diary: 20 marks
c. Seminar Presentation: 30 marks
d. Viva-Voce Examination: 30 marks

MTIN315I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits- 60 Hours) (L-T-P: 0-0-2)

Objective(s)

The students are required to undergo an internship in work related to Commerce and Management during the semester break at the end of fourth Semester or fifth Semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Identify career alternatives prior to graduation. (Understanding)
CO 2: Translate theory into practice. (Applying)
CO 3: Improve work habits and attitudes towards job success in workplace (Creating)

INTRODUCTION

The field of Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the BBA programme the students are made acquainted with the various facets of General Management, Marketing, HR and Finance functions. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

1. The internship should be for a minimum duration of **two weeks for 80 hours** which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.
2. The students have to undergo the internship during the semester break at the end of 3rd semester examination or at the end of 5th semester examination. Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student
3. 3.The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management.
4. 4.After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department. e. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise of the following:

a. Recommendation Letter from the Department.
b. Completion Certificate from the Organisation where the student has worked as intern.
c. Internship Diary as per the prescribed format.
d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.
e. The Contents of the Report must include:
    I. Introduction.
    II. Objectives of the Internship.
    III. About the Organisation (Sector, Activities, Operations).
    IV. Description of the work.

The Assessment for the internship must have the following components:

a. Internship Report: 20 marks

b. Internship Diary: 20 marks
c. Seminar Presentation: 30 marks
d. Viva-Voce Examination: 30 marks

RESEARCH PROJECT/DISSERTATION

BBA (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	MTDI408P	Dissertation-I	6
8	Research Project/Dissertation	MTDI409P	Dissertation-II	6
BBA (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	MTDI410P	Dissertation-I	18
8	Research Project/Dissertation	MTDI411P	Dissertation- II	20

BBA (Honours)

MTDI408P: RESEARCH PROJECT/ DISSERTATION - I
(6 Credits - 180 Hours) (L-T-P: 0-0-6)

Objective(s)
The basic objective of the project work is to give students an idea of research during 7th semester. In which they need to undertake a field survey for collecting data. Further they need to analyse the data and present a report on the topic in which they have conducted research. The evaluation is done on the basis of the project report, presentation and viva-voce examination.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Define the different types of research project. (Remembering)
CO 2: Explain the various steps of designing research project (Understanding)
CO 3: Build questionnaires and schedules (Applying)
CO 4: Assess the data for analysis (Analyzing)
CO 5: Appraise the findings in the report (Evaluating)
CO 6: Design a research project report (Creating)

Guidelines Related To Project:
The entire project will be carried out in one phase during 7th semester. It includes Introduction and Review of Literature part, Research Methodology, Data Analysis and Interpretation and Findings, suggestions and conclusion part.

The Dissertation will comprise of the following:
1. Synopsis: Submission of a write up on a specific area/topic of study
2. Review of Literature: Submission of a specified number of reviews to respective guide
3. Research Methodology: Lecture based on the topic of study
4. Referencing Style: Lecture on referencing style to be followed while submitting report
5. Training on application of Statistical software used in research
6. Submission of Progress Report

Report should comprise of Introduction, Review of Literature, Research Methodology and References. EVALUATION:
A diary is to be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester.

Evaluation will be done by the respective guide based on timely submission of part-work and quality of work as follows:
Synopsis (30 marks)
Review of Literature (30 marks)
Research Methodology (30 marks)
Publication in Referred Journal: (10 marks)

MTDI409P: RESEARCH PROJECT/ DISSERTATION - II

(6 Credits - 180 Hours) (L-T-P: 0-0-6)

Objective*(s): The basic objective of the project work is to give students an idea of research during 7th semester. In which they need to undertake a field survey for collecting data. Further they need to analyse the data and present a report on the topic in which they have conducted research. The evaluation is done on the basis of the project report, presentation and viva-voce examination.*

Course / Learning Outcomes

At the end of this course students will be able to:

CO1: define the different types of research project. (Remembering)
CO2: explain the various steps of designing research project (Understanding)
CO3: build questionnaires and schedules (Applying)
CO4: assess the data for analysis (Analyzing)
CO5: appraise the findings in the report (Evaluating)
CO6: design a research project report (Creating)

Guidelines Related To Project:

The entire project will be carried out in one phase during 7th semester. It includes Introduction and Review of Literature part, Research Methodology, Data Analysis and Interpretation and Findings, suggestions and conclusion part.

The Dissertation will comprise of the following:
1. Synopsis: Submission of a write up on a specific area/topic of study
2. Review of Literature: Submission of a specified number of reviews to respective guide
3. Research Methodology: Lecture based on the topic of study
4. Referencing Style: Lecture on referencing style to be followed while submitting report
5. Training on application of Statistical software used in research
6. Submission of Progress Report

Report should comprise of Introduction, Review of Literature, Research Methodology and References. EVALUATION:
A diary is to be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester.
Evaluation will be done by the respective guide based on timely submission of part-work and quality of work as follows:
Synopsis (30 marks)
Review of Literature (30 marks)
Research Methodology (30 marks)
Publication in Referred Journal: (10 marks)

BBA (Honours) with Research

MTDI410P: Dissertation-I

(18 Credits - 540 Hours) (L-T-P: 0-0-18)

Objective(s)

The objective of the course would be to educate the students about the various dimensions of a research based project work. The students will also be taught about the application of statistical tools through SPSS. In 7th sem (BBA – Research)

Course / Learning Outcomes

At the end of this course students will be able to:
CO 1: Define the different types of research project. (Remembering)
CO 2: Explain the various steps of designing research project (Understanding)
CO 3: Build questionnaires and schedules (Applying)
CO 4: Assess the data for analysis (Analyzing)
CO 5: Appraise the findings in the report (Evaluating)
CO 6: Design a research project report (Creating)

The Dissertation will comprise of the following:
1. Synopsis: Submission of a write up on a specific area/topic of study
2. Review of Literature: Submission of a specified number of reviews to respective guide
3. Research Methodology: Lecture based on the topic of study
4. Referencing Style: Lecture on referencing style to be followed while submitting report

5. Training on application of Statistical software used in research
6. Submission of Progress Report

Report should comprise of Introduction, Review of Literature, Research Methodology and References. EVALUATION:
A diary is to be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester.

Evaluation at Phase I will be done by the respective guide based on timely submission of part-work and quality of work as follows:
Synopsis (30 marks)
Review of Literature (30 marks)
Research Methodology (30 marks)
Publication in Referred Journal: (10 marks)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			H	M	
CO4				H	
CO5				H	
CO6					H

MTDI411P: DISSERTATION-II

(20 credits - 600 hours) (L-T-P: 0-0-20)

Objective(s)

The objective of the course would be to develop analytical skills among the students for solving any research queries. The students will also be taught about the preparation of a project report. In 8th semester of BBA Research

Course/ Learning Outcomes

At the end of this course students will be able to:
CO 1: Define the different types of research project. (Remembering)
CO 2: Explain the various steps of designing research project (Understanding)
CO 3: Build questionnaires and schedules (Applying)
CO 4: Analyse the data for analysis (Analyzing)
CO 5: Appraise the findings in the report (Evaluating)
CO 6: Design a research project report (Creating)

DISSERTATION GUIDELINES

Chapter I INTRODUCTION

a. Broad introduction to thesis topic and method.
b. Research problem. State broadly, in question form. Give sub-questions. Explain carefully. In
c. On sense, usually the problem is to expand the body of knowledge examined in the literature review.
d. Need for the research. Who will benefit? Discuss applied and scientific contributions.
e. Nominal definitions. Define central terms.
f. Context. Add further info to clarify the research problem.

Chapter II THEORY Literature review

Organize by idea; avoid stringing together abstracts of articles.

a. Overview. Theoretical foundations
b. Literature. Group articles by ideas. For a given idea, first discuss common strands in the literature, then departures.
c. Model of a process, usually. Based on the lit reviewed.
d. Hypotheses (in broad sense of the term; also called Propositions). For each, give brief restatement of justification tied to earlier sections; explain derivation and implications. Include assumptions. Explicitly state plausible rival hypotheses (explanations of process) of a substantive nature.
e. Scope of the study. Theoretical assumptions; discuss limitations they impose.

Chapter III METHODS

Outline in a few pages.

a. Introduction. General description of method and design
b. Design. Experiment, quasi-experiment, survey, and so forth. Detailed description
c. Sample. Universe, population, element, sample design, tolerance, probability.
d. Measurement. Operational definitions. Include, as applicable, detailed discussion of indexes/scales. Specify methods used to assess validity and reliability.
e. Analysis. Techniques to be used; justification. Nature of relationships expected (e.g., asymmetrical, symmetrical, reciprocal; linear, monotonic, other curvilinear; necessary, sufficient, necessary and sufficient). Include dummy tables and worked examples of statistics.
f. Validity. Design: Internal and external, with relevant subtypes.
g. Methodological assumptions. Discuss limitations they impose.

APPENDICES

a. Schedule. In Gantt Chart form.
b. Facilities. Faculty and staff expertise, library and computer resources, other special facilities contributing to a successful study.
c. Budget.
d. Bibliographic essay. Sources searched (indexes, abstracts, bibliographies, etc.). Strengths and weaknesses of literature.

Chapter IV FINDINGS

a. Brief overview.
b. Results of application of method; any unusual situations encountered. Nature of sample
c. Descriptive analysis. One-way frequency distributions on central variables
d. Validity/reliability analysis.
e. Tests of hypotheses. ANOVAs, cross tabulations, correlations, and such, depending on techniques used; give in same order as hypotheses.

Chapter V DISCUSSION

When discussing implications, deal with both the theoretical and the practical. Present only interpretations of the findings, not opinion.

a. Brief overview.
b. Discussion of results of application of method. Implications.
c. Discussion of descriptive analysis. Implications.
d. Discussion of tests of hypothesis. Implications.
e. Post-hoc analysis. Implications.

Chapter VI CONCLUSION

May include writer's opinion

a. Summary of entire thesis in a few pages.
b. Conclusions. Refer to lit review.
c. Implications. Speculate about broadest possible consequences, both theoretical and practical. Label speculation clearly.
d. Limitations. Theory, method.
e. Suggestions for future research.

Appendices. Bibliographic essay. Questionnaire and coding manual, if any. Raw data.
BIBLIOGRAPHY. Include all relevant sources examined, whether cited or not.

DEPARTMENT OF COMMERCE

PROGRAMME: BACHELOR OF COMMERCE
DEGREE: BCOM (HONOURS)/ BCOM (HONOURS) WITH RESEARCH

VISION
Creating an institute of academic excellence with commitment to quality teaching and research environment in the field of Commerce and Management

MISSION
1. To empowering students with all the knowledge and guidance which help them to become excellence in management professionals.
2. To impart value based education for students which ultimately enhances their credibility and employability
3. To develop a niche for ourselves in the specialized field of commerce and management.
4. To nurture and motivate the students to become globally competent.

Program Outcomes		
PO 1	Disciplinary Knowledge	Acquire Comprehensive disciplinary knowledge and its implications.
PO 2	Critical Thinking	Ability to engage in reflective and independent thinking by understanding the concepts of Commerce and Business. Ability to examine the problems in different branches of Commerce and Business.
PO 3	Problem Solving	Capability to reduce a business problem and apply the classroom learning into practice to offer a solution for the same.
PO 4	Leaders in communities	Effective decision making in business and commerce through meaningful and impactful community engagement practices.
PO 5	Research Skills	Ability to search for, locate, extract, organise, evaluate, analyse and report information that is relevant to particular problem.
PO 6	Moral and Ethical Values	Ability to ascertain unethical behaviour, falsification and manipulation of information

Program Specific outcomes (PSO)
PSO 1: To enhance knowledge related to major theories and models in key areas of Accountancy, Finance, Taxation, Marketing, Human resource management and other allied & interdisciplinary areas.
PSO 2: To nurture skills on entrepreneurship and business analysis required for an entrepreneur.
PSO 3: To empower the students to take-up professional courses viz., CA, CS, CMA, CFA and competitive examination like AFS/IFS.
PSO 4: To enable students to work on real life projects viz., Service learning, Internship, Industry Visit and real-life projects and assignments.
PSO 5: To enable students to manage self and various social systems for the betterment of the society at large.

BCOM WITH 4 YEAR UG DEGREE (HONOURS)/ BCOM WITH 4 YEAR UG DEGREE (HONOURS WITH RESEARCH)

COURSE OUTCOMES MAPPING WITH POs/PSOs

Course	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
1.1	M				M	M	H	M	M	M	
1.2	L	L			L	M	L	L	L		L
1.3				H				M		M	
1.4		M			M	L		L			
1.5			M							L	M
1.6		L						H			
1.7				M							M
1.8		L								H	
2.1	M				M	H	M		M		
2.2	M	L			L	M	L	L	L		M
2.3		L					M			H	
2.4	M	M	M				M	L	L		

2.5		M			M		L				H
2.6		H							H		M
2.7		L			M		H			L	
2.8		M					M				
3.1	M	L				M		M	H	H	
3.2	H	M	M		M	M	H	H	M		M
3.3	M	M	H					M	L		
3.4		M	H		M			M	H		
3.5		M				M	M	M	H	M	
3.6	M					H					L
4.1	H	M			L	M	H	M	M		
4.2	H	L				L		M		M	
4.3	M	L				L	H	M	M		
4.4		H			H	M		H	M	M	H
4.5	M	L			L	M	H		M		H
5.1	H	H	M	H		L	H	H	M	L	
5.2	M	M	H	H	H		M	H	H		M
5.3		H		L	M	H	H	M	H	M	
5.4	M	H	H	H		H	H	H	H		
5.5		M				M		M			H
6.1	H	M	H		H		H	H	H	L	
6.2		H		M	H	H	H	H	H	H	
6.3	H	H	M	M	H	H	H	H	H		M
6.4	H	H	H			H	H	H	H		
6.5	M	L				M			H		M
7.1	M	M	H					M	L		
7.2		M	H		M			M	H	L	
7.3		M				M	M	M	H		H
7.4	M					H				M	
7.5	H	M			L	M	H	M	M		L
7.6	H	L				L		M			M
8.1	M	L				L	H	M		H	
8.2		H				M		H	M	M	
8.3	M				L	M	H				H
8.4	H	H	M	H		L	H	H	M	M	M

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	CMFA100T	Financial Accounting	4
2	Major Course 2	CMMP101T	Management Principles and Applications	4
3	Major Course 3	CMBL200T	Business Law	4
3	Major Course 4	CMBE201T	Business Economics	4
4	Major Course 5	CMHR202T	Human Resource Management	5
4	Major Course 6	CMCM203T	Cost and Management Accounting	5
4	Major Course 7	CMQT204T	Quantitative Techniques for Business	4
5	Major Course 8	CMMM300T	Marketing Management	5
5	Major Course 9	CMCA301T	Corporate Accounting	5
5	Major Course 10	CMBE302T	Business Environment	4
6	Major Course 11	CMAG303T	Auditing and Corporate Governance	4
6	Major Course 12	CMFM304T	Financial Management	4
6	Major Course 13	CMTL305T	Taxation Law and Practices	4
6	Major Course 14	CMAT306P/ CMST307P/ CMSA308P/ CMIN309P/ CMMP310P	Audit Training/Salesperson training/SWOT Analysis of an industry/Internship/Project	4
7	Major Course 15	CMAA400T	Advanced Accounting	5
7	Major Course 16	CMFS401T	Financial Statement Analysis	5
8	Major Course 17	CMCR402T	Consumer Behaviour and Relationship Management	5
8	Major Course 18	CMIF403T	International Finance	5

CMFA100T: FINANCIAL ACCOUNTING

(4 Credits-60 hours) (L-T-P: 4-0-0)

Objective

The objective of this course is to help students to acquire conceptual knowledge of financial accounting and to impart skills for recording various kinds of business transactions and assess the financial condition of the business.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Define the theoretical framework and accounting process (Remembering)
CO 2: Explain the accounting process (Understanding)
CO 3: Identify the important constituents of business income (Applying)
CO 4: Analyse the final accounts (Analysing)
CO 5: Evaluate the accounting for inland branches (Evaluating)
CO 6: Elaborate the accounting system for dissolution of the partnership firm (Creating)

Module I: Theoretical Framework, Accounting Process, Financial Accounting Standards (10 Hours)

- **Theoretical Framework:** Accounting as an information system, the users of accounting information and their needs. Qualitative characteristics of accounting, Functions, advantages and limitations of accounting; accounting principles: Basic concepts and conventions, branches of accounting. Bases of accounting: cash basis and accrual basis

Accounting Process: Double entry

- book keeping system - Basic accounting equation, accounting cycle; Recording of a business transaction: Journal, Ledger and preparation of trial balance including adjustments, Capital and Revenue expenditure and receipts, Profit and Loss Account and Balance Sheet (Sole Proprietorship only). Rectification of Errors, Depreciation Accounting.
- **Financial Accounting Standards**: Concept, benefits, procedure for issuing accounting standards in India. International Financial Reporting Standards (IFRS): Need and procedures, Convergence to IFRS, Distinction between Indian Accounting Standards (IASs) and Accounting Standards (ASs).

Module II: Accounting for Hire Purchase and Installment System (12 Hours)

Meaning of Hire Purchase and Installment Purchase System - Journal entries and ledger accounts in the books of Hire Vendors and Hire purchasers for large value items including default and repossession, stock and debtors system; Difference between

Hire Purchase and Installment Purchase: Important Definitions, Hire Purchase Agreement, Hire Purchase Price, Cash Price, Hire Purchase Charges, Net Hire Purchase Price, Net Cash Price, Calculation of Interest, Calculation of Cash Price, Journal Entries and Ledger Accounts in the books of Hire Purchaser and Hire Vendor (Asset Accrual Method only).

Module III: Branch and Departmental Accounting (16 Hours)

- Meaning, objectives, need of Branch Accounting; classification of Branches; Accounting treatment of Branch Accounting – synthetic or Debtors System, Analytical or stock and debtor for system. Final Account system including accounting treatment for independent Branch.
- Departmental accounting; introduction, methods and techniques, allocation of expenses, inter departmental transfer, preparation of departmental Trading, Profit and Loss account and balance sheet.

Module IV: Royalty Accounts (12 Hours)

Meaning and definition, Technical Terms, Royalty, Landlord, Tenant, Minimum Rent, Short Workings, Recoupment of Short Workings under (Fixed Period) restrictive and non-restrictive (Floating Period), Recoupment within the Life of the Lease, Treatment of Strike and Stoppage of work, Accounting Treatment in the books of lessee and lessor, journal entries and Ledger Accounts including minimum rent account.

Module V: Accounting for Partnership Firm (10 Hours)

Partnership Accounts: Essential characteristics of partnership, Partnership deed, Final accounts, adjustments after closing the accounts, Fixed and fluctuating capital, Goodwill, Joint Life Policy, Change in Profit Sharing Ratio. Reconstitution of a partnership firm: Admission of a partner, Retirement of a partner, Death of a partner, Amalgamation of partnership firm; Dissolution of a partnership firm: Modes of dissolution of a firm, Accounting entries, Insolvency of partners, Sale of firm to a company, Gradual realization of assets and piecemeal distribution.

Suggested Readings

- Monga JR, Ahuja Girish and Sehgal Ashok: *Financial Accounting*; Mayur Paper Back, Noida
- Gupta RL and Radhaswamy, M: *Financial Accounting*; Sultan Chand and Sons, New Delhi
- Ramchandran, N and Kakani, RK, *Financial Accounting for Management,* Tata McGraw Hill.
- Gautam HC, Dam BB, Kakati PC, Chakraborty D, and Barman JK, *Financial Accounting*, Capital Publishing Company, Bhangaghor, Guwahati
- Edmonds T, McNair, F and Olds P, *Fundamental Financial Accounting Concepts*, Tata McGraw Hill.
- Jain SP, and Narang KL, *Financial Accounting*, Kalyani Publishers, New Delhi.
- Gautam HC, and Sikidar S, *Financial Statement Analysis*; New Central Book Agency (P) Ltd, Kolkata

Mapping of Cos to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M	H	L		M
CO 3	L			H	
CO 4			H		
CO5		M			H
CO6					M

CMMP101T: MANAGEMENT PRINCIPLES AND APPLICATIONS

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective

The objective of the course is to provide the student with an understanding of basic management concepts, principles and practices

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Define the basic concepts and facts of management. (Remembering)
CO 2: Identify the best practices from around the globe in management. (Understanding)
CO 3: Appraise the learning to transform the management practices of organisations. (Applying)
CO 4: Interpret management principles and practices. (Analysing)

Module I: Introduction to Management (15 Hours)

Concept and Definitions of Management; Need and Significance of Management; Managerial Functions- Planning, Organising, Staffing, Directing and Controlling; Evolution of the Management Thought, Classical Approach – Taylor and Fayol, Neo-Classical and Human Relations Approaches – Mayo, Hawthorne Experiments, Behavioural Approach, Systems Approach, Contingency

Approach; MBO and MBE- Peter F. Drucker, Michael Porter – Five-force analysis, Three generic strategies and value- chain, analysis; 'Fortune at the Bottom of the Pyramid' – C. K. Prahalad.

Module II: Planning (10 Hours)
Concept and significance of planning; types of plans; Strategic planning – Concept, process, Importance and limitations
Environmental Analysis and diagnosis (Internal and external environment) – Definition, Importance and Techniques (SWOT, BCG Matrix, Competitor Analysis), Business environment; Concept and Components; Decision-making – concept, importance; Committee and Group Decision-making, Process, Perfect rationality and bounded rationality, Techniques (qualitative and quantitative, MIS and DSS)

Module III: Organising (10 Hours)
Concept and process of organising; Span of management, Different types of authority (line, staff and functional), Decentralisation, Delegation of authority; Formal and Informal Structure; Principles of Organising; Network Organisation Structure

Module IV: Staffing and Directing (15 Hours)
Staffing: Concept of staffing, staffing process; Motivation: Concept, Importance, extrinsic and intrinsic motivation; Major Motivation theories - Maslow's Need-Hierarchy Theory; Hertzberg's Two-factor Theory, Vroom's Expectancy Theory.
Leadership: Concept, Importance, Major theories of Leadership (Likert's scale theory, Blake and Mouten's Managerial Grid theory,), Transactional leadership, Transformational Leadership, Transforming Leadership; Communication: Concept, purpose, process; Oral and written communication; Formal and informal communication networks, Barriers to communication, Overcoming barriers to communication.

Module V: Control and changing dynamics in management (10 Hours)
Control: Concept, Process, Limitations, Principles of Effective Control, Major Techniques of control - Ratio Analysis, ROI, Budgetary Control, EVA, PERT/CPM; Emerging issues in Management.

Suggested Readings

1. Koontz H and Weihrich H, Essentials of Management: An International and Leadership Perspective, McGraw Hill Education.
2. Robbins S P and Agrawal Madhushree Nanda, Fundamentals of Management: Essential Concepts and Applications, Pearson Education.
3. Terry G, Principles of Management, Richard D.Irwin
4. Newman, Summer, and Gilbert, Management, PHI
5. Donnelly James H., Fundamentals of Management, Pearson Education.
6. Singh B.P. and Singh A.K., Essentials of Management, Excel Books
7. Kreitner Robert, Management Theory and Application, Cengage Learning
8. Chhabra T N , Management Concepts and Practice, Dhanpat Rai & Co. (Pvt. Ltd.),New Delhi
9. Drucker Peter F, Practice of Management, Mercury Books, London

Mapping of COs to Syllabus:

Course Outcomes	Module-1	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4			M	H	M

CMBL200T: BUSINESS LAW

(4 Credits- 60 hours) (L-T-P: 5-0-0)

Objectives
The objectives of this course is to enable students to have a detailed understanding of the Indian Contract Act, 1872, Sales of Goods Act, Consumer Protection Act, Essential Commodities Act and the partnership act. The course also aims at giving the students in depth knowledge about Companies Act 2013.

Course/Learning Outcomes
At the end of the course students will be able to:
CO 1: Define the legal terms related to Contract Act, sales of goods Act, consumer protection, partnership Act and Companies Act 2013. (Remembering)
CO 2: Understand the legal provisions related to The Contract Act, The sales of goods Act, The Consumer protection Act, Essential commodities Act, Partnership Act and Companies Act 2013. (Understanding)
CO 3: Apply the legal provisions of the Contract Act, The sales of goods Act, The Consumer protection Act, Essential commodities Act, Partnership Act and Companies Act 2013 in business. (Applying)

CO 4: Analyze the relevant legal provision that applicable for the business. (Analysing)

Module I: The Indian Contract Act, 1872 (15 Hours)

a. Proposal- its communication, acceptance and revocation; Agreement vis-à-vis contract, void agreement & voidable contract
b. Consideration – essential elements, exception to rule- No consideration no contract; privity of contract and consideration
c. Capacity to contract; free consent – coercion, undue influence, misrepresentation, fraud; Mistake – of fact and of law
d. Legality of object – agreements opposed to public policy and in restraint of marriage, trade & legal proceedings; Contingent contracts
e. Performance of contract–liability of joint promisors; Consequences of breach of contract–liquidated damages and penalty
f. Quasi contract; Indemnity guarantee–surety's liability
g. Bailment–Duties and liabilities of bailor and bailee, bailment of pledges;
h. Agency–types of agency, agents duty to principal and vice-versa, ratification and revocation of agent's authority

Module II: The Sale of Goods Act, 1930 (15 Hours)

Sale of Goods Act, 1930: Essentials of a Contract of Sale; Sale Distinguished from Agreement to Sell, Bailment, Contract for Work and Labour and Hire-Purchase; Conditions and Warranties; Doctrine of Caveat Emptor; Performance of the Contract of Sale; Landmark judgments.

Module III: Consumer Protection: (15 Hours)

a) Consumer Protection Act, 1986: Consumer Protection in India; Rights of Consumers; Consumer Dispute Redressal Forums; Nature and Scope of Remedies.
b) Essential Commodities Act, 1955: Essential Commodities; Powers of Central Government; Authorities responsible to administer the Act; Delegation of powers; Nature of Order passed under the Act; Seizure and Confiscation of Essential Commodities; Offences by Companies.

Module IV: The Indian Partnership Act, 1932 (10 Hours)

a) Nature of Partnership; Relation of partners-inter se; Relation of partners to third parties; Incoming and outgoing partners
b) Dissolution of Firm; Registration of Firms-effect of non-registration

Module V: The Companies Act, 2013 (15 Hours)

a) Meaning, characteristics and kinds; Lifting the corporate veil; Registration and incorporation; Memorandum of Association–alteration therein
b) Doctrine of Ultra Vires–consequences of ultra vires transaction
c) Articles of Association–alteration therein, its relation with memorandum of Association; Rule of constructive notice; Doctrine of Indoor Management; Prospectus- liability for misstatement, statement in lieu of prospectus
d) Shares–statutory restrictions, kinds of share capital; Debentures
e) Directors- Position, Appointment, Removal, Power & Duties, their responsibility,
f) Meetings; Majority Powers and Minority Rights; Prevention of Oppression and Mismanagement
g) Winding up-liability under company Act 2013: Winding up by order of court and subject to its supervision; Voluntary winding up; Conduct of winding up

Suggested Readings

1. Guide to Competition Law- Containing Commentary on the Competition Act, 2002; MRTP Act, 1969 & the Consumer Protection Act, 1986 (Set of 2 Volumes)- S.M.Dugar, revised by Arijit Pasayat, Sudhansu Kumar (2016)
2. Consumer Protection Law and Practice- Dr. V.K. Aggarwal
3. Essential Commodities Act, 1955 (Act No. 10 of 1955) (Lawmann's) (2017)- Lawmann
4. Sale of Goods Act, 1930 (Lawmann's)(2017)- Lawmann
5. Indian Partnership Act, 1932 (Lawmann's) (2017)- Lawmann
6. The Indian Contract & Specific Relief Acts (Set of 2 Volumes) (2017)- Pollock and Sir Dinshaw Fardunji Mulla.
7. Tulsian, P.C, Business Law, Tata McGraw Hill, New Delhi.
8. Maheshwari & Maheshwari, Business Law, National Publishing House, New Delhi
9. A Compendium of Companies Act 2013, along with Rules ,by Taxmann Publications.
10. Kuchhal MC , Modern Indian Company Law, Shri Mahavir Book Depot (Publishers), Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO 2	H	H	H	H	H
CO 3	H	H	H	H	H
CO4	L	M	H	H	H

CMBE201T: BUSINESS ECONOMICS

(4 Credits- 60 HOURS) (L-T-P: 4-0-0)

Objective

This course is designed to provide students with the necessary knowledge and skills regarding Business Economics. The syllabus is designed in such a way that the students can relate to the various economic aspects of a business enterprise. By the end of the term the students will be able to understand the various economic theories, tools and laws applicable to business and will be able to implement them in their future for building a profitable business model.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Define and tell what business economics is. (Remembering)
CO 2: Understanding economic concepts related to business. (Understanding)
CO 3: Identify the various tools of economics and applying them in daily business activities. (Applying)
CO 4: Classification of the market according to the various structures (Analyzing)
CO 5: Evaluate the revenue and cost models of business (Evaluating)
CO 6: Create value to the organization by economic estimations. (Creating)

Module I: Basic Concepts (12 Hours)

Nature and scope of Business Economics; Scarcity and Choice; Positive and normative economics; Production possibility frontier, concepts of opportunity cost, rate of growth; Demand, Supply, rate of growth, and of total, average and marginal functions, Market demand, elasticity, shifts and movements.

Module II: Consumer Equilibrium (12Hours)

Concept of Utility: Cardinal theory & Ordinal theory: Indifference curves: Consumer equilibrium; utility maximization; Engels curve, Income and substitution effects: Hicks and Slutsky equation; inferior, normal and Giffen goods Applications of indifference curves to other economic problems; Revealed preference theory.

Module III: Production and Cost Analysis (12 Hours)

Concept of economic cost; Short run and long run cost curves; isoquants; production functions with one and more variable inputs; returns to scale; Law of variable proportion, total, average and marginal product, marginal rate of technical substitution, iso-cost line and firm's equilibrium, economies of scale; increasing and decreasing cost industries; Prices as parameters: Firm equilibrium and profit; short and long-run supply function; taxes and subsidies

Module IV: Market Structure (12 Hours)

Perfect competition: Equilibrium of the market. Long run industry supply: producer and consumer surplus. Applications: effects of taxes and subsidies. Monopoly: Equilibrium; supply; multipiant firm; monopoly power; deadweight loss; price discrimination; bundling; two-part tariffs. Monopolistic Competition: Product differentiation; equilibrium of the firm in the industry-with entry of new firms and with price competition. Comparison with pure competition

Module V: Macro Economics (12 Hours)

Trade Cycle - Phases of Trade Cycle, Cause and Remedies of Trade Cycle, Budget - Meaning and purpose of Government budgets, Types of budget- Revenue and functional, classifications of budgets; Employment - Types of Unemployment, Concept of Full Employment

Suggested Readings

1. Ahuja H.L, Advanced Economic Theory, S Chand
2. Seth M.L, Principles of Economics, Lakshmi Narain Agarwal
3. Jhingan M L, Micro Economics, S Chand
4. Salvatore Dominick, Srivastava Ravikesh, Managerial Economics, Oxford Press.

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M	M	H	M	H
CO2	L	M	M	M	M
CO3	M	M	M	M	H
CO4	M	M	H	H	H
CO5	M	L	L	M	M
CO6	M	M	H	H	H

CMHR202T: HUMAN RESOURCE MANAGEMENT

(5 Credit-75 Hours) (L-T-P: 5-0-0)

Objectives:

- *To familiarize students with the concept, techniques, programme, policy associated with Manpower Management.*
- *The subject will guide the students towards acquiring knowledge connecting with job evaluation, its form, method and evaluation process*
- *To visualise the different emerging and dynamic prospects of HRM in the Global Market*

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Remembering of different terms associated with HRM. (Remembering)
CO 2: Understanding about different plan and policy of HRM. (Understanding)
CO 3: Application of different appraisal method in HRM. (Application)
CO 4: Analysing the various emerging horizon in Manpower Management. (Analysing)

Module I: Introduction to HRM (15 Hours)

Concept and scope of HRM, Evolution and growth of HRM in India, Significance, Functions and challenges of HRM; status and qualities of HR Managers; objectives of Human Resource policies; HR Planning, Kaizen, TQM and Six Sigma. Personnel Management vs. HRM, HR Policies, HRM vs HRD. Emerging Challenges of Human Resource Management;

Module II: Recruitment and Acquisition of Human Resource (15 Hours)

Concept of recruitment, process of recruitment, sources of recruitment, Advantages and disadvantages of internal and external sources; selection procedure, difference between selection and recruitment, Types of tests and interviews, Job Evaluation, job description and job specification

Module III: Training and Development (15 Hours)

Concept and Importance; Identifying Training and Development Needs; Training vs. Development; Designing Training Programmes; Role- Specific and Competency- Based Training; Evaluating Training Effectiveness; Training Process Outsourcing; Management Development; Career Development.

Module IV: Performance Appraisal (15 Hours)

Nature, objectives and importance; Modern techniques of performance appraisal; potential appraisal and employee counselling; job changes - transfers and promotions; Compensation: concept and policies.

Module V: Emerging Horizons in HRM (15 hours)

Impact of Globalization on HRM, Future trends of HRM (Hybrid Work Model, Human Leadership, People Analytics, transition from Employee Well-being to Healthy Organization), concept of virtual organization, types of virtual organizations, learning organization; Distinction between Domestic and International HRM, Repatriation, Workforce diversity, Downsizing, Exit Interview; VRS; Human Resource Information System.

Suggested Reading:

1. Armstrong, Michael, Human resource management & Practice, 10th Edition.
2. Graham, Ryan, Strategic Human Resource Management, Pearson Education
3. C. B. Gupta, Human Resource Management, S Chand & Sons
4. S.S. Khanka, Human Resource Management,

Mapping of Course Outcomes

Course Outcomes	MI	MII	MIII	MIV	MV
CO1	M	H	M	L	L
CO2	H	M	M	M	M
CO3	M	L	M	H	M
CO4	L	M	L	H	H

CMCM203T: COST AND MANAGEMENT ACCOUNTING

(5 Credit- 75 hours) (L-T-P: 5-0-0)

Objective

To acquaint the students with basic concepts used in cost accounting, various methods involved in cost ascertainment and cost accounting bookkeeping systems.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Define the concept and the role of cost accounting and Management Accounting in the modern economic environment. (Remembering)

CO 2: Describe the methods of calculating stock consumption and labour cost. (Understanding)

CO 3: Apply the tools and techniques of Management Accounting in managerial decision (Applying) .

CO 4: Examine the methods of Allocation, apportionment and absorption of overheads. (Analysis)

CO 5: Interpret the impact of the selected costs method. (Evaluating)

Module: I Introduction to Cost and Management Accounting (10 Hours)

Meaning, objectives and advantages of cost accounting and Management Accounting; Difference between cost accounting, financial accounting and Management Accounting ; Cost concepts and classifications; Elements of cost; Installation of a costing system; Role of a cost accountant in an organization, Preparation of Cost Sheet.

Module II: Management Accounting (10 Hours)

Tools and Techniques of Management Accounting; Budgeting and Budgetary Control, Standard Costing and Variance Analysis, Absorption versus Variable Costing , Role of Management Accountant in Decision Making.

Module: III Material Costing and Labour costing (20 Hours)

a. Materials: Material/inventory control techniques; Accounting and control of purchases, storage and issue of materials; Methods of pricing of materials issues — FIFO, LIFO, Simple Average, Weighted Average

b. Labour: Accounting and Control of labour cost; Time keeping and time booking; Concept and treatment of idle time, over time, labour turnover and fringe benefits ; Methods of wage payment and the Incentive schemes-Halsey, Rowan, Taylor's Differential piece wage.

Module: IV Overhead Costing and Cost Records (20 Hours)

Definition; Importance; Classification; allocation, apportionment and absorption of overheads; Meaning of under- and over-absorption; Methods of absorption of manufacturing overheads, computation of Machine hour rate; Integrated and non-integrated accounting system; Reconciliation Cost and financial accounts.

Module: V (15 Hours)

Module costing; Job costing; Contract costing; Process Costing (process losses, valuation of work in progress, joint and by-products), Service costing (only transport); Distinguish between job costing and process costing.

Suggested Readings

1. Charles T. Horngren, Srikant M. Datar, Madhav V. Rajan, Cost Accounting: A Managerial Emphasis, Pearson Education.
2. Drury, Colin. Management and Cost Accounting. Cengage Learning.
3. Jawahar Lal, Cost Accounting. McGraw HillEducation
4. Nigam, B.M. Lall and I.C. Jain. Cost Accounting: Principles and Practice. PHI Learning
5. Rajiv Goel, Cost Accounting. International Book House
6. Singh, Surender. Cost Accounting, Scholar Tech Press, New Delhi.
7. Jain,S.P. and Narang , K.L Cost Accounting: Principles and Methods. Kalyani Publishers
8. Arora, M.N. Cost Accounting–Principles and Practice. Vikas Publishing House, New Delhi.
9. Maheshwari, S.N. and S.N. Mittal. Cost Accounting: Theory and Problems. Shri Mahavir Book Depot, New Delhi.
10. Iyengar, S.P. Cost Accounting. Sultan Chand &Sons
11. Jhamb H.V. , Fundamentals of Cost Accounting, AneBooksPvt.Ltd.
12. Introduction to Management Accounting Charles T. Horngren, Gary L. Sundem, Dave Burgstahler, Jeff O. Schatzberg, Pearson Education.
13. Management Accounting, Anthony A. Atkinson, Robert S. Kaplan, Ella Mae Matsumura, S. Mark Young. Dorling Kindersley (India) Pvt. Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module-1	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2			H	L	
CO 3		H			
CO 4				H	
CO 5				L	H

CMQT204T: QUANTITATIVE TECHNIQUES FOR BUSINESS

(4 Credits-60 hours) (L:T: P-4:0:0)

Objectives

1. Students will be able to apply quantitative techniques such as statistical analysis, linear programming, simulation, and decision analysis to solve business problems and make data-driven decisions.
2. Students will be able to design and conduct experiments to test hypotheses and evaluate business strategies.
3. Students will be able to interpret the results of quantitative analyses and effectively communicate findings to stakeholders using visual aids such as graphs, charts, and tables.

Course/Learning Outcomes

CO 1: Remembering: Remembering the key theories behind quantitative methods.
CO 2: Understanding: Understanding the relevance & application of various quantitative techniques in business decisions.
CO 3: Applying: Application of different quantitative techniques under different circumstances to take business decisions.
CO 4: Analysing: Analysing and solving business problems using quantitative methods.

Module I: Linear Algebra (10 Hours)

Matrices, vectors, systems of linear equations; Calculus: derivatives, integrals, optimization, applications business; Differential equations: first-order equations, second-order equations, applications in business.

Module II: Optimization (15 Hours)

Linear programming, quadratic programming, convex programming, applications in business; Game theory: Basic concepts, two-person zero-sum games, mixed strategies.

Module III: Descriptive statistics (15 Hours)

Descriptive statistics: measures of central tendency, measures of variability, graphical representation of data.

Module IV: Inferential statistics (10 Hours)

Probability theory - random variables, distributions, conditional probability, Bayes' theorem, hypothesis testing, confidence intervals, goodness-of-fit tests; correlation and regression - simple regression, multiple regression.

Module V: Time series (10 Hours)

Trend analysis, seasonal analysis, ARIMA models, forecasting

Suggested Readings

1. Sydsaeter, Knut & Hammond, Peter J.: Mathematics for Economic Analysis [Pearsons Education]
2. Chiang, A.C.: Fundamental Methods of Mathematical Economics [Tata Mc Graw Hills]
3. Allen, R.G.D.: Mathematical Analysis for Economics [Macmillan]
4. Vohra, N. D. Vohra: Quantitative Techniques in Management, Tata McGraw Hill.
5. Mohan Man, Gupta P. K., Swarup Kanti, Introduction to Management Science Operations Research, Sultan Chand & Sons.

COs mapping to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	M	L	L
CO2	H	H	H	H
CO3	H	H	H	H
CO4	H	H	H	H

CMMM300T: MARKETING MANAGEMENT

(5 credits – 75 hours) (L-T-P: 5-0-0)

Objective

To apply relevant knowledge, skills and exercise professional judgement in selecting and applying marketing principles and concepts in different business contexts and to contribute to the evaluation of the performance of an organisation and its strategic and operational development.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Define and explain marketing mix models in workplace and contribute to organisational growth (Remembering and Understanding)
CO 2: Assess the impact of product and brand management decisions on organizational performance (Applying)

CO 3: Examine the effectiveness of pricing and promotion decisions (Analysing)
CO 4: Determine appropriate distribution and retailing strategies in improving organisational performance (Evaluating**)**

Module I: Introduction to Marketing (15 Hours)
Marketing in the Twenty-First Century; The Impact of the New Economy; Change in Customers; Changes in Business Scenario; Marketing Objectives; Marketing Environment; Marketing Mix; Elements of Marketing Mix, Product Mix, Price Mix, Promotion/Communication Mix, Place Mix/ Distribution Mix; Significance of Marketing Mix; Factors Affecting Marketing Mix; Growth & Future of marketing in India.

Module II: Product, and Product Brand Management (15 Hours)
Definition, Features, Characteristics and Classification of Product; Product Life Cycle definitions, Stages of the Product Life Cycle; Implications of the Product Life Cycle Concept; Types of New Products; Challenges to New Product Development; Steps in the Development of the New Product; Introduction, Objectives, Problems and Process of Test Marketing; Introduction to Product Brand, Definition of Product Branding, Purpose of Branding, Features of Good Brands, Significance and Importance of Branding, Branding in a new economy.

Module III: Pricing and Promotion Decision (15 Hours)
a) Pricing Decisions; Concept of Price; Significance of Pricing; Factors Affecting Pricing Decisions; Major Pricing Methods; Pricing Policies and Strategies; Geographical Pricing, Product Line Pricing, Discounts and Rebates.
b) Meaning and Nature of Promotion, Importance of Promotion, Communication Process, Concept of Integrated Marketing Communication, Meaning of Promotion Mix, Elements of Promotion Mix (Methods of Promotion), Factors Influencing Promotion Mix Decisions, Promotion Mix Strategies, Communication Planning and Control.

Module IV: Distribution and Retailing (15 Hours)
a) Channels of Distribution: Meaning of a Channel of Distribution, Importance of Channels of Distribution, Types of Distribution Channels, Choice of a Channel of Distribution, Functions of Distribution Middlemen, Distribution Strategies, Wholesaling.
b) Meaning of Physical Distribution, Importance of Physical Distribution, Elements of Physical Distribution, Marketing Logistics Decisions.
c) Meaning of Retailing, Functions and Services of Retailers, Types of Retailing; Malls and major markets; FDI in retail market; Management of Retailing Operations: An Overview, Retailing in India – Changing Scenario.

Module V: Rural Marketing, Consumer Protection and Developments in Marketing (15 Hours)
a) Growing Importance of Rural Markets, Distinguishing Characteristics of Rural Markets, Understanding Rural Consumer and Rural Markets, Marketing Mix Planning for Rural Markets.
b) Consumer Protection, Need for Consumer Protection, Measures for Consumer Protection, Consumerism – Evolution, Meaning and Approaches, Laws to Protect Interests of Consumers.
c) Recent Developments in Marketing, Social Marketing, Direct Marketing, Online Marketing, Relationship Marketing, Green Marketing, Marketing Ethics, Sustainable Marketing, Marketing of Services.

Suggested Readings
1. Gupta C.B., Principles of Marketing, Sultan Chand & Sons.
2. Kotler Philip , Marketing Management, Pearson Education, New Delhi.
3. Sherlekar S. A., Marketing Management, Himalaya Publishing House, Mumbai.
4. Kumar A & Meenakshi, Marketing Management, Vikas Publishing House, New Delhi.
5. Saxena R, Marketing, Himalaya Publishing House, Mumbai.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L			
CO 2		M	L	L
CO 3	M	M	M	
CO 4		H	H	M

CMCA301T: CORPORATE ACCOUNTING

(5 credits– 75 hours) (L-T-P: 5-0-0)

Objectives
The course aims to help the students to acquire the conceptual knowledge of the corporate accounting system and to learn the techniques of preparing the financial statement of companies.

Course/Learning Outcomes

CO 1: Explain the matters related to issues of share capital, debentures, bonus shares, redemption of preference shares and debentures of a company. (Understanding)
CO 2: Construct the profit and loss account and balance sheet of corporate entities. (Applying)
CO 3: Analyse the valuation of intangible asstets and shares of a company.(Analysing)
CO 4: Determine the alteration and reduction of company's share capital.(Evaluating)
CO 5: Adapt the accounting problems related to amalgamation of companies and Holding companies.(Creating)

Module I: Accounting for Share Capital & Debentures (15 hours)

Types of shares; Accounting for Share Capital, Issue of Rights and Bonus Shares; ESOPs andBuy-Back of shares; Issue and Redemption of preference Shares and Debentures. Underwriting of Shares and Debentures. [In reference to Relevant Accounting Standards (AS and Ind AS) and Guidance Notes as applicable.]

Module II: Final Accounts (15 hours)

Preparation of profit and loss account and balance sheet of corporate entities, excluding calculation of managerial remuneration, Disposal of company profits

Module III: Valuation of Intangible Assets and Shares (15 hours)

Valuation of Intangible Assets and Shares, Value Added Statement, Economic Value Added, Market Value Added, Shareholder Value Added and Valuation of Shares

Module IV: Amalgamation of Companies and Internal reconstruction (15 hours)

Concepts and accounting treatment for Amalgamation of companies as per AS 14/ Ind AS 103 (excluding inter- company holdings). Internal reconstruction: concepts and accounting treatment excluding scheme of reconstruction.

Module V: Accounts of Holding Companies (15 hours)

Preparation of consolidated balance sheet with one subsidiary company, Relevant provisions of Accounting Standard: 21 (ICAI).

Note:

1. The relevant Accounting Standards (both AS & Ind AS) for all of the above topics should be covered.
2. Any revision of the relevant Indian Accounting Standards/Accounting Standards would become applicable.
3. The relevant provisions of The Companies Act,2013, as applicable for all of the above topics should be covered.

Suggested Readings

1. Monga J.R., Fundamentals of Corporate Accounting. Mayur Paper Backs, New Delhi.
2. Shukla M.C., Grewal T.S.,and Gupta S.C.. Advanced Accounts .Vol.- II. S. Chand & Co., New Delhi.
3. Maheshwari S.N., and S. K. Maheshwari. Corporate Accounting. Vikas Publishing House, New Delhi.
4. Sehgal A , Fundamentals of Corporate Accounting. Taxman Publication, New Delhi.
5. Goyal V.K. and Goyal R,. Corporate Accounting. PHI Learning.
6. Jain, S.P. and Narang K.L.. Corporate Accounting. Kalyani Publishers, New Delhi.
7. Goyal B K, Fundamentals of Corporate Accounting, International Book House\
8. Dam B.B anf Gautam H.C., "Corporate Accounting" Gayatri Publications, Guwahati
9. Compendium of Statements and Standards of Accounting. The Institute of Chartered Accountants of India, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	L	M		
CO2		H			M
CO3			H		
CO4	L			H	
CO5				H	H

CMBE302T: BUSINESS ENVIRONMENT

(4 credits– 60 hours) (L-T-P: 4-0-0)

Objective

The course attempts to understand the macro environment in which a business organisation operates. It also aims to analyse and understand the policies of the government implemented from time to time and to assess their impact on business.

Course/Learning Outcomes

At the end of the course students will be able to:
CO 1: Explain the various categories that constitute the business environment (Understanding)

CO 2: Outline how an entity operates in a business environment (Understanding)
CO 3: Evaluate the importance of corporate social responsibilities in an economy (Evaluating)
CO 4: Examine the role of Multinational Corporations and strategies adopted by them in details (Analysing)
CO 5: Assess the impacts of Government policy on the economic environment of North Eastern Region of India (Evaluating)

Module I: Business Environment (15 hours)
Concept, Components and importance of Indian Business Environment; Types of Business environment-Cultural, Demo graphic and social-cultural, political, technological, economic and legal environment; Significance and approaches of environmental forecasting; Interaction between internal and external environment.

Module II: Economic trends (12 hours)
History of Economic system in India; Economic reforms in India –Liberalization, privatization and globalization and its impact on business; Industrial Policy, Fiscal Policy; Monetary Policy; Foreign Investments policy in India.

Module III: Multinational Corporations (8 hours)
Multinational corporations and their participation in India; strategies of multinational corporations; competitive strengths policies and performance.

Module IV: Business Ethics and Social Responsibilities (10 hours)
Business ethics and social responsibilities; relationship between business and society; Corporate power social accountability; Ethical issues and values in business; Corporate Social policies - issues and challenges; Ecological and environmental issues.

Module V: Economic Development of North Eastern Region of India (15 hours)
Special package for economic development of the north eastern region; DONER and its role in economic development, infrastructure and industry; North East Industrial Policy- promotional measures for cross-border trade, Role of NEC and NEDFI. Problems and prospects of the industry in Assam, Brief study of the tea industry, paper industry, food processing industry, silk industry and bell metal industry; tourism industry.

Suggested Readings
1. Wheelen, Concepts of Strategic Management and Business policy, Pearson Education, New Delhi.
2. Islam Swabera & Kharkongor; Business Environment, Taxman's Publication, New Delhi.
3. Misra S.K., Puri V.K.; Indian Economy, Himalaya Publishing House, Mumbai.
4. Deepashree, Indian Economy, Tata McGraw Hill, New Delhi.
5. Dutta Rnddar and Sundaram KPM , S. Chand & Co. Ltd., New Delhi.
6. Aswathapa K., Essential of Business Environment, Himalaya Publishing House
7. Gupta, Liberalisation - its impact on Indian Economy, Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M	H	L		M
CO 3	L			H	
CO 4			H		
CO 5		M			H

CMAG303T: AUDITING AND CORPORATE GOVERNANCE

(4 Credits-60 hours) (L-T-P: 4-0-0)

Objectives:
The course aims to provide knowledge of the various concepts related to auditing, principles , procedures and techniques in accordance with current legal requirements. The course also focuses on the procedures related corporate governance theories , models and various corporate scandals in India and Abroad. It also tries to familiarize the learners with the ethics and moral values that a business organization should adhere to and also describes the various corporate responsibilities towards the society.

COURSE/LEARNING OUTCOMES
After completing the course successfully the student will be able to-
CO 1: Understand the basic concepts of auditing and execute the knowledge of special areas of audit and computer aided audit techniques and tools(Understanding and Applying)
CO 2: Explain the concepts of audit of Limited companies, liabilities of statutory Auditors under the companies Act 2013(Understanding)

CO 3: Analyse the procedures related Corporate Governance theories and models and various corporate scandals in India and Abroad(Analysing)
CO 4: Evaluate the requirements of different business ethics, corporate ethics in a business(Evaluating)
CO 5: Explain the concept of CSR with responsibility with corporate Sustainability(Understanding)

Module I: Introduction (10 hours)
Introduction, Meaning, Objectives, Basic Principles and Techniques; Classification of Audit, Audit Planning, Internal Control – Internal Check and Internal Audit; Audit Procedure – Vouching and verification of Assets & Liabilities.

Module II: Audit of Companies (12 hours)
Audit of Limited Companies: Company Auditor- Qualifications and disqualifications, Appointment, Rotation, Removal, Remuneration, Rights and Duties Auditor's Report- Contents and Types. Liabilities of Statutory Auditors under the Companies Act 2013;

Module III: Special Areas of Audit (10 hours)
Special Areas of Audit: Special features of Cost audit, Tax audit, and Management audit; Recent Trends in Auditing: Basic considerations of audit in EDP Environment; Computer aided audit techniques and tools; Auditing Standards; Relevant Case Studies/Problems.

Module IV: Business Ethics (8 hours)
Morality and ethics, business values and ethics, approaches and practices of business ethics, corporate ethics, ethics program, codes of ethics, ethics committee; Ethical Behaviour: Concepts and advantages; Rating Agencies; Green Governance; Clause 49 and Listing Agreement

Module V: Corporate Governance (10 hours)
Conceptual framework of Corporate Governance: Theories & Models, Broad Committees; Corporate Governance Reforms. Major Corporate Scandals in India and Abroad: Common Governance Problems noticed in various Corporate Failures. Codes & Standards on Corporate Governance

Module VI: Corporate Social Responsibility (CSR) (10 hours)
Concept of CSR, Corporate Philanthropy, Strategic Planning and Corporate Social Responsibility; Relationship of CSR with Corporate Sustainability; CSR and Business Ethics, CSR and Corporate Governance; CSR provisions under the Companies Act 2013; CSR Committee; CSR Models, Codes, and Standards on CSR

Suggested Readings

1. Ravinder Kumar and Virender Sharma, *Auditing Principles and Practice*, PHI Learning. Aruna Jha, *Auditing*. Taxmann Publication.
2. A. K. Singh, and Gupta Lovleen. *Auditing Theory and Practice*. Galgotia Publishing Company.
3. Anil Kumar, *Corporate Governance: Theory and Practice*, Indian Book House, New Delhi
4. KV Bhanumurthy and Usha Krishna, *Politics, Ethics and Social Responsibility of Business,* Pearson Education
5. N Balasubramanian, A Casebook on Corporate Governance and Stewardship, McGraw Hill Education
6. Christine Mallin, *Corporate Governance (Indian Edition*), Oxford University Press Relevant Publications of ICAI on *Auditing* (CARO)
7. Sharma, J.P., *Corporate Governance, Business Ethics, and CSR*, Ane Books Pvt Ltd, New Delhi

Note: Latest edition of text books may be used

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	L	H			
CO 2	L	H				
CO 3				L	H	M
CO 4				H		
CO 5				L		H

CMFM304T: FINANCIAL MANAGEMENT

(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective
This Course will explain the financial tools and techniques, which can be used to help firms maximize value by improving decisions relating to capital budgeting, capital structure and working capital management.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Explain the objectives and scope of financial management and time value of money (Remembering)
CO 2: Explain various capital structure theories and factor affecting capital structure decision (Understanding)
CO 3: Analyse the process of working capital management and capital budgeting process(Analysing)
CO 4: Critically judge the various theories of dividend and determine the factors affecting dividend polices (Evaluating)

Module I: Introduction (10 hours)

Nature, scope and objective of Financial Management, Time value of money, Risk and return (including Capital Asset Pricing Model), Valuation of securities – Bonds and Equities.

Module II: Investment Decisions (15 hours)

The Capital Budgeting process, Cash flow Estimation, Payback period Method, Accounting Rate of return, Net Present Value(NPV), Net Terminal Value, Internal Rate of Return (IRR), Modified Internal rate of return, Profitability Index, Capital budgeting under Risk- Certainty Equivalent Approach and Risk Adjusted Discount Rate.

Module III: Financing Decisions (15 hours)

Cost of Capital and Financing Decision: Sources of long-term financing Estimation of components of cost of capital. Methods for calculating cost of equity , capital Cost of retained Earnings, Cost of Debt and Cost of Preference Capital, Weighted Average Cost of capital (WACC) and Marginal cost of capital. Capital structure- Theories of capital structure (Net Income, Net Operating, MM, Hypothesis, and Traditional Approach). Operating and financial leverage; Determinants of capital structure.

Module IV: Dividend Decisions (10 hours)

Theories of Relevance and irrelevance of dividend decision for corporate valuation; Cash and stock dividends; Dividend polices in practice

Module V: Working Capital Decisions (10 hours)

Concepts of working capital, the risk –return trade off, sources of short-term finance, working capital estimation, cash management, receivables management, inventory management and payables management.

Suggested Readings

1. Financial Management and Policy, James C.Van Horne and Sanjay Dhamija, Pearson Education.
2. Principles of Financial Management, Levy h.andM.Sarnat, Pearson Education.
3. Fundamentals of Financial Management, Brigham and Houston, Cengage Learning.
4. Basic Financial Management, Khan and Jain, McGraw Hill Education
5. Fundamentals of Financial Management, Prasanna Chandra, McGraw Hill Education
6. Financial Management-text and Problems, Singh, J.K, DhanapatiRai and Company , Delhi
7. Fundamentals of Financial Management, Rustagi, R.P, Taxmann Publications Pvt.Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2		H	L		
CO 3			H		H
CO 4				H	M

CMTL305T: TAXATION LAW AND PRACTICES

(4 Credits – 60 hours) (L-T-P: 4 - 0 - 0)

Objective

To provide basic knowledge and equip the students with application of the principles of taxation and to acquaint them with the various provisions of Income-tax Act, 1961, Indirect tax laws (including GST Act 2017) and the relevant rules for filing of returns.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Define the various concepts related to direct taxes and Indirect taxes. (Remembering)
CO 2: Explain the provisions of the direct tax laws and Indirect tax laws (including GST Act 2017). (Understanding)
CO 3: Execute the knowledge of the provisions of the direct tax laws and indirect tax laws to the various situations in actual practice. (Applying)
CO 4: Analyse the procedures related to filing of returns, TDS and GST return filing. (Analysing)
CO 5: Evaluate the requirements of different assessee for filing tax returns under the income tax laws. (Evaluating)
CO 6: Develop the skill of creativity in the field of indirect tax and direct tax laws with regard to tax savings and Indirect.

(Creating)

Module I: Introduction (15 hours)
Basic concepts: Income, agricultural income, person, assessee, assessment year, previous year, gross total income, total income, maximum marginal rate of tax; Permanent Account Number (PAN)
Residential status: Scope of total income on the basis of residential status, Exempted income under section10

Module II: Computation of Income under different heads-1 (15 hours)
Income from Salaries; Income from house property; Profits and gains of business or profession (basic numerical only); Capital gains; Income from other sources

Module III: Total Income and Tax Liability of Individuals (10 hours)
Assesses Total Income (Clubbing of Income) ; Set off and Carry Forward of Losses ; Deductions, Rebate and Relief ; Taxation of Individual ; Advance Tax; Tax Deducted at Source & Tax Collected at Source (excluding Non-resident); Filing of Return of Income ; Self-Assessment & Intimation .

Module IV: Concept of Indirect Taxes (10 hours)
Concept and Features of Indirect Taxes, Difference between Direct and Indirect Taxes, Background of erstwhile Indirect Taxes (Central Excise, VAT etc.), Customs Act-Basic Concepts and Definitions, Types of Duties, Valuation Rules, Computation of Assessable Value and Duties.

Module V: Goods and Services Tax (GST) Laws (10 hours)
Introduction to GST Law, Levy and Collection of CGST and IGST, Application of CGST/IGST law, Concept of Supply including Composite and Mixed Supplies, Charge of Tax including Reverse Charge, Exemption from Tax, Composition Levy, Basic concepts of Time and Value of Supply, Input Tax Credit, Computation of GST Liability, Registration, Tax Invoice – Electronic Way Bill, Returns and Payment of Taxes

Suggested Readings

1. Singhania, Vinod K. and Monica Singhania. Students' Guide to Income Tax, University Edition. Taxmann Publications Pvt. Ltd., New Delhi.
2. Ahuja, Girish and Ravi Gupta. Systematic Approach to Income Tax. Bharat Law House, Delhi. Journals
3. Income Tax Reports. Company Law Institute of India Pvt. Ltd., Chennai.
4. Taxman. Taxmann Allied Services Pvt. Ltd., New Delhi.
5. Current Tax Reporter. Current Tax Reporter, Jodhpur. Software
6. Singhania Vinod Kumar, e- filing of Income Tax Returns and Computation of Tax, Taxmann Publication Pvt. Ltd., New Delhi. Latest version
7. Excel Utility' available at incometaxindiaefiling.gov.in
8. Agarwala, D.S., Banka,Vikash Kumar, Saraf ,Ayush, Practical Guide to GST Compliances, Taxmann Publication Pvt. Ltd., New Delhi

Mapping of COs to Syllabus

Course Outcomes	Module-1	Module II	Module III	Module IV	Module V
CO 1	H			M	M
CO 2	M	H		H	H
CO 3		M	H	M	M
CO 4			M	M	H
CO 5			H		
CO 6			M	M	M

CMAT306P: AUDIT TRAINING

(4 Credit: 60 hours) (L-T-P:3-0-1)

Objectives:

- *To familiar with various concepts and principles of audit*
- *To understand the roles and responsibilities of an auditor*
- *To plan, conduct and report the audit*
- *To understand the interpretations of auditing standards*
- *To understand the principles and practice of auditing*
- *Learning through case studies & exercises.*

Course/Learning Outcomes

After completing the course successfully, the student will be able to-

CO 1: Define the various concepts related to Auditing (Remembering)

CO 2: Explain the concepts of various types of audit and audit techniques(Understanding)

CO 3: Execute the Knowledge of special areas of Audit and computer aided audit techniques and tools (Applying)

CO 4: Examine the procedures related to various tecniques of audit and preparation of audit report (Analysing)

Module I: Introduction (15 hours)

Audit: Meaning, objectives, nature and scope; Audit concepts: vouching, verification, internal control, internal check; Roles, liabilities and responsibilities of an auditor.

Module II: Audit types (15 hours)

Types of audit: Statutory audit, concurrent audit, internal audit, external audit, financial audit, operational audit, tax audit, cost audit, management audit.

Module III: Audit techniques (15 hours)

Vouching, confirmation, reconciliation, testing, physical examination, analysis, scanning, inquiry, verification of posting, Flow chart, observation, audit plan, audit check list, audit working paper, audit note.

Objectives of Investigation – Audit of Computerised Accounts – Electronic Auditing – Investigation under the provisions of Companies Act.

Module IV: Audit training (Practical) (15 hours)

Undergo an audit training to get a practical exposure of auditing in a particular organisation. Preparation of audit report of the organisation.

Suggested Readings

1. Ravinder Kumar and Virender Sharma, *Auditing Principles and Practice*, PHI Learning. Aruna Jha, *Auditing*. Taxmann Publication.
2. A. K. Singh, and Gupta Lovleen. *Auditing Theory and Practice*. Galgotia PublishingCompany.
3. Anil Kumar, *Corporate Governance: Theory and Practice*, Indian Book House, New Delhi
4. MC Kuchhal, *Modern Indian Company Law*, Shri Mahaveer Book Depot.(Publishers). (Relevant Chapters)
5. KV Bhanumurthy and Usha Krishna, *Politics, Ethics and Social Responsibility ofBusiness,* Pearson Education
6. Erik Banks, *Corporate Governance: Financial Responsibility, Controls and Ethics*,Palgrave Macmillan

Note: Latest edition of text books may be used

Mapping of COs to Syllabus

Course Outcome	Module I	Module II	Module III	Module IV
CO 1	H	H	L	L
CO 2	L	H	H	L
CO 3	L	L	H	H
CO 4	L	L	H	H

CMST307P: SALESPERSON TRAINING

(4 Credit: 60 hours) (L-T-P: 3-0-1)

Objectives

The course curriculum for most sales courses offers enhanced knowledge and understanding of business operations and management. With an extensive curriculum covering topics in commerce, banking, management, finance, marketing, so on and so forth, the courses pave paths for future sales professionals or teachers, researchers, and professors.

1. *To provide basic training of Sales Management*
2. *To demonstrate effective selling*
3. *Apply negotiation skills to selling situations.*
4. *To understand the various selling styles.*
5. *To identify successful techniques for working with customers in business situations.*

Course/Learning Outcomes

CO 1: Define the various concept related to sales, sales Personal selling etc. (Remembering)

CO 2: Explain the concepts of Sales territories and sales quota. (Understanding)

CO 3: Execute the knowledge of various sales appraising performance. (Applying)

CO 4: Examine the various effective techniques for selling a particular product. (Analysing)

Module I: An Overview of Sales
Meaning, scope and objectives, Modern Concept of Sales person, Sales organization-Importance, types and basic issues, Skills and Qualities required in sales Person, Various steps in selling process, Sales budget, Theories of Personal selling.

Module II: Importance and Techniques of Sales Person Training
Sales Personnel Planning (Quantitative and qualitative aspects of sales personnel planning process), Recruitment (Sources of sales recruits and process of recruiting sales representatives), Selection (Significance of sound selection and procedure), Training (Significance, areas, methods of sales training and its evaluation, Placement of sales force), Compensating sales personnel (Requirements of a sound compensation plan, methods and policies regarding reimbursement of sales expenses). Methods for appraising sales personnel's performance.

Module III: Sales Territories and Quotas
Meaning, objectives, types and factors determining the size of a sales territory and setting sales quotas, Reasons for establishing, revising and assigning sales territories to Sales personnel, Administering the quota system. Motivation & Compensation for Salesperson

Module IV: Practical
1. Case studies
2. Role playing exercise
3. Preparation of sale presentation plan by each student on basis of selected product.
4. Project specific information gathering/participation in community activities

Suggested Readings
- Salesmanship-Himalayan Publishing House
- Personal Selling and Sales management

Mapping of CO s to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	H	L	H
CO2	H	M	H	L
CO3	M	H	M	L
CO4	L	L	H	H

CMSA308P: SWOT ANALYSIS OF AN INDUSTRY

(4 Credit: 60 hours) (L-T-P:0-0-4)

Objectives
- *Understand the concepts and principles of SWOT analysis and its relevance to industry analysis.*
- *Conduct comprehensive industry research to identify industry-specific strengths, weaknesses, opportunities, and threats.*
- *Apply critical thinking skills to analyze and interpret SWOT findings within the context of an industry.*
- *Evaluate the competitive position of an industry by integrating SWOT analysis with other strategic frameworks.*
- *Develop effective strategic recommendations based on SWOT analysis to address industry challenges and capitalize on opportunities.*

Course outcome:
CO 1: Remembering the key terms used in industry analysis. (Remembering)
CO 2: Understanding the concepts & principles of SWOT analysis and its relevance to industry. (Understanding)
CO 3: Applying SWOT analysis techniques to various industry contexts. (Applying)
CO 4: Analysing industry data to formulate business strategies based of SWOT Analysis findings. (Analysing)

Module I:
Introduction to SWOT Analysis and Industry Analysis: Overview of industry analysis and its importance, Introduction to the SWOT framework and its components, Integrating SWOT analysis with other strategic frameworks, SWOT Analysis in Strategic Decision Making. (No. of sessions 10)

Module II:
Identifying Industry Strengths & Weaknesses: Understanding industry resources, capabilities, and competitive advantages, Techniques for identifying and evaluating industry strengths, Case studies on successful industry strengths assessment. Identification of industry vulnerabilities, and limitations; evaluation of factors that hinder industry competitiveness & growth; analyzing industry weaknesses using real-world examples. (No. of sessions 20)

Module III:
Exploring Industry Opportunities & Evaluation of threats: Recognizing emerging trends and market opportunities, Assessing

customer needs, market demand, and industry growth potential, Case studies highlighting successful industry opportunity identification. Identification of competitive pressures, market risks, technological obsolescence, and regulatory changes. Techniques for assessing and prioritizing industry threats. (No. of sessions 20)

Module IV:
Application of SWOT analysis: Applying SWOT analysis to a specific industry or sector of interest. Conduct a comprehensive SWOT analysis on the selected industry. Formulation of strategic recommendations based on the SWOT analysis findings.

Suggested Readings

- SWOT Analysis Develop strengths to decrease the weaknesses of your business - Management & Marketing Christophe Speth (author) eBook (17 Aug 2015)

Mapping of CO s to Syllabus

Course Outcome	Module I	Module II	Module III	Module IV
CO1	L	L	L	L
CO2	H	H	H	H
CO3	M	H	H	H
CO4	M	H	H	H

CMAA400T: ADVANCED ACCOUNTING

(5 Credits--75 hours) (L-T-P: 5-0-0)

Objective

The objective of this course is to provide advanced knowledge in the field of accounting. It stresses on specialised accounting processes followed in specific organisations. This course also gives insight into various modern concepts of Accounting.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Define the recent concepts of accounting (Remembering)
CO 2: Explain the conceptual framework in the preparation and presentation of financial statements (Understanding)
CO 3: Explain the various modes of liquidation of companies (Understanding))
CO 4: Compare the accounting techniques followed under general and special processes and determine insurance claims from loss of profit and stock (Analysing and Applying)
CO 5: Construct financial statements of insurance and banking companies (Creating)

Module I: Conceptual Framework (10 hours)

Conceptual Framework in the preparation and presentation of Financial Statements: Objectives, Purpose, Constituents of Financial Statements, Underlying assumptions in the preparation of Financial Statements, Qualitative Characteristics and Elements of Financial Statements, GAAP and Accounting Standards in India, Compliance Requirements of Accounting Standards in India, Applicability of Accounting Standards

Module II: Accounts of Banking Companies (15 hours)

Features of Banking Companies, Banking Regulation Act, 1949, Rebate on Bills Discounted, Income recognition, Statutory books to be maintained, special features of Bank book keeping, Preparation and presentation of Financial Statements of Banks, Advances and its classification, provisions to be made against advances.

Module III: Accounts of Insurance Companies and Insurance Claims (20 hours)

Accounting of Insurance Companies: Meaning of Insurance Business, Accounts of Life insurance company – Revenue Account, Profit and Loss Account and Balance Sheet, Ascertainment of profit under Life insurance business, Accounts of general insurance business – Revenue Account, Profit and Loss Account and Balance Sheet.
Insurance Claims: Average clause, indemnity period, procedure of ascertaining loss of stock and loss of profit, Ascertainment of claims against loss of stock and loss of profit.

Module IV: Investment Accounts and Liquidation of a company (20 hours)

Investment Account: Meaning, features, concept of cum-interest, ex-interest, cum-dividend, ex- dividend, Accounting for fixed interest earning securities and variable earning securities, bonus shares and right shares, Intercompany investment.
Winding up of a company: Meaning, winding up by National Company law Tribunal, Modes of Winding up, preferential payments, Preparation of Statement of Affairs, Liquidator's Final statement of Account.

Module V: Inflation and Government Accounting (10 hours)

Inflation Accounting: Meaning, Need, Objectives, Current Purchasing Power Method, Current Cost Accounting; Government Accounting: Meaning, features and Objectives of Government Accounting; difference between commercial accounting and

Government Accounting; General Principles of Government Accounting; System of financial administration and financial control in India; Accounts keeping of the government; Classification of Accounts in Government Accounting; Accounting for Human Resources in an organisation.

Suggested Readings

1. JawaharLal, Financial Accounting, S Chand
2. Hanif & Mukherjee, Advanced Accounting, McGraw Hill Education.
3. Dam B. B., Advanced Accounting, Capital Publishing Company
4. Khan M. Y. , Advanced AccountingM.C. Shukla, Advanced Accounting, S Chand & Co.
5. Maheshwari S. N. , Advanced Accounting, Vikas Publishing.

Mapping of Course Outcomess

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1					H
CO 2	H				
CO 3				H	
CO 4			H		
CO 5		H	H		

CMFS401T: FINANCIAL STATEMENT ANALYSIS

(5 credits – 75 hours) (L-T-P: 5-0-0)

Objective

The course introduces the knowledge of decision makers information about a business enterprise for use in decision-making and to evaluate the economic situation of the firm and predicting its future course based on the financial statements.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Define the role of standard setters and regulators in Financial Reporting (Remembering).
CO 2: Illustrate the information provided by Balance Sheet, Income Statement and Cash Flow Statement (Understanding)
CO 3: Identify and compare cash flow classifications of operating, investing and financing activities (Applying)
CO 4: Analysing the link between Income statement, Balance Sheet and Cash Flow Statement (Analysing)
CO 5: Criticise rations used to analyse a company's liquidity, profitability, solvency and efficiency (Evaluating)
CO 6: Build a strong base on financial statement analysis (Creating)

Module I: Introduction to Financial Statement Analysis (15 hours)

Meaning and Scope of Financial Statement Analysis; Financial Statements and other information sources; Financial Statement Analysis Framework; Classification of Business Activities; Financial Reporting Standards; Regulatory Authorities; International Financial Reporting Standards Framework (IFRS); Comparison of IFRS with other Reporting Standards.

Module II: Analysis of Income Statement (15 hours)

Components and format of Income Statement; Revenue Recognition; Expense Recognition; Non- recurring and Non-operating items; Earnings Per Share(EPS) : Simple Vs complex capital structure, Basic EPS, Diluted EPS; Analysis of Income Statement: Common size analysis, Comparative income statement Analysis , Income Statement Ratios. Case Study I

Module III: Analysis of Balance Sheet (15 hours)

Components and format of Balance Sheet; Measurement Bases of Assets and Liabilities; Equity: Components, Statement of Changes in Shareholders Equity; Uses and Analysis of Balance Sheet: Common size analysis, comparative analysis, Balance Sheet Ratios. Case Study II

Module IV: Cash Flow Statement (15 hours)

Components and format of Cash Flow Statement; Linkages and Preparation: Cash Flow Statement with Income Statement and Balance Sheet, Preparation of Cash Flow Statement, Conversion from Indirect to Direct method; Cash Flow Statement Analysis: Evaluation of Sources and Uses of Cash, Common size analysis, Free Cash Flow to Firm and Free Cash Flow to Equity, Cash Flow Ratios. Case Study III

Module V: Financial Statement Analysis Techniques (15 hours)

Financial Analysis Process; Analysis tools and techniques; Common Ratios: Activity Ratios, Liquidity Ratios, Solvency Ratios, Profitability Ratios; Integrated Financial Ratio Analysis. CAMEL analysis for banking companies. Case Study IV

Suggested Readings

1. Thomas R. Robinson and Elaine Henry: International Financial Statement Analysis, Wiley.

2. Charles H. Gibson: Financial Statement Analysis, Cengage.
3. Subramanyam K R and Wild John J. : Financial Statement Analysis, McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	L	L		M	
CO 2	M	H	H	M	
CO 3		M			H
CO 4				H	
CO 5		M	M	M	H
CO 6	M	H	H	H	

CMCR402T: CONSUMER BEHAVIOUR AND RELATIONSHIP MANAGEMENT

(5 Credits-75 hours) (L-T-P: 5-0-0)

Objectives

- *To learn the concept of market, consumer, and sellers and so on.*
- *To understand the importance of regulatory measures in consumer marketing.*
- *To find out the remedies available in case of consumers' problems.*
- *To develop an understanding of underlying concepts and issues in Consumer relationship*

Course/Learning Outcomes

After completing the course successfully, the student will be able to

CO 1: Learn the concept of market, consumer, and sellers and so on (Remembering).
CO 2: Understand the importance of regulatory measures in consumer marketing (Understanding).
CO 3: Develop insights into the remedies available in case of consumers' problems. (Applying)
CO 4: Analyse the relationship of CRM in various sector of Industry. (Analysing)

Module I: Introduction to Consumer Behaviour (15 hours)

Definition, Nature, Scope, Consumer Behaviour's Applications in Marketing, Consumer research process –Defining Research Objectives, Collecting & Evaluating Secondary Data, Primary Research Design, Collecting Primary Data, Analyzing Data & Report Preparation

Module II: Factors affecting Consumer Behaviour (15 hours)

Factors influencing Consumer Behaviour– External Influences – Culture, Sub Culture, Social Class, Reference Groups, Family, Internal Influences– Needs & Motivations, Perception, Personality, Lifestyle, Values, Learning, Memory, Beliefs & Attitudes.

Module III: Marketing Communications, Decision Making Models, Consumer Rights (15 hours)

Marketing Communication Process, Types of Communication systems – Interpersonal, Impersonal, Persuasive Communication, Consumer Decision Making Models – Black Box Model - Economic model - Howard & Sheth model, Consumer Protection Act 1986, rights of consumers.

Module IV: Customer Relationship Management (15 hours)

Meaning, concept, Characteristics, and Elements of CRM – CRM Process – Importance of CRM – Planning and Managing CRM Programme – Concept of Customer Loyalty – Customer Value Assessment – Customer Acquisition, Customer Retention Strategies – CRM in modern times and recent development.

Unit V: Services of CRM in various sector: (15 hours)

Status of Customer Relationship Management in service industry in India; Relevance of CRM for Hospital Services; Customer Relationship Management in Banking and Financial Services; CRM in Insurance Sector; Future of CRM;

Suggested Readings

1. Reference Books: 1. Hawkins, Best and Coney, Consumer Behaviour,Tata McGraw Hill, New Delhi
2. John A Howard, Consumer Behaviour in Marketing Strategy, Prentice Hall New Delhi
3. Schiffman L G and Kanuk L L Consumer Behaviour, Prentice Hall New Delhi
4. Anita Ghatak, Consumer Behaviour in India, D K Agencies (P) Ltd New Delhi
5. Sarkar A Problems of Consumer Behaviour in India, Discovery Publishing House New Delhi
6. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. *Consumer Affairs"* (2007) Delhi University Publication. 334 pp.

Note: The Latest edition of text books and Acts should be used.

Mapping of Course Outcomes

Course Outcomes	MI	MII	MIII	MIV	MV
CO1	M	H	M	L	L
CO2	H	H	H	H	M
CO3	M	L	H	M	H
CO4	L	M	M	H	H

CMIF403T: INTERNATIONAL FINANCE

(5 credits-75 Hours) (L-T-P: 5-0-0)

Objective

The purpose of the course is to familiarize the learners with various concept and technique of international finance that can help in effective financial management in business. The focus is on the practical application of the concepts learnt.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Describe the nature and scope of international finance, international financial system and Instruments. (Understanding)

CO 2: Understand Foreign Exchange Markets and analyse the factors affecting the exchange rates. (Understanding and Analysing)

CO 3: Evaluate various kinds of risks due to fluctuation in the exchange rate and management of these risks. (Evaluating)

CO 4: Analyse issues in International Capital Budgeting. (Analysing)

Module I International Financial Environment: (13 hours)

Evolution of International Monetary System, Bimetallism, Gold Standard, Bretton Woods System, Flexible Exchange Rate Regime and Current Exchange Rate, Arrangements, Globalization and Multinational Enterprise, Issues in international Finance.

Module II: Foreign Exchange Markets: (13 hours)

Spot Markets, Spot Rate Quotations, Trading in Spot Markets, Cross Exchange Rates. Forward Markets: Concept of Forward Rates, Long and Short Forward Positions, Premium and Discounts. Arbitrage, Hedging and Speculation.

Module III: Exchange Rate Determination: (15 hours)

Factors affecting Exchange Rate, Relative Inflation Rate, Relative Interest Rate, Relative Income Levels, Government Controls, expectations, etc. Theories of Exchange Rate (Purchasing Power Parity, Interest Rate Parity and Fisher's Effect).

Module IV: International Financial Markets and Foreign Exchange Risk Management: (18 hours)

Foreign Portfolio Investment, International Bond & Equity market, GDR, ADR. International Financial Instruments, Foreign Bonds, Eurobonds and Global Bonds. Floating rate Notes, Zero-coupon Bonds. Types of risk exposure – Transaction exposure, Economic exposure and Translation exposure, Measurement of risk exposure. Management of currency risk using currency forwards and futures, currency options and currency swaps. Interest Rate Risk and its management. EXIM bank and Exit policy in international market

Module V: International Capital Budgeting: (16 hours)

Cross border investment decision: Types and issues, Greenfield investment vs. cross border M&As. Estimation of cash flows from cross border investment projects. Risks in cross border investment decision-currency risk, political risk, country risk, inflation risk etc. Valuation techniques by incorporating risk and other factors.

Suggested Readings

1. Agnihotri, Anurag. —International Financial Management‖ Vikas Publications.
2. Apte, P.G. —Multinational Financial Management‖ Tata McGraw-Hill, New Delhi.
3. Eun, Cheol S. & Resnick, Bruce G. —International Financial Management‖ Tata McGraw-Hill.
4. Madura, Jeff. —International Financial Management‖ Cengage Learning.
5. Maurice, Levi D. —International Finance‖ Routledge.
6. Shapiro, Alan C. —Multinational Financial Management‖ John Wiley.
7. Sharan,V. International Financial Management, 6th ed. PHI Lerarning

Mapping COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			H	
CO 2	L	M	H	M	
CO 3			M	H	L
CO 4				L	H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	CMFA102T	Fundamentals of Accounting	4
2	Minor Course 2	CMFI103T/ CMEP104T	Financial Market and Institutions/ Export Import Procedures	4
3	Minor Course 3	CMIR205T	Intellectual Property Rights	4
4	Minor Course 4	CMSM206T/ CMCT207T	Investment in Stock Market/Corporate Tax Planning	4
5	Minor Course 5	CMFM311T/ CMIL312T/ CMCR313T	Fundamentals of Marketing Management/Industrial Relations and Labour Laws/ Corporate Restructuring and Valuation	4
6	Minor Course 6	CMTF314T/ CMFA315T	Tax Filing & E-Return/Financial Analytics	4
7	Minor Course 7	CMFF404T/ CMSP405T/ CMCR406T	Fundamentals of Financial Management/Security Analysis and Portfolio Management/Corporate Financial Reporting & Analysis	3
7	Minor Course 8	CMRM407T	Research Methodology	2
8	Minor Course 9	CMSM408T/ CMFC409T/ CMSL410T	Service Marketing/ Financial & Commodity Derivatives/Supply Chain and Logistics Management	3

CMFA102T: FUNDAMENTALS OF ACCOUNTING
(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Objective
To provide basic knowledge on introduction, principles and practices of accounting, techniques used in accounting, Accounting Equation; Preparing journal entries, ledger accounts; Trial Balance, preparation of cash book, preparation of depreciation accounts using different methods and students' skills in preparing Financial Statements and its interpretations. Also to give knowledge on accounting for non-for profit organisations.

Course Outcome:
CO 1: Understanding accounting concepts, types, rules, principles and the importance of accounting information to the users.
CO 2: Recording of business transactions using the double-entry accounting, different types of transactions and preparation of ledger accounts and trial balance.
CO 3: Applying the concept of revenue and capital items in preparation of receipts & payments account and income & expenditure account
CO 4: Evaluate and Analyse financial statements to evaluate the financial performance of an undertaking
CO 5: Analyse the depreciation methods and its application in business world

Module I: Introduction (15 hours)
Accounting: Meaning, objectives, types, concepts; accounting information and its need to different stakeholders; Accounting Equation: Components, double entry system,

Module II: Recording of Transactions (10 hours)
Journal: meaning, recording of journal entry; special purpose books: concepts and preparation of Cash book, ledger, trial balance and adjustment entries.

Module III: Accounting for Non-For Profit Organisation (10 hours)
Non-for Profit Organisation: meaning, features; Receipt and Payment Account: Concepts and its preparation, Income and Expenditure account: concept and its preparation, preparation of Balance sheet for non-for profit organisation.

Module IV: Financial Statement (15 hours)
Financial statement: its concepts, importance; income statement, position statement, statement of cash flow, interpretation of financial statements.

Module V: Accounting for Depreciation (10 hours)
Depreciation: meaning, causes; Methods, computation and accounting treatment

Suggested Readings

1. CA Dr KM Bansal and Dr Ritu Gupta, Basic Accounting, Taxxman Publication, edition 2022
2. CA Dr. P C Tulsian, Tushar & CA Bharat Tulsian, Accountancy S Chand CA Intermediate Tulsian's

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M	H	L		M
CO 3	L			H	
CO 4			H		
CO 5		M			H

CMFI103T: FINANCIAL MARKET AND INSTITUTIONS

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Objective

This course primarily deals with the Financial System of India. It will enable students to acquire a basic understanding of the structure, organization and functioning of the financial system and will give an exposure to different financial instruments and their implications in the existing regulatory framework.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: State the concept and importance of the financial system for the national economy. (Remembering)
CO 2: Understand the market structure, Different types of financial Instruments, Financial Institutions and financial services. (Understanding)
CO 3: Differentiate the role of Money markets and Capital markets and distinguish between banking and Non- Banking financial Institutions. (Analysing)
CO 4: Analyse the different types of financial services and financial instruments. (Applying)
CO 5: Evaluate the function of financial intermediaries. (Evaluating)

Module I: Financial System (10 Hours)

Introduction to financial system, role and the structure of financial system; an overview of financial institutions, market structure and its components, financial instruments and services; financial system and economic significance; reforms in the financial system.

Module II: Financial Markets (20 Hours)

a) Money Markets: Meaning, objectives, importance, characteristics, money markets instruments, participants and functions of money market, role of Reserve Bank of India and Commercial Banks in the Indian money market.
b) Capital Markets: Meaning, objectives and functions, classification of capital markets, capital market instruments.
c) Primary market or new issue market: meaning, methods of marketing of securities, Book Building, Red herring prospectus.
d) Secondary Market: Meaning, characteristics and functions, growth of stock exchange, functions of stock exchange, types of speculators on stock exchange, SENSEX, NIFTY, OTCEI (Over the Counter Exchange of India); Debt Market; Derivatives Market.

Module III: Financial Instruments (10 Hours)

a) Financial instruments: meaning, role, and classification of financial instruments: general issue, functional categories, maturity and type of interest rate; financial derivatives and employee stock options.
b) Proposed functional category and instrument breakdown
c) Investment, type of investments, assets, liabilities
d) IAS 32 financial instruments

Module IV: Financial Institutions (10 Hours)

Commercial banking- introduction, its role in project finance and working capital finance; Development financial institutions (DFIs)- An overview and role in Indian economy; Life and non- life insurances companies in India; Mutual funds- Introduction and their role in capital market development. Non-banking financial companies (NBFCs), Financial Regulatory Authorities.

Module V: Financial Services (10 Hours)

Financial Services- Introduction, characteristics, types; investment banking; depositories and custodians; credit rating; factoring and forfeiting; housing finance; leasing and hire purchase; merchant banking; venture capital.

Suggested Readings

1. Bhole, L.M., Financial Markets and Institutions. Tata McGraw Hill Publishing Company.

2. Khan, M.Y., Indian Financial System-Theory and Practice. New Delhi: Vikas Publishing House
3. Sharma, G.L., and Y.P. Singh eds. Contemporary Issues in Finance and Taxation. Academic Foundation, Delhi
4. Khan and Jain, Financial Services, Tata McGraw Hill.
5. Singh, J.K., Venture Capital Financing in India. Dhanpat Rai and Company, New Delhi.
6. Annual Reports of Major Financial Institutions in India.

Mapping of Course Outcomess

Course Outcomes	Module-1	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	L	H	M	M	M
CO 3		H	M		
CO 4			H		H
CO 5				H	M

CMEP104T: EXPORT IMPORT PROCEDURE

(4 Credits-60 hours)(L-T-P: 4-0-0)

Objectives

- *Understand the documentation and procedures involved in international trade*
- *Students will be able to identify potential export and import markets based on country prospects and regulatory requirements.*
- *Students will be able to manage logistics and supply chain operations involved in exporting and importing goods, including transportation, warehousing, and inventory management.*

Course/Learning Outcomes

CO 1: Remembering the process of international trade. (Remembering)
CO 2: Understanding the regulatory requirements involved in international trade. (Understanding)
CO 3: Evaluate potential market, prepare necessary documentation, comply with regulatory requirements, manage logistics and develop appropriate strategies. (Applying)
CO 4: Solve problems and make decisions related to international trade. (Analysing)

Module I: The Basic Formalities of Export and Import: (15 Hours)

Registration of Exporters, Importers - Import Export Code Number, Selection of Product & Market, Export-import Documentation, Quality Control and Pre shipment Inspection, Labelling, Marking, Packaging; Export import procedure and Methods of Payment, Trade Financing.

Module II: Export prospects of a country (15 Hours)

Search of Product -Types, Schemes, Factors; Search of Market - determinants & Schemes; Guidelines for International Business Negotiations: Appointing Sales Agents Abroad, Processing of an Export Order, Export logistics- Freight forward.

Module III: Export documentation (15 Hours)

Document related to Excise clearance, Documents related to customs clearance, Documents related to foreign exchange clearance, Documents related to transportation and procedures, Documents required for Preparation of main documents : Bill of Lading, Auxiliary documents, Mate's Receipt, Inspections Certificate, Insurance Certificate, Place of Origin, Packing/Shipping note.

Module IV: Review of Export Promotion Policies and schemes (15 Hours)

EPCG scheme, Duty drawback, DE passbook scheme, Gem and Jewellery Promotion Scheme, Other Export Promotion Schemes; Export Promotion: Institutional set up – Export Houses, EPZ, FTZ, EHTP, STP, SEZ, AEZ, 100% E.O.U., Focus Market & Focus Product Scheme.

Suggested Readings

1. "Foreign Trade Policy and Handbook of Procedures" by the Ministry of Commerce and Industry, Government of India.
2. Export-Import Procedures and Documentation" by Tulsian P.C. and Tulsian Bharat - Pearson Education India
3. International Business: Competing in the Global Marketplace" by Charles W. L. Hill - McGraw-Hill Education.
4. Export-Import Procedures and Documentation" by Bhatia Rakesh- New Age International Publishers
5. Export-Import Management: Practices and Procedures" by Velayutham R. - Oxford University Press

Mapping of Course Outcomess

Course Outcome	Module I	Module II	Module III	Module IV
CO1	H	L	M	H
CO2	H	M	H	H

CO3	M	H	H	M
CO4	M	H	H	M

CMIR205T: INTELLECTUAL PROPERTY RIGHTS

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objectives

- *To provide a comprehensive understand on the basics of intellectual property law, including the different types of IP and their legal protections.*
- *To understand the economic and social importance of intellectual property, including its role in promoting innovation and creativity.*
- *To understand the legal framework for protecting and enforcing IP rights, including national and international laws and regulations.*
- *To learn about the processes for obtaining and maintaining patents, trademarks, copyrights, and trade secret.*

Course/Learning Outcomes

CO 1: Remembering: Remembering the process of patent application process, legal framework for IP Protection and Environment

CO 2: Understanding: Understanding the regulatory requirements of trademark registration process, copyright law, infringement and litigation

CO 3: Applying: Applying Intellectual Property Management & Enforcement, Challenges and Opportunities in Global IP protection, Ethical Dilemmas in IP Law and Practice, IP policies and Best Practices.

Module I: Introduction to Intellectual Property Rights (20 hours)

Definition of Intellectual Property, Importance of Intellectual Property, Types of Intellectual property, Legal Framework for IP Protection and Enforcement, National and International Laws and Regulations, Enforcement Mechanisms.

Module II: Types of Intellectual Property (20 hours)

Patent: Patentable Subject Matter, Patent Application Process, Patent Infringement and Litigation; Trademark Law: Trademark Registration Process, Trademark Infringement and Litigation; Copyright Law: Subject matter, registration process, Infringement and Litigation; Trade secrets: Protection & enforcement of trade secrets.

Module III: Ethical considerations (20 hours)

Ethical considerations in Intellectual Property Management & Enforcement, Challenges and Opportunities in Global IP protection, Ethical Dilemmas in IP Law and Practice, IP policies and Best Practices

Suggested Readings

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	L	M	H
CO2		M		H
CO3	M		H	M

CMSM206T: INVESTING IN STOCK MARKETS

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objectives

- *To give knowledge and insights on the functioning of Indian Stock market*
- *To Develop tools and skills for security analysis-fundamental and technical*
- *To develop trading and investment skills in securities market*

Course/Learning Outcomes

CO 1: Understand the functioning of Indian Stock market and the regulations governing the stock market

CO 2: Understand the fundamental principles of investment including risk and return

CO 3: Develop the necessary skills to make informed trading and investment decisions

CO 4: Analyse different investment strategies including long term and short term investment

Module I: Basics of Investing (15 hours)

Basics of Investment & Investment Environment; Risk and Return, Instruments of Investment- Equity shares, Preference shares, Bonds and Debentures. Indian Security Markets: Primary Markets (IPO, FPO, Private placement, Offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants:

Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE, NSE, MSEI. Security Market Indices: Nifty & Sensex, Sources of financial information; Trading in securities: types of orders, using brokerage and analyst recommendations.

Module II: Indian Security Markets (15 hours)
Primary Markets (IPO, FPO, Private placement, Offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE, NSE, MSEI. Security Market Indices: Nifty & Sensex; Sources of financial information; Trading in securities: types of orders, using brokerage and analyst recommendations.

Module III: Fundamental Analysis (15 hours)
Top down and bottom up approaches, Analysis of international & domestic economic scenario, Industry analysis, Company analysis (Quality of management, financial analysis :Both Annual and Quarterly, Income statement analysis, position statement analysis including key financial ratios, Cash flow statement analysis, Industry market ratios: PE, PEG, Price over sales, Price over book value, EVA), Understanding Shareholding pattern of the company.

Module IV: Technical Analysis (15 hours)
Trading rules (credit balance theory, confidence index, filter rules, market breath, advances vs declines and charting (use of historic prices, simple moving average and MACD) basic and advanced interactive charts. Do's & Don'ts of investing in markets.

Suggested Readings
1. Kumar, Vinod and Nangia, Raj Sethi, Investing in Stock Markets, Ane books
2. Singh J K , Singh Amit Kumar, Investing in Stock Markets, A K Publications, Delhi.
3. Tripathi, Vanita and Pawar, Neeti (2019), Investing in Stock Market, Taxmann Publications

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	

CMCT207T: CORPORATE TAX PLANNING

(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective
To provide Basic knowledge of corporate tax planning and its impact on decision-making

Course/Learning Outcomes
After learning this course, the students will be able to:
CO 1: Define the basic concepts of Taxation of Companies and residential status (Remembering)
CO 2: Summarise the various uses of corporate tax planning in business (Understanding)
CO 3: Apply the concept of Tax-planning in specific management decisions (Applying)
CO 4: Explain the provisions of taxation related to non-residents/ International Taxation (Analysing)
CO 5: Assessing Tax planning in respect of business restructuring cases (Evaluating)

Module I: Introduction (10 hours)
Tax planning, tax management, tax evasion, tax avoidance; Corporate tax in India; Types of companies; Residential status of companies and tax incidence; Tax liability and minimum alternate tax; Tax on distributed profits

Module II: Tax planning-1 (10 hours)
Lectures Tax planning with reference to setting up of a new business: Location aspect, nature of business, form of organization; Tax planning with reference to financial management decision - Capital structure, dividend including deemed dividend and bonus shares; Tax planning with reference to sale of scientific research assets

Module III: Tax planning-2 (15 hours)
Tax planning with reference to specific management decisions - Make or buy; own or lease; repair or replace Tax planning with reference to employees' remuneration Tax planning with reference to receipt of insurance compensation Tax planning with reference to distribution of assets at the time of liquidation.

Module IV: Special provisions relating to non-residents (10 hours)
Double taxation relief; Provisions regulating transfer pricing; Advance rulings; Advance pricing agreement

Module V: Tax planning with reference to business restructuring (15 hours)
Amalgamation, Demerger, Slump sale, Conversion of sole proprietary concern/partnership firm into company, Conversion of company into LLP, Transfer of assets between holding and subsidiary companies.

Suggested Readings

1. Vinod K. Singhania and Monica Singhania, Corporate Tax Planning. Taxmann Publications Pvt. Ltd., New Delhi.
2. Girish Ahuja and Ravi Gupta. Corporate Tax Planning and Management. Bharat Law House, Delhi.
3. Shuklendra Acharya and M.G. Gurha. Tax Planning under Direct Taxes. Modern Law Publication, Allahabad.
4. D.P. Mittal, Law of Transfer Pricing. Taxmann Publications Pvt. Ltd., New Delhi.
5. IAS – 12 and AS – 22. 6. T.P. Ghosh, IFRS, Taxmann Publications Pvt. Ltd. New Delhi.
6. Journals 1. Income Tax Reports, Company Law Institute of India Pvt. Ltd., Chennai.
7. Taxman, Taxmann Allied Services Pvt. Ltd., New Delhi.
8. Current Tax Reporter, Current Tax Reporter, Jodhpur

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	L	L	
CO 2		H	H		M
CO 3		M	H		L
CO 4		L	L	H	M
CO 5	L				H

CMFM311T: FUNDAMENTAL OF MARKETING MANAGEMENT

(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective
To apply relevant knowledge, skills and exercise professional judgement in selecting and applying marketing principles and concepts in different business contexts and to contribute to the evaluation of the performance of an organisation and its strategic and operational development.

Course/Learning Outcomes
At the end of the course students will be able to:
CO 1: Define and explain marketing mix models in workplace and contribute to organisational growth (Remembering and Understanding)
CO 2: Assess the impact of product and brand management decisions on organizational performance (Applying)
CO 3: Examine the effectiveness of pricing and promotion decisions (Analysing)
CO 4: Determine appropriate distribution and retailing strategies in improving organisational performance (Evaluating**)**

Module I: Introduction to Marketing (15 classes)
Meaning of Marketing , nature, scope, Marketing Objectives; Importance of Marketing, core concepts of Marketing, Marketing Environment; Marketing Mix; Elements of Marketing Mix, Product Mix, Price Mix, Promotion/Communication Mix, Place Mix/ Distribution Mix; Significance of Marketing Mix; Factors Affecting Marketing Mix; Growth & Future of marketing in India.

Module II: Product, and Product Brand Management (15 hours)
Definition, Features, Characteristics and Classification of Product; Product Life Cycle definitions, Stages of the Product Life Cycle; Implications of the Product Life Cycle Concept; Types of New Products; Challenges to New Product Development; Steps in the Development of the New Product; Introduction, Objectives, Problems and Process of Test Marketing; Introduction to Product Brand, Definition of Product Branding, Purpose of Branding, Features of Good Brands, Significance and Importance of Branding, Branding in a new economy.

Module III: Pricing and Promotion Decision (15 Classes)
a) Pricing Decisions; Concept of Price; Significance of Pricing; Factors Affecting Pricing Decisions; Major Pricing Methods; Pricing Policies and Strategies; Geographical Pricing, Product Line Pricing, Discounts and Rebates.
b) Meaning and Nature of Promotion, Importance of Promotion, Communication Process, Concept of Integrated Marketing Communication, Meaning of Promotion Mix, Elements of Promotion Mix (Methods of Promotion), Factors Influencing Promotion Mix Decisions, Promotion Mix Strategies, Communication Planning and Control.

Module IV: Distribution and Retailing (15 Classes)
a) Channels of Distribution: Meaning of a Channel of Distribution, Importance of Channels of Distribution, Types of Distribution Channels, Choice of a Channel of Distribution, Functions of Distribution Middlemen, Distribution Strategies, Wholesaling.
b) Meaning of Physical Distribution, Importance of Physical Distribution, Elements of Physical Distribution, Marketing

Logistics Decisions.

c) Meaning of Retailing, Functions and Services of Retailers, Types of Retailing; Malls and major markets; FDI in retail market; Management of Retailing Operations: An Overview, retailing in India – Changing Scenario.

Suggested Readings

1. Gupta C.B., Principles of Marketing, Sultan Chand & Sons.
2. Kotler Philip , Marketing Management, Pearson Education, New Delhi.
3. Sherlekar S. A., Marketing Management, Himalaya Publishing House, Mumbai.
4. Kumar A & Meenakshi, Marketing Management, Vikas Publishing House, New Delhi.
5. Saxena R, Marketing, Himalaya Publishing House, Mumbai.

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L			
CO 2		M	L	L
CO 3	M	M	M	
CO 4		H	H	M

CMIL312T: INDUSTRIAL RELATION AND LABOUR LAWS

(4 Credit -60 Hours) (L-T-P : 4-0-0)

Objectives

- *To Understand evolution of industrial relations and its significance in managerial world.*
- *To conceive how to interact, negotiate and transact with trade unions.*
- *To understand the basic framework of collective bargaining and workers' participation*
- *To understand the legal structure provided for grievance handling under the Industrial Disputes Act 1947*

Course/Learning Outcomes

After completing the course successfully, the student will be able to

CO 1: Remembering the terminologies connecting with Industrial Relation. (Remembering)
CO 2: Understanding the various discipline and legislation of IRLL. (Understanding)
CO 3: Application of various dimensional framework associated with IRLL. (Applying)
CO 4: Analysing the provision connected with IRLL. (Analysing)

Module I: Introduction to Industrial Relations (IR) (10 hours)

Concept of Industrial Relations; Nature of Industrial Relations; Objectives of IR; Factors affecting IR in changing Environment, Evolution of IR in India;Trade Union; Employers' Organisation; Human Resource Management and IR, Role of ILO in Industrial Relations, worker education International Dimensions of IR

Module II: Trade Union (10 hours)

Trade Union: Origin and growth, unions after Independence, unions in the era of liberalisation; Factors Affecting Growth of Trade Unions in India, different forms of trade union, Multiplicity & Recognition of Trade Unions; Major Provisions of Trade Union Act 1926

Module III: Collective Bargaining and Workers' Participation in Management (15 hours)

a) Collective Bargaining: Meaning, Nature, Types, Process and Importance of Collective Bargaining, pre-requisites, issues involved; Status of Collective Bargaining in India, Functions and role of Trade Unions in collective bargaining
b) Workers' Participation in Management: Consent, practices in India, Works Committees, Joint management councils; Participative Management and co-ownership; Productive Bargaining and Gain Sharing

Module IV: Discipline and Grievance Redressal (10 hours)

Discipline: Causes of indiscipline, Maintenance of discipline and misconduct; Highlights of domestic enquiries; Principle of Natural Justice; Labour turnover; Absenteeism; Grievance: Meaning of Grievance, Settlement Machinery, Grievance redressal machinery in India, Grievance handling procedure; salient features of Industrial Employment (Standing orders) Act

Module V: Labour law and legislation (15 hours)

a) The Industrial Disputes Act, 1947: Definitions of Industry, workman, and Industrial Dispute; Authorities under the Act: Procedure, Powers and Duties of Authorities; Strikes and Lock outs: Lay-off and Retrenchment: Provisions relating to Layoff, Retrenchment, and closure
b) The Factories Act, 1948: Provisions relating to Health, Safety, Welfare facilities, working hours, Employment of young persons, Annual Leave with wages

Suggested Readings

1. PK Padhi, Industrial Relations and Labour Law, PHI Learning.
2. Arun Monappa, Industrial Relations and Labour Law, McGraw Hill Education.
3. SC Srivastav, Industrial Relations and Labour Law, Vikas Publishing House.
4. C.S Venkata Ratnam, Industrial Relations, Oxford University Press.
5. P.L. Malik's Handbook of Labour and Industrial Law, Vol 1 and 2, Eastern Book Company.
6. JP Sharma, Simplified Approach to Labour Laws, Bharat Law House (P) Ltd.

Note: Latest edition of text books may be used.

Mapping of Course Outcomes

Course Outcomes	MI	MII	MIII	MIV	MV
CO1	M	H	L	M	H
CO2	H	M	M	M	M
CO3	M	M	H	M	M
CO4	L	L	M	H	H

CMCR313T: CORPORATE RESTRUCTURING AND VALUATION

(4 Credit-60 hours) (L-T-P: 4-0-0)

Objectives

- *Understanding why 'things go wrong'.*
- *Gain understanding and insights on the laws, rules and procedures for corporate restructuring.*
- *Insights on financial and strategic implications of restructuring.*
- *Working on valuation to develop win-win restructuring deals.*

Course/Learning Outcomes

CO 1: Remembering key terms related to corporate restructuring. (Remembering)
CO 2: Understanding the different types of corporate restructuring initiatives. (Understanding)
CO 3: Application of value drivers to develop restructuring synergies. (Applying)
CO 4: Analysing empirical evidence on various corporate restructuring. (Analysing)

Module I: Fundamentals of Corporate restructuring (10 hours)

Corporate restructuring: Planning, Formulation and Execution of Various Corporate Restructuring Strategies - Mergers, Acquisitions, Takeovers, Disinvestments and Strategic Alliances, Demerger and Hiving off, Bankruptcy, equity restructuring, and spin-offs. Laws, rules and procedures governing corporate restructuring in India.

Module II: Drivers of valuation (20 hours)

Drivers of valuation: Weighted forecasts of growth in company revenue, Weighted forecasts of growth in company margin, Patterns of cash returned to shareholders, Changes in the company's debt-to-equity ratio, The economic conditions of the industry, Market volatility in the geographic areas in which the industry's major companies compete. Adjusted present value, WACC, capital cash flow, and discounted cash flow valuation.

Module III: Financial restructuring (15 hours)

Financial restructuring: Debt restructuring, Equity restructuring, reduction of capital, reorganization of share capital, buy back of shares –concept and necessity, procedure for buy back of shares.

Module IV: Restructuring of Sick companies (15 hours)

Revival, Rehabilitation and Restructuring of Sick Companies: Sick companies and their revival with special reference to the law and procedure relating to sick companies.

Suggested Readings

1. Higgins, Robert C. *Analysis for Financial Management* 8th edition (McGraw-Hill 2007)
2. Mergers and Acquisitions, Aurora, Shetty and Kale, Oxford, Latest Publication
3. Principles of Corporate Finance, Brealey& Myers, TATA McGraw Hill, Latest Edition
4. Corporate Finance, Ashvarath Damodaran, Wiley India, Latest Edition
5. Mergers, Acquisitions and business valuation, Excel books, Ravindhar Vadapalli, Latest Edition
6. Takeovers, Restructuring, and Corporate Governance, James J. Fred Weston, Mark L. Mitchell, J. Harold, Pearson, Latest Edition

Mapping of Course Outcomes

Course Outcome	Module I	Module II	Module III	Module IV
CO1	H	L	L	M
CO2	H	M	H	H
CO3	L	H	H	M
CO4	L	H	H	H

CMTF314T: TAX FILING AND E-RETURN

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objectives

The objective of this course is to provide fundamentals of Income tax Concepts, GST Concepts and provisions. It help the student to understand file online ITR, TDS return deal with Income Tax matters and e-filing of GST return.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Define the various concepts related to direct taxes and Indirect taxes. (Remembering)
CO 2: Explain the provisions of the direct tax laws and Indirect tax laws (including GST Act 2017). (Understanding)
CO 3: Execute the knowledge of the provisions of the direct tax laws and indirect tax laws to the various situations in actual practice. (Applying)
CO 4: Analyse the procedures related to filing of returns, TDS and GST return filing. (Analysing)

Module I: Computation of Income tax (15 Hours)

a) Basic concept, Definition of previous year, Assessment year, person, assessee, determination of residential status,
b) Brief about the various Sources of Income (with Illustration).

Module II: Introduction to Goods and Service Tax Act 2017 (15 Hours)

Introduction to GST Law, Levy and Collection of CGST and IGST, Application of CGST/IGST law, Concept of Supply including Composite and Mixed Supplies, Charge of Tax including Reverse Charge, Exemption from Tax, Composition Levy, Basic concepts of Time and Value of Supply, Input Tax Credit, Computation of GST Liability,

Module III: E-filing of Income tax returns (15 Hours)

Set off and Carry Forward of Losses ; Deductions, Rebate and Relief ; Taxation of Individual ; Advance Tax; Tax Deducted at Source & Tax Collected at Source (excluding Non-resident); Filing of Return of Income ; Self-Assessment & Intimation. .

Module IV: E-filing of GST returns (15 Hours)

E Filing of GST, GST-DVAT/ HVAT/CST Applicability., Tax Invoice generation, Bilty Challan, GST return, Online Payment (DVAT), Quarterly Return (DVAT), online submission of road permit

Suggested Readings

1. Singhania, Vinod K. and Monica Singhania. Students' Guide to Income Tax, University Edition. Taxmann Publications Pvt. Ltd., New Delhi.
2. Ahuja, Girish and Ravi Gupta. Systematic Approach to Income Tax. Bharat Law House, Delhi. Journals
3. Income Tax Reports. Company Law Institute of India Pvt. Ltd., Chennai.
4. Taxman. Taxmann Allied Services Pvt. Ltd., New Delhi.
5. Current Tax Reporter. Current Tax Reporter, Jodhpur. Software
6. Singhania Vinod Kumar, e- filing of Income Tax Returns and Computation of Tax, Taxmann Publication Pvt. Ltd., New Delhi. Latest version
7. Excel Utility' available at incometaxindiaefiling.gov.in
8. Agarwala, D.S., Banka,Vikash Kumar, Saraf ,Ayush, Practical Guide to GST Compliances, Taxmann Publication Pvt. Ltd., New Delhi

Mapping of Course Outcomess

Course Outcomes	Module-1	Module II	Module III	Module IV
CO 1	H	H	M	M
CO 2	M	M	H	H
CO 3	M	M	M	M
CO 4			H	H

CMFA315T: FINANCIAL ANALYTICS

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objectives

- *Understand and articulate a business problem and convert it into a viable analytics question;*
- *Apply Data Visualization for exploratory analysis and communicate effectively to diverse audience;*
- *Evaluate various analytical approaches and select the most appropriate for the given problem;*
- *Build Analytics solutions and assess their effectiveness;*
- *To develop solutions across a range of functional areas like marketing, Finance, HR and Operations.*

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: To demonstrate the awareness and knowledge of Financial Analytics (Remembering)

CO 2: To understand the basic concepts of analytics to the business scenarios (Understanding)

CO 3: To extend the knowledge about future trends in Financial Analytics (Applying)

CO 4: To interpret the analytics methodology (Analysing)

CO 5: To assess the relevance and effectiveness of financial analytics solutions (Evaluating)

CO 6: To apply the knowledge of technical skills in descriptive and predictive modeling to support business decision making

Module I: Data Bases, Data Warehousing and Data Mining (10 Hours)

Types of Data Sources- Structured Vs Semi Structured Vs Unstructured data; Data Warehouse Vs Databases, Relational databases vs Non-Relational Databases; RDBMS Data Structures; Columnar Data structures; Data mining meaning, Association Rules and Clustering; Decision trees; Random forests.

Module II: Analytics Methodology (10 Hours)

Introduction to Analytics Methodology; preparing objectives & identifying data requirements, Data Collection, Understanding data, Data preparation- Data Cleansing, Normalisation, Data Blending, Data Modelling, Evaluation & feedback.

Module III: Visualisation of Data (10 Hours)

Introduction, Data summarization methods; Tables, Graphs, Charts, Histograms, Frequency distributions, Relative Frequency Measures of Central Tendency and Dispersion; Box Plot; Basic probability concepts; Conditional probability; Probability distributions; Continuous and discrete distributions; Sequential decision making.

Module IV: Time Series (10 Hours)

Trend Analysis; Seasonality & Cyclical behaviour, Moving Average, Exponential smoothing methods- Single exponential, double exponential, HOLT-WINTERS, ARIMA; Multiple linear regression-based forecasting; GARCH.

Module V: Predictive Analysis (10 Hours)

Simple linear regression; Coefficient of determination; Significance tests; Residual Analysis; Confidence and prediction intervals; Multiple linear regression: Coefficient of multiple coefficient of determination, interpretation of regression coefficients; Categorical variables; Heteroscedasticity, multi-collinearity, outliers, autoregression and transformation of variables.

Module VI: Financial Analytics Future Trends (10 Hours)

Role of Artificial Intelligence in Finance; Machine Intelligence; Competitive Intelligence; Text Mining, Web Analytics (Web content mining, Web usage mining, Web structure mining); Social Networking Analysis, Big Data tools & Techniques, Ethical and legal considerations in Financial Analytics.

Suggested Readings

1. Turban E, Armson, JE, Liang, TP & Sharda, Decision support and Business Intelligence Systems, 8th Edition, John Wiley & Sons, 2007
2. Frank J. Ohlhorst, Big Data analytics, Ist Edition, Wiley. 2012.
3. Data Science for business- What you need to know about data mining and data analytic thinking, Foster Provost, Tom Fawcelt, O' Reilly Media publications, 2013

Mapping of Course Outcomess

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3						H
CO 4		H	H	H	H	
CO 5						H
CO 6					H	

CMFF404T: FUNDAMENTALS OF FINANCIAL MANAGEMENT

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objective

This Course will explain the financial tools and techniques, which can be used to help firms maximize value by improving decisions relating to capital budgeting, capital structure and working capital management.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Explain the objectives and scope of financial management and time value of money (Remembering)
CO 2: Explain various capital structure theories and factor affecting capital structure decision (Understanding)
CO 3: Analyse the process of working capital management and capital budgeting process(Analysing)
CO 4: Critically judge the various theories of dividend and determine the factors affecting dividend polices (Evaluating)

Module I: Introduction (10 hours)

Nature, scope and objective of Financial Management, Time value of money, Risk and return (including Capital Asset Pricing Model), Valuation of securities – Bonds and Equities

Module II: Investment Decisions (15 hours)

The Capital Budgeting process, Cash flow Estimation, Payback period Method, Accounting Rate of return, Net Present Value(NPV), Net Terminal Value, Internal Rate of Return (IRR), Modified Internal rate of return, Profitability Index, Capital budgeting under Risk- Certainty Equivalent Approach and Risk Adjusted Discount Rate; Concepts of working capital, the risk – return trade off, sources of short-term finance, working capital estimation, cash management, receivables management, inventory management and payables management.

Module III: Financing Decisions (10 hours)

Cost of Capital and Financing Decision: Sources of long-term financing Estimation of components of cost of capital. Methods for calculating cost of equity , capital Cost of retained Earnings, Cost of Debt and Cost of Preference Capital, Weighted Average Cost of capital (WACC) and Marginal cost of capital. Capital structure- Theories of capital structure (Net Income, Net Operating, MM, Hypothesis, and Traditional Approach). Operating and financial leverage; Determinants of capital structure.

Module IV: Dividend Decisions (10 hours)

Theories of Relevance and irrelevance of dividend decision for corporate valuation; Cash and stock dividends; Dividend polices in practice

Suggested Readings

1. Financial Management and Policy, James C.Van Horne and Sanjay Dhamija, Pearson Education.
2. Principles of Financial Management, Levy h.andM.Sarnat, Pearson Education.
3. Fundamentals of Financial Management, Brigham and Houston, Cengage Learning.
4. Basic Financial Management, Khan and Jain, McGraw Hill Education
5. Fundamentals of Financial Management, Prasanna Chandra, McGraw Hill Education
6. Financial Management-text and Problems, Singh, J.K, DhanapatiRai and Company , Delhi
7. Fundamentals of Financial Management, Rustagi, R.P, Taxmann Publications Pvt.Ltd.

Mapping of Course Outcomess

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2		H	L		
CO 3			H		H
CO 4				H	M

CMSP405T: SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

(3 – Credits-45 hours) (L-T-P: 3-0-0)

Objectives

1. Gain knowledge and insights on the functioning of Financial Market.
2. Develop tools and skills for security analysis.
3. Develop tools and approaches to help navigate the complexities and challenges in Financial Market.

Course/Learning Outcomes

CO 1: Remembering relevant sections of corporate tax planning. (Remembering)
CO 2: Understand both the mechanics and operations of financial markets. (Understanding)

CO 3: Application of models used in valuation of equity and portfolio management. (Applying)
CO 4: Analyse the trading and evaluation of securities in equity and bond markets. (Analysing)

Module I Security analysis- I (10 hours)
Evaluation of fixed income securities, Stock market and indices, Index calculation, Evaluation of equity- Fundamental analysis- economy, industry and company. Technical analysis- chart pattern, price actions, determining support and resistance, break outs and break downs, working on tools.

Module II Security analysis II (10 hours)
Valuation of shares – Earnings, dividend and net assets, CAPM, Valuation of bonds and bond yields. – Working with analytics - Beta, covariance, variance and standard deviation, correlation and regression.

Module III Portfolio Management (15 hours)
Portfolio Management – Risks and Returns: Concept of portfolio and portfolio management, concept of risk, optimal portfolio- portfolio diversification, mechanics of diversification. Working with efficient frontier, capital market line and indifference curve on a hypothetical portfolio.

Module IV Behavioral Finance and event study (10 hours)
Behavioral Finance and event study: Meaning of Behavioral finance - when, how and why psychology influences investment decisions. The Event Study- assessing the market reaction to firm-specific and market events with statistical tools.

Suggested Readings

1. Damodaran, A., Damodaran on Valuation – Security Analysis for Investment and Corporate Finance, 2nd Edition, Wiley India, 2008.
2. Fischer, D.E. and Jordan, R., Security Analysis and Portfolio Management, 6th Edition, Pearson Education, 1995.
3. Graham, B., and Dodd, D.L., Security Analysis, 6th Edition, Tata McGraw-Hill Education, 2008.
4. Kevin, S., Security Analysis and Portfolio Management, PHI Learning, 2009.
5. Khatri, D.K., Security Analysis and Portfolio Management, Macmillan Publishers India, 2010.
6. Ranganathan, M. and Madhumati, R., Security Analysis and Portfolio Management, 2 nd Edition, Pearson, 2012.
7. Reily, F. and Brown, K.C., Analysis of Investments and Portfolio Management, 10th Edition, Cengage Learning, 2012.

Mapping of Course Outcomess

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	M	M	M
CO2	H	H	H	M
CO3	M	M	H	H
CO4	H	H	H	M

CMCR406T: CORPORATE FINANCIAL REPORTING & ANALYSIS

(3 Credits- 45 Hours) (L-T-P:3-0-0)

Objectives
- *To equip with Conceptual Framework on Financial Reporting, Quality, Accuracy and Relevance of Information to stakeholders,*
- *Understand the impact of global economic trends and events on financial reporting and analysis for corporations.*
- *To understand the importance of students with comprehensive understanding of financial reporting standards and recent advancements in financial reporting.sustainable and integrated reporting in the present day world.*
- *To develop requisite skills to analyse and interpret Financial Statements from the perspective of various stakeholders.*

Course/Learning Outcomes
CO 1: Remembering important sections of Indian Companies Act 2013 and accounting standards related to Corporate Financial Reporting. (Remembering)
CO 2: Understand the fundamentals and recent advancements in financial reporting and accounting standards for corporations. (Understanding)
CO 3: Develop the ability to use financial ratios and other analytical tools to assess a company's financial performance and sustainability reporting of corporations. (Applying)
CO 4: Analyze and interpret financial statements, including balance sheets, income statements, and cash flow statements. (Analysing)

Module I: Introduction to Financial Reporting (10 hours)
Conceptual Framework on Financial Reporting, Quality, Accuracy and Relevance of Information to stakeholders, Generally Accepted Accounting Principles (GAAP)- International Financial Reporting Standards (IFRS), Adoption and Convergence of IFRS,

Overview of IND-AS.

Module II: Recent Advances in Financial Reporting & Disclosures (10 hours)
Triple Bottom Line, Sustainability and Integrated Reporting- Natural Resource Accounting, Human Resource Accounting, Environment, Social & Governance (ESG), Fair Value Accounting (IND AS113).

Module III: Financial Statements (15 hours)
Preparation & Presentation of Financial Statements- IND AS 1 & Schedule III of Companies Act 2013; Relevant sections related Financial Statement in Indian Companies Act 2013 – Section 2(40), Section 129, 130, 131, 132, 133, 134, 135 & 136; Standalone & Consolidated Financial Statements (IND AS 109); Segment Reporting (IND AS 108); Financial Reporting of Banking & Insurance Companies.

Module IV: Financial Statement Analysis (10 hours)
Analysis of Cash Flow Statement, Income Statement & Balance Sheet; Financial Ratios & Trend Analysis; Comparative & Common Size Financial Statements; Financial forecasting- Time Series Analysis, Regression Analysis and Monte Carlo Simulation.

Suggested Readings
1. Hawkins, David F. Corporate Financial Reporting and Analysis: Text and Cases. 4th ed. Homewood, IL: Irwin/McGraw-Hill.
2. Corporate Financial Reporting and Analysis: A Global Perspective by David Young, Jacob Cohen and Daniel A. Bens (Wiley, 4th edition).
3. Financial Analysis and Decision Making: Tools and Techniques to Solve Financial Problems and Make Effective Business Decisions by David E. Vance (McGraw-Hill Education, 1st edition).
4. The Interpretation of Financial Statements by Benjamin Graham and Spencer B. Meredit.
5. Financial Statement Analysis and Security Valuation by Stephen Penman (McGraw-Hill Education, 5th edition)
6. Financial Reporting and Analysis: Using Financial Accounting Information by Charles H. Gibson (South-Western College Pub, 13th edition)

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	M	L
CO2	H	H	H	M
CO3	L	L	M	H
CO4	L	L	H	H

CMRM407T: RESEARCH METHODOLOGY

(2 Credit: 30 hours) (L-T-P: 3-0-0)

Objectives:
- *The students will gain a strong and enduring understanding of how to systematically design research, gather and analyze data, to help drive business decisions.*
- *The students will learn a practical framework for conducting research, knowledge to properly design research, techniques and tools to analyze data and practical information sources.*
- *The students will be able to maximize their ability to apply what they learn.*

Course/Learning Outcomes
CO 1: Remembering of different concepts of research methodology. (Remembering)
CO 2: Understanding how to proceed with a research work. (Understanding)
CO 3: Working on research proposal and research design and choice of research analytics. (Applying)
CO 4: Measurement of data and data analysis. (Analysing)

Module I Research Design (10 hours)
Research Design: Introduction to Research- Defining and developing a Research Problem, how to approach. Types of research and research design.

Module II Survey design & Measurement (5hours)
Survey design & Measurement: Survey Design- Variables, design of research instruments and data preparation - Validity & Reliability, Best Practices.
Measurement & Scaling Types, Sampling – sample size and techniques.

Module III Research Analytics & Report writing (15 hours)
Research Analytics & Report writing: Hypotheses testing, Correlation and Regression overview and intro to SPSS, Factor

analysis, Cluster Analysis.
Research Report writing - Best practices, References and Bibliography, Ethics in Research.

Suggested Readings

1. *Marketing Research: An Applied Orientation* (Sixth Edition), Naresh K. Malhotra, Prentice Hall
2. Marketing Research: Methodological Foundations 8 th Edition by Gilbert A. Churchill & Dawan Iacobucci.
3. Marketing Research: David AAker/V.Kumar/Robert PLeone,George S Day. Willey publication.11th edition.
4. Essentials of Marketing Research – 4/e, Tony Proctor, PHI, 2005 Market Research Best Practice. 30 Visions of the Future – Peter Mouncey, et.al, 2007.

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III
CO1	M	L	L
CO2	H	H	M
CO3	M	H	M
CO4	L	L	H

CMSM408T: SERVICE MARKETING

(3 Credits--45 Hours) (L-T-P: 3-0-0)

Objectives

- *To define and study the characteristics, Components, Classification of Service Marketing*
- *Managing service encounters, common encounter situations, Managing Service Encounters for Satisfactory Outcomes, Service Failure, Service Recovery, Process of Service Recovery*

Course/Learning Outcomes

CO 1: Remembering the different new term and terminology relating with Service Marketing. (Remembering)
CO 2: Understand the various dimension of Service Marketing. (Understanding)
CO 3: Analyse the various Trend in Service Marketing. (Applying)
CO 4: Creation of different Strategies of Relationship in Service Marketing. (Analysing)

Module I Introduction to Service Marketing (8 hours)

Meaning, Definition, Characteristics, Components, Classification of Service Marketing, Factors Leading to a Service Economy

Module II Service Consumer Behaviour (10 hours)

Understanding the Service Customer as a Decision Maker, Customer purchase is Associated with Risk, How Service Customers Evaluate the Service, The Service Consumer Decision Process, and The Decision-Making Process in the Service Sector, Components of Customer Expectations, Service Satisfaction, Service Quality Dimensions

Module III the Service Delivery Process and Strategic Issue in Service Marketing (10 hours)

Managing Service Encounters, Common Encounter Situations, Managing Service Encounters for Satisfactory Outcomes, Service Failure, Service Recovery, Process of Service Recovery, Customer Retention and Benefits. Market Segmentation in the Marketing of Services, Target Marketing, Positioning of Services-How to Create a positioning Strategy, Developing and maintaining Demand and Capacity

Module IV Relationship and Challenges of Service Marketing (10 hours)

Marketing Planning for Services, Developing and Managing the Customer Service Function, Developing and Maintaining Quality of Services, the levels of Customer Relationships, Dimensions of a Relationship marketing, Goal of relationship marketing, Challenges faced in Service Marketing in modern times

Module V Recent Trends and Ethics In Service Marketing (7 Hours)

Tourism Industry, Hospitality, Health Care, Banking, Insurance, IT & Entrainment Industry, Service Ethics

Suggested Readings

1. Zeithaml,A, Valarie, Services Marketing, Mc Graw Hill, 7th Edition
2. R. Srinivasan, Services Marketing The Indian Context, PHI, 4th Edition.

Mapping of Course Outcomes

Course Outcomes	MI	MII	MIII	MIV	MV
CO1	H	H	H	M	L
CO2	M	H	M	L	M
CO3	L	M	M	H	M

CO4	M	M	H	M	H

CMFC409T: FINANCIAL AND COMMODITY DERIVATIVES

(3 Credits- 45 hours) (L-T-P: 3-0-0)

Objectives

- *To provide students with an understanding of the basics of financial and commodity derivatives and how they are used for risk management and speculation.*
- *To have a comprehensive understanding of various types of derivatives, such as futures, options, swaps, and forwards, and how they function.*
- *To provide an Illustration of the use of derivatives in risk management, including portfolio diversification and hedging of financial and commodity risks.*

Course/Learning Outcomes

CO 1: Remembering the concepts and mechanics of derivatives, including futures, options, swaps, and forwards. (Remembering)
CO 2: Understanding the dynamics of derivative market and its instruments. (Understanding)
CO 3: Use derivatives to hedge financial and commodity risks in real-world scenarios. (Applying)
CO 4: Analyze the impact of various market factors, such as interest rates, volatility, and supply and demand, on derivatives pricing. (Analyse)

Module I: Introduction to derivative instruments: (15 hours)

Evolution of derivative instruments, types and its uses, exchange traded vs. OTC derivatives, concept of Hedging, speculation and arbitrage; Underlying assets, financial derivative market in India- its regulation and structure; Energy & Commodity derivatives- commodity specific issues, demand-supply dynamics, price trends and factors that influence prices, commodity exchanges in India.

Module II: Forward contracts: (10 hours)

Basic properties of Forward contracts, risk involved, pricing of forward contracts, payoffs from forward contracts, risk hedging using Forward contracts.

Module III: Futures (10 hours)

Basic properties of futures, Forward vs. Futures, Pricing and valuation of Futures, Convergence of futures price to spot price, payoffs from futures, Futures on Financial and commodity underlying, Market quotes, Margins & Settlement, role of clearing house, Hedging strategies- perfect hedge, long, short and cross hedge.

Module IV: Options & SWAPS (10 hours)

Types of options- Plain Vanilla & Exotic, call & Put option, parties involved- buyer and writer, pricing of options- binomial model, the Black-Scholes-Merton Model, Put-call Parity, Relevance of option Greeks- Delta, Gamma, Theta, Vega and Rho; Options on Financial and commodity underlying, basic principles of option trading and trading strategies; SWAPs: concept and features, Types- interest rate, currency and Debt-Equity SWAPs.

Suggested Readings

1. *Financial Derivatives: Theory, Concepts and Problems* by S. L. Gupta - Published by Sultan Chand & Sons.
2. *Commodity Derivatives* by Helyette Geman - Published by Wiley Finance
3. *Derivatives Markets* by Robert L. McDonald - Published by Pearson Education
4. *Commodity Options: Trading and Hedging Volatility in the World's Most Lucrative Market* by Carley Garner - Published by FT Press
5. *Fundamentals of Futures and Options Markets* by John C. Hull - Published by Pearson Education
6. *Commodity Derivatives: Markets and Applications* by Neil C. Schofield - Published by Wiley Finance
7. *Options and Futures: New Trading Strategies* by George Jabbour and Phillip Budwick - Published by Wiley Finance
8. *Energy Derivatives: Trading Emerging Markets* by Helyette Geman - Published by Wiley Finance

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2	H	M	M	M
CO 3	L	H	H	H
CO 4	L	M	H	H

CMSL410T: SUPPLY CHAIN and LOGISTICS MANAGEMENT
(3 Credits – 45 Hours) (L-T-P: 3-0-0)

Objective
The objective of this paper is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for an international firm.

Course/Learning Outcomes
After learning the course, the students will be able to:
CO 1: Define the process of supply chain management. (Remembering)
CO 2: Demonstrate operational purchasing methods and techniques on supplier management and supply in specific business contexts. (Understanding)
CO 3: Explain the strategic importance of logistics elements and describe how they affect supply chain management. (Understanding)
CO 4: Apply sales and operations planning, MRP and lean manufacturing concepts. (Applying)
CO 5: Analyse the creation of new value in the supply chain for customers, society and the environment. (Analysing)

Module I: Basic Framework (10 hours)
Concept of supply chain management (SCM); SCM and trade Logistics; Business view of SCM; Push and pull of SCM; Decision phases; Impellers and drivers in SCM Process views of SCM, planning and operations; Supply chain modelling; Role of Relationship marketing in SCM; managing relationships with suppliers and customers; Designing strategic distribution network; Factors influencing distribution network.

Module II: Supply Chain and Information Management Systems (10 hours)
Purchasing Process- Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle; Supplier selection and evaluation; Vendor development; Importance of information management; Distribution and sharing of information; Information Technology as a platform for effective and efficient supply chain management

Module III: Logistic System (10 hours)
Concept, objectives and scope of logistics; System elements; Inbound and Outbound logistics; Reverse inventory, Value added role of logistics, Logistics interface with manufacturer and marketing, Packing, Marking, Just in time concept; Third party logistic outsourcing–challenges and future directions.

Module IV: Transportation (10 hours)
Importance of effective transportation system; Service choices and their characteristics; inter- modal services; Transport cost characteristics and rate fixation; Carrier selection determinants and decision; Structure of Shipping: World seaborne trade; international shipping - characteristics and structure;Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Charter, party agreement; Development in sea transportation-Unitization, containerisation, inter and multimodal transport; CFC and ICD; Indian shipping – growth, policy and problems; Ports and port trust; International Air transport: International set up for air transport: Freight rates; India's exports and imports by air – Problems and prospects; Carriage of Goods by sea, sea and combined transport.

Module V: Warehousing and Inventory Management (5 hours)
Warehousing And Marketing Strategy; Objectives and functions of warehousing; Warehouse Strategies; Material handling equipment and material mobility Warehousing evaluation and requirements; Inventory management-inventory categories, EOQ, LT, ICC; Inventory levels; Material planning and sourcing of procurement; Methods of cost reduction.

Suggested Readings
1. Ballau, R.H., Business Logistics Management, Prentice Hall,Englewood Cliffs.
2. Bes, J., Chartering Practices.
3. Bes, J., Dictionary of Shipping and chartering Practices.
4. Christopher, M., Logistics and Supply Chain Management, Prentice Hall.
5. ICAO Journal, New York., various issues.
6. Indian Shipping and Transport, Mumbai, Various issues.
7. John J Coyle, C. John and Langley,Brian J Gibs, Logistics approach to Supply Chain Management, Cengage Learning.
8. Burt, Dobler and Starling, World Class Supply Management, Tata McGraw Hill.
9. Bowersor, Donald J and David J Closs, Logistics management and Integrated Supply Chain Management, Tata McGraw Hill

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	L			

CO2		M	L	L
CO3			M	M
CO4		M		
CO5	M		H	

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	CMBP105T	Business & Professional Communications	3
2	S E Course 2	CMTI106T	Trading and Investment in Share Market	3
3	S E Course 3	CMED208T	Entrepreneurship Development	3

CMBP105T: BUSINESS AND PROFESSIONAL COMMUNICATIONS
(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objectives
This course enables the students towards developing communication skill in the professional platform. It will improvise one's managerial, leadership and motivational skill in the different professions and business.

Course/Learning Outcomes
CO 1: Know about different terms and concept of business communication (Remembering).
CO 2: Understanding about the modes and method of communication in business and profession. (Understanding)
CO 3: Application of Various guidelines related with business communication. (Applying)
CO 4: Analyse the implication of communication process in sustainable development towards the society. (Analysing)

Module I: Introduction to Business Communication (10 Hours)
Importance of communication in business, Different types of business communication, the media and tools of communication in different business houses and professions, Communication Process. Barriers and different Gateway to Communication

Module II: Verbal and Non- Verbal Communication (10 hours)
Meaning, features, importance and types of verbal and Non- verbal Communication, Group discussion, meetings, Seminar, Conference; Body language, Gestures, Facial expression, tone, appearance; Art of facing interview, selection Process, Appraisal System, Disciplinary Committees, Exit Interview.

Module III: Professional Written Communication Skill (15 Hours)
Formats of writing business letter and Memos, Notice and Disciplinary Action, preparing professional Resume and Job Application, joining letter, promotional letter, Resignation letter, Meeting and Minutes writing, Tender preparation, Effective Business Report writing, Digital Communication, Power point Presentation, Content writing, knowledge sharing via web /internet

Module IV: Sustainable communication (10 Hours)
Meaning, importance of sustainable communication; foundation of sustainable communication: clear ambition, sustainable claims, compelling message, transparent communication, accessible information; sustainable communication strategy in business.

Suggested Readings
1. Pal, Rajendra, Korlahalli, J.B Essentials of Business Communication, Sultan Chand & Sons
2. Dr Jain, V.K, Dr Biyani Omprakash Business Communication, S. Chand
3. David L. Lewis Communication in the Workplace
4. Sinha. K.K Business Communication, Taxman Publication

Mapping of Course Outcomes

Course Outcomes	MI	MII	MIII	MIV
CO1	H	M	L	M
CO2	H	H	M	H
CO3	M	L	H	M
CO4	L	L	M	M

CMTI106T: TRADING AND INVESTMENT IN SHARE MARKET

(3 Credits: 45 hours) (L-T-P: 2-0-1)

Objectives

- *To provide essential skills on equity trading & investments;*
- *To give hands on experience of investing & trading in equity market using virtual stock market platform.*
- *To increase financial literacy among the students for wealth creation.*

Course/Learning Outcomes

CO 1: Demonstrate a basic understanding of investments and the nature of investing;
CO 2: Exhibit the acquaintance of the securities market and its constituents;
CO 3: Apply knowledge gained to perform analysis of various securities;
CO 4: Analyse and apply models to securities performance and forecasting;
CO 5: Construct optimal portfolios and evaluate those using models.

Module I: Capital Market (10 hours)

Overview of the capital market in India - Primary Market: IPO, FPO, Private placement, Offer for sale; Role and importance of Primary market, Book building process. Secondary Market: Cash market and derivative market: Futures and Options.

Module II: Market participants: (10 hours)

Stock broker, Investor, Depositories, Clearing House- Concept, Roles of the participants and distinguishing features; Stock Exchanges in India, Stock Market Index.

Module III: Trading in Securities: (15 hours)

How shares are traded? Technical analysis for trading in stocks- when to entry and exit with stop loss, determining support & resistance, break out and break down; Trading stocks in virtual platform, Trading strategies- price, volume & momentum study; Common mistakes to be avoided while trading; Discipline required in trading; Types of orders- cash and carry & Mark to market orders and trading settlement; Trading in F&O segment & strategies.

Module IV: Investment in stock market: (10 hours)

Fundamental analysis for investment; Economy- GDP, Monetary Policy, Government Budget & Fiscal Policy, Understanding external shocks to market; Industry- Banking, FMCG, IT, Pharmaceuticals, Metal & Real Estate; Company analysis- Financial Statements from investors' perspectives, key parameters & ratios to make informed investment decisions.

Suggested Readings

1. Graham Benjamin, The Intelligent Investor, published by Harper Collins.
2. William J. O'Neil, How to Make Money in Stocks, McGraw-Hill Education.
3. John C. Hull, Options, Futures, and Other Derivatives, Pearson Education.
4. Research Analyst, NISM, XV Publication.

Mapping of Course Outcomess to syllabus:

Course Outcomes	MI	MII	MIII	MIV
CO1	H	M	L	M
CO2	H	H	M	H
CO3	M	L	H	M
CO4	L	L	M	M
CO5		M		H

CMED208T: ENTREPRENEURSHIP DEVELOPMENT

(3 Credits-45 Hours) (L-T-P: 3-0-0)

Objectives

- *Students will be able to understand the mindset and thinking of successful entrepreneurs, and apply that thinking to their own business ideas.*
- *Students will be able to identify and evaluate business opportunities based on market research, competition analysis, and industry trends.*
- *Students will be able to create a comprehensive business plan that includes market research, financial projections, and operational strategies.*
- *Students will be able to identify and overcome the challenges of starting and growing a business, including managing risk, dealing with competition, and adapting to changing market conditions.*

Course/Learning Outcomes

CO 1: Remembering key concepts related to entrepreneurship. (Remembering)
CO 2: Understand the mindset and thinking of successful entrepreneurs. (Understanding)
CO 3: Innovate and create value through their business ideas, products, or services, and develop a competitive advantage in the marketplace. (Applying)
CO 4: Evaluate business opportunities and create business plan based on market research, competition analysis, and industry trends. (Analysing)

Module I: Introduction to entrepreneurship (15 hours)

Entrepreneurship capabilities and skills, Ways to be enterprising in everyday life- thinking creatively, taking initiative, organizing activities, making reasoned evaluations, developing new skills and using them in different situations, problem solving, working as a part of team and using technology in learning, Legal compliance to set up an enterprise- industry and enterprise specific.

Module II: Setting up an enterprise (10 hours)

Enterprise Opportunities- local, national and global, Changes in taste and fashion, advances in technology, changes in Government policy, changes in the size and structure of population, changes in real income, Risk involved in entrepreneurship- identify risks, analyse the implications of each risk, plan how to manage the risk.

Module III: Business Idea (10 hours)

Sources of business ideas and tests of feasibility, Significance of writing the business plan/project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation, planning & control; preparation of project report, financial forecasting – Cash flow forecast, break even and income statement, sources of finance for setting up an enterprise.

Module IV: Markets and customers (10 hours)

Market research- Identifying the target market, positioning; creating brand and brand loyalty to increase sales, market share and profit, marketing communication to reach intended consumers.

Mapping of Course Outcomes

Course Outcome	Module I	Module II	Module III	Module IV
CO1	M	M	L	L
CO2	H	H	M	M
CO3	H	H	H	H
CO4	M	H	H	H

Suggested Readings

1. Entrepreneurship: Theory, Process, and Practice by Donald F. Kuratko - Cengage Learning.
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries - Crown Business.
3. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers by Alexander Osterwalder and Yves Pigneur - John Wiley & Sons.
4. Disciplined Entrepreneurship: 24 Steps to a Successful Startup by Bill Aulet - John Wiley & Sons.
5. The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company by Steve Blank and Bob Dorf - K & S Ranch.

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	CMIN107I	Internship	4
4	Internship	CMIN208I	Internship	4
5	Internship	CMIN315I	Internship	2

CMIN107I/ CMIN108I: Internship (Exit of 1st Year or 2nd Year)
(4 Credit: 120 hours)

CMIN316I: Internship (At the end of 4th Semester and evaluated in 5th Semester)
(2 Credits: 60 hours)

OBJECTIVES

The students are required to undergo an internship in work related to Commerce and Management during the semester break after the end of 3rd/4th Semester till they reach 6th semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation. After the internship the students have to present their experiences in the form of reports and seminar presentations at a specified date towards the end of the sixth semester. Students will be evaluated on the basis of the report, seminar presentation and viva-voce examination.

COURSE/ LEARNING OUTCOMES

At the end of the internship students will be able to:
CO2: Familiarise themselves with the working in the corporate sector. (Understanding)
CO3: Application of theoretical acquired knowledge to practical scenarios within the internship setting. (Applying)
CO3: Execute tasks related to the internship role under the supervision. (Applying)
CO4: Examine data and information relevant to assigned internship projects. (Analysing)
CO5: Develop strategies to improve processes or procedures based on internship experience. (Creating)
CO6: Assess personal performance and progress throughout the internship period.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

1. The internship should be for a minimum duration of 80 hours which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.
2. The students have to undergo the internship during the Summer Break at the end of 3rd/ 4th Semester Examination or Winter Break at the end of 5th Semester Examination. Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student.
3. The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management.
4. After the completion of the internship, the students must submit the Internship Report which should include of the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department.
5. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

1. The Internship Report must comprise of the following:
    a. Recommendation Letter from the Department.
    b. Completion Certificate from the Organisation where the student has worked as intern.
    c. Internship Diary as per the prescribed format.
    d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.

e. The Contents of the Report must include:
f. Introduction.
g. Objectives of the Internship.
h. About the Organisation (Sector, Activities, Operations).
i. Description of the work.
j. Learning Outcomes.

2. The Assessment for the internship must have the following components:
   a. Internship Report: 20 marks
   b. Internship Diary: 20 marks
   c. Seminar Presentation: 30 marks
   d. Viva-Voce Examination: 30 marks

CMIN309P: INTERNSHIP (During 6th Semester)

(4 Credit: 120 hours) (L-T-P: 0-0-4)

INTRODUCTION

The field of Commerce and Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the 4 YEAR (B.Com.) programme, the students are made acquainted with the various facets of Accounting, Management and Finance, marketing and entrepreneurship. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

OBJECTIVES

The students are required to undergo an internship in work related to Commerce and Management during the semester break after the end of 3rd/4th Semester till they reach 6th semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation. After the internship the students have to present their experiences in the form of reports and seminar presentations at a specified date towards the end of the sixth semester. Students will be evaluated on the basis of the report, seminar presentation and viva-voce examination.

Course/ Learning Outcomes

At the end of the internship students will be able to:

CO 1: Familiarise themselves with the working in the corporate sector. (Observation)
CO 2: Identify the situations and real life problems in business management and operations. (Knowledge)
CO 3: Work on projects under a supervisor and deal with situations. (Application)
CO 4: Develop and understand group cohesion. (Co-ordination)
CO 5: Know about the pattern of working and environment in business organisations. (Awareness)
CO 6: Improve communication skills, presentation and other soft skills. (Personality Development)

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

The internship should be for a minimum duration of 100-120 hours which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively. The students have to undergo the internship during the Summer Break at the end of 2nd/ 4th/5th Semester Examination or Winter. Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student.

The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management. After the completion of the internship, the students must submit the Internship Report which should include of the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 2nd Semester (If anyone leave after first year) or at the end of 4th semester (If anyone leave after second year of the programme or even those who will complete the programme till 4th year based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise of the following:

Recommendation Letter from the Department.
Completion Certificate from the Organisation where the student has worked as intern.

Internship Diary as per the prescribed format.
Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.

The Contents of the Report must include:
Introduction
Objectives of the Internship
About the Organisation (Sector, Activities, Operations)
Description of the work

The Assessment for the internship must have the following components:

Internship Report:	20 marks
Internship Diary:	20 marks
Seminar Presentation:	30 marks
Viva-Voce Examination:	30 marks

RESEARCH PROJECT/ DISSERTATION

BCOM (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	CMDI411P	Project Phase I	6
8	Research Project/Dissertation	CMDI412P	Project Phase II	6
BCOM (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	CMDI410P	Dissertation I	18
8	Research Project/Dissertation	CMDI411P	Dissertation II	20

BCOM (Honours)

CMPP411P: PROJECT PHASE I
(6 Credits: 180 hours) (L-T-P: 0-0-6)

Objective
The objective of the course would be to educate the students about the various dimensions of a research-based project work. The students will also be taught about the application of statistical tools through SPSS etc.

The Dissertation will comprise of the following:
1. Synopsis: Submission of a write up on a specific area/topic of study
2. Review of Literature: Submission of a specified number of reviews to respective guide
3. Research Methodology: Lecture based on the topic of study
4. Referencing Style: Lecture on referencing style to be followed while submitting report
5. Training on application of Statistical software used in research
6. Submission of Progress Report

Report should comprise of Introduction, Review of Literature, Research Methodology and References.

EVALUATION:
A diary is to be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester.
Evaluation will be done by the respective guide based on timely submission of part-work and quality of work as follows:
Synopsis (30 marks)
Review of Literature (30 marks)
Research Methodology (30 marks)
Publication in Referred Journal: (10 marks)

Course/ Learning Outcomes
CO 1: Define the different types of research project. (Remembering)
CO 2: Explain the various steps of designing research project (Understanding)
CO 3: Building questionnaire and schedules (Applying)
CO 4: Examining the data for analysis (Analyzing)

CO 5: Appraising the findings in the report (Evaluating)
CO 6: Designing a research project report (Creating)

Mapping of COs to course

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				H
CO2		M			
CO3			H	M	
CO4				H	
CO5		M		H	
CO6					H

CMPP412P: PROJECT PHASE II
(6 Credits: 180 hours) (L-T-P: 0-0-6)

Objective
The objective of the course would be to develop analytical skills among the students for solving any research queries. The students will also be taught about the preparation of a project report.

Course/ Learning Outcomes
CO 1: Define the different types of research project. (Remembering)
CO 2: Explain the various steps of designing research project (Understanding)
CO 3: Building questionnaire and schedules (Applying)
CO 4: Analyzing the data for analysis (Analyzing)
CO 5: Appraising the findings in the report (Evaluating)
CO 6: Designing a research project report (Creating)

BCOM (Honours) with Research

CMDI410P: Dissertation I
(18 Credits -540 Hours) (L-T-P: 0-0-18)

CMDI411P: Dissertation II
(20 Credits -600 Hours) (L-T-P: 0-0-20)

DISSERTATION GUIDELINES

Chapter I: INTRODUCTION
a. Broad introduction to thesis topic and method. Page or two. Write after remainder of proposal is completed.
b. Research problem. State broadly, in question form. Give sub-questions. Explain carefully. In one sense, usually the problem is to expand the body of knowledge examined in the literature review.
c. Need for the research. Who will benefit? Discuss applied and scientific contributions.
d. Nominal definitions. Define central terms.
e. Context. Add further info to clarify the research problem.

Chapter II: THEORY: LITERATURE REVIEW
Organize by idea; avoid stringing together abstracts of articles
a. Overview. Theoretical foundations.
b. Literature. Group articles by ideas. For a given idea, first discuss common strands in the literature, then departures.
c. Model. Of a process, usually. Based on the lit reviewed.
d. Hypotheses (in broad sense of the term; also called Propositions). For each, give brief restatement of justification tied to earlier sections; explain derivation and implications. Include assumptions. Explicitly state plausible rival hypotheses (explanations of process) of a substantive nature
e. Scope of the study. Theoretical assumptions; discuss limitations they impose.

Chapter III: METHODS
Outline in a few pages.
a. Introduction. General description of method and design
b. Design. Experiment, quasi-experiment, survey, and so forth.detailed description

c. Sample. Universe, population, element, sample design, tolerance, probability.
d. Measurement. Operational definitions, Include, as applicable, detailed discussion of indexes/ scales. Specify methods used to assess validity and reliability.
e. Analysis. Techniques to be used; justification. Nature of relationships expected (e.g., a symmetrical, symmetrical, reciprocal; linear, monotonic, other curvilinear; necessary, sufficient, necessary and sufficient). Include dummy tables and worked examples of statistics.
f. Validity. Design: Internal and external, with relevant subtypes.
g. Methodological assumptions. Discuss limitations they impose.

APPENDICES:
a. Schedule. In Gantt Chart form.
b. Facilities. Faculty and staff expertise, library and computer resources, other special facilities contributing to a successful study
c. Budget.
d. Bibliographic essay. Sources searched (indexes, abstracts, bibliographies, etc.). Strengths and weaknesses of literature.

Chapter IV: FINDINGS
a. Brief overview.
b. Results of application of method; any unusual situations encountered. Nature of sample.
c. Descriptive analysis. One-way frequency distributions on central variables.
d. Validity/reliability analysis.
e. Tests of hypotheses. ANOVAs, cross tabulations, correlations, and such, depending on techniques used; give in same order as hypotheses.

Chapter V: DISCUSSION
When discussing implications, deal with both the theoretical and the practical. Present only interpretations of the findings, not opinion.
a. Brief overview.
b. Discussion of results of application of method. Implications.
c. Discussion of descriptive analysis. Implications.
d. Discussion of tests of hypothesis. Implications.
e. Post-hoc analysis. Implications.

Chapter VI: CONCLUSION
May include writer's opinion
a. Summary of entire thesis in a few pages.
b. Conclusions. Refer to lit review.
c. Implications. Speculate about broadest possible consequences, both theoretical and practical. Label speculation clearly.
d. Limitations. Theory, method
e. Suggestions for future research.

APPENDICES, Bibliographic essay, Questionnaire and coding manual, if any. Raw data.
BIBLIOGRAPHY, Include all relevant sources examined, whether cited or not.

Mapping of COs to course

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			H	M	
CO4				H	
CO5				H	
CO6					H

DEPARTMENT OF CHEMISTRY

PROGRAMME: BACHELOR OF SCIENCE in CHEMISTRY (BSC)

DEGREE: BSC CHEMISTRY (HONOURS)/ BSC CHEMISTRY (HONOURS) WITH RESEARCH

PROGRAM OUTCOMES – UG PROGRAMME

PO 1: **Disciplinary Knowledge**: Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study.

PO 2: **Critical Thinking**: Take informed actions after identifying the assumptions that frame ourthinking and actions, checking out the degree to which these assumptions are accurate andvalid, and looking at our ideas and decisions (intellectual, organizational, and personal) fromdifferent perspectives.Critically evaluate practices, policies and theories by following scientific approach to knowledge development .

PO 3: **Communication Skills**: Ability to express thoughts and ideas effectively in writing and orally; communicate with others using appropriate media; confidently share one's views and express herself/ himself; demonstrate the ability to listen carefully; and present complex information in a clear and concise manner to different groups .

PO 4: **Social Interaction**: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 5: **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate incivic life through volunteering.

PO 6: **Moral and Ethical Awareness**: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 7: **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

PO 8: **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life- long learning in the broadest context socio- technological changes. Critical sensibility to lived experiences, with self awareness and reflexivity of both and society.

PO 9: **Information and Digital Literacy:** Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 10: **Research related skills:** A sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause- and- effect relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Ability to apply one's learning to real life situations.

PROGRAM SPECIFIC OUTCOMES (BSC CHEMISTRY)

PSO 1: **Scientific Problem-solving skill** Sound knowledge of fundamentals which can develop the problem-solving skills using chemical principles.

PSO 2: **Analytical skills**: Develop analytical skills such as synthesizing, separating, characterizing chemical compounds and chemical reaction with the help of sophisticated instruments.

PSO 3: **Skills related to employability**: Develop deep knowledge in some applied areas of chemistry such as pesticides chemistry, pharmaceutical chemistry etc. which helps in employability.

PSO 4: **Learning on life processes:** Develop basic understanding the role of chemistry in natural products as well as biological system.

SYLLABUS (BSC CHEMISTRY)

MAJOR COURSES			
Sl. No	**Course Code**	**Course Name**	**Sl. No.**
1	CHFC100T	Fundamentals of Chemistry I (3-0-0)	1.1
2	CHFC101L	Fundamentals of Chemistry I Lab (0-0-1)	1.2
3	CHFC102T	Fundamentals of Chemistry II (3-0-0)	2.1
4	CHFC103L	Fundamentals of Chemistry II Lab (0-0-1)	2.2
5	CHOF200T	Organic Chemistry I: Oxygen containing functional group (3-0-0)	3.1
6	CHOF201L	Organic Chemistry I: Oxygen containing functional group Lab (0-0-1)	3.2
7	CHTH202T	Physical Chemistry I: Thermodynamics (3-0-0)	3.3

8	CHTH203L	Physical Chemistry I: Thermodynamics Lab(0-0-1)	3.4
9	CHHC204T	Organic Chemistry II: Heterocyclic chemistry (3-0-0)	4.1
10	CHHC205L	Organic Chemistry II: Heterocyclic chemistry Lab (0-0-1)	4.2
11	CHPC206T	Physical Chemistry II: Phase equilibria and chemical kinetics (3-0-0)	4.3
12	CHPC207L	Physical Chemistry II: Phase equilibria and chemical kinetics Lab (0-0-1)	4.4
13	CHSP208T	Inorganic Chemistry I: s and p block elements (3-0-0)	4.5
14	CHSP209L	Inorganic Chemistry I: s and p block elements Lab (0-0-1)	4.6
15	CHBI300T	Organic Chemistry III: Biomolecules (3-0-0)	5.1
16	CHBI301L	Organic Chemistry III: Biomolecules Lab (0-0-1)	5.2
17	CHCO303T	Inorganic Chemistry II: Coordination Chemistry (3-0-0)	5.3
18	CHCO304L	Inorganic Chemistry II: Coordination Chemistry Lab (0-0-1)	5.4
19	CHSQ305T	Physical Chemistry III: Spectroscopy and quantum Chemistry (3-0-0)	5.5
20	CHSQ306L	Physical Chemistry III: Spectroscopy and quantum Chemistry (0-0-1)	5.6
21	CHOS307T	Organic Chemistry IV: Organic Spectroscopy (3-0-0)	6.1
22	CHOS308L	Organic Chemistry IV: Organic Spectroscopy Lab (0-0-1)	6.2
23	CHBO309T	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (3-0-0)	6.3
24	CHBO310L	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (0-0-1)	6.4
25	CHEL311T	Physical Chemistry IV: Electrochemistry (3-0-0)	6.5
26	CHEL312L	Physical Chemistry IV: Electrochemistry Lab (0-0-1)	6.6
27	CHMP313P	Minor Project	6.7
28	CHAI400T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	7.1
29	CHAI401L	Inorganic Chemistry IV: Advanced Inorganic Chemistry Lab (0-0-1)	7.2
30	CHQC402T	Quantum Chemistry and Group theory (5-0-0)	7.3
31	CHAI400T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	8.1
32	CHAI401L	Inorganic Chemistry IV: Advanced Inorganic Chemistry Lab (0-0-1)	8.2
33	CHQC402T	Quantum Chemistry and Group theory (5-0-0)	8.3
MINOR COURSES			
34	CHAS104T	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (3-0-1)	1.3
35	CHAS105L	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab (0-0-1)	1.4
36	CHGC106T	Green Chemistry (3-0-1)	1.5
37	CHGC107L	Green Chemistry Lab (0-0-1)	1.6
38	CHSP108T	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (3-0-0)	2.3
39	CHSP109L	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (0-0-1)	2.4
40	CHIM110T	Inorganic materials and Industrial Importance (3-0-0)	2.5
41	CHIM111L	Inorganic materials and Industrial Importance (0-0-1)	2.6
42	CHFG210T	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I (3-0-0)	3.5
43	CHFG211L	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I Lab (0-0-1)	3.6
44	CHPC212T	Polymer Chemistry (3-0-0)	3.7
45	CHPC213L	Polymer Chemistry Lab (0-0-1)	3.8
46	CHSP214T	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (3-0-1)	4.7
47	CHSP215L	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (0-0-1)	4.8
48	CHRO216T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	4.9
49	CHDQ314T	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (3-0-0)	5.7
50	CHDQ315L	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (0-0-1)	5.8
51	CHAC316T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	5.9
52	CHBC317T	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (3-0-0)	6.8
53	CHBC318L	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (0-0-1)	6.9
54	CHAP319T	Physical Chemistry V: Advanced Physical Chemistry (4-0-0)	6.10
55	CHAM406T	Analytical Methods in Chemistry (3-0-0)	7.4
56	CHRM407T	Research Methodology	7.5
57	CHML408T	Molecules of Life (3-0-0)	8.4
SKILL ENHANCEMENT COURSES			

58	CHBC112L	Basic Analytical Chemistry (1-0-2)	1.7
59	CHCH113L	Chemoinformatics (1-0-2)	2.7
60	CHIP217L	Intellectual Property Rights (3-0-0)	3.9

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
1.1	H	H	H					H	M		H	L		
1.2	H	H	H	M				M	M	L	H	M		
1.3	M	M								L		M		M
1.4	H	H	H	M				L	M		H	L		
1.5	H	H	H	M	L	L	M	M	M	M	H		M	
1.6	H	H	H	H	L	L	M	M	M	M	H	M	H	
1.7	H	H	H	H	M		M	M	M	M	H	H	H	
2.1	H	H	H	M				M	M	L	H	M		
2.2	H	H	H	M				M	M	L	H	M		
2.3	M	M					M			H	M	M	H	
2.4	H	H	H	M				L	M		H	L		
2.5	H	H	H		L			M	M	M	H		M	
2.6	H	H	H	M	L			M	M	M	H	M	H	
2.7	H	H	H	H	M			M	H	M	H	M	H	
3.1	H	H	H					H	M		H			
3.2	H	H	H	M				M	M	L	H	M		
3.3	H	H	H					H	M		H	L		
3.4	H	H	H	M				M	M	L	H	M		
3.5	H	H	H					L	M		H			
3.6	M		H	M		H		L			M	M		
3.7	H	H	H		L			M	M	L	H		M	
3.8	H	H	H	M	L			M	M	M	H	M	H	
3.9	H	H	H	H	M			M	M	M	H		H	
4.1	H	H	H					H	M		H			M
4.2	H	H	H	M				M	M	L	H	M		M
4.3	H	H	H	M				H	M	M	H			M
4.4	H	H	H	M			L	M	M	L	H	M	M	M
4.5	H	H	H					H	M		H			
4.6	H	H	H	M				M	M	L	H	M		
4.7	H	H	H	M				L	M		H	M		
4.8	M		H	M		H		L			M	M	L	
4.9	H	H	H	M				H	M	M	H		M	
5.1	H	H	H					H	M		H			H
5.2	H	H	H	M				M	M	L	H	M		H
5.3	H	H	H					H	M		H			
5.4	H	H	H	M				M	M	L	H	M		
5.5	H	H	H					H	H		H			
5.6	H	H	H	M				M	H	L	H	H		
5.7	H	H	M	L						L		M		M
5.8	M	M	H	M				L	M		H	L	M	
5.9	H	H	H	M		H		H			H		L	
6.1	H	H	H					H	M	M	H			
6.2	H	H	H	M				M	M	L	H	H		
6.3	H	H	H					H	M		H			
6.4	H	H	H	M				M	M	L	H	M		
6.5	H	H	H					H	M		H	L		
6.6	H	H	H	M			L	M	M	L	H	M		
6.7		M	H			M		H	H	H	H	M	M	M
6.8	H	H	M	L						L	H	M	L	
6.9	M	M	H	M				L	M	L	H	L	M	
6.10	H	H	H	M		H		H			H		L	

7.1	H	H	H	M		H		H			H		L	
7.2	H	H	H	M			L	M	M	L	H			
7.3	H	H	H			M		H	H	M	H			
7.4	H	H	H		L			M	M	M	H		M	
7.5	H	H	H	M	L			M	H	H	H	L		
8.1	H	H	H	M		H		H			H		L	
8.2	H	H	H	M			L	M	M	L	H			
8.3	H	H	H	M		H		H			H		L	
8.4	H	H	H					H	H	M	H		M	H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	CHFC100T	Fundamentals of Chemistry I (3-0-0)	4
		CHFC101L	Fundamentals of Chemistry I Lab (0-0-1)	
2	Major Course 2	CHFC102T	Fundamentals of Chemistry II (3-0-0)	4
		CHFC103L	Fundamentals of Chemistry II Lab (0-0-1)	
3	Major Course 3	CHOF200T	Organic Chemistry I: Oxygen containing functional group (3-0-0)	4
		CHOF201L	Organic Chemistry I: Oxygen containing functional group Lab (0-0-1)	
3	Major Course 4	CHTH202T	Physical Chemistry I: Thermodynamics (3-0-0)	4
		CHTH203L	Physical Chemistry I: Thermodynamics Lab(0-0-1)	
4	Major Course 5	CHHC204T	Organic Chemistry II: Heterocyclic chemistry (4-0-0)	5
		CHHC205L	Organic Chemistry II: Heterocyclic chemistry Lab (0-0-1)	
4	Major Course 6	CHPC206T	Physical Chemistry II: Phase equilibria and chemical kinetics (4-0-0)	5
		CHPC207L	Physical Chemistry II: Phase equilibria and chemical kinetics Lab (0-0-1)	
4	Major Course 7	CHSP208T	Inorganic Chemistry I: s and p block elements (3-0-0)	4
		CHSP209L	Inorganic Chemistry I: s and p block elements Lab (0-0-1)	
5	Major Course 8	CHBI300T	Organic Chemistry III: Biomolecules (4-0-0)	5
		CHBI301L	Organic Chemistry III: Biomolecules Lab (0-0-1)	
5	Major Course 9	CHCO303T	Inorganic Chemistry II: Coordination Chemistry (4-0-1)	5
		CHCO304L	Inorganic Chemistry II: Coordination Chemistry Lab (0-0-1)	
5	Major Course 10	CHSQ305T	Physical Chemistry III: Spectroscopy and quantum Chemistry (3-0-0)	4
		CHSQ306L	Physical Chemistry III: Spectroscopy and quantum Chemistry (0-0-1)	
6	Major Course 11	CHOS307T	Organic Chemistry IV: Organic Spectroscopy (3-0-0)	4
		CHOS308L	Organic Chemistry IV: Organic Spectroscopy Lab (0-0-1)	
6	Major Course 12	CHBO309T	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (3-0-0)	4
		CHBO310L	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (0-0-1)	
6	Major Course 13	CHEL311T	Physical Chemistry IV: Electrochemistry (3-0-0)	4
		CHEL312L	Physical Chemistry IV: Electrochemistry Lab (0-0-1)	
6	Major Course 14	CHMP313P	Minor Project	4
7	Major Course 15	CHAI400T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	5
		CHAI401L	Inorganic Chemistry IV: Advanced Inorganic Chemistry Lab (0-0-1)	
7	Major Course 16	CHQC402T	Quantum Chemistry and Group theory (5-0-0)	5
8	Major Course 17	CHAP403T	Physical Chemistry V: Advanced Physical Chemistry (5-0-0)	5
8	Major Course 18	CHRO404T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	5
		CHRO405L	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies Lab (0-0-1)	

CHFC100T: FUNDAMENTALS OF CHEMISTRY I
(3 Credits-45 hours) (L-T-P: 3-0-0)

Objective
This course will discuss about the basic concepts of inorganic, organic and physical chemistry

Course/ Learning Outcomes
At the end of this course students will be able to:
CO 1: Recall the basic concepts of organic chemistry like electronic displacements, nomenclature, hybridization etc. and chemical kinetics (Remembering)
CO 2: Predict the structure and properties of molecules and also the kinetics of the reactions. (Applying)
CO 3: Evaluate the optical activity, absolute and relative configuration using the concept of stereochemistry (Evaluating)

Module I: Inorganic Chemistry (15 lectures)

a) Atomic Structure (8 lectures)

Review of: Bohr's theory and its limitations, Heisenberg uncertainty principle. Dual behaviour of matter and radiation, de-Broglie's relation. Hydrogen atom spectra. Need of a new approach to atomic structure.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms).

Rules for filling electrons in various orbitals, electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

b) Chemical Bonding and Molecular Structure (7 lectures)

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy (no derivation), Born-Haber cycle and its applications, Fajan's rules, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR (H_2O, NH_3, PCl_5, SF_6, ClF_3, SF_4) and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral complexes.

Concept of resonance and resonating structures in various inorganic and organic compounds. MO treatment of homonuclear diatomic molecules of 1st and 2nd periods and heteronuclear diatomic molecules such as CO, NO and NO^+.

Module II: Organic Chemistry (15 lectures)

a) Basics of Organic Chemistry (6 lectures)

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.

Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophilicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes.

Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

b) Stereochemistry (9 lectures)

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis-trans and, syn-anti isomerism E/Z notations with C.I.P rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centers, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

Module III: Physical Chemistry (15 lectures)

Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Suggested Readings

1. A new Concise Inorganic Chemistry, J. D. Lee, E L. B. S.
2. Basic Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley.
3. Concepts and Models in Inorganic Chemistry, McDaniel Douglas and J. Alexander, Wiley.
4. Inorganic Chemistry: Principles of Structure and Reactivity, J. Huheey, E. Keiter and R. Keiter, Pearson Publication.Organic Chemistry, T.W. G. Solomon, John Wiley and Sons.
5. A Guide Book to Mechanisms in Organic Chemistry, P. Sykes, Orient Longman.
6. Stereochemistry of Carbon Compounds, E. L. Eliel, Tata McGraw Hill.
7. Organic Chemistry (Vol I and II), I. L.. Finar, E. L. B. S.
8. Organic Chemistry, R. T. Morrison, R. N. Boyd, Prentice Hall.

9. Shriver & Atkins' Inorganic Chemistry, P. Atkins, T. Overton, J. Rourke, F. Armstrong and M. Weller, Oxford University Press.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3		H	

CHFC101L: FUNDAMENTALS OF CHEMISTRY LAB

(1 Credits- 30 hours) (L-T-P: 0-0-1)

Objective

This course will help the students to learn about the basic laboratory experiments of Inorganic, Organic and Physical chemistry together.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concept of molarity, normality, molality etc. (Remembering)
CO 2: Illustrate the concept of solubility for purification of organic compounds via recrystallization (Understanding)
CO 3: Identify unknown organic molecule by determining the melting point of the compounds. (Creating)
CO 4: Evaluate the activation energy of a given reaction. (Evaluating)

Module I: Organic Experiments

a. Checking the calibration of the thermometer.
b. Purification of organic compounds by crystallization using the following solvents:
    1. Water
    2. Alcohol
    3. Alcohol-Water
c. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus).
d. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.
e. Determination of boiling point of liquid compounds (boiling point lower than and more than 100 °C by distillation and capillary method).
f. Estimation of oxalic acid by titrating it with KMnO4.
g. Estimation of Cu (II) ions iodometrically using Na2S2O3.
h. Detection of elements in organic compounds.

Module II: Inorganic Experiments

a. Estimation of oxalic acid by titrating it with KMnO4.
b. Estimation of Cu (II) ions iodometrically using Na2S2O3.

Module III: Physical Experiments

Chemical Kinetics: Study the kinetics of the following reactions.

a. Initial rate method: Iodide-persulphate reaction.
b. Integrated rate method:
    - Acid hydrolysis of methyl acetate with hydrochloric acid.
    - Saponification of ethyl acetate.
    - Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate.

Suggested Readings

1. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.
2. Practical Organic Chemistry B. S. Furniss, A.J. Hannaford, P.W.G. Smith, and A. R. Tatchell, , Pearson.
3. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall
4. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall
5. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1		H	
CO 2	H		

CO3	H		
CO4			H

CHFC102T: FUNDAMENTALS OF CHEMISTRY II
(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective
This course will discuss about the fundamental concepts of inorganic, organic and physical chemistry.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain the periodicity of elements and thermodynamics of chemical reactions. (Understanding)
CO 2: Calculate the change in free energy accompanying a chemical reaction. (Applying)
CO 3: Explain the mechanism of different organic reactions. (Analysing)

Module I: Physical Chemistry (15 lectures)
a) Thermodynamics and Chemical Equilibrium (6 lectures)
Review of thermodynamics and the Laws of Thermodynamics.
Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between *G* and G^o, Le Chatelier's principle. Relationships between *Kp, Kc* and *Kx* for reactions involving ideal gases.
b) Ionic Equilibria (9 lectures)
Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Module II: Organic Chemistry (15 lectures)
a) Chemistry of Aliphatic Hydrocarbons (10 lectures)
- **Carbon-Carbon sigma bonds:** Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.
- **Carbon-Carbon pi bonds:** Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.
  Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/AntiMarkownikoff addition), mechanism of oxymercuration-demercuration, hydroboration oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation(oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethylbenzene.
  Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.
- **Cycloalkanes and Conformational Analysis:** Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

b) Aromatic Hydrocarbons (5 lectures)
Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

Module III: Inorganic Chemistry (15 lectures)
a) Atomic Structure (6 lectures)
Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de-Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance.
Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals.
Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.
b) Periodicity of Elements (6 lectures)
s, *p*, *d*, *f* block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to *s* &*p*-block.
i. Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
ii. Atomic radii (van der Waals).

iii. Ionic and crystal radii.
iv. Covalent radii (octahedral and tetrahedral).
v. Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

c) Oxidation-Reduction (3 lectures)

Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.

Suggested Readings

1. Organic Chemistry, T. W. G. Solomons, John Wiley and Sons.
2. A Guide Book to Mechanism in Organic Chemistry, P. Sykes, Orient Longman.
3. Organic Chemistry (Vol. I & II), I. L.. Finar, E. L. B. S.
4. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice Hall.
5. Physical Chemistry, G. M. Barrow, Tata McGraw Hill.
6. Physical Chemistry, G. W. Castellan, Narosa.
7. General Chemistry Cengage Lening India Pvt. Ltd. J. C. Kotz, P. M. Treichel, and J. R. Townsend, New Delhi.
8. University Chemistry, B. H. Mahan, Narosa.
9. General Chemistry, R. H. Petrucci, Macmillan Publishing Co.: New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		H
CO 2	M		
CO 3		H	

CHFC103L: FUNDAMENTALS OF CHEMISTRY II LAB

(1Credits – 30 hours) (L-T-P: 0-0-1)

Objective

This course will help the students to learn about the laboratory experiments of Inorganic, Organic and Physical chemistry together.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the chromatographic technique for separation and purification of mixture of organic compounds. (Understanding)
CO 2: Apply the concept of acid-base titration for estimation. (Applying)
CO 3: Apply principles of experiments related to pH meter and thermochemistry (Applying)

Module I: Organic Experiments

1. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography.
2. Separation of a mixture of two sugars by ascending paper chromatography.
3. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC).
4. Estimation of Sodium carbonate and Sodium hydroxide present together in mixture.
5. Estimation of Fe(II) and oxalic acid using standardized $KMnO_4$ solution.

Module II: Inorganic Experiments

1. Estimation of Sodium carbonate and Sodium hydroxide present together in mixture.
2. Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution.

Module III: Physical Experiments

1. Preparation of buffer solutions of different pH
   - Sodium acetate-acetic acid.
   - Ammonium chloride-ammonium hydroxide.
2. pH metric titration of
   - strong acid vs. strong base.
   - weak acid vs. strong base.
   - Determination of dissociation constant of a weak acid.
3. Thermochemistry
   - Determination of heat capacity of calorimeter for different volumes.
   - Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

Suggested Readings

1. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.
2. Practical Organic Chemistry B. S. Furniss, A.J. Hannaford, P.W.G. Smith, and A. R. Tatchell, , Pearson.
3. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall
4. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall
5. Experiments in Physical Chemistry, C. W. Garland, J. W. Nibler and D. P. Shoemaker, McGraw-Hill, New York.
6. Experimental Physical Chemistry A. M. Halpern and G. C. McBane, W.H. Freeman & Co. New York.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1	H		
CO 2		H	
CO3			H

CHOF200T: ORGANIC CHEMISTRY-I: OXYGEN CONTAINING FUNCTIONAL GROUPS

(3 Credits – 45 hours) (L-T-P:3-0-0)

Objective

This course is aimed at familiarizing students with the concepts of different functional groups.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall concepts of chemical reactivity of different organic compounds. (Remembering)
CO 2: Explain the chemistry of halogenated hydrocarbons. (Understanding)
CO 3: Solve problems of transformation of functional groups using different reactions conditions. (Applying)
CO 4: Differentiate alcohols, phenol, ethers, epoxides. (Analysing)

Module I: Chemistry of Halogenated Hydrocarbons (10 lectures)

Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination.
Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; S_NAr, Benzyne mechanism.
Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.
Organometallic compounds of Mg (Grignard reagent) – Use in synthesis of organic compounds.

Module II: Alcohols, Phenols, Ethers and Epoxides (10 lectures)

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt-Blanc Reduction; Oxidation of diols by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement.
Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism.
Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$.

Module III: Carbonyl Compounds and Carboxylic acids (25 lectures)

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α - substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, $LiAlH_4$, $NaBH_4$, Meerwein-Pondorf-Verley (MPV), PDC.
Addition reactions of α, β- unsaturated carbonyl compounds: Michael addition.
Active methylene compounds: Keto-enol tautomerism, preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.
General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituents on acidic strength, typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.
Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of at acyl group, mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann- bromamide degradation and Curtius rearrangement.

Suggested Readings

1. Organic Chemistry, R. T. Morrison and R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Organic Chemistry (Volume 1), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

3. Organic Chemistry, T. W. G. Solomons and C. B. Fryhle, John Wiley & Sons, Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2		H	
CO 3	H	H	H
CO 4		H	

CHOF201L: ORGANIC CHEMISTRY-I: OXYGEN CONTAINING FUNCTIONAL GROUPS LAB

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective

This course helps the students to understand clearly about the synthesis of some organic compounds and detection of functional group.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall principles and procedures involved in functional group detection of organic compounds and preparations. (Remembering)
CO 2: Explain the chemistry behind the detection of functional groups. (Understanding)
CO 3: Carry out reactions to transform functional groups. (Applying)
CO 4: Assess optimal conditions for organic reactions. (Evaluating)

Module I:

a. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.
b. Organic preparations:

Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and phenols (β -naphthol, vanillin, salicylic acid) by any one method:

i. Using conventional method.
ii. Using green approach.
iii. Benzolyation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and one of the following phenols (β -naphthol, resorcinol, p- cresol) by Schotten-Baumann reaction.
iv. Oxidation of ethanol/ isopropanol (Iodoform reaction).
v. Selective reduction of meta dinitrobenzene to m-nitroaniline.
vi. Hydrolysis of amides and esters.
vii. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
viii. S-Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).
ix. Aldol condensation using either conventional or green method.
x. The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization and melting point.

Suggested Readings

1. Practical Organic Chemistry, F. G. Mann, and B. C. Saunders, Pearson Education.
2. Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A.R. Tatchell, Pearson.
3. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia and R. Aggarwal, University Press.
4. Comprehensive Practical Organic Chemistry: Qualitative Analysis, V. K. Ahluwalia and S. Dhingra, University Press.

Mapping of Cos to Syllabus

Course Outcomes	Exp a	Exp b
CO 1	H	H
CO 2	H	
CO 3	H	
CO 4		M

CHTH202T: PHYSICAL CHEMISTRY-I: CHEMICAL THERMODYNAMICS
(3 Credits – 45 hours) (L-T-P:3-0-0)

Objective
In this course, students learn how the laws of thermodynamics influence chemical and phase equilibria in ideal and non-ideal fluids (liquids and gases).

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain the laws of thermodynamics and the properties of thermodynamic functions (Understanding)
CO 2: Derive equations relating different thermodynamic functions (Applying)
CO 3: Apply thermodynamic laws and equations to explain phase and chemical equilibria in closed systems in the gas and liquid phases. (Application)
CO 4: Compare conditions in which the different thermodynamic relations can be applied (Evaluating)

Module 1: Chemical Thermodynamics (15 hours)
Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.
First law: Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.
Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature.
Second Law: Concept of entropy; thermodynamic scale of temperature, statement of these law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.
Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.
Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

Module II: Systems of Variable Composition (10 hours)
Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

Module III: Chemical Equilibrium (10 hours)
Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exoergic and endoergic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants K_p, K_c and K_x. Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.

Module 4: Solutions and Colligative Properties (10 hours)
a) Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions.
b) Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

Suggested Readings
1. Physical Chemistry, P. Atkins and J. Paula, Oxford University Press.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. Physical Chemistry, T. Engel and P. Reid, Prentice-Hall.
4. Molecular Thermodynamics, D. A. McQuarrie and J. D. Simon, Viva Books Pvt. Ltd., New Delhi.
5. Commonly Asked Questions in Thermodynamic, M. J. Assael, A. R. H. Goodwin, M. Stamatoudis, W. A. Wakeham and S. Will, CRC Press, NY.
6. Physical Chemistry, I.N. Levine, Tata Mc GrawHill.
7. 2000 solved problems in chemistry, C.R. Metz, Schaum Series.

Mapping of COs to Modules

	Module I	Module II	Module III	Module IV
CO1	H			
CO 2	H	M	M	
CO 3			H	
CO 4		H	H	M

CHTH203L: PHYSICAL CHEMISTRY-I: CHEMICAL THERMODYNAMICS LAB

(1Credits- 30 hours) (L-T-P: 0-0-1)

Objective

In this course, students learn some practical aspects of thermodynamics viz. calorimetry, which deals with measurements of heats of reaction in the liquid phase using an adiabatic isobaric calorimeter.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall principles and methods of thermochemistry. (Remembering)
CO 2: Explain methods and principles to carry out calorimetric measurements. (Understanding)
CO 3: Measure heats of reactions following appropriate procedures. (Applying)
CO 4: Calculate the heats of reactions in each experiment. (Analysing)
CO 5: Design experiments to measure enthalpy changes in solution. (Creating)

Module I: Thermochemistry

a. Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).
b. Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
c. Calculation of the enthalpy of ionization of ethanoic acid.
d. Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
e. Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step.
f. Determination of enthalpy of hydration of copper sulphate.
g. Study of the solubility of benzoic acid in water and determination of Δ*H*.
Any other experiment carried out in the class.

Suggested Readings

1. B. D. Khosla, V. C. Garg and A. Gulati, Senior Practical Physical Chemistry, R. Chand & Co., New Delhi.
2. Experimental Physical Chemistry, V. D. Athawale and P. Mathur, New Age International, New Delhi.

Mapping of COs to Modules

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g
CO 1	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H
CO 5	M	M	M	M	M	M	M

CHHC204T: ORGANIC CHEMISTRY II: HETEROCYCLIC CHEMISTRY

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective

This course is designed to make the students familiar with reaction mechanisms, natural product chemistry and heterocyclic chemistry.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the preparation and reactions of amines, nitrile, isonitrile and nitro compounds etc. (Remembering)
CO 2: Preparation and properties of polynuclear aromatic compounds. (Understanding)

CO 3: Synthetic route for the preparation of heterocycles and applications in the present research. (Applying)
CO 4: Structural elucidation of polynuclear aromatic compounds, alkaloids and terpens etc. (Analysing)

Module I: Nitrogen Containing Functional Groups (20 lectures)
Preparation and important reactions of nitro compounds, nitriles and isonitriles.
Amines: Preparation and properties: Effect of substituent and solvent on basicity; Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid.
Diazonium Salts: Preparation and their synthetic applications.

Module II: Polynuclear Hydrocarbons (6 lectures)
Aromaticity of polynuclear hydrocarbons, structure elucidation of naphthalene; Preparation and properties of naphthalene, phenanthrene and anthracene.

Module III: Heterocyclic Compounds (24 lectures)
Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole(Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction)

Module IV: Alkaloids and Terpenes (10 lectures)
Natural occurrence, General structural features, Isolation and their physiological action, Hoffmann's exhaustive methylation, Emde's modification; Structure elucidation and synthesis of Nicotine, medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral.

Suggested Readings

1. Organic Chemistry, R. T. Morrison and R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Organic Chemistry (Volume 1), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Introduction to the Chemistry of Heterocyclic compounds, R. M. Acheson, John Wiley & Sons.
5. Organic Chemistry, T. W. G. Solomons, John Wiley & Sons, Inc.
6. Textbook of Organic Chemistry, P. S. Kalsi, New Age International (P) Ltd. Pub.
7. Organic Chemistry, J. Clayden, , N. Greeves, , S. Warren and P .Wothers, Oxford University Press.
8. Natural Product Chemistry, J. Singh, S.M. Ali. and J. Singh, Pragati Parakashan.

Mapping of COs to Syllabus

Course Outcome	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4		H		H

CHHC205L: ORGANIC CHEMISTRY II: HETEROCYCLIC CHEMISTRY LAB

(1 Credits- 30 hours) (L-T-P: 0-0-1)

Objective
This course is designed to make the students familiar with the concepts of qualitative organic analysis.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Gain knowledge about Qualitative analysis of organic compounds. (Remembering)
CO 2: Explain the chemistry of various tests used in the detection of functional groups and elements present in an organic sample. (Understanding)
CO 3: Qualitative analysis for the identification of organic compounds from mixtures. (Applying)
CO 4: Analyze the melting point of the compound and its derivative for the determination of its exact structure. (Analysing)

Module I:
a. Functional group test for nitro, amine and amide groups.
b. Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, carbonyl compounds and esters).

Suggested Readings

1. Practical Organic Chemistry, F. G. Mann, and B. C. Saunders, Pearson Education.
2. Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A.R. Tatchell, Pearson.
3. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia and R. Aggarwal, University Press.
4. Comprehensive Practical Organic Chemistry: Qualitative Analysis, V. K. Ahluwalia and S. Dhingra, University Press.

Mapping of COs to Module

Course Outcomes	Exp a	Exp b
CO 1		H
CO 2	H	
CO 3		H
CO 4		H

CHPC206T: PHYSICAL CHEMISTRY II: PHASE EQUILIBRIA AND CHEMICAL KINETICS

(3 Credits-45 hours) (L-T-P: 3-0-0)

Objective

This course is designed to make the students familiar with theories of Chemical kinetics and phase equilibria.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall basic concepts of chemical kinetics and adsorption (Remembering)
CO 2: Explain concepts such as the Gibbs phase rule for non-reactive and reactive systems. (Understanding)
CO 3: Apply the concepts of phase equilibria to systems with varying components. (Applying)
CO 4: Analyze the kinetics of different types of chemical reactions. (Analysing)

Module I: Phase Equilibria (30 lectures)

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications.

Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions, Three component systems, water-chloroform-acetic acid system, triangular plots.

Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and nonideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation. Nernst distribution law: its derivation and applications.

Module II: Chemical Kinetics (20 lectures)

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii)consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions.

Temperature dependence of reaction rates; Arrhenius equation; activation energy, collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.

Module III: Catalysis (6 lectures)

Types of catalyst, Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Module IV: Surface chemistry (4 lectures)

Physisorption, chemisorption, adsorption isotherms.

Suggested Readings

1. Physical Chemistry, A. Peter and J. de Paula, Oxford University Press.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. Molecular Thermodynamics, D. A. McQuarrie and J. D. Simon, Viva Books Pvt. Ltd. New Delhi.
4. Physical Chemistry, T. Engel and P. Reid, Prentice-Hall.
5. Commonly Asked Questions in Thermodynamics, M. J. Assael, A. R. H. Goodwin, M. Stamatoudis, W. A. Wakeham and S. Will, CRC Press, NY.
6. Chemistry concepts and applications, S.S. Zundhal, Cengage India.
7. Physical Chemistry, D. W. Ball, Cengage India.
8. Physical Chemistry, R. G. Mortimer, Elsevier: NOIDA, UP.
9. Physical Chemistry, I. N. Levine, Tata McGraw-Hill .

10. Physical Chemistry, C. R. Metz, Tata McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1		H		H
CO 2	H			
CO 3	H			
CO 4		H	M	

CHPC207L: PHYSICAL CHEMISTRY-II: PHASE EQUILIBRIA AND CHEMICAL KINETICS LAB

(1 Credits- 30 hours) (L-T-P: 0-0-1)

Objective

This course is designed to make the students to understand the practical application of chemical kinetics and phase equillibria.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Measure the distribution coefficient of liquids, CST and equivalence points through potentiometric titrations. (Applying)
CO 2: Find out how CST of the phenol-water system is affected by impurities. (Analysing)
CO 3: Find the Kinetics of different types of chemical reaction (Analysing)
CO 4: Explain the different isotherms using adsorption techniques. (Understanding)

Module I:

a. Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.
b. Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method:
    1. simple eutectic and
    2. congruently melting systems.
c. Distribution of acetic/ benzoic acid between water and cyclohexane.
d. Study the equilibrium of at least one of the following reactions by the distribution method:
    1. $I_2(aq) + I^- \rightarrow I_3^-(aq)$
    2. $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$.
e. Study the kinetics of the following reactions.
    1. Initial rate method: Iodide-persulphate reaction.
    2. Acid hydrolysis of methyl acetate with hydrochloric acid
    3. Compare the strengths of HCl and H2SO4 by studying kinetics of hydrolysis of methylacetate.
f. Adsorption
    1. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

Suggested Readings

1. Senior Practical Physical Chemistry, B. D. Khosla, V. C. Garg and A. Gulati, R. Chand & Co. New Delhi.
2. Experiments in Physical Chemistry, C. W. Garland, J. W. Nibler and D. P. Shoemaker, McGraw-Hill, New York.
3. Experimental Physical Chemistry, A. M. Halpern and G. C. McBane, W. H. Freeman & Co. New York.

Mapping of COs to Module

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f
CO 1	H					H
CO 2	H		H	H		
CO 3	M				H	
CO 4		M				

CHSP208T: INORGANIC CHEMISTRY I: METALLURGY, S - AND P-BLOCK ELEMENTS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

This course helps the students to understand clearly about the principle of metallurgy and the properties of s and p block elements.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the concepts of general principles of metallurgy, the chemistry of s and p block elements (Remembering)

CO 2: Explain the structure, bonding, properties and uses of some important inorganic compounds. (Understanding)
CO 3: Apply the concepts to solve simple problems on periodic properties of s-block elements. (Applying)
CO 4: Analyze the periodic properties p block elements. (Analysing)

Module I: General Principles of Metallurgy (10 lectures)
Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent, Electrolytic reduction, hydrometallurgy with reference to cyanide process for silver and gold, Methods of purification of metals: electrolytic process, van Arkel-de Boer process and Mond's process, Zone refining.

Module II: Chemistry of s Block Elements (15 lectures)
a. General characteristics: melting point, flame colour, reducing nature, diagonal relationships and analogous behaviour of first member of each group.
b. Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogen and water.
c. Common features such as ease of formation, thermal stability and solubility of the following alkali and alkaline earth metal compounds: hydrides, oxides, peroxides, super oxides, carbonates, nitrates, sulphates.

Module III: Chemistry of p-block elements (5 lectures)
Electronic configuration, atomic and ionic size, metallic/non-metallic character, melting point, ionization enthalpy, electron gain enthalpy, electronegativity, allotropy of C, P, S; inert pair effect; diagonal relationship between B and Si and anomalous behaviour of first member of each group.

Module IV: Structure, bonding and properties: acidic/basic nature, stability, ionic/covalent nature, oxidation/reduction, hydrolysis, action of heat on the following compounds (10 lectures)
a. Hydrides: hydrides of Group 13 (only diborane), Group14, Group 15 (EH_3 where E=N, P, As, Sb, Bi), Group 16 and Group 17.
b. Oxides: oxides of phosphorus, sulphur and chlorine.
c. Oxoacids: oxoacids of phosphorus and chlorine; peroxoacids of sulphur.
d. Halides: halides of silicon and phosphorus.

Module V: Preparation, properties, structure and uses of the following compounds (5 lectures)
a. Borazine.
b. Silicates, silicones.
c. Interhalogen and pseudohalogen compounds.

Suggested Readings
1. Concise Inorganic Chemistry, J. D. Lee, Pearson Education.
2. Concepts & Models of Inorganic Chemistry, B. E. Douglas, D. H. Mc Daniel and J. J. Alexander, John Wiley Sons, N.Y.
3. Chemistry of the Elements, N. N. Greenwood and A. Earnshaw, Butterworth- Heinemann.
4. Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, Wiley, VCH.
5. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Pearson.
6. Inorganic Chemistry, D. F. Shriver, P.W. Atkins and C. H. Langford, Oxford University Press.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		
CO 2		L		H	H
CO 3		H			
CO 4			H		

CHSP209L: INORGANIC CHEMISTRY-II: S- AND P-BLOCK ELEMENTS LAB
(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective
This course helps the students to understand clearly about the synthesis of some inorganic compounds and Iodo/Iodimetric and Complexometric titrations.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Recall the idea of different types of estimations of inorganic compounds. (Remembering)
CO 2: Explain the principles of different types of Iodimetric titrations. (Understanding)
CO 3: Utilize the methods of preparation of some inorganic complexes. (Applying)
CO 4: Analyse the principle of complexometric titrations for the estimation of inorganic compounds. (Analysing)

Module I:

a. **Iodo / Iodimetric Titrations**
   1. Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (iodometrically).
   2. Estimation of antimony in tartar-emetic iodimetrically.

b. **Complexometric titrations using disodium salt of EDTA**
   1. Estimation of Mg^{2+}, $Zn^{2+.}$
   2. Estimation of Ca^{2+} by substitution method.

c. **Inorganic Preparations**
   1. Cuprous chloride, Cu_2Cl_2.
   2. Manganese (III) phosphate, $MnPO_4.H_2O$.
   3. Aluminium potassium sulphate $KAl(SO_4)_2.12H_2O$ (potash alum) or chrome alum.

Suggested Readings

1. A textbook of quantitative inorganic analysis, A. I. Vogel, ELBS.
2. Practical Inorganic Chemistry, G. Marr and B.W. Rockett, Van Nostrand Reinhold.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c
CO 1	M	M	
CO 2	H		
CO 3			H
CO 4		H	

CHBI300T: ORGANIC CHEMISTRY III: BIOMOLECULES

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective

This course aims at helping the students to become acquainted with the basic concepts of biomolecules, energy in biosystem and pharmaceutical compounds

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concept of energy in the biosystem. (Understanding)
CO 2: Suggest the scheme for the synthesis of a peptide. (Applying)
CO 3: Explain the roles of lipids, proteins, enzymes and nucleic acids in a living system. (Analysing)
CO 4: Suggest mechanisms for creating a particular sequence of the protein or nucleic acid. (Creating)

Module I: Nucleic Acids (8 lectures)

Components of nucleic acids, Nucleosides and nucleotides; Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Structure of polynucleotides (DNA and RNA).

Module II: Amino Acids, Peptides and Proteins (20 lectures)

a) Amino acids, Peptides and their classification. α-Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pKa values, isoelectric point and electrophoresis.
b) Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups, Solid-phase synthesis; primary, secondary and tertiary structures of proteins, Denaturation.

Module III: Enzymes (5 lectures)

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes. Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors, specificity of enzyme action (including stereo specificity), enzyme inhibitors and their importance.

Module IV: Lipids (6 lectures)

Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity.

Module V: Concept of Energy in Bio systems (15 lectures)

Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism).

ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD+, FAD.
Conversion of food to energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle.
Caloric value of food, standard caloric content of food types.

Module VI: Pharmaceutical Compounds: Structure and Importance (6 lectures)
Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarial: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

Suggested Readings
1. Biochemistry, J. M. Berg, J. L. Tymoczko and L. Stryer, W.H. Freeman and Co.
2. Principles of Biochemistry, D. L., Nelson, M. M. Cox and A. L. Lehninger, W.H. Freeman and Co.
3. Harper's Illustrated Biochemistry, R. K. Murray, D. K. Granner, P. A. Mayes, V. W. Rodwell, Lange Medical Books/ McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1					H	
CO 2		H				
CO 3	H	H	H	H		
CO 4	H	H				H

CHBI301L: ORGANIC CHEMISTRY III: BIOMOLECULES LAB

(1 Credit -30 hours) (L-T-P: 0-0-1)

Objective
This course aims at helping the students to become acquainted with the estimation of some amino acid, protein etc.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Recall principles of estimation of some amino acids and proteins. (Remembering)
CO 2: Understand the principles involved in estimations of amino acids, proteins. (Understanding)
CO 3: Apply the principles they learn to carry out the aforementioned estimations. (Applying)
CO 4: Analyse the experimental data of these experiments. (Analysing)

Module I:
a. Estimation of glycine by Sorenson's formalin method.
b. Study of the titration curve of glycine.
c. Estimation of proteins by Lowry's method.
d. Study of the action of salivary amylase on starch at optimum conditions.
e. Effect of temperature on the action of salivary amylase.

Suggested Readings
1. Quantitative Organic Analysis, I. V. Arthur, Pearson.
2. Analytical Techniques in Biochemistry and Molecular Biology, R. Katoch, Springer.

Mapping of COs to Module

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H	H	H	H
CO 2	H	H	H		
CO 3	H	H	H		
CO 4	M	M	M	M	M

CHCO303T: INORGANIC CHEMISTRY II: COORDINATION CHEMISTRY

(4 Credits-60 hours) (L-T-P: 4-0-0)

Objective
This course helps the students to understand clearly about the transition elements, coordination complexes and inorganic reaction mechanism.

Course / Learning Outcomes

At the end of this course students will be able to:
CO 1: Recollect the properties of transition elements and coordination compounds. (Remembering)
CO 2: Infer the properties of transition elements. (Understanding)
CO 3: Correlating various Theories of coordination compounds with properties. (Applying)
CO 4: Explain the reaction mechanisms involved in different complexes of transition elements (Analysing)

Module I: Coordination Chemistry (24 lectures)
Theory of coordination complexes, valence bond theory (inner and outer orbital complexes), Crystal field theory, measurement of 10 Dq (Δo), CFSE in weak and strong fields, Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry, Jahn-Teller theorem, square planar geometry, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds, Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect.

Module II: Transition Elements (15 lectures)
Study of electronic configuration, colour, variable valency, magnetic and catalytic properties, Stability of various oxidation states and e.m.f (Latimer diagrams), difference between the first, second and third transition series.
Chemistry of Cr, Mn, and Fe in various oxidation states with special reference to the following compounds: peroxo compounds of chromium, potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide.

Module III: Lanthanoids and Actinoids (6 lectures)
Electronic configuration (anomalies), common oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method).

Module IV: Inorganic Reaction Mechanism (15 lectures)
Concept of inorganic reaction mechanisms, Labile and inert complexes, substitution reactions in square planar complexes, trans-effect and theories, thermodynamic and kinetic stability.

Suggested Readings
1. Inorganic Chemistry, J. E. Huheey, Keiter and O.K. Medhi, Prentice Hall.
2. Inorganic Chemistry, K. F. Purcell and J. C. Kotz, W.B. Saunders Co.
3. Inorganic Chemistry (adapted), G. L. Miessler and D. A. Tarr, Pearson.
4. Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, Wiley-VCH.
5. Chemistry of the Elements, N. N. Greenwood and A. Earnshaw, Butterworth- Heinemann.

Mapping of the COs to the Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		H	
CO 2	H			
CO 3		H		
CO 4				H

CHCO304L: INORGANIC CHEMISTRY II: COORDINATION CHEMISTRY LAB
(1 Credit – 30 hours) (L-T-P: 0-0-1)

Objective
This course helps the students to understand clearly about the synthesis of some inorganic compounds, gravimetric preparation and some spectroscopic methods to understands the properties of some inorganic complexes.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Recall principles and methods for gravimetric analysis of inorganic compounds. (Remembering)
CO 2: Explain the principle of gravimetric estimation of some transition metal complexes. (Understanding)
CO 3: Apply the principles and methods to know the properties of complexes. (Applying)
CO 4: Adopt suitable methods to prepare inorganic compounds. (Creating)

Module I:
a. **Gravimetric Analysis:**
   1. Estimation of nickel (II) using Dimethylglyoxime (DMG).
   2. Estimation of copper as CuSCN.
   3. Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$.
   4. Estimation of Al(III) by precipitating with oxine and weighing as $Al(oxine)_3$ (aluminium oxinate).
b. **Inorganic Preparations:**
   1. Tetraamminecopper (II) sulphate, $[Cu(NH_3)_4]\ SO_4.H_2O$.

2. Acetylacetonate complexes of Cu^{2+}/Fe^{3+}.
3. Tetraamminecarbonatocobalt (III) nitrate.
4. Potassium tri(oxalato)ferrate(III).

c. **Properties of Complexes**
1. Measurement of 10 Dq by spectrophotometric method.
2. Verification of spectrochemical series.
3. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetone, DMG, glycine) by substitution method.

Suggested Readings
1. A text book of Quantitative Analysis, A.I. Vogel, , ELBS.
2. Practical Inorganic Chemistry, G. Marr and B.W. Rockett, Van Nostrand Reinhold.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c
CO 1	M	M	
CO 2	H		
CO 3			H
CO 4		H	

CHSQ305T: PHYSICAL CHEMISTRY III: QUANTUM CHEMISTRY AND SPECTROSCOPY

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

This course aims to introduce students to the introductory principles of quantum chemistry and molecular spectroscopy

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the postulates of quantum mechanics and spectroscopy. (Understanding)

CO 2: Apply the postulates to a few model systems and to the Hydrogen atom (Applying)

CO 3: Apply principles of spectroscopy to obtain structural information of small molecules (Applying)

CO 4: Compare spectroscopic techniques, theories of chemical bonding. (Evaluating)

Module 1: Quantum Chemistry (25 hours)

a. Postulates of quantum mechanics, quantum mechanical operators and commutation rules, Schrödinger equation and its application to free particle and —particle-in-a-box (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wave functions, probability distribution functions, nodal properties, Extension to two- and three-dimensional boxes, separation of variables, degeneracy.
Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wave functions. Vibrational energy of diatomic molecules and zero-point energy.
Angular momentum, Rigid rotator model of rotation of diatomic molecule. Schrödinger equation in Cartesian and spherical polar (Derivation not required). Separation of variables. Spherical harmonics. Discussion of solution (Qualitative).
Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus. Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

b. Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+.Bonding and antibonding orbitals. Qualitative extension to H_2. Comparison of LCAO-MO and VB treatments of H_2 (only wave functions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH).

Module 2: Molecular Spectroscopy (20 hours)

Interaction of electromagnetic radiation with molecules and various types of spectra; Born Oppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies.

Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.
Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.
Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and pre dissociation, calculation of electronic transitions of polyenes using free electron model.
Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low-resolution spectra, different scales (δ and σ), spin-spin coupling and high-resolution spectra, interpretation of PMR spectra of organic molecules.
Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

Suggested Readings

1. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. Mc Cash, Tata McGraw-Hill: New Delhi.
2. Introductory Quantum Chemistry, A. K.Chandra, Tata McGraw-Hill.
3. Fundamentals of Quantum Chemistry, J. E. House, Elsevier: USA.
4. Quantum Chemistry, J. P. Lowe and K. Peterson, Academic Press.
5. Atomic & Molecular Spectroscopy, R. Kakkar, Cambridge University Press.

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	H
CO 2	H	
CO 3		H
CO4		H

CHSQ306L: PHYSICAL CHEMISTRY III: QUANTUM CHEMISTRY AND SPECTROSCOPY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

Objective

In this course, students get to learn to use the phenomenon of light absorption by some molecules to determine chemical properties associated with them and the reactions in which they participate.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Remember the laws to apply when carrying out UV-visible absorbance measurements. (Remembering)
CO 2: Explain how the laws can be used to determine concentrations or molar extinction coefficients of molecules. (Understanding)
CO 3: Carry out measurements of molecular absorption in the lab. (Applying)
CO 4: Analyze vibrational spectra of diatomic molecules (Analyzing)
CO 5: Suggest alternative ways of carrying out experiments or analysis of data. (Creating)

Module I:

UV/Visible spectroscopy

a. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1}, kJ mol^{-1}, cm^{-1}, eV).
b. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.
c. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

Colorimetry

a. Verify Lambert-Beer's law and determine the concentration of CuSO4/KMnO4/K2Cr2O7 in a solution of unknown concentration.
b. Determine the concentrations of KMnO4 and K2Cr2O7 in a mixture.
c. Study the kinetics of iodination of propanone in acidic medium.
d. Determine the amount of iron present in a sample using 1, 10-phenathroline.
e. Determine the dissociation constant of an indicator (phenolphthalein).
f. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

Vibrational Spectroscopy

Analysis of the given vibration-rotation spectrum of HCl(g).

Suggested Readings

1. Senior Practical Physical Chemistry, B. D. Khosla, V. C. Garg and A. Gulati, R. Chand & Co.: New Delhi.

2. Experiments in Physical Chemistry, C. W. Garland, J. W. Nibler and D. P. Shoemaker, McGraw-Hill: New York.
3. Experimental Physical Chemistry, A. M. Halpern and G. C. Mc Bane, W.H. Freeman & Co.: New York.

Mapping of COs to Syllabus

Course Outcomes	**UV/Visible spectroscopy**	**Colorimetry**	**Vibrational Spectroscopy**
CO 1	H	H	
CO 2	H	H	
CO 3	H	H	
CO 4			H
CO 5	M	M	

CHOS307T: ORGANIC CHEMISTRY IV: ORGANIC SPECTROSCOPY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to make the students familiar with different spectroscopic techniques, carbohydrates, dyes, polymer

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the principles of UV, IR and NMR spectroscopy. (Remembering)
CO 2: Explain absolute configuration of carbohydrates; mutarotation. (Understanding)
CO 3: Apply different mechanisms to the polymerization reactions. (Applying)
CO 4: Analyse the application of different types of dyes. (Analysing)

Module I: Organic Spectroscopy (17 lectures)

General principles Introduction to absorption and emission spectroscopy.

UV Spectroscopy: Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λmax for the following systems: α, β-unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds.

Applications of IR, UV and NMR for identification of simple organic molecules.

Module II: Carbohydrates (12 lectures)

Occurrence, classification and their biological importance.

Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation.

Disaccharides – Structure elucidation of maltose, lactose and sucrose.

Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

Module III: Dyes (6 lecture)

Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing; Synthesis and applications of: Azo dyes – Methyl orange; Triphenyl methane dyes -Malachite green and Rosaniline; Phthalein Dyes – Phenolphthalein; Natural dyes –structure elucidation and synthesis of Alizarin and Indigotin; Edible Dyes with examples.

Module IV: Polymers (10 lectures)

Introduction and classification including di-block, tri-block and amphiphilic polymers; Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermo softening (PVC, polythene); Fabrics – natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and

synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives; Introduction to; Biodegradable and conducting polymers with examples.

Suggested Readings

1. Textbook of Organic Chemistry, P. S. Kalsi, New Age International (P) Ltd. Pub.
2. Organic Chemistry, R. T. Morrison, R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. F. W. Billmeyer, Textbook of Polymer Science, John Wiley & Sons, Inc.
4. Polymer Science, V. R. Gowariker, N. V. Viswanathan and J. Sreedhar, New Age International (P) Ltd. Pub.
5. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Organic Chemistry, T.W. Graham Solomons, John Wiley & Sons, Inc.
7. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, O. Wothers, Oxford University Press.
8. Natural Product Chemistry, J. Singh, S. M. Ali and J. Singh, Pragati Prakashan.
9. Organic Spectroscopy, W. Kemp, Palgrave.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3				H
CO 4			H	

CHOS308L: ORGANIC CHEMISTRY IV: ORGANIC SPECTROSCOPY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

Objective

This course is intended to explain the concept of qualitative organic analysis, extraction of compounds from natural products, synthesis of some polymers

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the principals involved in the extraction of organic compounds. (Remembering)
CO 2: Explain the procedure for the preparation of organic molecules. (Understanding)
CO 3: Analyse unknown organic compounds. (Analysing)

Module I

a. Extraction of caffeine from tea leaves.
b. Preparation of urea formaldehyde resin.
c. Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, e.g. salicylic acid, cinnamic acid, nitrophenols etc.

Suggested Readings

1. Quantitative Organic Analysis, Part 3, A. I. Vogel, , Pearson.
2. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.
3. Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell, Pearson.
4. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia, and R. Aggarwal, University Press.
5. Comprehensive Practical Organic Chemistry: Qualitative Analysis, V. K. Ahluwalia and S. Dhingra, , University Press.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c
CO 1	H		
CO 2		H	
CO 3			H

CHBO309T: Inorganic Chemistry III: BIOINORGANIC AND ORGANOMETALLIC CHEMISTRY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

This course will explain the biological systems containing metal ions, basic principles of Inorganic qualitative analysis, classification and preparation of organometallic compounds.

Course/ Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the role of metal ions in biological systems (Remembering)
CO 2: Explain the analysis and separation of ions from mixture. (Understanding)
CO 3: Make use of the properties of metal ions for effective target binding (Applying)
CO 4: Concept of electron contribution from metals and ligands in analysing reactivity and stability of organometallic compounds. (Analysing)

Module I: Bioinorganic Chemistry (10 lectures)

Metal ions present in biological systems, classification of elements according to their action in biological system,
Geochemical effect on the distribution of metals, Sodium / K-pump, carbonic anhydrase and carboxypeptidase, Excess and deficiency of some trace metals, Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cisplatin as an anti-cancer drug, Iron and its application in bio-systems, Haemoglobin, Myoglobin; Storage and transfer of iron.

Module II: Basic Principles of inorganic Qualitative Analysis (10 lectures)

Basic principles involved in analysis of cations and anions, solubility products, common ion effect, principles involved in separation of cations into groups and choice of group reagents, interfering anions (fluoride, borate, oxalate, phosphate) and removal.

Module III: Organometallic Compounds (20 lectures)

Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands.
Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series, structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT.π-acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.
Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.
Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds.
Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). structure and aromaticity, comparison of aromaticity and reactivity with that of benzene.

Module IV: Catalysis by Organometallic Compounds (5 lectures)

Study of the following catalytic mechanisms:

1. Alkene hydrogenation (Wilkinson's Catalyst).
2. Synthetic gasoline (Fischer Tropsch reaction).
3. Polymerisation of ethene,(Ziegler-Natta catalyst).

Suggested Readings

1. Vogel's Qualitative Inorganic Analysis, G. Svehla, Prentice Hall.
2. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus, Wiley India.
3. Principles of Bioinorganic Chemistry, S. J. Lippard and J.M. Berg, University Science Books.
4. Inorganic Chemistry, Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter, R. L. H. Keiter, Pearson.
5. Inorganic Chemistry, D. D. Shriver, P. Atkins, and C. H. Langford, Oxford University Press.
6. Inorganic Chemistry, K. F. Purcell, and J. C. Kotz, W.B. Saunders Co.
7. Principles of Organometallic Chemistry, P. Powell, Chapman and Hall.
8. Organometallic Chemistry of the Transition Metals, R. H. Crabtree, John Wiley New York, NY.

Mapping of COs to Syllabus

Course Outcome	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2		H		
CO 3		H	H	
CO 4			H	H

CHBO310L: INORGANIC CHEMISTRY III: BIOINORGANIC AND ORGANOMETALLIC CHEMISTRY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

Objective

This course helps the students to understand clearly about the qualitative analysis of some acidic and basic radicals and also about the principles involved in chromatographic separation.

Course Outcomes

At the end of this course students will be able to:

CO 1: Recall the principles of separating and identifying ions in a mixture. (Remembering)
CO 2: Interpret the chemistry of the reactions for separation and identification of ions. (Understanding)
CO 3: Apply the principles to carry out the separation of ions in a mixture in the laboratory. (Applying)
CO 4: Analyse the experimental results in the laboratory. (Analysing)
CO 5: Evaluate the process of chromatographic separations of metal ions. (Evaluating)

Qualitative analysis: Qualitative semi-micro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:
CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-}, NH_4^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}, Sb^{3+}, Fe^{3+}, Al^{3+},Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}.
Mixtures should preferably contain one interfering anion, **or** insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) **or** combination of anions e.g.$CO_3^{2-}$and SO_3^{2-}, NO_2^- and NO_3^-, Cl^-, and Br^-, Cl^- and I^-, Br^- and I^-, $NO_3^-$and Br^-, $NO_3^-$and I^-.
Spot tests should be done whenever possible.
Chromatography: Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:

1. Ni (II) and Co (II).
2. Cu(II) and Cd(II).

Suggested Readings

1. Vogel's Qualitative Inorganic Analysis, Revised by G. Svehla.
2. A Textbook of Quantitative Analysis, A. I. Vogel, ELBS.

Mapping of COs to Module

Course Outcomes	Qualitative analysis	Chromatography
CO 1	M	
CO 2	M	
CO 3	H	
CO 4		M
CO 5		H

CHEL311T: Physical Chemistry IV: Electrochemistry

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

This course helps the students to understand clearly about the theories of electrochemistry and electrochemical cells.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall fundamental concepts of electrochemistry. (Remembering)
CO 2: Explain principles associated with Faraday's laws of electrolysis. (Understanding)
CO 3: Application of theories of conductance measurements. (Applying)
CO 4: Distinguish between different types of electrochemical cells, electrodes. (Analysing)

Module I: Conductance (20 lectures)

Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules.
Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.

Module II: Electrochemistry (25 lectures)

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry.

Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining(i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and SbO/Sb2O3 electrodes.
Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers. Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

Suggested Readings

1. Physical Chemistry, P.W. Atkins and J. D. Paula, Oxford University Press.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. Physical Chemistry, R. G. Mortimer, Elsevier, NOIDA, UP.
4. Physical Chemistry, G. M. Barrow, Tata McGraw Hill, New Delhi.
5. Physical Chemistry, T. Engel and P. Reid Prentice-Hall.
6. Concise Physical Chemistry, D. W. Rogers, Wiley.
7. Physical Chemistry, R. J. Silbey, R. A. Alberty and M. G. Bawendi John Wiley & Sons, Inc.

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	L	H
CO 3	H	L
CO 4		H

CHEL312L: PHYSICAL CHEMISTRY IV: ELECTROCHEMISTRY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

Objective

This course helps the students to understand clearly about practical application of electrochemistry.

Course / Learning Outcomes:

At the end of this course students will be able to:

CO 1: Recall the basic concepts of conductometry and potentiometry. (Remembering)
CO 2: Explain the principles of conductometric and potentiometric titrations. (Understanding)
CO 3: Determine the cell constant, conductivity, equivalence points through conductometry. (Applying)
CO 4: Analysing and the data obtained from conductometric and potentiometric titrations. (Analysing)

Module I:

Conductometry

a. Determination of cell constant.
b. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
c. Perform the following conductometric titrations:
    1. Strong acid vs. strong base.
    2. Weak acid vs. strong base.
    3. Mixture of strong acid and weak acid vs. strong base.
    4. Strong acid vs. weak base.

Potentiometry:

a. Perform the following potentiometric titrations:
    1. Strong acid vs. strong base.
    2. Weak acid vs. strong base.
    3. Dibasic acid vs. strong base.
    4. Potassium dichromate vs. Mohr's salt.

Suggested Readings

1. Senior Practical Physical Chemistry, B. D. Khosla, V. C. Garg and A. Gulati, R. Chand & Co., New Delhi.
2. Experiments in Physical Chemistry, 8th ed, C. W. Garland, J. W. Nibler and D. P. Shoemaker, McGraw-Hill: New York.
3. Halpern, A. M. & Mc Bane, G. C. Experimental Physical Chemistry, W. H. Freeman and Co. New York.

Mapping of COs to Syllabus

Course Outcomes	Conductometry	Potentiometry
CO 1	H	H

CO 2	H	H
CO 3	H	
CO 4	H	H

CHAI400T: INORGANIC CHEMISTRY IV: ADVANCED INORGANIC CHEMISTRY

(4 Credits – 60 hours)

Objectives

This course helps the students to understand clearly about the inorganic reaction mechanisms including photochemical, chemistry of main group compounds and organometallic compounds. Special focus given to solid state chemistry.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Demonstrate the mechanism of Inorganic photochemical reactions (Understanding)

CO 2: Make use of the properties of metals/non-metals for synthesizing organometallic compounds and catalytic activity study (Applying)

CO 3: Analyse the structure, bonding and synthesis of some inorganic solids. (Analysing)

CO 4: understand structure, properties of different inorganic complexes and mechanism of inorganic reactions.

Module I: Descriptive Inorganic Chemistry (20 lectures)

a. Structure and bonding in polyhedral boranes and carboranes, styx notation, Wade's rules, electron count in polyhedral boranes, synthesis of polyhedral boranes, isolobal analogy, boron halides, phosphine-boranes, boron heterocycles, borazine.
b. Silanes, silicon halides, silicates, silicones, silanols, zeolites, germanium, tin and lead organyls, silenes, germenes, stannenes, phosphorous halides, phosphazenes, sulphur halides, structural features and reactivity of S-N heterocycles.
c. Synthesis and reactivity of organo-lithium, beryllium and magnesium compounds, calixarines, cryptands and crown ethers in complexation chemistry.
d. Preparation and reactivity of aluminium organyls, carbalumination, hydro alumination, chemistry of Ga (I) and In (I), reduction of Al, Ga and In organyls, Metal organic framework structures (MOFs).

Module II: Mechanism of Inorganic Reactions (10 lectures)

Substitution in octahedral and square planar complexes, lability, trans-effect, conjugate base mechanism, racemisation, electron transfer reactions - inertness and lability, inner sphere and outer sphere mechanism, Marcus theory, solid state reactions – topotactic and epitactic mechanisms.

Module III: Inorganic Photochemistry (5 lectures)

Photosubstitution and photoredox reactions of chromium, cobalt and ruthenium compounds, Ligand field and charge transfer state (Thexi and DOSENCO states), cis-trans isomerization, photocatalysis and solar energy conservation by ruthenium complexes.

Module IV: Organometallic Chemistry (15 lectures)

a. Valence electron count (16/18 electron rules), synthesis, structure, bonding and reactivity of mono and polynuclear metal carbonyls, substituted metal carbonyls, vibrational spectra of metal carbonyls, metal-metal bonding.
b. Types of M-C bonds, synthesis and reactivity of metal alkyls, carbenes, alkenes, alkynes, and arene complexes, metallocenes and bent metallocenes, isolobal analogy.
c. Reactions of organometallic complexes: Substitution, oxidative addition, reductive elimination, insertion and de insertion, catalysis, hydrogenation, hydroformylation, Monsanto process, Wacker process, alkene polymerization.

Module V: Introduction to Solid State Chemistry (10 lectures)

Structure of simple solids – metals, alloys and compounds; common structure types; synthesis of solid-state compounds - ceramic method, microwave synthesis, sol-gel, precursor method, hydrothermal synthesis, CVD and intercalation; characterization of solids, bonding in solids – free-electron and molecular orbital theory; bands in solid state compounds, properties of solids – optical, magnetic and electrical properties of solids.

Suggested Readings

1. Concepts and Models of Inorganic Chemistry, B. E. Douglas, D. H. McDaniel and J. J. Alexander, John Wiley
2. Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Wiley.
3. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter and R. L. Keiter, Pearson
4. Education.
5. Inorganic.Chemistry, G. L. Miessler and D. Tarr, Pearson Education.
6. 5 Inorganic Chemistry, G. Wulfsberg, University Science Books.
7. Mechanisms of Inorganic Reactions, F. Basalo and R. G. Pearson, John Wiley

8. Organometallic Chemistry of the Transition Metals, R. H. Crabtree, John Wiley.
9. Solid State Chemistry: An Introduction, L. Smart, E. Moore, Nelson Thorns Ltd.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1			H		
CO 2	M			H	
CO 3		H			H
CO 4	H			H	

CHAI401L: Inorganic chemistry IV: Advanced Inorganic Chemistry Lab

(1Credit -30 hours) (L-T-P: 0-0-1)

Objectives

*This course helps the students to understand clearly about the qualitative and quantitative analysis and spectroscopic characterization of coordination compounds after synthesis***.**

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the procedures followed to carry out the qualitative and quantitative analysis. (Remembering)
CO 2: Explain the reason behind each step for Analysing mixtures and preparing compounds and metal nanoparticles. (Understanding)
CO 3: Apply different spectroscopic methods to characterize coordination compounds. (Applying)

Module I:

a. Qualitative analysis (tertiary mixtures, alloys, ores).
b. Quantitative analysis (binary mixtures, alloys, ores).
c. Inorganic preparation (crystallization, precipitation, calcination).
d. Coordination compounds through ligand synthesis and spectroscopic characterization, magnetic properties.
e. Metal Nanoparticle synthesis and characterization.

Suggested readings

1. Vogel's Textbook of Quantitative Chemical Analysis,J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, and B. Sivasankar, Pearson.
2. Vogel's Qualitative Inorganic Analysis, G. Svehla and S. Mittal, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H			
CO 2	H	H	H	L	H
CO 3				H	

CHQC402T: QUANTUM CHEMISTRY AND GROUP THEORY

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective

In this course students learn quantum mechanics methods (including a few approximation methods) necessary to calculate the energy eigen values and wavefunctions of systems like the H atom and atoms more complex than the H atom as well as to classify molecules into groups based on their symmetry properties

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the postulates and principles of quantum chemistry and group theory. (Understanding)
CO 2: Apply the principles of quantum chemistry to simple model systems and to the Hydrogen atom (Applying)
CO 3: Apply the rules of group theory to assign molecules to different point groups and to set up character tables (Applying)
CO 4: Examine methods to calculate eigenvalues and eigenfunctions of model systems, the H atom and He atom as well as to assign molecules to different point groups.(Analyzing)
CO 5: Evaluate the uses of approximation methods in quantum chemistry and of representations of groups (Evaluating)

Module I: Quantum Chemistry I

Planck's theory, wave-particle duality, uncertainty principle, operators, eigen functions and eigen values in quantum mechanics, postulates of quantum mechanics, Schrodinger equation, free particle, particle in a box, degeneracy, harmonic oscillator, angular momentum, rigid rotator, the hydrogen atom

Module II: Quantum Chemistry II
Approximate methods in quantum mechanics - the variation theorem, linear variation principle and perturbation theory (first order and non-degenerate), application of variation method and perturbation theory to the Helium atom, electron spin, the spin statistics theorem(antisymmetry), the Pauli exclusion principle, Slater determinants, many electron atoms and spin-orbit coupling, term symbols and spectroscopic states

Module III: Chemical Applications of Group Theory
Symmetry elements and operations, equivalent symmetry elements and equivalent atoms, identification of symmetry point groups with examples, groups of very high symmetry, molecular dissymmetry and optical activity, systematic procedure for symmetry classification of molecules and illustrative examples, brief review of matrix representation of groups, reducible and irreducible representations, rules about irreducible representations as derived from great orthogonality theorem, relationship between reducible and irreducible groups, character tables.

Suggested readings
1. Quantum Chemistry, I. N. Levine, PHI Learning Pvt. Ltd.
2. Molecular quantum Mechanics, P. Atkins and R. Friedman, Oxford University Press.
3. Introduction to Quantum mechanics, D. J. Griffiths, Pearson Education Ltd.
4. Chemical Applications of Group Theory, F. A. Cotton, Willey India Pvt. Ltd.
5. Molecular Symmetry and Group Theory, R. L. Carter, John Wiley & Sons.
6. Molecular Symmetry and Group Theory, A. Vincent, Wiley.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	M	H	H
CO 5	M	H	H

CHAP403T: PHYSICAL CHEMISTRY V: ADVANCED PHYSICAL CHEMISTRY

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective
This course helps the students to understand clearly about the theories of chemical kinetics, molecular reaction dynamics and electrochemistry.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain the interactions of ionic species with solvent molecules. (Understanding)
CO 2: Apply the knowledge of chemical kinetics to some important types of reactions. (Applying)
CO 3: Analyse the application of electrochemistry in different fields. (Analysing)
CO 4: Calculate the rate of different types of chemical reactions. (Evaluating)

Module I: Chemical Kinetics (15 lectures)
Hard Sphere collision theory, theories of unimolecular reactions: Lindemann theory, drawbacks of Lindemann theory-Hinshelwood modification. Steady state approximation and its applications, oscillating reactions, chemical chaos, Belousov-Zhabotinski reaction, straight chain reactions - hydrogen-halogen reactions, alkane pyrolysis, Branching-chain reactions - the hydrogen-oxygen reaction, explosion limits, Enzyme catalyzed reactions, Michaelis-Menten mechanism- Lineweaver-Burk and Eadie plots, enzyme inhibiton.

Module II: Study of Fast Reactions (8 lectures)
Stopped flow technique, temperature and pressure jump methods, NMR studies in fast reactions, shock tube kinetics, relaxation kinetics, Linearized rate equation, relaxation time in single step fast reactions, determination of relaxation time.

Module III: Molecular Reaction Dynamics (15 lectures)
Collisions of real molecules- trajectory calculations, Laser techniques, reactions in molecular beam, estimation of activation energy and calculation of potential energy surface, the transition state theory (TST) of bimolecular gaseous reactions, statistical and thermodynamic formulations. Comparison between TST and hard sphere collision theory, kinetics of reactions in solution-

diffusion controlled and chemically controlled reactions, TST of reactions in solution- Bronsted and Bjerrum equation, effect of ionic strength, kinetic salt effect.

Module IV: Electrochemistry - I (10 lectures)

a) Ion-solvent interaction- the Born model, Thermodynamic parameters of ion solvent interactions- structural treatment, the ion-dipole model-its modifications, ion-quadrupole and ion-induced dipole interactions.
b) Primary solution- determination of hydration number, compressibility method and viscosity-mobility method, Debye-Huckel theory of ion-ion interactions, derivation, validity and limitations, extended Debye-Huckel-Onsager equation, random walk model of ionic Diffusion-Einstein Smoluchowski reaction.

Module V: Electrochemistry – II (12 lectures)

a) **Theories of Electrical Interface:** Electrocapillary phenomena - Lippmann equation, electron transfer at interfaces, polarizable, non-polarizable and non-polarisable interfaces, Butler-Volmer equation, Tafel plot.
b) **Systems for Electro-Chemical Energy Storage and Conversion**: Types of Batteries, Lead- acid batteries, Nickel-cadmium batteries and Li-ion batteries, electrical double layer capacitor, pseudo-capacitor, fuel cells.

Suggested readings

1. Physical Chemistry, P. Atkins and J. Paula, Oxford University Press, Oxford.
2. Physical chemistry, I. R. Levine, Mcgraw Hill Education.
3. Chemical Kinetics, K. J. Laidler, Pearson.
4. Modern Electrochemistry Part 1, 2A and 2B, J. O. Bockris and A. K. N. Reddy, Springer.
5. Electrochemical Methods Fundamentals and Applications, J. Bard and L. R. Faulkner, Willy India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 2				H	M
CO 3	H	H	H		
CO 4			H		H
CO 5	H	H	H		

CHAP403T: Physical Chemistry V: Advanced Physical Chemistry Lab

(1Credit – 30 hours) (L-T-P: 0-0-1)

Objective

This course helps the students to understand clearly about the application of different theories of physical Chemistry

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the theoretical concepts of experiments related to chemical kinetics and electrochemistry etc. (Remembering)
CO 2: Explain the principles and the procedures for spectrophotometry-based experiments. (Understanding)
CO 3: Apply the theoretical knowledge for determination of rate constant, pH, emf etc. (Applying)
CO 4: Analyse the practical utility of different theories of chemical kinetics, electrochemistry, adsorption etc. (Analysing)

Module I:

a. Chemical Kinetics based experiments.
b. Electrochemistry based experiments.
c. Spectrophotometry based experiments.
d. pH-metric Titrations.
e. Adsorption on porous materials - equilibrium, kinetic and thermodynamic studies.

Suggested readings

1. Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publishing House.

Mapping of COs to Modules

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H			
CO 2			H		
CO 3	H	H		H	
CO 4	M	M			M

CHRO404T: ORGANIC CHEMISTRY V: REAGENTS IN ORGANIC SYNTHESIS AND MECHANISTIC STUDIES

(4 Credits-60 hours) (L-T-P: 4-0-0)

Objective

This course is aimed at familiarizing students with the concepts of different reagents in organic synthesis and their mechanistic studies

Course / Learning Outcomes:

At the end of this course students will be able to:

CO 1: Apply the practical utility of metal and metal-free oxidising agents in organic synthesis. (Applying)
CO 2: Compare various kinds of reducing agents in chemo selective and stereo selective synthesis. (Analysing)
CO 3: Recall various concepts associated with the kinetics of organic reaction mechanisms. (Remembering)

Module I: Kinetics and Energetics of Reaction Mechanism (15 lectures)

Transition state theory of reaction rates - kinetics and thermodynamics of activation, reaction profiles for multistep reactions, Hammond postulate, Curtin-Hammett Principle, kinetic and thermodynamic control, Linear free energy relationships (LFER), Hammett equation - substituent and reaction constants, the Taft treatment of polar and steric effects in aliphatic compounds, kinetic isotope effects in organic reactions, effects of conformation on reactivity, stereoelectronic effects, neighbouring group participation, anomeric effect.

Module II: Oxidation Reactions (15 lectures)

Metal and non-metal based oxidations (Cr, Mn, Al, Ag, Os, Ru, Se, DMSO, hypervalent iodine), reagents (Fremy's salt, silver carbonate, peroxides/per-acids), Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation, Sharpless asymmetric dihydroxylation, Baeyer-Villiger oxidation, Wacker oxidation, hydroboration-oxidation, Prevost reaction and Woodward modification.

Module III: Reduction Reactions (15 lectures)

Catalytic hydrogenation (Pd/Pt/Rh/Ni), Wilkinson catalyst, Noyori asymmetric hydrogenation, metal based reductions using Li/Na/Ca in liquid ammonia, Sodium, Magnesium, Zinc, Titanium and Samarium (Birch, Pinacol formation, McMurry, Acyloin formation, dehalogenation and deoxygenations), Hydride transfer reagents from Group III and Group IV in reductions (NaBH4triacetoxyborohydride, L-selectride, K-selectride, Luche reduction, LiAlH4, DIBAL-H, and Red-Al, Trialkylsilanes and Trialkylstannane, Meerwein-Pondorff-Verley reduction), stereo/enantioselective reductions (Chiral Boranes, Corey-Bakshi-Shibata).

Suggested readings

1. Advanced Organic Chemistry, Part A and B, F. A. Cary and R. I. Sundberg, Springer.
2. Organic Synthesis, M. B. Smith, Academic Press.
3. Modern Methods of Organic Synthesis, W. Carruthers and I. Coldham, Cambridge University Press.
4. Organic Chemistry, J. Clayden, N. Greeves and S. Warren. Oxford University Press.
5. Organic Chemistry, S. H. Pine, McGraw-Hill Bool.
6. Advanced Organic Chemistry: Reactions, Mechanisms and Structure (4th edn.), J. March, Wiley Student Edition, John Wiley & Sons Asia Pte. Ltd.
7. Modern Synthetic Reaction, H. O. House, W. A. Benjamin Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1		H	
CO 2			H
CO 3	H		

CHRO405L: ORGANIC CHEMISTRY V: REAGENT IN ORGANIC SYNTHESIS AND MECHANISTIC STUDIES LAB

(1 Credit -30 hours) (L-T-P: 0-0-1)

Objective

This course is aimed at familiarizing students with the concepts of calculation of saponification value, iodine number of oil/fat and preparation of some indicator

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Apply the concept of organic reagents synthesis of known compounds (understanding)
CO 2: Evaluate some important parameters in some common substance (Evaluating)
CO 3: Apply the solubility concept for isolation active components (Applying)

Module I:

Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).

a) Preparation of methyl orange.
b) Saponification value of an oil or a fat.
c) Determination of Iodine number of an oil/ fat.
d) Isolation and characterization of DNA from onion/ cauliflower/peas.

Suggested Readings:

1. Quantitative Organic Analysis, I. V. Arthur, Pearson.
2. Analytical Techniques in Biochemistry and Molecular Biology, R. Katoch, Springer.
3. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.
4. Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell, Pearson.
5. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia, and R. Aggarwal, University Press.

Mapping of COs to Modules

Course Outcomes	Exp a	Exp. b	Exp. c	Exp. d	Exp. e
CO 1		H			
CO 2			H		
CO 3	H				H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	CHAS104T	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (3-0-1)	4
		CHAS105L	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab (0-0-1)	
		CHGC106T	Green Chemistry (3-0-1)	4
		CHGC107L	Green Chemistry Lab (0-0-1)	
2	Minor Course 2	CHSP108T	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (3-0-0)	4
		CHSP109L	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (0-0-1)	
		CHIM110T	Inorganic materials and Industrial Importance (3-0-0)	4
		CHIM111L	Inorganic materials and Industrial Importance (0-0-1)	
3	Minor Course 3	CHFG210T	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I (3-0-0)	4
		CHFG211L	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I Lab (0-0-1)	
		CHPC212T	Polymer Chemistry (3-0-0)	4
		CHPC213L	Polymer Chemistry Lab (0-0-1)	
4	Minor Course 4	CHSP214T	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (3-0-1)	4
		CHSP215L	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (0-0-1)	
		CHRO216T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	4
5	Minor Course 5	CHDQ314T	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (3-0-0)	4
		CHDQ315L	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (0-0-1)	
		CHAC316T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	4
6	Minor Course 6	CHBC317T	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (3-0-0)	4
		CHBC318L	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (0-0-1)	
		CHAP319T	Physical Chemistry V: Advanced Physical Chemistry (4-0-0)	4
7	Minor Course 7	CHAM406T	Analytical Methods in Chemistry (3-0-0)	3
7	Minor Course 8	CHRM407T	Research Methodology	2
8	Minor Course 9	CHML408T	Molecules of Life (3-0-0)	3

CHAS104T: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY AND ALIPHATIC HYDROCARBONS
(3 Credits- 45 hours) (L-T-P: 3-0-0)

Objective

This course is intended to explain the fundamental concepts of inorganic chemistry (like atomic structure, chemical bonding) and organic chemistry (Like basics of organic chemistry and hydrocarbons) together.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the fundamental concept of inorganic and organic chemistry. (Remembering)
CO 2: Explain various concepts of atomic structure and chemical bonding. (Understanding)
CO 3: Predict the structure and properties of molecules. (Applying)
CO 4: Evaluate the role of quantum mechanics in inorganic chemistry. (Evaluate)

Module I: Inorganic Chemistry (23 lectures)

a. **Atomic Structure (10 lectures)**

Review of: Bohr's theory and its limitations, Heisenberg uncertainty principle.

Dual behaviour of matter and radiation, de-Broglie's relation. Hydrogen atom spectra. Need of a new approach to atomic structure.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s).

Rules for filling electrons in various orbitals, electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

b. **Chemical Bonding and Molecular Structure (13 lectures)**

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR (H_2O, NH_3, PCl_5, SF_6, ClF_3, SF_4) and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral.

Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals.

Module II: Organic Chemistry (22 lectures)

a. **Fundamentals of Organic Chemistry (10 lectures)**

Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Reaction intermediates: Carbocations, Carbanions and free radicals. Electrophiles and nucleophiles.

Aromaticity: Benzenoids and Hückel's rule.

b. **Aliphatic Hydrocarbons (12 lectures)**

Functional group approach for the following reactions (preparations physical property & chemical reactions) to be studied with mechanism in context to their structure.

Alkanes: *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, Grignard reagent. *Reactions:* Free radical Substitution: Halogenation.

Alkenes: *Preparation:* Elimination reactions: Dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). *Reactions:* cis-addition (alk. $KMnO_4$) andtrans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Alkynes: *Preparation:* Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. *Reactions:* formation of metal acetylides and acidity of alkynes, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. Hydration to form carbonyl compounds.

Suggested Readings

1. A new Concise Inorganic Chemistry, J. D. Lee, E L. B. S.
2. Basic Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley.
3. Concepts and Models in Inorganic Chemistry, McDaniel Douglas and J. Alexander, Wiley.
4. Inorganic Chemistry: Principles of Structure and Reactivity, J. Huheey, E. Keiter and R. Keiter, Pearson Publication.
5. Organic Chemistry, T.W. G. Solomon, John Wiley and Sons.
6. A Guide Book to Mechanisms in Organic Chemistry, P. Sykes, Orient Longman.
7. Stereochemistry of Carbon Compounds, E. L. Eliel, Tata McGraw Hill.
8. Organic Chemistry (Vol I and II), I. L.. Finar, E. L. B. S.
9. Organic Chemistry, R. T. Morrison, R. N. Boyd, Prentice Hall.
10. Shriver & Atkins' Inorganic Chemistry, P. Atkins, T. Overton, J. Rourke, F. Armstrong and M. Weller, Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	L
CO 3	H	H
CO 4	H	

CHAS105L: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY AND ALIPHATIC HYDROCARBONS LAB

(1 Credit -30 hours) (L-T-P: 0-0-1)

Objective

This course is design to make the students to understand the fundamental application of inorganic and organic chemistry.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the concept of titration and chromatography for estimation and separation. (Remembering)

CO 2: Explain the principles of titration and chromatography. (Understanding)

CO 3: Applying the concept of titration and chromatography to the estimation of samples. (Application)

CO 4: Decide the method for appropriate chromatographic separation of organic molecules in a mixture. (Analysis)

Module I:

Section A: Inorganic Chemistry - Volumetric Analysis

a. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
b. Estimation of oxalic acid by titrating it with KMnO4.
c. Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.
d. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
e. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.

Section B: Organic Chemistry

a. Purification of OC by crystallisation (from water and alcohol) and distillation.
b. Criteria of purity: Determination of M pt/B pt.
c. Detection of extra elements (N, S, Cl, Br, I) in organic compounds.
d. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)
e. Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography.
f. Identify and separate the sugars present in the given mixture by paper chromatography.

Suggested Readings

1. Vogel's Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
2. Vogel's Quantitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
3. Textbook of Practical Organic Chemistry, A. I. Vogel, Prentice Hall.
4. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Orient Longman.

Mapping of COs to Syllabus

Course Outcomes	Section A	Section B
CO 1	H	H
CO 2		H
CO 3	H	H
CO 4		M

CHGC106T: GREEN CHEMISTRY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

This course is intended to explain the principles of green chemistry and its application.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the principles, goals and limitations of green chemistry. (Remembering)

CO 2: Understand how the principles of green chemistry apply to chemical synthesis. (Understanding)

CO 3: Analyse the benefits of green reactions. (Analysing)

CO 4: Assess the overall impact on research and the environment. (Evaluating)

Module I: Introduction to Green Chemistry (4 lectures)

What is Green Chemistry? Need for Green Chemistry, goals of green chemistry, limitations/ obstacles in the pursuit of the goals of Green Chemistry.

Module II: Principles of Green Chemistry and Designing a Chemical synthesis (21 lectures)

Twelve principles of Green Chemistry with their explanations and special emphasis on the following with examples:

a. Designing a Green Synthesis using these principles; Prevention of Waste/ by-products; maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.
b. Prevention/ minimization of hazardous/ toxic products reducing toxicity risk = (function) hazard x exposure; waste or pollution prevention hierarchy Green solvents.
c. Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy.
d. Selection of starting materials; avoidance of unnecessary derivatization–careful use of blocking/protecting groups.
e. Use of catalytic reagents, comparison of heterogeneous and homogeneous catalysis, bio catalysis, asymmetric catalysis and photo catalysis.
f. Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD — subdivision of ISD, minimization, simplification, substitution, moderation and limitation.
g. Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

Module III: Examples of Green Synthesis/ Reactions and some real-world cases (12 lectures)

a. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).
b. Microwave assisted reactions
c. Ultrasound assisted reactions
d. Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.
e. Designing of Environmentally safe marine antifoulant.
f. Right fit pigment: synthetic azo-pigments to replace toxic organic and inorganic pigments.
g. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.
h. Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils.
i. Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting.

Module IV: Future Trends in Green Chemistry (8 lectures)

Oxidation reagents and catalysts, biomimetic, multifunctional reagents; combinatorial green chemistry; Proliferation of solvent free reactions; co crystal controlled solid state synthesis (C_2S_3); Green chemistry in sustainable development.

Suggested Readings

1. New Trends in Green Chemistry, V. K. Ahluwalia, M. R. Kidwai, Anamalaya Publishers.
2. Oxford Green Chemistry -Theory and Practical, P. T. Anastas and J. K. Warner, University Press.
3. Introduction to Green Chemistry, A. S. Matlack, Marcel Dekker.
4. Real-World Cases in Green Chemistry, M. C. Cann and M. E. Connely, American Chemical Society, Washington.
5. Introduction to Green Chemistry, M. A. Ryan and M. Tinnes, American Chemical Society Washington.
6. Green Chemistry an Introductory Text 2nd Ed., M. Lancaster, RSC Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		M	H	
CO 3		H	H	
CO 4			H	

CHGC107L: GREEN CHEMISTRY LAB

(1Credit – 30 hours) (L-T-P: 0-0-1)

Objective

This course is design to make the students to learn the application of principles of green chemistry in laboratory.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the principles. (Understanding)

CO 2: Apply the principles of green chemistry in the laboratory. (Applying)
CO 3: Analyse and interpret experimental data. (Analysing)

Module I:

Safer starting materials

a. Preparation and characterization of nano particles of gold using tea leaves.

Using renewable resources

a. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil.

Avoiding waste

a. Principle of atom economy.
b. Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.
c. Preparation of propene by two methods can be studied.
    1. Triethylamine ion + OH- → propene + trimethyl propene + water H_2SO4/H_2O
    2. 1-propanol propene + water

The other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

Use of enzymes as catalysts

a. Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.

Alternative Green solvents

a. Extraction of D-limonene from orange peel using liquid CO2 prepared from dry ice.
b. Mechano chemical solvent free synthesis of azomethines.

Alternative sources of energy

a. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).
b. Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Suggested Readings

1. Green Chemistry: Theory and Practice, P. T. Anastas and J. C. Warner, Oxford University Press.
2. Greener approaches to undergraduate chemistry experiment, M. Kirchoff, and M. A. Ryan, American Chemical Society, Washington DC.
3. Introduction to Green Chemistry, M. A. Ryan, American Chemical Society, Washington DC.
4. Green Chemistry Experiments: A monograph, R. K. Sharma, I. T. Sidhwani, and M. K. Chaudhari, I. K. International Publishing House Pvt Ltd. New Delhi, Bangalore.
5. Real world cases in Green Chemistry, M. C. Cann and M. E. Connelly, American Chemical Society.
6. Real world cases in Green Chemistry, M. C. Cann and P. Thomas, American Chemical Society.
7. Green Chemistry: An introductory text, M. Lancaster, RSC publishing.
8. Introduction to Organic Laboratory Techniques – a Microscale Approach, D. L. Pavia, G. S. Kriz, G. M. Lampman and R. G. Engels, Brooks-Cole Laboratory Series for Organic Chemistry, 2006.

Mapping of COs to Syllabus

Course Outcomes	Safer starting materials	Using renewable resources	Avoiding waste	Use of enzymes as catalysts	Alternative Green solvents	Alternative sources of energy
CO 1	H	H	H	H	H	H
CO 2	H	H	H	H	H	H
CO 3	H	H	H	H	H	H

CHSP108T: CHEMISTRY OF S- AND P- BLOCK ELEMENTS, STATES OF MATTER AND CHEMICAL KINETICS.

(3 Credits- 45 hours) (L-T-P: 3-0-0)

Objective

This course is intended to explain the chemistry of s - and p- block elements and states of matter.

Course / Learning Outcomes

At the end of this course students will be able to:
CO 1: Explain the properties of s - and p- block elements. (Understanding)
CO 2: Understand the concept of an ideal gas, real gas and properties of matter. (Understanding)
CO 3: Apply the Kinetic Theory of gases and Chemical kinetics to solve problems. (Applying)
CO 4: Analyse different techniques to extract metals from their respective ores. (Analysing)

Module I: Inorganic Chemistry (22 lectures)

a. **General Principles of Metallurgy (4 lectures)**

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy with reference to cyanide process for silver and gold, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, van Arkel-de Boer process and Mond's process.

b. **s- and p- block Elements (18 lectures)**

Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken, and Alfred-Rochow scales). Allotropy in C, S, and P.

Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

Compounds of *s*- and *p*-Block Elements.

Hydrides of nitrogen (NH_3, N_2H_4, N_3H, NH_2OH) Oxoacids of P, S and Cl.

Halides and oxohalides: PCl_3, PCl_5, $SOCl_2$ and SO_2Cl_2.

Module II: Physical Chemistry (23 lectures)

b. **Kinetic Theory of Gases (4 lectures)**

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.

Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

c. **Liquids (5 lectures)**

Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

d. **Solids (5 lectures)**

Forms of solids. Unit cells, crystal systems, Bravais lattice type. Laws of Crystallography - Law of constancy of interfacial angles Law of rational indices. X–Ray diffraction by crystals, Bragg's law. Defects in crystals. Glasses and liquid crystals.

e. **Chemical Kinetics (9 lectures)**

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

Suggested Readings

1. Physical Chemistry, G. M. Barrow, Tata McGraw Hill.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. General Chemistry , J. C. Kotz, P. M. Treichel and J. R. Townsend, Cengage Lening India Pvt. Ltd., New Delhi.
4. University Chemistry, B. H. Mahan, Narosa.
5. General Chemistry, R. H. Petrucci, Macmillan Publishing Co., New York.
6. A New Concise Inorganic Chemistry, J. D. Lee, E.L.B.S.
7. Basic Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley.
8. Inorganic Chemistry, D. F. Shriver and P. W. Atkins, Oxford University Press.
9. Inorganic Chemistry, G. Wulfsberg, Viva Books Pvt. Ltd.
10. Inorganic Chemistry(adapted), G. L. Miessler an D. A. Tarr. Pearson.

Mapping of COs to Module

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3		H
CO 4	H	

CHSP109L: CHEMISTRY OF S- AND P- BLOCK ELEMENTS, STATES OF MATTER AND CHEMICAL KINETICS LAB.

(1 Credit – 30 hours) (L-T-P: 0-0-1)

Objective

This course will make the students to understand about qualitative analysis and kinetics experiments.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Gain knowledge about semi-micro qualitative analysis of salt. (Remembering)
CO 2: Explanation of group analysis for basic radicals present in salt. (Understanding)
CO 3: Apply the concept of salt analysis to identify ions present in a mixture of salts. (Applying)
CO 4: Comparison of acidic strength by studying the kinetics of hydrolysis of the ester. (Analysing)

Module I:

a. **Inorganic Chemistry**

Semi-micro qualitative analysis of mixtures using H2S or any other scheme- not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following:

Cations: NH^{4+}, Pb^{2+}, Bi3+, Cu^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^{+}.

Anions: CO_3^{2-}, S^{2-}, SO_3^{2-}, NO^{3-}, CH_3COO^{-}, Cl^{-}, Br^{-}, I–, NO^{3-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, $C_2O_4^{2-}$, F^{-} (Spot tests should be carried out wherever feasible)

b. **Physical Chemistry**

1. **Surface tension measurement (use of organic solvents excluded).**
   i. Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
   ii. Study of the variation of surface tension of a detergent solution with concentration.
2. **Viscosity measurement (use of organic solvents excluded).**
   i. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
   ii. Study of the variation of viscosity of an aqueous solution with concentration of solute.
3. **Chemical Kinetics: Study the kinetics of the following reactions.**
   i. Initial rate method: Iodide-persulphate reaction.
   ii. Integrated rate method:
   - Acid hydrolysis of methyl acetate with hydrochloric acid.
   - Saponification of ethyl acetate.
   - Compare the strengths of HCl and H2SO4 by studying kinetics of hydrolysis of methyl acetate.

Suggested Readings

1. Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
2. Quantitative Chemical Analysis, A. I. Vogel, Prentice Hall.
3. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b
CO 1	H	
CO 2	H	
CO 3	H	
CO 4		H

CHIM110T: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

(3 Credit – 45 hours) (L-T-P: 3-0-0)

Objective

This course will make the students to learn about the different types of inorganic materials of industrial importance.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Remember the composition of some industrially important materials. (Remembering)
CO 2: Understand the processes involved in the preparation of silicates materials. (Understanding)
CO 3: Know the principle involved in the preparation and applications of fuel cells, industrial application of catalysts. (Applying)
CO 4: Know the differences between different types of surface coatings; know how to paint formulations are made. (Analysing)

Module I: Silicate Industries (15 lectures)

a. *Glass:* Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass, composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

b. *Ceramics:* Brief introduction to types of ceramics, superconducting and semiconducting oxides, fullerenes, carbon nanotubes and carbon fibre.

C. *Cements:* Manufacture of cement and the setting process, quick setting cements.

Module II: Fertilizers (10 lectures)

Different types of fertilizers (N, P and K). Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, superphosphate of lime.

Module III: Surface Coatings (5 lectures)

Brief introduction to and classification of surface coatings, Paints and pigments-formulation, composition and related properties, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Metallic coatings (electrolytic and electroless).

Module IV: Batteries (10 lectures)

Working of the following batteries: Pb acid, Li-Battery, solid state electrolyte battery, fuel cells, solar cell and polymer cell.

Module V: Catalysis (10 lectures)

General principles and properties of catalysts, homogenous catalysis and heterogenous catalysis and their industrial applications, deactivation or regeneration of catalysts.
Application of zeolites as catalysts.

Module VI: Chemical explosives (10 lectures)

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX), Introduction to rocket propellants.

Suggested Readings

1. Industrial Chemistry, Vol I, E. Stocchi, Ellis Horwood Ltd. UK.
2. Elementary Principles of Chemical Processes, R. M. Felder and R. W. Rousseau, Wiley Publishers, New Delhi.
3. Introduction to Ceramics, W. D. Kingery, H. K. Bowen and D. R. Uhlmann, Wiley Publishers, New Delhi.
4. Riegel's Handbook of Industrial Chemistry, J. A. Kent CBS Publishers, New Delhi.
5. Engineering Chemistry, P. C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.
6. Engineering Chemistry, R. Gopalan, D. Venkappayya and S. Nagarajan, Vikas Publications, New Delhi.
7. Engineering Chemistry B. K. Sharma, , Goel Publishing House, Meerut.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M		H		
CO2	H					H
CO3				H	M	
CO4			H			

CHIM111L: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

Objective

This course will make the students to learn analysis of industrially important inorganic materials.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the aforementioned principles. (Understanding)
CO 2: Apply knowledge and understanding in carrying out lab experiments. (Applying)
CO 3: Analyse and interpret experimental data. (Analysing)

Module I:

a. Determination of free acidity in ammonium sulphate fertilizer.
b. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
c. Estimation of phosphoric acid in superphosphate fertilizer.
d. Analysis of Nitrogen in unknown sample

e. Determination of composition of dolomite (by complexometric titration).
f. Analysis of Phosphate in unknown sample
g. Analysis of Cement.
h. Preparation of pigment (zinc oxide).

Suggested Readings

1. Industrial Chemistry, Vol I, E. Stocchi, Ellis Horwood Ltd. UK.
2. Elementary Principles of Chemical Processes, R. M. Felder and R.W. Rousseau, Wiley Publishers, New Delhi.
3. Introduction to Ceramics, W. D. Kingery, H. K. Bowen and D. R. Uhlmann, Wiley Publishers, New Delhi.
4. Riegel's Handbook of Industrial Chemistry, J. A. Kent, CBS Publishers, New Delhi.
5. Engineering Chemistry, P. C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.
6. Engineering Chemistry, R. Gopalan, D. Venkappayya and S. Nagarajan, Vikas Publications, New Delhi.
7. Engineering Chemistry, B. K. Sharma, Goel Publishing House, Meerut.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g	Exp h
CO1	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H

CHFG210T: CHEMICAL ENERGETICS, EQUILIBRIA AND FUNCTIONAL GROUP ORGANIC CHEMISTRY

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to make the students familiar with important concepts of physical chemistry (like chemical energetics, chemical and ionic equilibrium) and organic chemistry (like functional group chemistry) together.

Course / Learning Outcomes

At the end of this course students will be able to:
CO 1: Explain the thermodynamics of chemical reactions. (Understanding)
CO 2: Calculate the change in free energy accompanying a chemical reaction. (Applying)
CO 3: Explain the mechanism of nucleophilic substitution reaction. (Analysing)
CO 4: Learn the methods of preparation, reactions and mechanism of some organic compounds. (Creating)

Module I: Physical Chemistry (23 lectures)

a. **Chemical Energetics (9 lectures)**

Review of thermodynamics and the Laws of Thermodynamics.
Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.
Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

b. **Chemical Equilibrium (4 lectures)**

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between G and G^o, Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.

c. **Ionic Equilibria (10 lectures)**

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Module II: Organic Chemistry (22 lectures)

Functional group approach for the following reactions (preparations physical properties and Chemical reactions) to be studied in context to their structure with mechanism.

a. **Aromatic hydrocarbons (6 lectures)**

Preparation (benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.
Reactions: (benzene): Electrophilic substitution reactions: nitration, halogenation sulphonation. Friedel-Craft's reaction (alkylation and acylation) Side chain oxidation of alkyl benzenes.

b. **Alkyl and Aryl Halides (6 lectures)**

1. **Alkyl Halides**

Preparation: from alkenes *and* alcohols.

Reactions: Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions, hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

2. **Aryl Halides**

Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.
Reactions (Chlorobenzene): Aromatic electrophilic and nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$).

c. **Alcohols, Phenols and Ethers (10 lectures)**

1. **Alcohols:**

Preparation: Preparation of 1^o, $2^o$and 3^oalcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.
Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO4, acidic dichromate, conc. HNO3), factors affecting acidity, Oppeneauer oxidation.

2. **Phenols:**

(Phenol case) *Preparation:* Cumene hydroperoxide method, from diazonium salts. *Reactions:* Electrophilic substitution: Nitration, halogenation and sulphonation.

d. **Ethers (aliphatic and aromatic).**

Preparation: Williamson ether synthesis.
Reactions**:** Cleavage of ethers with HI.

e. **Aldehydes and ketones (aliphatic and aromatic):**

Preparation: from acid chlorides and from nitriles.
Reactions – Nucleophilic addition, Nucleophilic addition – elimination reaction including Reaction with HCN, ROH, $NaHSO_3$, NH_2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.

Suggested Readings

1. Organic Chemistry, T. W. G. Solomons, John Wiley and Sons.
2. A Guide Book to Mechanism in Organic Chemistry, P. Sykes, Orient Longman.
3. Organic Chemistry (Vol. I & II), I. L.. Finar, E. L. B. S.
4. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice Hall.
5. Physical Chemistry, G. M. Barrow, Tata McGraw Hill.
6. Physical Chemistry, G. W. Castellan, Narosa.
7. General Chemistry Cengage Lening India Pvt. Ltd. J. C. Kotz, P. M. Treichel, and J. R. Townsend, New Delhi.
8. University Chemistry, B. H. Mahan, Narosa.
9. General Chemistry, R. H. Petrucci, Macmillan Publishing Co.: New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H

CHFG211L: CHEMICAL ENERGETICS, EQUILIBRIA AND FUNCTIONAL GROUP ORGANIC CHEMISTRY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

Objective

The objective of this course is to make the students familiar with laboratory experiments related to thermochemistry, Ionic equilibria, Preparation of some organic compounds and also qualitative analysis of organic compounds

Course /Learning Outcomes

At the end of this course students will be able to:
CO 1: Recall principles and methods used to measure heats of reaction. (Remembering)
CO 2: Explain methods and underlying principles used to carry out the experiments related to Ionic equilibria. (Understanding)
CO 3: Learn to prepare specific organic compounds using appropriate procedures. (Applying)
CO 4: Analyses of organic compounds possessing monofunctional groups. (Analysing)

Module I: Physical Chemistry

Thermochemistry:

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO3, NH4Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of *H*.

Ionic equilibria

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH meter.
2. Preparation of buffer solutions
   i. sodium acetate-acetic acid.
   ii. Ammonium chloride-ammonium hydroxide.
   iii. Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

Module II: Organic Chemistry

1. Preparations: Mechanism of various reactions involved to be discussed, recrystallization, determination of melting point and calculation of quantitative yields to be done.
   i. Bromination of phenol/aniline.
   ii. benzoylation of amines/phenols.
   iii. Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone.
2. Systematic qualitative organic analyses of organic compounds possessing monofunctional groups (alcohols, phenols, carbonyl, -COOH) and preparation of one suitable derivative.

Suggested Readings

1. Textbook of Practical Organic Chemistry A. I. Vogel, , Prentice-Hall.
2. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Orient Longman.
3. Senior Practical Physical Chemistry, B. D. Khosla, S. Chand & Co.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H
CO 5	M	M

CHPC212T: POLYMER CHEMISTRY

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to make the students familiar with fundamental concepts of polymers and polymerization process.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the different processes by which polymers are formed. (Understanding)
CO 2: Apply the methods to measure the molecular weights of polymers. (Applying)
CO 3: Analyse polymers based on their physical, thermal, flow and mechanical properties. (Analysing)
CO 4: Based on the properties predict possible applications or uses of the polymer. (Evaluating)

Module I: Introduction and history of polymeric materials (4 hours)

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

Module II: Functionality and its importance (8 hours)

Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bi-functional systems, Poly-functional systems.

Module III: Kinetics of Polymerization (8 hours)

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

Module IV: Crystallization and crystallinity (4 hours)

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

Module V: Nature and structure of polymers and Molecular weight determination of polymers (10 hours)
Structure Property relationships. Determination of molecular weight of polymers (Mn, Mw, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

Module VI: Glass transition temperature (Tg), determination of Tg, Polymer Solution and properties of Polymers (26 hours)
Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).
Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.
Properties of Polymers (Physical, thermal, Flow & Mechanical Properties).
Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly (vinyl chloride) and related polymers, poly (vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly (p-phenylene sulphide polypyrrole, polythiophene)].

Suggested Readings
1. Seymour's Polymer Chemistry, Marcel Dekker, Inc.
2. Principles of Polymerization, G. Odian, John Wiley.
3. Text Book of Polymer Science, F.W. Billmeyer, John Wiley.
4. Polymer Science & Technology, P. Ghosh,Tata Mcgraw-Hill.
5. Organic Chemistry of Synthetic High Polymers, R. W. Lenz.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 2	H	H	H			
CO 3					H	
CO 4				H	H	H
CO 5						H

CHPC213L: POLYMER CHEMISTRY LAB
(1 credit – 30 hours) (L-T-P: 0-0-1)

Objective
The objective of this course is to make the students familiar with laboratory experiments related to Synthesis and characterization of Polymer molecules

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Carry out preparations and characterization of polymers in the lab. (Applying)
CO 2: Analyse and interpret experimental results. (Analysing)

Module I: Polymer synthesis
a. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid (AA).
    1. Purification of monomer.
    2. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile (AIBN).
b. Preparation of nylon 66/6.
c. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein.
    1. Preparation of IPC.
    2. Purification of IPC.
    3. Interfacial polymerization.
d. Redox polymerization of acrylamide.
e. Precipitation polymerization of acrylonitrile.
f. Preparation of urea-formaldehyde resin.
g. Preparations of novalac resin/resold resin.
h. Microscale Emulsion Polymerization of Poly(methylacrylate).

Module II: Polymer characterization
a. Determination of molecular weight by viscometry:
    1. Polyacrylamide-aq. $NaNO_2$ solution.

2. (Poly vinyl proplylidine (PVP) in water.

b. Determination of the viscosity-average molecular weight of poly (vinyl alcohol) (PVOH) and the fraction of —head-to-head‖ monomer linkages in the polymer.
c. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).
d. Testing of mechanical properties of polymers.
e. Determination of hydroxyl number of a polymer using colorimetric method.

Suggested Readings

1. Contemporary Polymer Chemistry, H. R. Allcock, F. W. Lampe and J. E. Mark, Prentice-Hall.
2. Textbook of Polymer Science, F. W. Billmeyer, Wiley-Interscience.
3. Polymer Science and Technology, J. R. Fried, Prentice-Hall.
4. Introduction to Macromolecular Science, P. Munk and T. M. Aminabhavi, John Wiley & Sons.
5. Introduction to Physical Polymer Science, L. H. Sperling, John Wiley & Sons.
6. Polymer Chemistry: An Introduction, Malcolm P. Stevens, Oxford University Press.
7. Polymer Chemistry, C. E. Carraher Jr. Seymour**/** Carraher's.

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	H

CHSP214T: SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objective

This course will discuss solutions, phase equilibrium, electrochemistry, biomolecules like amino acid, carbohydrate and some N- and O-containing functional groups

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the concepts of solutions, electrochemistry and phase equilibrium. (Remembering)
CO 2: Explain the properties and reactivity of different organic compounds. (Understanding)
CO 3: Solve problems on electrochemistry, phase equilibrium, solutions etc. (Applying)
CO 4: Differentiating between the primary, secondary, tertiary and quaternary structure of proteins. (Analysing)

Module I: Physical Chemistry (23 Lectures)

a. **Solutions (7 lectures)**

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law–non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids.

b. **Phase Equilibrium (6 lectures)**

Phases, components, and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur).

c. **Conductance (5 lectures)**

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions.

Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid base).

d. **Electrochemistry (5 lectures)**

Reversible and irreversible cells. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data. Calculation of equilibrium constant from EMF data.

Module II: Organic Chemistry (22 Lectures)

a. **Carboxylic acids and their derivatives (4 lectures)**

Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard – Zelinsky Reaction. Carboxylic acid derivatives (aliphatic): (Up to 5 carbons).

Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion.

b. **Amines and Diazonium Salts (5Lectures)**

Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes.

c. **Amino Acids, Peptides and Proteins (8 Lectures)**

Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. Reactions of Amino acids: ester of –COOH group, acetylation of –NH2 group, complexation with Cu2+ ions, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme).

d. **Carbohydrates (5 Lectures)**

Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, maltose) and brief idea about polysacharrides.

Suggested Readings

1. Physical Chemistry, G. M. Barrow, Tata McGraw-Hill.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. General Chemistry, J. C. Kotz, P. M. Treichel and J. R. Townsend, Cengage Lening India Pvt. Ltd., New Delhi.
4. University Chemistry, B. H. Mahan, Narosa.
5. General Chemistry, R. H. Petrucci, Macmillan Publishing Co.: New York.
6. Organic Chemistry, R. T. Morrison and R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. Organic Chemistry (Volume 1), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Organic Chemistry (Volume 2), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Lehninger's Principles of Biochemistry, D. L. Nelson and M. M. Cox, W. H. Freeman.
10. Biochemistry, J. M. Berg, J. L. Tymoczko and L. Stryer, W. H. Freeman.

Mapping of COs to syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3	H	
CO 4		H

CHSP215L: SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II LAB

(1 credit – 30 hour) (L-T-P: 0-0-1)

Objective

The objective of this course is to make the students familiar with laboratory experiments related to Distribution, Phase equilibria, conductance, chromatographic techniques, qualitative organic analysis and other related experiments of organic chemistry

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the concepts of phase equilibria and electrochemistry. (Remembering)
CO 2: Explain the chemistry behind the qualitative analysis of unknown organic compounds. (Understanding)
CO 3: Apply chromatography to separate a mixture of two or more amino acids. (Applying)
CO 4: Analyse unknown organic compounds with the help of different chemical tests. (Analysing)

Module I: Physical Chemistry

Distribution

Study of the equilibrium of one of the following reactions by the distribution method:

$I_2(aq) + I^-(aq) \rightleftharpoons I_3^-(aq)$ $Cu^{2+}(aq) + xNH_2(aq) \rightleftharpoons [Cu(NH_3)_x]^{2+}$

Phase equilibria

1. Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.

2. Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.
3. Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

Conductance

1. Determination of cell constant.
2. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
3. Perform the following conductometric titrations:
4. Strong acid vs. strong base.
5. Weak acid vs. strong base.

Module II: Organic Chemistry

1. Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.
2. Separation of amino acids by paper chromatography.
3. Determination of the concentration of glycine solution by formylation method.
4. Titration curve of glycine.
5. Action of salivary amylase on starch.
6. Effect of temperature on the action of salivary amylase on starch.
7. Determination of the saponification value of an oil/fat.
8. Determination of the iodine value of an oil/fat.
9. Differentiation between a reducing/nonreducing sugar.
10. Extraction of DNA from onion/ cauliflower.

Suggested Readings

1. Textbook of Practical Organic Chemistry, A. I. Vogel, Prentice Hall.
2. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Orient Longman, 1960.
3. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.
4. Comprehensive Practical Organic Chemistry, V. K. Ahluwalia and R. Aggarwal, , Universities Press.

Mapping of CO to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3		H
CO 4		H

CHRO216T: ORGANIC CHEMISTRY V: REAGENTS IN ORGANIC SYNTHESIS AND MECHANISTIC STUDIES

(4 credits – 75 hours) (L-T-P: 4-0-0)

Objective

The objective of this course is to make the students familiar with Kinetics and Energetics of Reaction Mechanism and oxidation and reduction reaction

Course / Learning Outcomes

CO 1: Apply the practical utility of metal and metal-free oxidising agents in organic synthesis. (Applying)
CO 2: Compare various kinds of reducing agents in chemo selective and stereo selective synthesis. (Analysing)
CO 3: Recall various concepts associated with the kinetics of organic reaction mechanisms. (Remembering)

Module I: Kinetics and Energetics of Reaction Mechanism (15 lectures)

Transition state theory of reaction rates - kinetics and thermodynamics of activation, reaction profiles for multistep reactions, Hammond postulate, Curtin-Hammett Principle, kinetic and thermodynamic control, Linear free energy relationships (LFER), Hammett equation - substituent and reaction constants, the Taft treatment of polar and steric effects in aliphatic compounds, kinetic isotope effects in organic reactions, effects of conformation on reactivity, stereoelectronic effects, neighbouring group participation, anomeric effect.

Module II: Oxidation Reactions (15 lectures)

Metal and non-metal based oxidations (Cr, Mn, Al, Ag, Os, Ru, Se, DMSO, hypervalent iodine), reagents (Fremy's salt, silver carbonate, peroxides/per-acids), Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation, Sharpless asymmetric dihydroxylation, Baeyer-Villiger oxidation, Wacker oxidation, hydroboration-oxidation, Prevost reaction and Woodward modification.

Module III: Reduction Reactions (15 lectures)

Catalytic hydrogenation (Pd/Pt/Rh/Ni), Wilkinson catalyst, Noyori asymmetric hydrogenation, metal based reductions using Li/Na/Ca in liquid ammonia, Sodium, Magnesium, Zinc, Titanium and Samarium (Birch, Pinacol formation, McMurry, Acyloin formation, dehalogenation and deoxygenations), Hydride transfer reagents from Group III and Group IV in reductions (NaBH4triacetoxyborohydride, L-selectride, K-selectride, Luche reduction, LiAlH4, DIBAL-H, and Red-Al, Trialkylsilanes and Trialkylstannane, Meerwein-Pondorff-Verley reduction), stereo/enantioselective reductions (Chiral Boranes, Corey-Bakshi-Shibata).

Suggested readings

1. Advanced Organic Chemistry, Part A and B, F. A. Cary and R. I. Sundberg, Springer.
2. Organic Synthesis, M. B. Smith, Academic Press.
3. Modern Methods of Organic Synthesis, W. Carruthers and I. Coldham, Cambridge University Press.
4. Organic Chemistry, J. Clayden, N. Greeves and S. Warren. Oxford University Press.
5. Organic Chemistry, S. H. Pine, McGraw-Hill Bool.
6. Advanced Organic Chemistry: Reactions, Mechanisms and Structure (4th edn.), J. March, Wiley Student Edition, John Wiley & Sons Asia Pte. Ltd.
7. Modern Synthetic Reaction, H. O. House, W. A. Benjamin Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1		H	
CO 2			H
CO 3	H		

CHDQ314T: CHEMISTRY OF D-BLOCK ELEMENTS, QUANTUM CHEMISTRY & SPECTROSCOPY

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to make the students familiar with coordination chemistry, quantum chemistry, spectroscopy and photochemistry

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall properties of d- and f- block elements. (Remembering)
CO 2: Explain the principles of quantum mechanics and spectroscopy. (Understanding)
CO 3: Calculate positions of absorption lines of molecules and energies and wavefunctions. (Applying)
CO 4: Differentiate between theories behind the formation of coordination compounds. (Analysing)

Module I: Inorganic Chemistry (22 Lectures)

a. **Transition Elements (8 Lectures)**

General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu.
Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

b. **Coordination Chemistry (6 Lectures)**

Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC system of nomenclature.

c. **Crystal Field Theory (8 Lectures)**

Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Jahn-Teller distortion, Square planar coordination.

Module II: Physical Chemistry (23 Lectures)

a. **Quantum Chemistry & Spectroscopy (19 Lectures)**

Wave-particle duality. Link between spectroscopy and quantum chemistry. Electromagnetic radiation and its interaction with matter. Types of spectroscopy. Difference between atomic and molecular spectra. Born Oppenheimer approximation: Separation of molecular energies into translational, rotational, vibrational and electronic components. Postulates of quantum mechanics, quantum mechanical operators. Free particle. Particle in a 1-D box (complete solution), quantization, normalization of wave functions, concept of zero-point energy.

Microwave (pure rotational) spectra of diatomic molecules. Selection rules. Structural information derived from rotational spectroscopy.
Vibrational Motion: Schrödinger equation of a linear harmonic oscillator and brief discussion of its results (solution not required). Electronic Spectroscopy

b. **Photochemistry (4 Lectures)**

Laws of photochemistry. Lambert-Beer's law. Fluorescence and phosphorescence. Quantum efficiency. Primary and secondary processes in photochemical reactions. Photochemical and thermal reactions. Photoelectric cells.

Suggested Readings

1. Physical Chemistry, G. M. Barrow, Tata McGraw-Hill.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. General Chemistry, J. C. Kotz, P. M. Treichel and J. R. Townsend, Cengage Lening India Pvt. Ltd., New Delhi.
4. University Chemistry, B. H. Mahan, Narosa.
5. General Chemistry, R. H. Petrucci, Macmillan Publishing Co.: New York.
6. A New Concise Inorganic Chemistry, J. D. Lee, , E.L.B.S.
7. Basic Inorganic Chemistry, F. A. Cotton, and G. Wilkinson, John Wiley.
8. Inorganic Chemistry, D. F. Shriver, and P. W. Atkins, Oxford University Press.
9. Inorganic Chemistry, G. Wulfsberg, Viva Books Pvt. Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3		H
CO 4	H	

CHDQ315L: CHEMISTRY OF D-BLOCK ELEMENTS, QUANTUM CHEMISTRY & SPECTROSCOPY LAB

(1 credit – 30 hours) (L-T-P: 0-0-1)

Objective

This course will make the students familiar with the laboratory experiments related to uv-visible spectroscopy, colourimetry and estimation of metal ions.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall principles and methods for gravimetric analysis of inorganic compounds. (Remembering)
CO 2: Explain the principle involved in gravimetric estimation. (Understanding)
CO 3: Apply the principles to perform complexometric titration. (Applying)
CO 4: Analyse the given vibration-rotation spectrum of HCl(g). (Analysing)

Module I:

a. **Inorganic Chemistry**

1. Estimation of the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel (II) or aluminium as oxinate in a given solution gravimetrically.
2. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
3. Estimation of total hardness of a given sample of water by complexometric titration.
4. To draw calibration curve (absorbance at λmax vs. concentration) for various concentrations of a given coloured compound and estimate the concentration of the same in a given solution.
5. Determination of the composition of the Fe^{3+} - salicylic acid complex / Fe^{2+} -phenanthroline complex in solution by Job's method.
6. Determination of concentration of Na^{+} and K^{+} using Flame Photometry.

b. **Physical Chemistry**

UV/Visible spectroscopy:

1. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λmax values. Calculate the energies of the two transitions indifferent units (J molecule-1, kJ mol-1, cm-1, eV).
2. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.
3. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde,2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

Colourimetry:

1. Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration.
2. Analyse the given vibration-rotation spectrum of HCl(g).

Suggested Readings

1. Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
2. Quantitative Chemical Analysis, A. I. Vogel, Prentice Hall.
3. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.

Mapping of COs to Syllabus

Course Outcomes	Module I
CO 1	H
CO 2	H
CO 3	H
CO 4	H

CHAC316T: INORGANIC CHEMISTRY IV: ADVANCED INORGANIC CHEMISTRY

(4 credits – 75 hours) (L-T-P: 4-0-0)

Objective

This course aims at helping the students to become acquainted with the basic concept of transition metals, organometallics, mechanism of Inorganic Reactions, solid state chemistry

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the properties of main group and transition elements for needful applications. (Remembering)
CO 2: Demonstrate the mechanism of Inorganic photochemical reactions (Understanding)
CO 3: Make use of the properties of metals/non-metals for synthesizing organometallic compounds and catalytic activity study (Applying)
CO 4: Analyse the structure, bonding and synthesis of some inorganic solids. (Analysing)

Module I: Descriptive Inorganic Chemistry (20 lectures)

a. Structure and bonding in polyhedral boranes and carboranes, styx notation, Wade's rules, electron count in polyhedral boranes, synthesis of polyhedral boranes, isolobal analogy, boron halides, phosphine-boranes, boron heterocycles, borazine.
b. Silanes, silicon halides, silicates, silicones, silanols, zeolites, germanium, tin and lead organyls, silenes, germenes, stannenes, phosphorous halides, phosphazenes, sulphur halides, structural features and reactivity of S-N heterocycles.
c. Synthesis and reactivity of organo-lithium, beryllium and magnesium compounds, calixarines, cryptands and crown ethers in complexation chemistry.
d. Preparation and reactivity of aluminium organyls, carbalumination, hydro alumination, chemistry of Ga (I) and In (I), reduction of Al, Ga and In organyls, Metal organic framework structures (MOFs).

Module II: Mechanism of Inorganic Reactions (10 lectures)

Substitution in octahedral and square planar complexes, lability, trans-effect, conjugate base mechanism, racemisation, electron transfer reactions - inertness and lability, inner sphere and outer sphere mechanism, Marcus theory, solid state reactions – topotactic and epitactic mechanisms.

Module III: Inorganic Photochemistry (5 lectures)

Photosubstitution and photoredox reactions of chromium, cobalt and ruthenium compounds, Ligand field and charge transfer state (Thexi and DOSENCO states), cis-trans isomerization, photocatalysis and solar energy conservation by ruthenium complexes.

Module IV: Organometallic Chemistry (15 lectures)

a. Valence electron count (16/18 electron rules), synthesis, structure, bonding and reactivity of mono and polynuclear metal carbonyls, substituted metal carbonyls, vibrational spectra of metal carbonyls, metal-metal bonding.
b. Types of M-C bonds, synthesis and reactivity of metal alkyls, carbenes, alkenes, alkynes, and arene complexes, metallocenes and bent metallocenes, isolobal analogy.
c. Reactions of organometallic complexes: Substitution, oxidative addition, reductive elimination, insertion and de insertion, catalysis, hydrogenation, hydroformylation, Monsanto process, Wacker process, alkene polymerization.

Module V: Introduction to Solid State Chemistry (10 lectures)

Structure of simple solids – metals, alloys and compounds; common structure types; synthesis of solid state compounds - ceramic method, microwave synthesis, sol-gel, precursor method, hydrothermal synthesis, CVD and intercalation; characterization of solids, bonding in solids – free-electron and molecular orbital theory; bands in solid state compounds, properties of solids – optical, magnetic and electrical properties of solids.

Suggested Readings

1. Concepts and Models of Inorganic Chemistry, B. E. Douglas, D. H. McDaniel and J. J. Alexander, John Wiley
2. Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Wiley.
3. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter and R. L. Keiter, Pearson
4. Education.
5. Inorganic.Chemistry, G. L. Miessler and D. Tarr, Pearson Education.
6. 5 Inorganic Chemistry, G. Wulfsberg, University Science Books.
7. Mechanisms of Inorganic Reactions, F. Basalo and R. G. Pearson, John Wiley
8. Organometallic Chemistry of the Transition Metals, R. H. Crabtree, John Wiley.
9. Solid State Chemistry: An Introduction, L. Smart, E. Moore, Nelson Thorns Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1			H		
CO 2					H
CO 3	H	H	M		
CO 4	H			H	

CHBC317T: ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objective

This course aims at helping the students to become acquainted with the basic concept of transition elements, organometallics, bioinorganic chemistry, active methylene compounds, polynuclear hydrocarbons and organic spectroscopy

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the role of metal ions present in biological systems. (Understanding).
CO 2: Apply the 18-electron rule for organometallic compounds. (Applying)
CO 3: Compare the reactivity of polynuclear and heteronuclear aromatic molecules. (Analysing)
CO 4: Evaluate the structure of organic compounds from the UV-Visible and IR-Spectroscopy. (Evaluate)

Module I: Inorganic Chemistry (22 lectures)

a. Chemistry of 3d metals (4 lectures)

Oxidation states displayed by Cr, Fe, Co, Ni and Co.

A study of the following compounds (including preparation and important properties);

Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, $K_3[Fe(CN)_6]$, sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

b. Organometallic Compounds (10 lectures)

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeise's salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach).

c. Bio-Inorganic Chemistry (8 lectures)

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na+, K+ and Mg2+ ions: Na/K pump; Role of Mg2+ ions in energy production and chlorophyll. Role of iron in oxygen transport, haemoglobin, myoglobin, storage and transport of iron.

Module II: Organic Chemistry (23 lectures)

a. Structure, preparation and properties of some aromatic molecules (8 lectures)

Structure elucidation of naphthalene, preparation and properties of naphthalene. Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Furan, Pyrrole, Thiophene, and Pyridine.

b. Active methylene compounds (4 lectures)

Preparation: Claisen ester condensation. Keto-enol tautomerism. Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon).

Reactions: Synthetic uses of ethylacetoacetate (preparation of non-hetero molecules having upto 6 carbon).

c. Application of Spectroscopy to Simple Organic Molecules (11 lectures)

Application of visible, ultraviolet and infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λ_{max} and ε_{max}, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating l max of conjugated dienes and α, β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Suggested Readings

1. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. Keiter and R. Keiter, Pearson Publication.
2. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Pearson Publication.
3. A New Concise Inorganic Chemistry, J. D. Lee, E.L.B.S.
4. Basic Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley & Sons.
5. Organic Chemistry (Vol. I & II), I. L. Finar, E.L.B.S.
6. Applications of Absorption Spectroscopy of Organic Compounds, J. L. Dyer, Prentice Hall.
7. Spectroscopic Identification of Organic Compounds, R. M. Silverstein, G. C. Bassler and T. C. Morrill, John Wiley & Sons.
8. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice Hall.
9. A Guide Book to Mechanism in Organic Chemistry, P. Sykes, Orient Longman.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H

CHBC318L: ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY LAB

(1Credit – 30 hours) (L-T-P: 0-0-1)

Objective

This course aims at helping the students to become acquainted with the basic experimental concepts on Transition metal complex synthesis and their conductance, systematic qualitative organic analysis, separation by Chromatography

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Qualitative analysis of the organic sample. (Remembering)
CO 2: Explain the concepts of retention factors in chromatographic techniques. (Understanding)
CO 3: Application of paper chromatography techniques. (Applying)
CO 4: Preparation of transition metal complex and comparison of their conductance. (Analysing)

Module I: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the R_f value in each case. (Combination of two ions to be given)
   I. Paper chromatographic separation of Fe^{3+}, $A1^{3+}$and Cr^{3+}.
   II. Paper chromatographic separation of Ni^{2+}, Co^{2+}, $Mn^{2+}$and $Zn^{2+.}$
2. Preparation of any two of the following complexes and measurement of their conductivity:
   I. Tetraamminecarbonatocobalt (III) nitrate.
   II. Tetraamminecopper (II) sulphate.
   III. Potassiumtrioxalatoferrate (III) trihydrate.
   IV. Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl2 and LiCl3.

Module II: Organic Chemistry

Systematic Qualitative Organic Analysis of Organic Compounds possessing mono functional groups (-COOH, alcoholic, phenolic, carbohydrates, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Suggested Readings

1. Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
2. Quantitative Chemical Analysis, A. I. Vogel, Prentice Hall
3. Textbook of Practical Organic Chemistry, A. I. Vogel, Prentice Hall.
4. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Orient Longman.

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO 1		H
CO 2	H	
CO 3	H	
CO 4	H	

CHAP319T: PHYSICAL CHEMISTRY V: ADVANCED PHYSICAL CHEMISTRY

(4 credits – 75 hours) (L-T-P: 4-0-0)

Objective

This course aims at helping the students to become acquainted with the concepts of chemical kinetics, molecular reaction dynamics, electrochemistry

Course / Learning Outcomes

CO 1: Explain the interactions of ionic species with solvent molecules. (Understanding)
CO 2: Apply the knowledge of chemical kinetics to some important types of reactions. (Applying)
CO 3: Analyse the application of electrochemistry in different fields. (Analysing)
CO 4: Calculate the rate of different types of chemical reactions. (Evaluating)

Module I: Chemical Kinetics (15 lectures)

Hard Sphere collision theory, theories of unimolecular reactions: Lindemann theory, drawbacks of Lindemann theory-Hinshelwood modification. Steady state approximation and its applications, oscillating reactions, chemical chaos, Belousov-Zhabotinski reaction, straight chain reactions - hydrogen-halogen reactions, alkane pyrolysis, Branching-chain reactions - the hydrogen-oxygen reaction, explosion limits, Enzyme catalyzed reactions, Michaelis-Menten mechanism- Lineweaver-Burk and Eadie plots, enzyme inhibiton.

Module II: Study of Fast Reactions (8 lectures)

Stopped flow technique, temperature and pressure jump methods, NMR studies in fast reactions, shock tube kinetics, relaxation kinetics, Linearized rate equation, relaxation time in single step fast reactions, determination of relaxation time.

Module III: Molecular Reaction Dynamics (15 lectures)

Collisions of real molecules- trajectory calculations, Laser techniques, reactions in molecular beam, estimation of activation energy and calculation of potential energy surface, the transition state theory (TST) of bimolecular gaseous reactions, statistical and thermodynamic formulations. Comparison between TST and hard sphere collision theory, kinetics of reactions in solution-diffusion controlled and chemically controlled reactions, TST of reactions in solution- Bronsted and Bjerrum equation, effect of ionic strength, kinetic salt effect.

Module IV: Electrochemistry - I (10 lectures)

a. Ion-solvent interaction- the Born model, Thermodynamic parameters of ion solvent interactions- structural treatment, the ion-dipole model-its modifications, ion-quadrupole and ion-induced dipole interactions.
b. Primary solution- determination of hydration number, compressibility method and viscosity-mobility method, Debye-Huckel theory of ion-ion interactions, derivation, validity and limitations, extended Debye-Huckel-Onsager equation, random walk model of ionic Diffusion-Einstein Smoluchowski reaction.

Module V: Electrochemistry – II (12 lectures)

a. **Theories of Electrical Interface:** Electrocapillary phenomena - Lippmann equation, electron transfer at interfaces, polarizable, non-polarizable and non-polarisable interfaces, Butler-Volmer equation, Tafel plot.
b. **Systems for Electro-Chemical Energy Storage and Conversion**: Types of Batteries, Lead- acid batteries, Nickel-cadmium batteries and Li-ion batteries, electrical double layer capacitor, pseudo-capacitor, fuel cells.

Suggested readings

1. Physical Chemistry, P. Atkins and J. Paula, Oxford University Press, Oxford.
2. Physical chemistry, I. R. Levine, Mcgraw Hill Education.
3. Chemical Kinetics, K. J. Laidler, Pearson.
4. Modern Electrochemistry Part 1, 2A and 2B, J. O. Bockris and A. K. N. Reddy, Springer.
5. Electrochemical Methods Fundamentals and Applications, J. Bard and L. R. Faulkner, Willy India.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1				H	M

CO 2	H	H	H		
CO 3			H		H
CO 4	H	H	H		

CHAM406T: ANALYTICAL METHODS IN CHEMISTRY

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objective

This course aims at helping the students to become acquainted with Qualitative and quantitative aspects of analysis, different methods of analysis

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Define principles of different methods of analysis. (Remembering)
CO 2: Explain different optical methods of analysis. (Understanding)
CO 3: Identify kinds of errors in chemical analysis. (Applying)
CO 4: Analyse the techniques of thermogravimetry to estimate ions in a mixture. (Analysing)

Module I: Qualitative and quantitative aspects of analysis (5 hours)

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution of indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Module II: Optical methods of analysis (15 hours)

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument.

Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers.

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Module III: Thermal methods of analysis (5 hours)

Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Module IV: Electroanalytical methods (10 hours)

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

Module V: Separation techniques (10 hours)

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation.

Technique of extraction: batch, continuous and counter current extractions.

Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media.

Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods.

Suggested Readings

1. A Text book of Quantitative Inorganic Analysis, A. I. Vogel, ELBS, Longman.
2. Instrumental Methods of Analysis, H. H. Willard, Wadsworth Publishing Company, Belmont, California, USA.
3. Analytical Chemistry, G. D. Christian, John Wiley & Sons, New York.
4. Exploring Chemical Analysis, D. C. Harris, New York, W.H. Freeman.
5. Basic Concepts of Analytical Chemistry, S.M. Khopkar, New Age, International Publisher.
6. Principles of Instrumental Analysis, D.A. Skoog, F. J. Holler and T. A. Nieman, Thomson Asi Pvt. Ltd. Singapore.
7. Laboratory Hand Book of Chromatographic & Allied Methods, O. Mikes and R. A. Chalmers, Elles Horwood Ltd. London.
8. Analytical Chemistry – Methods of separation, R.V. Dilts, Van Nostrand.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	H	H
CO 2		H			
CO 3	H				
CO 4			H		H

CHRM407T: RESEARCH METHODOLOGY

(2 credits – 30 hours) (L-T-P: 2-0-0)

Objective

This course aims at helping the students to become acquainted with different methods of scientific research, data analysis, way to write project proposal

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the different methods of scientific Research. (Understanding)
CO 2: Explain how to use e-resources for research. (Understanding)
CO 3: Explain the analysis and presentation of data. (Understanding)
CO 4: Apply the knowledge of chemical safety and handle chemicals safely in the lab. (Applying)
CO 5: Construct a proposal for project funding. (Creating)

Mode of Assessment:

Modules I-II will be assessed based on a written examination (2 credits) while Module III will be assessed on the basis of a seminar (1-credit).

Module I: Methods of Scientific Research and Chemical Safety (10 lectures)

a. Print resources, digital resources, information technology and library resources, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving an oral presentation, writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publication of scientific work; writing ethics – avoiding plagiarism.

b. Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals, overview of chemical regulations in India.

Module II: Data Analysis (10 lectures)

The Investigative Approach: Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments.

Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemometrics, Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, r and its abuse. Basic aspects of multiple linear regression analysis.

Module III: Project Proposal Writing (Seminar Module) (10 lectures)

In this module, students will be reviewing scientific articles, writing reports on the papers they have read and finally prepare a research proposal.

Suggested Readings

1. Practical skills in chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A. Jones, Prentice-Hall, Harlow.
2. Data analysis for chemistry, D. B. Hibbert and J. J. Gooding, Oxford University Press.
3. Errors of observation and their treatment, Fourth Ed., J. Topping, Chapman Hall, London.
4. Quantitative chemical analysis, D. C. Harris, Freeman.
5. How to use Excel in analytical chemistry and in general scientific data analysis, R. de Levie, Cambridge Univ. Press.
6. Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.
7. OSU safety manual 1.01.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	H		L
CO 3		H	
CO 4	H		
CO 5			H

CHML408T: MOLECULES OF LIFE

Objective

This course aims to introduce properties of molecules involved in various physiological processes.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the properties and functions of the biomolecules they study. (Understanding)
CO 2: Write mechanisms of biomolecular reactions. (Applying)
CO 3: Differentiate between different biomolecules. (Analysing)
CO 4: Assess the importance of biomolecules in specific processes. (Evaluating)

Module I: Carbohydrates (8lectures)

Classification of carbohydrates, reducing and non-reducing sugars, General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosachharides, structure of disacharrides (sucrose) and brief idea of polysaccharides.

Module II: Amino Acids, Peptides and Proteins (8 lectures))

Classification of Amino Acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C–terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides.

Module III: Enzymes and correlation with drug action (8 lectures)

Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action (Including stereospecifity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non-competitive inhibition including allosteric inhibition). Drug action-receptor theory. Structure –activity relationships of drug molecules, binding role of –OH group, -NH2 group, double bond and aromatic ring.

Module IV: Nucleic Acids (10 lectures)

Components of Nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Module V: Lipids (5 lectures)

Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number.

Module VI: Concept of Energy in Biosystems (6 lectures)

Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate-Glycolysis, Fermentation, Krebs Cycle.

Suggested Readings

1. Organic Chemistry, R. T. Morrison and R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Organic Chemistry (Volume 1), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Organic Chemistry (Volume 2), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Lehninger's Principles of Biochemistry, D. L. Nelson and M. M. Cox, W. H. Freeman.
5. Biochemistry, J. M. Berg, J. L. Tymoczko and L. Stryer, W. H. Freeman.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M	H	M	M	H
CO 2		H		H		M
CO 3		M			M	
CO 4			H		H	

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	CHBC112L	Basic Analytical Chemistry (1-0-2)	3
2	S E Course 2	CHCH113L	Chemoinformatics (1-0-2)	3
3	S E Course 3	CHIP217L	Intellectual Property Rights (3-0-0)	3

CHBC112L: BASIC ANALYTICAL CHEMISTRY

(3 Credits- 45 hours) (L-T-P: 1-0-2)

Objective

This course is intended to explain the fundamental concepts analytical chemistry and its applications.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall concept of data analysis and principles of chromatography. (Remembering)
CO 2: Explain terms associated with analytical measurements. (Understanding)
CO 3: Determining various parameters of soil and water samples. (Applying)
CO 4: Analyse a mixture of metal ions through paper chromatography. (Analysis)

Module I:

Introduction to Analytical Chemistry and its interdisciplinary nature, concept of sampling, importance of accuracy, precision and sources of error in analytical measurements, Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators.

a. Determination of pH of soil samples.
b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample.
b. Determination of dissolved oxygen (DO) of a water sample.

Module II:

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc. Paper chromatographic separation of mixture of metal ion (Ni^{2+} and Co^{2+}).

Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

Suggested Instrumental demonstrations:

a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.
b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.
c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink.

Suggested Readings

1. Instrumental Methods of Analysis, H. H. Willard, CBS Publishers.
2. Instrumental Methods of Analysis, D. A. Skoog and J. J. Leary, Saunders College Publications, New York.
3. Fundamentals of Analytical Chemistry, D. A. Skoog, D. M. West, F. J. Holler, Saunders College Publishing, Fort Worth.
4. Quantitative Chemical Analysis, D. C. Harris, W. H. Freeman and Co., New York.
5. Analytical Chemistry Handbook, J. A. Dean, McGraw Hill.
6. Vogel's Qualitative Inorganic Analysis, G. Svehla, Prentice Hall.
7. Vogel's Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, Prentice Hall.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	M	
CO 2	H	H
CO 3	H	
CO 4	M	H

CHCH113L: CHEMOINFORMATICS

(3 Credits- 45 hours) (L-T-P: 1-0-2)

Objective

This course is intended to explain concepts of molecular modelling and its application in drug designing.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the principles of molecular modelling. (Remembering)
CO 2: Explain principles of molecular modelling. (Understanding)
CO 3: Predict properties of compounds, build models. (Applying)
CO 4: Elucidate structure and properties, carry out the computer-assisted synthesis of drugs. (Creating)

Module I:

a. Introduction to Chemoinformatics: History and evolution of chemoinformatics, Use of chemoinformatics, Prospects of chemoinformatics, Molecular Modelling and Structure elucidation.
Representation of molecules and chemical reactions: Nomenclature, Different types of notations, SMILES coding, Matrix representations, Structure of Mol files and Sd files, Libraries and toolkits, Different electronic effects, Reaction classification.
Searching chemical structures: Full structure search, sub-structure search, basic ideas, similarity search, three-dimensional search methods, basics of computation of physical and chemical data and structure descriptors, data visualization.

b. Applications: Prediction of Properties of Compounds; Linear Free Energy Relations; Quantitative Structure-Property Relations; Descriptor Analysis; Model Building; Modelling Toxicity; Structure-Spectra correlations; Prediction of NMR, IR and Mass spectra; Computer Assisted Structure elucidations; Computer Assisted Synthesis Design, Introduction to drug design; Target Identification and Validation; Lead Finding and Optimization; Analysis of HTS data; Virtual Screening; Design of Combinatorial Libraries; Ligand-Based and Structure Based Drug design; Application of Chemoinformatics in Drug Design.

Hands-on Exercises

Suggested Readings

1. An introduction to Chemoinformatics, R. L. Andrew and J. Valerie, Gillet Springer: The Netherlands.
2. Chemoinformatics: A text-book. J. Gasteiger and T. Engel, Wiley-VCH.
3. QSAR & Molecular Modeling, S. P. Gupta, Anamaya Pub.: New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I
CO 1	H
CO 2	M
CO 3	M
CO 4	M

CHIP217L: INTELLECTUAL PROPERTY RIGHTS

(3 Credits- 45 hours) (L-T-P: 3-0-0)

Objective

This course is intended to explain the concepts intellectual property rights and its need.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the basic concepts of intellectual property. (Remembering)
CO 2: Explain the need for protection of intellectual property. (Understanding)
CO 3: Develop the knowledge of different types of intellectual property. (Applying)
CO 4: Distinguish between different types of intellectual property. (Analysing)

Module I: Introduction to Intellectual Property

Historical Perspective, different Types of IP, importance of protecting IP.

Module II: Copyrights, Trade Marks, Patents

a. Introduction, how to obtain, differences from Patents.
b. Introduction, how to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc., differences from designs.

c. Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge.
d. Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India, geographical indications.
e. Definition, rules for registration, prevention of illegal exploitation, importance to India.
f. Industrial Designs: Definition, how to obtain, features, international design registration.

Layout design of integrated circuits, Circuit Boards, Integrated Chips, importance for electronic industry.

Module III: Trade Secrets

Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.

Module IV: Different International agreements

World Trade Organization (WTO):

1. General Agreement on Tariffs & Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement.
2. General Agreement on Trade related Services (GATS).
3. Madrid Protocol.
4. Berne Convention.
5. Budapest Treaty.
6. Paris Convention.

WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity.

IP Infringement issue and enforcement – role of Judiciary, role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Intellectual Property in the Indian Context – Various laws in India Licensing and technology transfer.

Suggested Readings

1. Textbook on intellectual property rights, N. K. Acharya, Asia Law House.
2. Understanding Trips: Managing Knowledge in Developing Countries, M. Guru and M. B. Rao, Sage Publications.
3. Intellectual Property Rights: Unleashing the Knowledge Economy, P. Ganguli, Tata McGraw-Hill.
4. Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, A. R. Miller and M. H. Davis, West Group Publishers.
5. Intellectual property rights in the WTO and developing countries, J. Watal, Oxford University Press, Oxford.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	M	
CO 3	M			H
CO 4	M	M		

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	CHIN114I	Internship	4
4	Internship	CHIN218I	Internship	4
5	Internship	CHIN320I	Internship	2

CHIN114I/ CHIN218I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 hours)

CHIN320I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours)

Internship programme

Objectives:

1. To help students in gaining experience in their chosen professional field and hence building their own network.
2. To prepare students for the job market.

3. To help students in developing their interpersonal skills.
4. To offer students the real world exposure.

Keeping in mind about the above objectives, the department of chemistry, ADBU is planning for student's internship as per the following strategies

1. Finding of suitable organization/ institutions/ industries offering internship programme by the students.
2. Students must seek consent from the project supervisor/departmental head for application.
3. After due approval, students should appear in the internship interview.
4. Confirmation from the respective institutions end for allowing the internship.
5. After being selected, students should apply to the Director of school or Dean (academics) supported by the industry offer letter.
6. An office order will be issued to the students from academic section on recommendation by the Director/Dean.
7. Finally, a student can proceed to an internship only after receiving an office order from academic section.
8. Internship report submission at the department by the interns and notification of completion by the department.

Note: The internships of 8-10 weeks of 10 credits, after 2nd or 4th semester, will be mandatory for the students desirous of exiting with a certificate or Diploma, respectively. [Source: Internship policy of NEP].

RESEARCH PROJECT /DISSERTATION

BSC CHEMISTRY (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	CHDI409P	Research Project Phase I	6
8	Research Project/Dissertation	CHDI410P	Research Project Phase II	6
BSC CHEMISTRY (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	CHDI411P	Dissertation I	18
8	Research Project/Dissertation	CHDI412P	Dissertation II	20

CHDI409P: RESEARCH PROJECT PHASE I

(6 credits – 180 hours) (L-T-P: 0-0-6)

In the project Phase I, the students will be trained to carry out literature survey. In addition, proper training will be provided to learn the uses of various software and tools for enhancing their skills in the field of research and development.

CHDI410P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-6)

After successful completion of the Literature Review work, the students will be trained to carry out both **Theoretical and Experimental** based research projects. Finally, they will report and submit their dissertation thesis. Research training in **Phase II** will definitely help them in their future research study.

BSC CHEMISTRY (Honours) with Research

CHDI411P: DISSERTATION I

(18 Credits -540 Hours) (L-T-P: 0-0-18)

In the Dissertation Phase I, the students will be trained to carry out literature survey. In addition, proper training will be provided to learn the uses of various software and tools for enhancing their skills in the field of research and development. Along with their Literature review work, they will also carry out the research problem as assigned by the supervisor.

CHDI412P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-20)

In the Dissertation Phase II, the students will complete and summarize their research work. They will present their research work in front of faculty members and external examiner and will finally submit the dissertation thesis.

DEPARTMENT OF MATHEMATICS

PROGRAMME: BACHELOR OF SCIENCE in MATHEMATICS (BSC)

DEGREE: BSC MATHEMATICS (HONOURS)/ BSC MATHEMATICS (HONOURS) WITH RESEARCH

VISION:

Be a globally recognized Department of Mathematics with a reputation for excellence in teaching, research, and outreach; imparting the best possible education to the students to nurture their talent and creativity in the pursuit of truth with the vision of the Assam Don Bosco University to prepare socially aware citizens.

MISSION:

1. To provide adequate understanding of Mathematical laws by means of both conventional techniques and skilful approaches.
2. To familiarize students as well as faculty members with the state-of –the –art by means of talks, workshops, symposia.
3. To stimulate curiosity mixed with enthusiasm for further investigation into research in Mathematics and relevant fields.

PROGRAM OUTCOMES – UG PROGRAMME

PO 1: **Disciplinary Knowledge**: Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study.

PO 2: **Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. Critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO 3: **Communication Skills**: Ability to express thoughts and ideas effectively in writing and orally; communicate with others using appropriate media; confidently share one's views and express herself/ himself; demonstrate the ability to listen carefully; and present complex information in a clear and concise manner to different groups.

PO 4: **Social Interaction**: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 5: **Effective Citizenship**: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 6: **Moral and Ethical Awareness**: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 7: **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

PO 8: **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life- long learning in the broadest context socio- technological changes. Critical sensibility to lived experiences, with self-awareness and reflexivity of both and society.

PO 9: **Information and Digital Literacy: Ca**pability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 10: **Research –related skills: A** sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause- and- effect relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Ability to apply one's learning to real life situations.

Programme Specific Outcomes - B. Sc (Hons) Mathematics

PSO 1: **Solid Foundation in Knowledge:** Bachelor Degree in Mathematics is the culmination of in-depth knowledge of the core branches of mathematics, and some related areas like Computer Science, Programming Languages, Statistics and Data Science. Thus, this programme helps students in building a solid foundation for further higher studies and research in Mathematics and allied fields.

PSO 2: **Competency in Skills:** The skills and knowledge gained leads to proficiency in analytical reasoning, critical understanding, analysis and synthesis in order to solve theoretical and practical problems in Mathematics and relevant areas.

PSO 3: **Problem Solving:** Students undergoing this programme learn to logically question assertions, to recognize patterns and to distinguish between essential and irrelevant aspects of problems. This helps them to learn behave responsibly in a rapidly changing interdependent society.

PSO 4: **Interdisciplinary and Research Skills**: Students completing this programme will be able to present mathematics clearly and precisely, make real-life problems precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.

PSO 5: **Proficiency in Employments**: This programme will help students to enhance their employability in teaching, research and other jobs in different public and private sectors.

Mapping of Courses to POs and PSOs

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03	PS04	PS05
MACA100T	H	M						M	L	M	H	M	H	M	L
MACA101L	H	M	M					M	M	L	H	M	H	M	M
MAAL102T	H	H			L		L			M	H	M	H	M	M
MAMC200T	H	M	L			L	L	M	L	H	H	M	H	H	L
MADE201T	H	H	L	M	L		L	M	L	H	H	M	H	H	M
MADE202L	H	H	L	M	L		L	M	M	H	5H	M	H	H	M
MARA203T	H	H	L		M	L		H	L	M	H	M	H	M	L
MANM204T	H	M		L		M	M	H	M		H	M	M	M	M
MAAA205T	H	H			L		L			M	H	M	H	M	M
MALA300T	H	M		L		M		M	L	H	H	M	M	H	M
MAPS301T	H	H	L	M	L		L	M	L	H	H	M	H	H	M
MAPS302L	M	H	L	M	L		L	M	M	H	5H	M	H	H	M
MAPB303T	H	M		L	M	M	M			L	H		M	M	
MAMS304T	H	M			M			M		L	H	M	M	M	L
MARI305T	H	L			M	L		M		M	H	L	M	L	
MANT306T	H	M	L	M	M			M	M	H	H	M	M	M	L
MAMP307P			H	H	M	M	L	M	H	H	H	L	M	M	M
MAAB400T	H	H	L		L		L			M	H	M	H	M	M
MAAP401T	H	H		M	M	M	M	H		L	H	M	M	L	L
MATP402T	H	H		M	M	M	M	H		L	H	M	M	L	L
MAFA403T	H	H		M	M	M	M	H		L	H	M	M	L	L
MAEC103T	M	L			L	L		L							
MAEA104T	M	M			M	L		L	M	M	M	M	M	M	L
MAON206T	M	M			M	L			M	M	M	M	M	M	L
MASD207T	M	M	M					M	L	M	M		L	M	
MARC208T	M	M		M	M	M				L	M	M	M	M	
MAGT209T	H	M	M		M		M		H	M	H	M	M	H	M
MAVC308T	M	M			M	L			M	M	M	M	M	M	L
MALP309T	H	M	L				M		M	H	M	M	M	M	M
MABI310T	H	H	L	M	L		L	M	L	H	H	M	H	H	M
MAFE311T	M	H	M	M					M	M		M	M	M	
MAEL312T	H	M			M			M		L	H	M	M	M	L
MAAF313T	H	M	M			M		M	M	M	M	M	M	M	
MAMC314T	H	M	M	M				M	L	M	M	M	M	M	
MADG315T	H	H					L	M	M	H	M		M	H	M
MABA404T	M	H	M	M	M	M	M		L	L	M	M	L		M
MAIG405T	H	M	L				M		M	H	M	M	M	M	M
MARM406T		H	H	M	M	H	H	H	M	H		M	H	M	L
MADS407T	H	M	M	L				M	H	M	M	M	M	H	M
MACT408T	H	H	M			M		M	H	H	M	M	M	M	M

MAIC409T	H	H	M			M		M	H	H	M	M	M	M	M
MAPC105T	M	M	M		L	M	M	M	H	H	M	H	H	H	H
MALS106T	H	M	M	L				M	H	M	M	M	M	H	M
MAIP107T	M	H	M	M	M	M	M		L	L	M	M	L		M
MALM210T	M	M	M		L	M	M	M	H	H	M	H	H	H	H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	MACA100T	Calculus	4
		MACA101L	Calculus Lab	
2	Major Course 2	MAAL102T	Algebra	4
3	Major Course 3	MAMC200T	Multivariate Calculus	4
3	Major Course 4	MADE201T	Differential Equations	4
		MADE202L	Differential Equations Lab	
4	Major Course 5	MARA203T	Real Analysis	5
4	Major Course 6	MANM204T	Numerical Methods and Coordinate Geometry	5
4	Major Course 7	MAAA205T	Abstract Algebra	4
5	Major Course 8	MALA300T	Linear Algebra	5
5	Major Course 9	MAPS301T	PDE and Systems of ODE	5
		MAPS302L	PDE and System of ODE Lab	
5	Major Course 10	MAPB303T	Probability and Statistics	4
6	Major Course 11	MAMS304T	Metric Space and Complex Analysis	4
6	Major Course 12	MARI305T	Riemann Integration and Series of Functions	4
6	Major Course 13	MANT306T	Number Theory	4
6	Major Course 14	MAMP307P	Minor Project	4
7	Major Course 15	MAAB400T	Advanced Abstract Algebra.	5
7	Major Course 16	MAAP401T	Applied Analysis	5
8	Major Course 17	MATP402T	Topology	5
8	Major Course 18	MAFA403T	Functional Analysis	5

MACA100T: CALCULUS

(3 Credits – 45 hours) (L-T-P: 3-0-1)

Objective(s)

The objective of the course is to introduce to a student the fundamental and advanced notion of calculus. Apart from that, analogous notion in case of vector valued function will also be introduced.

Course/Learning Outcomes:

At the end of this course students will be able to:

CO 1: Explain the fundamental concepts of differentiation and integration to solve some of the important problems of calculus (Understanding).

CO 2: Apply the formulae of differential and integral calculus, to solve problem related to asymptote, curve tracing, conics, reduction formulae, volumes, arc length, surface area of revolution etc and vector function with applications. (Applying).

CO 3: Classify various curves along with their properties in both Cartesian and polar equations (Analysing).

Module I: (10 hours)

Hyperbolic functions, higher order derivatives, Leibniz rule and its applications to problems of type, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, Hospital's rule, applications in business, economics and life sciences.

Module II: (10 hours)

Reduction formulae, derivations and illustrations of reduction formulae of the type, volumes by slicing, disks and Washer's methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

Module III: (12 hours)

Techniques of sketching conics, reflection properties of conics, rotation of axes and second-degree Equations, classification into conics using the discriminates, polar equations of conics.

Module IV: (13 hours)

Introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler 's second law.

Suggested Readings

1. Thomas G.B. and Finney R.L., Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. Strauss M.J., Bradley G.L. and Smith K. J., Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. Anton H., Bivens I. and Davis S., Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore,2002.
4. Courant R. and John F., Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2	H	H		H
CO3	H	M	H	

MAAL102T: ALGEBRA

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

This course introduces the fundamentals of algebra and its applications in varieties of physical contexts. Additionally, this course also provides a thorough method for numerically resolving various issues that arise in their field.

Course/Learning Outcomes:

At the end of the course students will be able to:

CO 1: Demonstrate various results of complex numbers, functions and matrices. (Understanding)
CO 2: Solve problems related to trigonometric, basic algebra, and number system. (Applying)
CO 3: Inspect the properties of system of linear equations, and inequalities. (Analysing)

Module I: (12 hours)

Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications.

Module II: (15 hours)

Equivalence relations, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set, Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm, Congruence relation between integers, Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.

Module III: (18 hours)

Inequalities involving arithmetic, geometric and harmonic means, Cauchy Schwarz inequality, relations between roots and coefficients of polynomial equation of degree n, roots of symmetric functions, Cardon's methods solution of cubic equation.

Module IV: (15 hours)

Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax=b, solution sets of linear systems, applications of linear systems, linear independence. Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of Rn , dimension of subspaces of Rn and rank of a matrix, Eigenvalues, Eigen Vectors and Characteristic Equations of a matrix.

Suggested Readings

1. Titu Andreescu and Dorin Andrica Complex Numbers from A to Z, Burkhouse, 2006.
2. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.
3. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Indian Reprint, Pearson Education Asia,

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	M	H
CO2	M	H	H	H
CO3	M	H	H	

MAMC200T: MULTIVARIATE CALCULUS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

This course introduces notions of vector operations in three and higher dimensions, partial derivatives in terms of matrices, methods for integrating over surfaces and curves and Stokes' and Green's theorem.

Course/Learning Outcomes:
At the end of this course students will be able to:
CO 1: Illustrate differentiation and integration of functions of several variables. (Understanding).
CO 2: Determine area, volume using double and triple integration. (Evaluating).
CO 3: Analyse multiple integrals by changing the variables. (Analysing).
CO 4: Make use of Green's, Stokes' and Gauss' theorem in some physical applications. (Applying).

Module I: (15 hours)
Functions of several variables, limit and continuity of functions of two variables Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems.

Module II: (15 hours)
Double integration over rectangular region, double integration over non-rectangular region, Double integrals in polar coordinates, Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical coordinates.

Module III: (15 hours)
Change of variables in double integrals and triple integrals. Line integrals, Applications of line integrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields, independence of path, Definition of vector field, divergence and curl.

Module IV: (15 hours)
Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.

Suggested Readings
1. Thomas G.B. and Finney R.L., Calculus, Pearson Education, Delhi.
2. Strauss M.J., Bradley G.L. and Smith K. J., Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. Marsden E., Tromba Basic Multivariable Calculus, and Weinstein A., Basic Multivariable Calculus, Springer (SIE), Indian reprint.
4. James Stewart, Multivariable Calculus, Concepts and Contexts, Brooks /Cole, Thomson Learning, USA.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	M	H	H
CO 2		H	M	M
CO 3			H	M
CO 4				H

MADE201T: DIFFERENTIAL EQUATIONS

(3 Credits – 45 hours) (L-T-P: 3-0-1)

Objective(s)
The course aims to introduce the theory of ordinary differential equation. The course focuses not only at how to formulate a physical problem using differential equation but also at different methods of solution.

Course/Learning Outcomes:
At the end of this course students will be able to:
CO 1: Solve linear and non-linear differential equation of first and higher order using various techniques. (Applying).
CO 2: Apply these techniques to solve and analyse various mathematical models. (Analysing).
CO 3: Learn basics of differential equations and formulate Differential Equations for various Mathematical models. (Creating).

Module I: (15 hours)
Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Module II: (15 hours)
Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills), exponential growth of population, limited

growth of population, limited growth with harvesting.

Module III: (15 hours)
General solution of homogeneous equation of second order, principle of superposition for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non- homogeneous equations of higher order with constant coefficients, Euler 's equation, method of undetermined coefficients, method of variation of parameters.
Equilibrium points, Interpretation of the phase plane, predator-prey model and its analysis, epidemic model of influenza and its analysis, battle model and its analysis.

Suggested Readings

1. Belinda Barnes and Glenn R. Fulford, Mathematical Modelling with Case Studies, A Differential Equation Approach using Maple and MATLAB, 2nd Ed., Taylor and Francis group, London and New York, 2009.
2. Edwards C.H. and Penny D.E., Differential Equations and Boundary Value problems Computing and Modelling, Pearson Education India, 2005.
3. Ross S.L., Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
4. Martha L Abell, James P Braselton, Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO1	H	L	H
CO2	L	H	H
CO3		H	H

MARA203T: REAL ANALYSIS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)
This course aims to introduce analysis of the real number system and covers the basic aspects on the fundamentals of real analysis including all the essential ideas of mathematical analysis in general.

Course/Learning Outcomes:
At the end of this course students will be able to:
CO 1: Illustrate the concept of limit point, limit of a function, sequence and series of real functions. (Understanding).
CO 2: Examine convergence of sequence and series of real numbers and functions. (Analysing).
CO 3: Explain the continuity, uniform continuity and differentiability of functions. (Evaluating.)
CO 4: Make use of various convergence tests for sequence, series of real numbers and functions. (Applying).

Module I: (10+5 hours)
Real number system as a complete ordered field, Archimedean property, supremum, infimum. Open and closed sets, limit points, interior points, Euclidean space, compact spaces, Bolzano Weierstrass theorem, Heine Borel theorem in R only. Sequence of real numbers, bounded sequence, limsup, liminf, Cauchy sequences, Series, convergence of series, root and ratio tests, absolute convergence.

Module II: (18+5 hours)
Limit, Continuity, types of discontinuity, Intermediate value theorem, Fixed point theorem, uniform continuity, Monotonic functions. Limits of functions (approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.

Module III: (16+2 hours)
Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem. Rolle's theorem, Mean value theorem, intermediate value property of derivatives, Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials, Taylor's theorem to inequalities. Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema.

Module IV: (16+3 hours)
Sequence and series of real valued functions, Point wise and uniform convergence, uniform convergence and continuity, uniform convergence and differentiation, uniform convergence and integration. Cauchy criteria for uniform convergence. Series of functions and convergence, Weierstrauss M-test.

Suggested Readings

1. Rudin R., Principles of Mathematical Analysis (5th edition), McGraw Hill Kogaku Sha Ltd., 2004.
2. Apostol T., Mathematical Analysis (5th edition), Addison-Wesley; Publishing Company, 2001.
3. Bartle R.G. and Sherbert D.R., Introduction to Real Analysis (3rd edition), John Wiley and Sons, Inc., New York 2000.
4. Bartle R.G., The Elements of Real Analysis (3rd edition), Wiley International Edition, 1994.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	M	M	M
CO2	L	H		H
CO3		H	M	H
CO4		H		H

MANM204T: NUMERICAL METHODS AND COORDINATE GEOMETRY

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

This course introduces various numerical methods of solutions. It also covers various conic section along with their properties.

Course/Learning Outcomes:

At the end of this course students will be able to:

CO 1: Illustrate the concept of numerical methods on algebraic, transcendental equation, differentiation, integration and differential equations. (Understanding).
CO 2: Utilize appropriate methods to solve interpolation, differentiation, integration, and ordinary differential equations problems. (Applying).
CO 3: Classify the various forms of conic sections in cartesian and polar coordinates. (Analysing).
CO 4: Discuss the graphs of some special curves by using polar coordinates on the plane. (Creating).

Module I: (10 +4) hours)

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation. Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.

Module II: (15+3) hours)

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss
Jacobi method, Gauss Seidel method and their convergence analysis.
Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

Module III: (12+3) hours)

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpsons 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule. Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four.

Module IV: (11+3) hours)

Transformation of coordinates, pair of straight lines. Parabola, parametric coordinates, tangent and normal, ellipse and its conjugate diameters with properties, hyperbola and its asymptotes

Module V: (12+2) hours)

Techniques of sketching conics, reflection properties of conics, rotation of axes and second-degree equations, classification into conics using the discriminates, polar equations of conics.

Suggested Readings

1. Brian Braide, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2. Jain M.K., Iyengar S.R.K. and Jain R.K. Numerical Methods for Scientific and Engineering Computation, 6th Ed., Jain, New age International Publisher, India, 2007.
3. Gerald C.F. and Wheatley P.O., Applied Numerical Analysis, Pearson Education, India, 2008.
4. Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed.PHI Learning Private Limited, 2013.
5. John H. Mathews and Kurtis D. Fink, Numerical Methods using MATLAB, 4th Ed., PHI Learning Private Limited, 2012.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		
CO 2		H	H		

CO 3				H	M
CO 4				M	H

MAAA205T: ABSTRACT ALGEBRA

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

This course introduces the ideas of algebraic structures, symmetry properties of specific geometric objects and also to equip students with the knowledge necessary to draw conclusions about a problem's solution from its associated algebraic structure's characteristics.

Course/Learning Outcomes:

At the end of this course students will be able to:

CO 1: Interpret the properties of basic algebraic structures. (Understanding).
CO 2: Solve problems of algebraic structures, sub-structures and their mappings. (Applying).
CO 3: Classify the properties of groups, rings. (Analysing).

Module I: (18 hours)

Groups, Basic properties, Symmetries of a square, Dihedral group, Order of a group, Order of an element, Subgroups, Center of a group, Centralizer of an element, Cyclic groups and properties, Generators of a cyclic group, Classification of subgroups of cyclic groups. Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.

Module II: (18 hours)

Normal subgroups, factor groups, Cauchy's theorem for finite abelian groups. Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.
Automorphisms and Properties: Automorphism groups, Automorphism groups of finite and infinite cyclic groups, Characteristic subgroups, Commutator subgroup and its properties; Applications of factor groups to automorphism groups.

Module III: (12 hours)

Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

Module IV: (12 hours)

Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III,field of quotients.

Suggested Readings

1. John B. Farleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. Artin M, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian Contemporary Abstract Algebra,4th Ed.,Narosa Publishing House New Delhi,1999.
4. Joseph J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.
5. Herstein I.N., Topics in Algebra, Wiley Eastern Limited, India, 1975.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	H	M
CO2	M	H	H	M
CO3	M	M	M	H

MALA300T: LINEAR ALGEBRA

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The goal is to introduce students to the fundamentals of linear algebra and its application in computational and applied mathematics.

Course/Learning Outcomes:

At the end of this course students will be able to:

CO 1: Interpret the concepts of finite dimensional vector spaces and inner product spaces. (Understanding).
CO 2: Formulate linear transformations, matrix representation, rank, nullity. (Creating).
CO 3: Construct orthonormal of vectors in inner product spaces. (Applying).
CO 4: Analyse diagonalizability of linear transformations, matrices. (Analysing).

Module I: (12+4 hours)
Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Module II: (15+4 hours)
Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

Module III: (15+3 hours)
Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators, Eigenspaces of a linear operator, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator.

Module IV: (18+4 hours)
Inner product spaces and norms, Gram-Schmidt orthogonalization process, orthogonal complements, Bessel's inequality, the adjoint of a linear operator, Least Squares Approximation, minimal solutions to systems of linear equations, Normal and self-adjoint operators, Orthogonal projections and Spectral theorem.

Suggested Readings
1. Lang S., Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
2. Gilbert Strang Thomson, Linear Algebra and its Applications, 2007.
3. Kumaresan S., Linear Algebra- A Geometric Approach, Prentice Hall of India,1999.
4. Linear Algebra, 2nd Ed., Kenneth Hoffman, Ray Alden Kunze, Prentice-Hall of India Pvt.Ltd., 1971.

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2		H	H	
CO 3		M		H
CO 4			H	L

MAPS301T: PDE AND SYSTEMS OF ODE

(4 Credits – 60 hours) (L-T-P: 4-0-1)

Objective(s)
The objective of this course is to present the main results in the context of ordinary and partial differential equations that allow learning about the different methods of solving practical problems analytically.

Course/Learning Outcomes:
At the end of this course students will be able to:
CO 1: Explain the different types of differential equations and relationship of various functions in differential problems. (Understanding).
CO 2: Develop derivative techniques to predict the behaviour of nonlinear phenomena and find solution. (Applying).
CO 3: Analyse boundary conditions of problems which are not solvable initially. (Analysing).
CO 4: Assess various higher order methods for the solution of complex problem. (Evaluating).

Module I: (15 hours)
Review of first order ODE. Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients, Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown functions, Pfaffian diff equation.

Module II: (15 hours)
Partial Differential Equations – Basic concepts and Definitions, Mathematical Problems. First-Order Equations: Classification, Construction and Geometrical Interpretation. Method of Characteristics for obtaining General Solution of Quasi Linear Equations. Canonical Forms of First-order Linear Equations. Method of Separation of Variables for solving first order partial differential equations.

Module III: (12 hours)
Derivation of Heat equation, Wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order Linear Equations to canonical forms.

Module IV: (18 hours)
The Cauchy problem, the Cauchy-Kowaleewskaya theorem, Cauchy problem of an infinite string. Initial Boundary Value Problems, Semi-Infinite String with a fixed end, Semi-Infinite String with a Free end, Equations with non-homogeneous boundary conditions, Non-Homogeneous Wave Equation. Method of separation of variables, Solving the Vibrating String Problem, Solving the Heat Conduction problem given first order PDE with initial data.

Suggested Readings
1. Debnath L., Tyn Myint U.,Linear Partial Differential Equations for Scientists and Engineers, 4th edition, Springer, Indian reprint, 2006.
2. Ross S.L.Differential equations, 3rd Ed., John Wiley and Sons, India, 2004.
3. Martha L Abell, James P Braselton, Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
4. Amarnath T., An Elementary Course in Partial Differential Equations, Narosa Publications.
5. Sneddon I.N., Elements of Partial Differential Equations, Dover Publications, 2006.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	L	
CO 2	M	H	L	
CO 3		M	H	L
CO 4			H	H

MAPB303T: PROBABILITY AND STATISTICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)
The objective of this course is to introduce fundamental notions of probability and statistical methods. It aims to introduce tools at an advanced to intermediate level that will help to address successfully a range of issues in the discipline.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain the ideas of probability, random variables and distribution functions along with their properties. (Understanding).
CO 2: Apply the basic ideas of the measures of central tendency, correlation and regression to solve social and scientific related problems. (Applying).
CO 3: Use appropriate statistical methods to summarize and analyse data using testing of hypothesis. (Analysing).

Module I: Basic Probability and Continuous Probability Distributions (12+6 hours)
Probability spaces, conditional probability, independence; Discrete and Continuous random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality, distribution function and densities, normal, exponential and gamma densities.

Module II: Bivariate Distribution (9+3 hours)
Bivariate distributions and their properties, distribution of sums and quotients, conditional densities.

Module III: Applied Statistics (12+3 hours)
Measure of Central tendency: Moments, skewness and Kurtosis-Probability distribution: Binomial, Poisson and Normal-evaluation of statistical parameters for these three distributions, Correlation and regression-Rank correlation. Curve fitting by the method of least squares-fitting of straight lines, second degree parabolas and more general curves.

Module IV: (12+3 hours)
Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Suggested Readings
1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Hoel P.G., Port S.C. and Stone C.J., Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).
3. Ross S., A first course in Probability, 6th Ed.Pearson Education India, 2002.
4. An Introduction to Probability Theory and its Applications, Vol.1. 3rd Ed. W. Feller, Wiley, 1968.
5. Bali N.P., and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

Mapping COs to the Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	M	M
CO2	H	H	M	M
CO3	L	M	H	H

MAMS304T: METRIC SPACES AND COMPLEX ANALYSIS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

This course introduces the basic properties of metric spaces, complex system and their properties.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate the basic concepts of metric spaces, complex numbers and properties. (Understanding).
CO 2: Analyse compactness, connectedness, continuity in metric spaces. (Analysing).
CO 3: Discuss analytic functions and their integrations. (Creating).
CO 4: Interpret Cauchy integral formulae, power/Laurent series, Cauchy Residue theorem. (Evaluating).

Module I: (12 hours)

Metric spaces: definition and examples. Sequences in metric spaces, Cauchy sequences. Complete Metric Spaces. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, Cantor's theorem. Subspaces, dense sets, separable spaces.

Module II: (18 hours)

Compact metric spaces, Compact subsets of Rn , The Bolzano-Weierstrass theorem, Cantor's theorem, Supremum and Infimum on compact sets, Total boundedness, equivalence of sequential compactness with compactness for metric spaces. Connectedness, Connected subsets of R. Continuity and connectedness, Continuous and uniformly continuous functions on a metric space. Sequential criterion of continuity. Homeomorphisms. Contraction mappings, Banach contraction principle. C(X) as a metric space. Arzel´a-Ascoli Theorem. Stone-Weierstrass Theorem.

Module III: (15 hours)

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability. Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions.

Module IV: (15 hours)

Definite integrals of functions, Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula. Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples. Laurent series and its examples, absolute and uniform convergence of power series. Singular points, residue at pole and its examples, Cauchy's residue theorem.

Suggested Readings

1. Satish Shirali and Harikishan L. Metric Spaces, Vasudeva Springer Verlag, London, 2006.
2. Kumaresan S., Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
3. Simmons G.F., Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.
4. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed.,
5. McGraw – Hill International Edition, 2009.
6. Joseph Bak and Donald J. Newman, Complex Analysis, 2nd Ed., Undergraduate Texts in
7. Mathematics, Springer-Verlag New York, Inc., New York, 1997.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	L
CO 2	M	H		
CO 3			H	H
CO 4			M	H

MARI305T: RIEMANN INTEGRATION AND SERIES OF FUNCTIONS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

In this course Riemann integral theory is discussed to understand the sequences and series of functions.

Course/Learning Outcomes:

At the end of this course students will be able to:

CO 1: Discuss the properties of Riemann integrable functions and fundamental theorems of integration. (Creating).
CO 2: Interpret improper integrals including Beta and Gamma functions. (Evaluating).
CO 3: Make use of different tests to check the convergence of the functions and improper integrals. (Applying).
CO 4: Examine uniform convergence and convergence of power series. (Analysing).

Module I: (18 hours)

Riemann integration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus.

Module II: (12 hours)

Improper integrals; Convergence of Beta and Gamma functions.

Module III: (15 hours)

Pointwise and uniform convergence of sequence of functions. Theorems on continuity,
derivability and integrability of the limit function of a sequence of functions. Series of functions; Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.

Module IV: (15 hours)

Power series, radius of convergence, Abel's Theorem; Weierstrass Approximation Theorem.

Suggested Readings

1. Ross K.A., Elementary Analysis: The Theory of Calculus, Undergraduate Texts.
2. K.A. Ross, Mathematics, Springer (SIE), Indian reprint, 2004.
3. Bartle R.G. and D.R. Sherbet, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia)
4. Pvt. Ltd., Singapore, 2002.
5. Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition), 2011.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3			H	M
CO 4				H

MANT306T: NUMBER THEORY

(4 Credits – 40 hours) (L-T-P: 4-0-0)

Objective(s)

This course is designed to provide students with an opportunity to work with conjectures, proofs, and analysing mathematics. Also, the course provides an introduction to some basic cryptographic techniques, with a main emphasis on asymmetric cryptography.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Develop the ideas of congruences, primitive roots, residue system, partitions, Euler-Pentagon number system. (Applying).
CO 2: Discuss importance of results like Chinese remainder theorem, Fermat's little theorem etc. (Creating).
CO 3: Interpret the use of primitive roots in congruence relations. (Evaluating).
CO 4: Analyse different schemes of classical cryptography. (Analysing).

Module I: (15 hours)

Divisibility, Congruences, complete residue system, reduced residue system, Chinese remainder theorem., Arithmetic modulo p, Fermat's little theorem, Wilson's theorem. Arithmetic functions-Mobius function, Euler function.

Module II: (15 hours)
Quadratic residues and congruences of second degree in one unknown, Legendre symbol, Jacobi symbol, congruences of second degree with prime modulus and with composite modulus.

Module III: (18 hours)
Primitive roots and indices, order, necessary and sufficient condition for the existence of primitive roots, construction of reduced residue system. Continued fractions, simple continued fractions, approximation of irrational numbers by continued fractions, solution of Pell's equation. Introduction to partitions, geometric representation, generating functions, Euler's Pentagonal number theorem.

Module IV: (12 hours)
Basic of Cryptography: History of cryptography, terminologies used in cryptography; Substitution Techniques- The Caesar Cipher, One Time Pads, The Vernam Cipher, Book Cipher; Transposition Techniques-Encipherment/Decipherment Complexity,

Suggested Readings

1. Burton David M., Elementary Number Theory, 2nd edition, Universal Book Stall, New Delhi,1994.
2. Jones, G. A., &Jones, J. Mary. Elementary Number Theory. Undergraduate Mathematics Series (SUMS). First Indian Print.2005.
3. Neville Robinns. Beginning Number Theory (2nd ed.). Narosa Publishing House Pvt. Limited, Delhi,2007.
4. Hardy G.H. and Wright E.M., An Introduction to the Theory of Numbers, 4th edition, Oxford, Clarendon Press, 1960.
5. Andrews G.E., Number Theory, Hindustan Publishing Corporation, New Delhi, 1992.
6. Stallings, William, Cryptography and Network Security, Principles and Practice (7th ed.). Pearson Education Limited. England, 2017.
7. Trappe, Wade & Washington, Lawrence C., Introduction to Cryptography with Coding Theory (2nd ed.). Pearson Education International,2006.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	L
CO 2	H	M	L	
CO 3		L	H	
CO 4	L	M	M	H

MAMP307P: MINOR PROJECT
(4 Credits – 120 Hours)(L-T-P: 0-0-4)

Objective(s):

Course Outcomes
At the end of this course students will be able to

MAAB400T: ADVANCED ABSTRACT ALGEBRA
(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)
The main goal is to introduce the advanced concepts and results of abstract algebra. Additionally, the course lays the strong foundations to study some advanced subjects like Field theory and Galois theory.

Course/Learning Outcomes:
At the end of this course students will be able to:
CO 1: Explain basic concepts of automorphisms, conjugacy, class equation. (Understanding).
CO 2: Make use of simple groups in Galois theory. (Applying).
CO 3: Inspect finite groups in fundamental theorem of finite abelian groups. (Analysing).
CO 4: Explain basic concepts of polynomial rings and domains. (Understanding).

Module I: (12+3 hours)
External direct products of groups, Properties of external direct products, internal direct products, classifications of groups of order p^2, p is prime, Fundamental Theorem of finite abelian groups.

Module II: (12+6 hours)
Group actions: Group actions and permutation representations; stabilizers and kernels, permutation representation associated with a given group action, Applications of group actions, Conjugacy class, The class equation, p-groups, Sylow's theorems and

applications of Sylow theorems; Finite simple groups, non-simplicity tests; Generalized Cayley's theorem, Index theorem, Embedding theorem and applications. Simplicity of An for n ≥ 5.

Module III: (12+3 hours)
Subnormal, normal series, derived group, solvable groups, composition series, nilpotent groups, Jordan-Holder theorem, free group, rank of a free group, fundamental theorem of free groups, presentation of groups.

Module IV: (12+3 hours)
Polynomial rings over commutative rings, division algorithms and consequences, principal ideal Domains. factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion, unique factorization in Z[x]. Divisibility in integral domains, irreducible, primes, unique factorization domains, Euclidean domains.

Module V: (12 hours)
Field extensions, algebraic and transcendental elements, geometrical constructions, splitting field, finite fields, structure of finite fields, normal, separable and inseparable extension of fields

Suggested Readings:
1. John B. Farleigh, A First Course in Abstract Algebra - 7th Ed., Pearson, 2002.
2. Artin M., Abstract Algebra - 2nd Ed., Pearson, 2011.
3. Joseph A. Gallian, Contemporary Abstract Algebra,8thEd., Narosa Publishing HouseNewDelhi,1999.
4. Dummit, David S., & Foote, Richard M. Abstract Algebra (3rd ed.). Student Edition. Wiley India,2016
5. Wallace D.A.R., Groups, Rings and Fields Springer Verlag London Ltd., 1998.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	M	M	
CO2		H			M
CO3	M	H			M
CO4				H	

MAAP401T: APPLIED ANALYSIS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)
In this course we aim to impart the knowledge of advanced mathematical techniques to solve various problems related to calculus of variation, transform analysis and some special functions.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Illustrate fundamentals concepts of calculus of variation and integral equations, Integral transforms, special functions and their applications. (Understanding).
CO 2: Apply the various method in solving science and engineering problems. (Applying).
CO 3: Analyse and classify Differential Equations, Partial Differential Equations and Integral Equations and their solutions by various methods. (Analysing).
CO 4: Determine the solutions of various classes of differential equations and special functions with their properties. (Evaluating).

Module I: (10+3 hours)
Linear functional, minimal functional theorem, general variation of a functional, Euler- Lagrange equation, Necessary and sufficient conditions for extrema, strong extremum and weak extremum, broken extremum; Weirstras Erdmann corner conditions.

Module II: (8+2 hours)
Linear integral equation of the first and second kind of Fredholm and Volterra type Reduction of ordinary differential equations into integral equations, Solution of integral Equations with separable kernels, Characteristic numbers and eigenfunctions, resolvent kernel.

Module III:(12+4 hours)
Fourier Transform. Properties of Fourier Transform, Fourier sine and cosine transform, Inverse Fourier Transform, Application of Fourier transform to ordinary and partial differential equations of initial and boundary value problems.

Module IV: (12+3 hours)
Laplace Transform and its properties, Convolution theorem, Inverse Laplace Transform, Application of Laplace Transform to solution of ordinary and partial differential equations of initial boundary value problems.

Module V: (18+2 hours)
General solution of Bessel equation, Recurrence relations, Orthogonal sets of Bessel functions, Modified Bessel functions, Applications. General solution of Legendre equation, Legendre polynomials, Associated Legendre polynomials, Rodrigues formula, Orthogonality of Legendre polynomial, Concept and calculation of green's function, Approximate Green's function, Green's function method for differential equations.

Suggested Readings

1. Doetsch G., Introduction to Theory and Application of Laplace Transforms, Springer Verlag,1990.
2. Murray Spiegel, Theory and problems of Laplace transforms - Schum's Outline Series Tata Mac Grawhill .
3. Brian Daries, Integral Transforms & their applications, Springers.
4. Debnath L., Bhatta D., Integral Transforms & their applications, Chapman & Hall/CRC.
5. Follone G.B., Fourier analysis and its applications, sally series, American Mathematical Society.
6. Becrends R.J., Morsche H.G., Vande Berg J.C., and Vande Vrie E.M., Fourier and Laplace Transform,Cambridge Press 2003.
7. Mark A. Pinsky, Introduction to Fourier analysis and wavelets, Graduate Studies in Mathematics volume 102, American Mathematical Society.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO2	M	H	H	H	M
CO3		H	H	H	
CO4			M	M	H

MATP402T: TOPOLOGY

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)
The primary goal of this course is to introduce students to the concept, results and applications of topology, which serve as the overarching framework for all types of mathematical analysis.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Demonstrate the basic characteristics and properties of metric spaces. (Understanding).
CO 2: Categorize the various properties related to Topological Spaces. (Creating).
CO 3: Examine the Connectedness and Compactness of Topological Spaces. (Analysing).
CO 4: Explain basic results related to Normed linear spaces, Banach spaces and Hilbert spaces. (Understanding).

Module I: (15+3 hours)
Metric spaces, open and closed sets, limit points, interior points, convergence, Cauchy sequence, completeness, completion in metric spaces, separable spaces.

Module II: (18+4 hours)
Topological Spaces, Basis for a topology, the order topology, the product topology, the subspace topology, Closed sets and limit points, convergent sequence, Continuous function, homeomorphism, metric topology.

Module III: (12+3 hours)
Connected spaces, connected subspaces of real line, Components, local connectedness, Compact spaces, compact spaces of real line, limit point compactness, local compactness.

Module IV: (15+5 hours)
The countability axioms, the separation axioms, Urysohn Lemma, Urysohnmetrization theorem. Tychonoff 's theorem, Stone-Cech Compactification.Local finiteness, the Nagata Smirnov Metrization theorem, precompactness, the Smirnov Metrization theorem, space of continuous function.

Suggested Readings

1. Simmons G.F., Introduction to topology and modern analysis, 2nd Edition, Tata-McGraw-Hill.
2. Munkres J.M., Topology, 2nd Edition, Prentice Hall.
3. Willard S., Topology, Dover, 1970.
4. Joshi K.D, Introduction to General Topology Wiley-Eastern, 1988.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2	M	H	H	
CO 3		M		H
CO 4			M	H

MAFA403T: FUNCTIONAL ANALYSIS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The primary goal of this course is to introduce the advanced knowledge of abstract analysis including various types of functional spaces and their properties which generate the strong foundation for research in pure and applied mathematics.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Demonstrate the basic characteristics and properties of normed linear spaces, (Understanding).

CO 2: Categorize the various properties related to Hilbert Spaces. (Creating).

CO 3: Deduct various results on Strong and weak convergence. (Evaluation).

CO 4: Explain basic results related to orthonormal set. (Understanding).

Module I : (15+4 hours)

Normed linear spaces, properties of normed linear spaces, Banach space, Hahn-Banach theorem, Open mapping theorem, Closed graph theorem, Principle of uniform boundedness,

Module II: (18+4 hours)

Hilbert spaces, Orthogonal complements, orthonormal sets, the Reisz representation theorem, Bessel's inequality, Parseval's identity, The dual space, self –adjoint, normal and unitary operators.

Module III: (12+3 hours)

Strong and weak convergence, fundamental properties, weak* convergence,

Module IV: (15+4 hours)

Orthonormal set and Fourier analysis, Functional and operators on Banach and Hilbert Spaces.

Suggested Readings

1. Somasundaram D., A first course in Functional Analysis, Narosa Publishing, 2015.
2. Kreyszig E., Introductory functional analysis with application, John Willey and Sons.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2	M	H	M	
CO 3		M	H	
CO 4	M			H

LAB Course: MACA101L: CALCULUS (0-0-2)

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s)

This course provides an in-depth understanding to the students for inbuilt software tools and how to use for the plotting of graph of a function, finding its intercepts, identifying its intervals of increase/decrease, recognize its local/global maxs/mins, and inspect its concavity, sketch the parametric curves, obtain surface of revolution of curves and trace of conics.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Classify functions by representing them graphically. (Understanding).

CO 2: Apply software tools to evaluate surface area and volume of revolution (Applying).

CO 3: Analyse the different curves by sketching them using software tools. (Analysing)

LIST OF PRACTICALS (USING ANY SOFTWARE)

- Plotting of Graphs of functions e^{ax+b}, $\log(ax+b)$, $1/(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $|ax+b|$, and to illustrate the effect of a and b on the graph .
- Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
- Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid)
- Obtaining surface of revolution of curves.
- Tracing of conics in cartesian coordinates/ polar coordinates.
- Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, hyperbolic paraboloid using cartesian coordinates.

Mapping of COs to Modules

Course Outcomes	P1	P2	P3	P4	P5	P6
CO 1	H	H	H		H	
CO 2	L	M	M	H	L	
CO 3	L	H	H	L	H	H

Lab Course: MADE202L: DIFFERENTIAL EQUATIONS

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s)

This course provides an in-depth understanding to the students for inbuilt software tools and how to use them for Plotting of solution family of first, second and third order differential equations; and applications of different mathematical models along with their solutions.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Classify Initial Value Problems (IVPs) and Boundary Value Problems (BVPs) and representing them through graphical representation . (Understanding).

CO 2: Apply software tools to solve nth order ODEs (Applying).

CO 3: Analyse accuracy of analytical solution by software tools. (Analysing)

CO 4: Evaluate solution of curve and verifying them graphically using software tools. (Evaluating)

LIST OF PRACTICALS (USING ANY SOFTWARE)

- Plotting of second order solution family of differential equation.
- Plotting of third order solution family of differential equation.
- Growth model (exponential case only).
- Decay model (exponential case only).
- Lake pollution model (with constant/seasonal flow and pollution concentration).
- Case of single cold pill and a course of cold pills.
- Limited growth of population (with and without harvesting).
- Predatory-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator).
- Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers).
- Battle model (basic battle model, jungle warfare, long range weapons).

Mapping of COs to Modules

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
CO1	H	M			M				H	
CO2		M		M		H	H	M		
CO3			H		M					H
CO4		H			M					H

Lab Course: MAPS302L: PDE AND SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS

(2 Credits – 60 Hours)(L-T-P: 0-0-2)

Objective(s)

This course provides solution by using software in solving Cauchy problem for first order PDE, and different Initial Boundary Value problems, finding the characteristics for the first order PDE, Plotting the integral surfaces of a given first order PDE with initial data.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Classifying various initial value and boundary value points and representing them through graphical representation. (Understanding)

CO 2: Apply software tools to solve higher order ODEs and PDEs. (Applying).

CO 3: Analyse complex differential equations using the software tools. (Analysing)

CO 4: Evaluate complex functions within a short span of time. (Evaluating)

LIST OF PRACTICALS (USING ANY SOFTWARE)

- Solution of Cauchy problem for first order PDE.
- Finding the characteristics for the first order PDE.
- Plot the integral surfaces of a given first order PDE with initial data.
- Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions

  a) $u(x,0) = \phi(x)$, $u_1(x,0) = \psi(x)$, $x \in R$, $t > 0$.

  b) $u(x,0) = \phi(x)$, $u_1(x,0) = \psi(x)$, $u(0,t) = 0$, , $x \in (0,\infty)$ $t > 0$.

  c) $u(x,0) = \phi(x)$, $u_1(x,0) = \psi(x)$, $u_x(0,t) = 0$, $x \in (0,\infty)$, $t > 0$.

  d) $u(x,0) = \phi(x)$, $u_1(x,0) = \psi(x)$, $u(0,t) = 0$, $u(l,t) = 0$, $0 < x < l$, $t > 0$

Mapping of COs to Modules

Course Outcomes	P1	P2	P3	P4
CO 1	H	M	L	
CO 2	H	M	L	M
CO 3		M	H	L
CO 4	L	H	M	

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	MAEC103T	Elementary Calculus	4
2	Minor Course 2	MAEA104T	Elements of Algebra	4
3	Minor Course 3	MAON206T	ODE and Numerical Methods	4
		MASD207T	Statics and Dynamic	
4	Minor Course 4	MARC208T	Real and Complex Analysis	4
		MAGT209T	Graph Theory	
5	Minor Course 5	MAVC308T	Vector Calculus and Coordinate Geometry	4
		MALP309T	Linear programming and Applications	
		MABI310T	Bio-Mathematics	
		MAFE311T	Finite Elements Methods	
6	Minor Course 6	MAEL312T	Metric Space and Linear Algebra	4
		MAAF313T	Elementary Fuzzy Mathematics	
		MAMC314T	Mechanics	
		MADG315T	Differential Geometry	
7	Minor Course 7	MABA404T	Boolean Algebra	3
		MAIG405T	Introduction to Game Theory	
7	Minor Course 8	MARM406T	Research methodology in Mathematical Science	2
8	Minor Course 9	MADS407T	Discrete Mathematics	3
		MACT408T	Coding Theory	
		MAIC409T	Introduction to Cryptography	

MAEC103T: ELEMENTARY CALCULUS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

The objective of the course is to present the fundamental notions of derivatives, higher order derivatives, partial derivatives, indefinite and definite integrals and their applications in solving various problems like Curve tracing, Indeterminate form, reduction formulae, area of surface of revolution, volume, arch length and sketching of conics etc.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concept of derivatives up to higher order and their applications. (Understanding).

CO 2: Evaluate indefinite and definite integrals. (Evaluating).

CO 3: Make use of integrations to determine areas and volumes. (Applying).

Module I: (15 hours)

Derivatives, higher order derivatives, successive differentiation and Leibnitz's rule and its applications; Mean value Theorem, Taylor 's Theorem, tangents and normal, concavity and inflection points, curvature, L' Hospital's rule.

Module II: (18 hours)

Partial differentiations, partial derivative as a slope, partial derivative as a rate, higher order partial derivatives (two and three variables), Euler 's theorem on homogeneous functions. Maxima, minima and saddle points; Method of Lagrange multipliers; Jacobians.

Module III: (15hours)

Standard methods of integration, integration of irrational function, reduction formulae, derivations and illustrations of the type.

Module IV: (12 hours)

Applications of Integrals: Area of plane curves, volume and surface area of solids of revolution, parametrization of a curve, arc length of parametric curves.

Suggested Readings

1. 1.Thomas G.B. and Finney R.L., Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. Strauss M.J., Bradley G.L. and Smith K. J., Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. Anton H., Bivens I. and Davis S., Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore,2002.
4. Courant R. and John F., Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		M
CO 2		H	M	
CO 3		M	M	H

MAEA104T: ELEMENTS OF ALGEBRA

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

The goal of this course is to introduce the fundamentals of algebra and the fundamental characteristics of matrices, as well as their use in various physical situations. Additionally, this course provides a comprehensive method for numerically resolving various types of problems that arise in their field of study.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate complex numbers and their various expansions. (Understanding).
CO 2: Develop reduced echelon form, rank of matrices and solve systems of linear equations. (Applying).
CO 3: Categories the fundamental concepts of groups, rings and vector space. (Analysing).

Module I: (12 hours)

Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications; expansion of cos x , sin x and tan x in positive integral powers of x, exponential and trigonometric function of a complex variable, Euler's expansion for cosine and sine; Gregory's Series; Hyperbolic functions.

Module II: (18 hours)

Matrices, elementary matrices, row reduction and echelon forms, rank of matrix, linear independence, inverse of matrix, system of linear equations, the matrix equation Ax=b, solution sets of linear systems, applications of linear systems, characteristic equation of a matrix. Eigen values, Eigen Vectors, Diagonalizing matrices.

Module III: (15 hours)

Binary operations, associative and commutative binary operations; Equivalence relations, Integer modulo n; Groups; elementary properties of groups; subgroups and examples of subgroups, permutation groups, cyclic groups and properties of cyclic groups, cosets, order of groups, Lagrange's theorem of finite group, normal subgroups, quotient groups, homomorphism and isomorphism of groups.

Module IV: (15 hours)

Rings and subrings, examples and properties; Definition and examples of a vector space, Sub-space and its properties, Linear independence, Basis and dimension of a vector space.

Suggested Readings

1. Gallian J.A., Contemporary Abstract Algebra, Brooks Cole.
2. J. B. Fraleigh, A First Course in Abstract Algebra Pearson.7th Ed.
3. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint.
4. Hoffman and R. Kunze., Linear Algebra, Prentice Hall, K.
5. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Burkhouse, 2006.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		M
CO3			H	H

MAON206T: ODE AND NUMERICAL METHODS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

The objective of the course is to introduce the fundamental notions of mathematical models, linear and nonlinear differential equations and their solutions by analytical methods. It also introduces the interpolation and numerical solutions of algebraic and transcendental equations.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Learn basics of differential equations and formulate Differential Equations for various Mathematical models. (Creating).

CO 2: Solve first order non-linear differential equation and linear differential equations of higher order using various techniques. (Evaluating).

CO 3: Develop the different numerical methods to solve a set of ordinary differential equations, interpolation problems, algebraic and transcendental equations. (Applying).

Module I: (12 hours)

Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations.

Module II: (10 hours)

Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills), exponential growth of population, limited growth of population, limited growth with harvesting.

Module III: (12 hours)

General solution of homogeneous equation of second order, principle of superposition for homogeneous equation, Linear homogeneous and non- homogeneous equations of higher order with constant coefficients, Euler 's equation, method of undetermined coefficients, method of variation of parameters.

Module IV: (16 hours)

Transcendental and Polynomial equations: Bisection method, Regula-Falsi Methods, Newton's method, Secant method. System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method; Interpolation: Lagrange and Newton's methods. Finite difference operators. Gregory forward and backward difference interpolation.

Module V: (10 hours)

Numerical differentiation**:** First and second order derivatives; Numerical integration**:** Trapezoidal Rule, Simpson's rule, finding eigenvalues by Iterations.

Suggested Readings

1. Belinda Barnes and Glenn R. Fulford, Mathematical Modelling with Case Studies, A Differential Equation Approach using Maple and MATLAB, 2nd Ed.,Taylor and Francis group, London and New York, 2009.
2. Edwards C.H. and Penny D.E., Differential Equations and Boundary Value problems Computing and Modelling, Pearson Education India, 2005.
3. Ross S.L., Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
4. Boyce, William E. and Dprima, Richard, C. Elementary Differential Equations, John Wiley, Indian Edition, 2000.
5. Chapra, Steven C. Applied Numerical Methods with MATLAB for Engineers and Scientists -
a. McGraw-Hill Education.22, 4th ed. (2018).
6. Jain, M. K., Iyengar, S. R. K., & Jain R. K., Numerical Methods for Scientific and Engineering Computation - 6th ed. (2012), New Age International Publishers. Delhi.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	M		
CO2	M	H	M	M	
CO3		L	M	H	H

MASD207T: STATICS AND DYNAMICS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

The objective of the course is to present the basic principle s of statics and dynamics and help to develop proficiency in applying these proficiency to formulate and solve different problems of mechanics.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Discuss the fundamental concepts of statics and dynamics. (Understanding).

CO 2: Analyse the equilibrium and motions of particles in different coordinate system (Analysing).

CO 3: Make use of different laws to study planetary orbital motion and forces. (Applying).

Module I: (20 hours)
Statics. Forces. Couples. Co-planar forces. Astatic equilibrium. Friction. Equilibrium of a particle on a rough curve. Virtual work. Catenary. Forces in three dimensions. Reduction of a system of forces in space. Invariance of the system. General conditions of equilibrium. Centre of gravity for different bodies. Stable and unstable equilibrium.

Module II: (20 hours)
Dynamics. Motion of a particle in two dimensions. Velocities and accelerations in Cartesian, polar, and intrinsic coordinates. Equations of motion referred to a set of rotating axes. Motion of a projectile in a resisting medium. Motion of a particle in a plane under different laws of resistance.

Module III: (20 hours)
Central Forces, Stability of nearly circular orbits. Motion under the, inverse square law. Kepler's laws. Time of describing an arc and area of any orbit. Slightly disturbed orbits. Motion of artificial satellites. Problems of motion of varying mass such as falling raindrops and rockets. Tangential and normal accelerations. Motion of a particle on a smooth or rough curve. Principle of conservation of energy. Motion of a particle in three dimensions. Motion on a smooth sphere, cone, and on any surface of revolution.

Suggested Readings
1. Whittaker, E.T. and McCrea, W. A Treatise on the Analytical Dynamics of Particles and Rigid Bodies: with an Introduction to the Problem of Three Bodies, (Cambridge University Press, 1988).
2. Loney, S. L., Elements of Statics & Dynamics, Part I, (Maxford Books, 2003).
3. Rao, S. Engineering Mechanics - Statics and Dynamics, (Pearson Education, 2008).
4. Chorlton, F., Textbook of Dynamics, 2nd edition (Horwood, 1983).
5. Ramsey, A. T., Dynamics, 2nd Edition (The University Press, 2007).

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	M
CO 2	H	H	M
CO 3	M	M	H

MARC208T: REAL AND COMPLEX ANALYSIS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)
The course aims at giving the student a fundamental knowledge, tools and methods on the topics of real and complex analysis. The course also aims at giving a deeper theoretical understanding, but even more how the theory may be applied in science and technology.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Summarize the properties of $\mathbb{R}$, sequence, series and analytic functions. (Understanding).
CO 2: Apply various convergence tests in infinite sequence and series of real numbers. (Applying).
CO 3: Determine power series, residue, integration of complex functions. (Evaluating).

Module I: (15 hours)
Review of Algebraic and Order Properties of R, B Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of R, The Archimedean Property, Density of Rational (and Irrational) numbers in R, Intervals.

Module II: (15 hours)
Sequence and Series: Sequences, theorems on limit of sequences, Cauchy's convergence criterion, infinite series, series of nonnegative terms, Absolute convergence, tests for convergence, comparison test, Cauchy's root Test, ratio Test, Rabbe's, Logarithmic test, De Morgan's Test, Alternating series, Leibnitz's theorem.

Module III: (15 Hours)
Analytic Functions: Properties of complex numbers, regions in the complex plane Functions of complex variable, Mappings; Mappings by the exponential function, Limits, Theorems on limits, Limits involving the point at infinity, Continuity, Derivatives, Differentiation formulae, Cauchy-Riemann equations, Sufficient conditions for differentiability; Analytic functions and their examples.

Module IV: (15 hours)
Cauchy's Theorems: Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula, Consequences of Cauchy integral formula, Liouville's theorem and the fundamental

theorem of algebra, Residues.

Suggested Readings

1. Bartle R.G. and Sherbet D.R., Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd. Singapore, 2002.
2. Brian S. Thomson, Andrew. M. Bruckner and Judith B. Elementary Real Analysis Bruckner, Prentice Hall, 2001.
3. Berberian S.K., A First Course in Real Analysis, Springer Verlag, New York.
4. Brown, James Ward, & Churchill, Ruel V. Complex Variables and Applications (9th ed.). McGraw-Hill Education. New York. 2014.
5. Zills, Dennis G., & Shanahan, Patrick D. A First Course in Complex Analysis with Applications. Jones & Bartlett Publishers, Inc. 2003.
6. Mathews, John H., & Howell, Rusell W. Complex Analysis for Mathematics and Engineering (6th ed.). Jones & Bartlett Learning. Narosa, Delhi. Indian Edition. 2012.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	M
CO2		H		
CO3			H	H

MAGT209T: GRAPH THEORY

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

The goal of the course is to elucidate the basic concept of graph theory and how to model for many common problems using the theory of graphs. It also discusses the various algorithms that can be used to find the best solution to some practical problems.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate the types and properties various graphs and digraphs. (Understanding).
CO 2: Categorize different types of graphs based on their properties. (Analysing).
CO 3: Deduct results associated to simple graphs, trees, blocks, planar graphs and colourability of graphs. (Evaluating).
CO 4: Discuss various algorithms to solve problems of minimal spanning tree, travelling salesman problem, shortest path problem. (Creating).

Module I: (15 Hours)

Graph: Types of Graphs, Subgraphs, walk, paths, cycles, intersection graphs, Degrees, Degree sequences, Partition, operations on graphs, Isomorphism, Cut Vertices, Cut Edges and Blocks. Trees, Spanning trees, cycle space, cocycle spaces, Kruskal's and Prim's algorithm for minimal spanning tree.

Module II: (15 Hours)

Eulerian graph and its Characterization, Hamiltonian graphs and its characterization, Necessary and sufficient conditions for a graph to be Hamiltonian. Connectivity, connectivity parameters, Menger's theorem. Factorization; Basic concepts, 1-factorization, 2- factorization. Matching and covers.

Module III: (15 Hours)

Planarity: Plane and planar graphs, outer planar graphs, Euler's Polyhedron formula, Kuratowski's theorems.
Colourability: Chromatic number. Four Colour conjecture, Five-colour theorem, chromatic polynomial. Adjacency and incidence matrix, Spectrum.

Module IV: (15 Hours)

Weigthed graph, Travelling salesman problem, shortest path problem, Dijkstra's algorithm, Floyed-Warshall algorithm, Bellman-Ford algorithm.

Suggested Readings

1. Harary, Graph theory, Narosa Publishing House, Delhi, 1969.
2. Bapat R.P., Graphs and Matrices, Springer London Dordrecht Heidelberg New York.
3. Edgar G. Goodaire and Michel M. Parmenter, Discrete Mathematics with graph theory, 3rd edition, Pearson Education Pvt. Ltd, 2015.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	H	H

CO2	H	H	H	
CO3	M	H	H	L
CO4	M	L	L	H

MAVC308T: VECTOR CALCULUS AND CO-ORDINATE GEOMETRY

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

This course is meant to give students in-depth knowledge co-ordinates geometry, general equation of second degree and the conditions for representing a pair of straight lines, general conics and their properties. Moreover, the course also introduces vector valued functions along with applications.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Summarize the various concept of transformation of coordinate system and second-degree equation and properties. (Understanding).

CO 2: Apply various methods related to vector calculus for determining arc length, surface area, volume. (Applying).

CO 3: Solve practical problems using Green's theorem and Stock's theorem. (Creating).

Module I: (20 hours)

Transformation of co-ordinate axes. Pair of straight lines. General equation of second degree and the conditions for representing a pair of straight lines, a parabola, an ellipse, a hyperbola and a circle.

Module II: (20 Hours)

General conics: tangent, condition of tangency, pole and polar, centre of a conic, equation of pair of tangents, reduction to standard forms, central conics, equation of the axes, and length of the axes, polar equation of a conic, tangent and normal and properties.

Module III: (10 hours)

Scalar triple product, vector triple product; Introduction to vector functions, operations with vector valued functions, limits and continuity of vector functions, differentiation and integration of vector functions; partial derivatives of vector point function.

Module IV: (10 hours)

Differential operator-Del, Gradient, Divergence and Curl. Line, Surface and volume integrals, Simple applications of Gauss divergence theorem, Green's theorem and Stokes theorem (without proof).

Suggested Readings

1. Jain, P.K. and Ahmad, K. Text Book of Analytical Geometry of two & three Dimensions, New Age Publications, 2014.
2. Das, B., Analytical Geometry and Vector Analysis, (Orient Book Company, 1995).
3. Khan, R.M., Analytical Geometry & Vector Analysis, (New Central Book Agency Pvt. Ltd., 2004).
4. Murray R. Spiegel, Vector Analysis, Schum's Outline Series, McGraw Hil.
5. Jain, P.K. and Ahmad, K. Text Book of Analytical Geometry of two & three Dimensions, New Age Publications, 2014.
6. Das, B., Analytical Geometry and Vector Analysis, (Orient Book Company, 1995).
7. Khan, R.M., Analytical Geometry & Vector Analysis, (New Central Book Agency Pvt. Ltd., 2004).
8. Murray R. Spiegel, Vector Analysis, Schum's Outline Series, McGraw Hil.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2			H	M
CO3			M	H

MALP309T: LINEAR PROGRAMMING AND APPLICATIONS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

To get familiarize with the mathematical formulation of the real-world problems, theoretical and graphical solution of the LPP and applications of various forms of LPP.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concept of convex set and extreme points. (Understanding).

CO 2: Apply the concept of LPP to game problems. (Understanding).
CO 3: Analyse the primal and dual problems, and sensitivity analysis of LPP. (Analysing).
CO 4: Formulate an optimization problem from its physical consideration to Linear programming problem. (Analysing).

Module I: (15 hours)
The Linear Programming Problem: Standard, Canonical and matrix forms, Graphical solution. Hyperplanes, Extreme points, Convex and polyhedral sets. Basic solutions; Basic Feasible Solutions; Reductionof any feasible solution to a basic feasible solution; Correspondence between basic feasible solutions and extreme points.

Module II: (15hours)
Introduction to linear programming problem, Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method, Big-M method and their comparison.

Module III:(12 hours)
Duality, Formulation of Dual problem; Primal-Dual relationships; economic interpretation of the dual.

Module IV: (18 hours)
Transportation Problem: Basic concept and Mathematical formulation of transportation problem; Methods of finding initial basic feasible solutions; North West corner rule. Least cost method; Vogel's Approximation method; Algorithm for solving Transportation Problem; Assignment Problem: Mathematical formulation and Hungarian method of solving.
Game Theory: Basic concept, Formulation of two-person zero-sum games, Games with mixed strategies, Linear Programming method of solving a game.

Suggested Readings

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
2. Hamdi A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.
3. Hadley G., Linear Programming, Narosa Publishing House, New Delhi, 2002
4. Hillier F.S. and Lieberman G.J., Introduction to Operations Research, 9th Ed., Tata McGrawHill, Singapore, 2009.
5. Paul R.Thie, &Keough G. E. An Introduction to Linear Programming and Game Theory. (3rd ed.). Wiley India Pvt. Ltd.,2014.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H		
CO 2			H	
CO 3			H	
CO 4	M			H

MABI310T: BIO- MATHEMATICS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)
This course aims to provide a fruitful introduction to the Mathematical and computational topics appropriate for the understanding of biological processes. The course extends the range of usage of mathematical models in biology, ecology and evolution.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: How to put the relationship of different parameters, and then their physical interpretation. (Remembering).
CO 2: For a given mathematical problem, classify the problems based on solution procedure and then study their significance in the practical fields. (Analysing).
CO 3: Derive the solution of a problem by using the existed methods and interpret the results. (Creating).
CO 4: Evaluate the mathematical and biological system solution procedure and analyse the results. (Evaluating).
CO 5: Develop the new solution methods for the new problems and models. (Creating).

Module I: (15 hours)
Continuous Population Models: Mathematical Biology and the modeling process: an overview. The Phase Plane, Local Stability, Autonomous Systems, Stability of Linear Autonomous Systems with Constant Coefficients, Linear Plane Autonomous Systems, Continuous Growth models, Insect Outbreak Model: Spruce Budworm, Delay Models, Linear Analysis of Delay Population Models, Delay Models in Physiology: Period Dynamic Diseases. Numerical solution of the models and its graphical representations.

Module II: (11 hours)
Discrete Population Models: Introduction: Simple Models, Cobwebbing: A Graphical Procedure of Solution, Discrete Logistic-Type Models: Chaos, Stability, Periodic Solutions and Bifurcations., Discrete Delay Models and Applications. Fishery Management Models, Ecological Implications and Caveats.

Module III: (12 hours)
Models for Interacting Populations: Predator-Prey Models: Lotka- Volterra Systems, Complexity and Stability, Analysis of a Predator-Prey model with Limit Cycle, Periodic Behavior, Parameter Domains of Stability. Discrete Growth Models for Interacting Populations, Predator –Prey Models: Detailed Analysis.

Module IV: (12 hours)
Dynamics of Infectious Diseases: Historical Aside on epidemics, Simple Epidemic Models and Practical Applications, Modelling the Population Dynamics of Acquired Immunity to Parasite Infection, Age-Dependent Epidemic Model and Threshold Criterion, Simple Drug Use Epidemic Model and Threshold Analysis.

Module V: (12 hours)
Growth and Control of Brain Tumours: Medical Background, Basic Mathematical Models of Glioma Growth and Invasion, Tumour Spread In Vitro: Parameter Estimation, Tumour Invasion in the Human Brain, Modelling Treatment Scenarios: General Comments, Modelling Tumour Resection (Removal) in Homogeneous Tissue. Analytical Solution for Tumour Recurrence After Resection. Modelling Tumour Polyclonally and Cell Mutation.

Suggesting Readings
1. Murray J.D., Mathematical Biology, Springer, Vol I and II, 1993.
2. Keshet L.E., Mathematical Models in Biology, SIAM, 1988.
3. Fung Y.C., Biomathematics, Springer-Verlag, 1990.
4. Brauer F., Driessche P.V.D. and Wu J., Mathematical Epidemiology Springer, 2008.
5. Kot M., Elements of Mathematical Ecology Cambridge University Press, 2001.
6. https://nptel.ac.in/courses/111/107/111107113/
7. http://www.authorstream.com/Presentation/manish.nandi-569200-mathematical modelling-and-its-application/

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				M
CO 2	M	H			M
CO 3	M		H		
CO 4		M	M	H	
CO 5	M		M		H

MAFE311T: FINITE ELEMENT METHODS

(4 Credits-60 hours) (L-T-P: 4-0-0)

Objective(s)
The goal of this course is to let the students understand finite element models for different ordinary and partial differential equations. Also by using these models, the students will be able to approximate the solutions of real life problems.

COURSE OUTCOME
CO 1: Illustrate the role and significance of shape functions in finite element formulations and its interpolation. (Understanding)
CO 2: Develop the ability to generate the governing finite elements governed by ordinary differential equations. (Applying)
CO 3: Analyse finite element method in higher order problems. (Analysing)

Module I: (25 hours)
Introduction to finite element methods, comparison with finite difference methods, Methods of weighted residuals, collocations, least squares and Galerkin's method. Variational formulation of boundary value problems equivalence of Galerkin and Ritz methods.

Module II: (20 hours)
Applications to solving simple problems of ordinary differential equations. Linear, quadratic and higher order elements in one dimensional and assembly, solution of assembled system.

Module III: (25 hours)
Simplex elements in two and three dimensions, quadratic triangular elements, rectangular elements, serendipity elements and

isoperimetric elements and their assembly, discretization with curved boundaries.

Module IV: (20 hours)
Interpolation functions, numerical integration, and modelling considerations. Solution of two-dimensional partial differential equations under different Geometric conditions.

Suggested Readings

1. ReddyJ.N., Introduction to the Finite Element Methods, Tata McGraw-Hill, 2003.
2. Bathe K.J., Finite Element Procedures, Prentice-Hall, 2001.
3. Cook R.D., Malkus D.S. and Plesha M.E., Concepts and Applications of Finite Element Analysis, John Wiley and Sons, 2002.
4. Thomas J.R. Hughes, The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Dover Publication, 2000.
5. George R. Buchanan, Finite Element Analysis, McGraw Hill, 1994.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	L
CO 2	L	H		M
CO 3		L	H	M

MAEL312T: METRIC SPACES AND LINEAR ALGEBRA

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)
This course introduces basic properties of metric spaces and linear algebra up to finite dimensions.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Demonstrate basic concepts of metric spaces. (Understanding).
CO 2: Formulate linear transformations, matrix representation, rank, nullity. (Creating).
CO 3: Elaborate the concept of finite dimensional vector space. (Evaluate).

Module I: (20 hours)
Metric spaces: definition and examples. Sequences in metric spaces, Cauchy sequences. Complete Metric Spaces. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, Cantor's theorem. Subspaces, dense sets, separable spaces.

Module II: (20 hours)
Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Module III: (20 hours)
Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

Suggested Readings

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. Lang S., Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
3. Gilbert Strang Thomson, Linear Algebra and its Applications, 2007.
4. Kumaresan S., Linear Algebra- A Geometric Approach, Prentice Hall of India,1999.
5. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt.Ltd., 1971.
6. Satish Shirali and Harikishan L. Metric Spaces, Vasudeva Springer Verlag, London, 2006.
7. Kumaresan S., Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
8. Simmons G.F., Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	
CO 2		H	M
CO 3			H

MAAF313T: ELEMENATRY FUZZY MATHEMATICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

This course provides an understanding of the basic mathematical elements of the theory of fuzzy sets. It provides also an emphasis on the differences and similarities between fuzzy sets and classical sets theories. The main objective of this course is to establish thorough background knowledge on evolutionary algorithms and enable the students to pursue individual research in solving real world optimization problems.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Apply fuzzy set theory in modelling and analysing uncertainty in a decision problem (Applying).
CO 2: Classify the difference between the classical logic and fuzzy logic (Understanding).
CO 3: Analyse and examine the difference between the crisp set and fuzzy set concepts. (Analysing).
CO 4: Determine fuzzy set theory and uncertainty concepts (Evaluating).

Module I: (12+6hours)

Internal arithmetic, Definition of fuzzy sets, α-level sets, convex fuzzy sets, Basic operations on fuzzy sets, types of fuzzy sets, , t-norms and t-conorms, Fuzzy numbers, arithmetic with fuzzy numbers

Module II (10+2hours)

Basic properties of fuzzy relations, fuzzy relations, properties of the Min-Max compositions, fuzzy equivalence relations, fuzzy function on fuzzy sets.

Module III (12+4hours)

Possibility Theory: Fuzzy measures, evidence theory, necessity measure, probability measure, possibility theory and fuzzy sets, fuzzy event, probability of fuzzy event.

Module IV: (12+3hours)

An overview of classical logic, multivalued logics, Linguistic variables, Linguistic modifiers, truth, and propositions of fuzzy logic, fuzzy quantifies, fuzzy implications.

Suggested Readings

1. Klir, G. J. and Yuan, B. Fuzzy Sets and Fuzzy Logic: Theory and Applications, (Prentice Hall of India, New Delhi, 1997).
2. Zimmermann, H. J. Fuzzy set theory and its Applications Allied publishers Ltd., New Delhi 1991.
3. Bojadzieve G. and Bojadzieve M, Fuzzy sets, fuzzy logic applications, World Scientific, 1995.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1		M	H	
CO 2	M			H
CO 3	H	M	M	M
CO 4		M	H	

MAMC314T: MECHANICS

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)

The course aims to provide the students with a solid conceptual and mathematical understanding of particle leading to various dynamical problems, conservative force fields and related areas. It also equips them with problem solving skills for further studies in applied sciences.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define basic mechanical concepts related to force and equilibrium of systems. (Remembering).
CO 2: Illustrate the laws and relation between discrete and continuous mechanical systems. (Understanding).
CO 3: Describe planar and spatial motion of a rigid body. (Remembering).
CO 4: Analyse the motion of a system of particles using conservation laws. (Analysing).

Module I: (20 hours)

Moment of a force about a point and an axis, couple and couple moment, Moment of a couple about a line, resultant of a force system, distributed force system, free body diagram, free body involving interior sections, general equations of equilibrium, two-point equivalent loading, problems arising from structures, static indeterminacy.

Module II: (20 hours)
Laws of Coulomb friction, application to simple and complex surface contact friction problems, transmission of power through belts, screw jack, wedge, first moment of an area and the centroid, other centres, Theorem of Pappus-Guldinus, second moments and the product of area of a plane area, transfer theorems, relation between second moments and products of area, polar moment of area, principal axes.

Module III: (20 hours)
Conservative force field, conservation for mechanical energy, work energy equation, kinetic energy and work kinetic energy expression based on centre of mass, moment of momentum equation for a single particle and a system of particles, translation and rotation of rigid bodies, Chasles' theorem, general relationship between time derivatives of a vector for different references, relationship between velocities of a particle for different references, acceleration of particle for different references.

Suggested Readings
1. Shames I.H. and Krishna Mohan Rao G., Engineering Mechanics: Statics and Dynamics, (4thEd.), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009.
2. Hibbeler R.C. and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, 11th Ed.,
3. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	M	H	
CO 3		H	
CO 4	M	M	H

MADG315T: DIFFERENTIAL GEOMETRY

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s)
This course presents the students the principles, concepts and techniques of differential geometry, enabling them analyse and understand the geometrical structures to solve many real-life problems.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Recall various properties of space curves and their applications. (Remembering).
CO 2: Interpret geometrical orientation of parametric curves and surfaces. (Understanding).
CO 3: Develop the physical mapping and nature of geodesic curves. (Applying).
CO 4: Analyse the different characteristics of Christoffel symbols and their transformation. (Analysing).

Module I: (12 hours)
Theory of Space Curves: Space curves, Planer curves, Curvature, torsion and Serret-Frenet formulae. Osculating circles, Osculating circles and spheres. Existence of space curves. Evolutes and involutes of curves.

Module II: (15 hours)
Theory of Surfaces: Parametric curves on surfaces. Direction coefficients. First and second Fundamental forms. Principal and Gaussian curvatures. Lines of curvature, Euler's theorem. Rodrigue's formula, Conjugate and Asymptotic lines. Developable: Developable associated with space curves and curves on surfaces, Minimal surfaces.

Module III: (18 hours)
Geodesics: Canonical geodesic equations. Nature of geodesics on a surface of revolution. Clairaut's theorem. Normal property of geodesics. Torsion of a geodesic. Geodesic curvature. Gauss-Bonnet theorem. Surfaces of constant curvature. Conformal mapping. Geodesic mapping. Tissot's theorem.

Module IV: (15 hours)
Tensors: Summation convention and indicial notation, Coordinate transformation and Jacobian, Contra-variant and Covariant vectors, Tensors of different type, Algebra of tensors and contraction, Metric tensor and 3-index Christoffel symbols, Parallel propagation of vectors, Covariant and intrinsic derivatives.

Suggested Readings
1. Willmore T.J., An Introduction to Differential Geometry, Dover Publications, 2012.
2. O'Neill B., Elementary Differential Geometry,.2nd Ed., Academic Press, 2006.

3. Weather burn C.E., Differential Geometry of Three Dimensions, Cambridge University Press, 2003.
4. Struik D.J., Hours on Classical Differential Geometry, Dover Publications, 1988.
5. Lang S., Fundamentals of Differential Geometry, Springer, 1999.
6. Spain B., Tensor Calculus: A Concise Course, Dover Publications, 2003.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		
CO 3		M	H	M
CO 4				H

MABA404T: BOOLEAN ALGEBRA

(3 Credits – 45 Hours) (L-T-P: 3-0-0)

Objective(s)

The primary objective of this course is to discuss the posets, lattices and their construction and properties. It also provides the solid background of Boolean algebra and its applications in various circuits.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain partial ordered sets and demonstrate their properties. (Understanding).
CO 2: Apply partially ordered sets in developing lattices. (Applying).
CO 3: Develop switching circuits utilizing Boolean algebra. (Creating).

Module I: (15 hours)

Definition with basic examples of partially ordered sets, maps between ordered sets, duality principle, maximal and minimal principles, construction and de-construction of ordered sets.

Module II: (15 hours)

Lattices as partially ordered sets and properties, complete lattices, lattices as algebraic structures, sublattices, products and homomorphisms, properties of modular and distributive lattices.

Module III: (15 hours)

Boolean algebra, Boolean polynomials, ideals, filters and equations, minimal forms of Boolean polynomials, Quinn-McCluskey method, Karnaugh diagrams, switching circuits and their applications.

Suggested Readings

1. Davey B.A.and Priestley H.A., Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.
2. Rudolf Ridl and Gunter Pilz, Applied Abstract Algebra, Undergraduate Texts in Mathematics, Springer (Indian Reprint), 2004.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	L	M	
CO 2	M	H	
CO 3			H

MAIG405T: INTRODUCTION TO GAME THEORY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

Throughout the course, students will be expected to demonstrate their understanding of Game Theory by being able to do each of the following:

1. *Understand the novel concept of a "game" and translate it into wide range of conflicts*
2. *Analyze and evaluate conflict dynamics and integrate increasing analytical skills into increasingly complex conflicts.*
3. *Review theoretical predictions obtained from Game Theory analyses against real world conflicts, formulate strategic alternatives which take into account the actions of others by identifying it and solve the games using various techniques.*

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define basics of game theory, concepts of players, strategies, payoff etc. (Remembering)

CO 2: Illustrate different types of game strategies. (Understanding)
CO 3: Make use of different methods to solve games and recommend which strategy to be implemented. (Applying)
CO 4: Determine the methods of solutions for real-life problem. (Evaluating)

Module I (8 hours)
Basics of game theory, Types of games, zero-sum games, non-zero-sum game, Simultaneous games, Sequential games, Prisoners Dilemma, Other Interesting two person games, Ultimate Game, Public Good Game, Theory of rational choice, Interacting decision makers, Solution of Game by Simplex method.

Module II (10 hours)
Strategic games, the Prisoner's Dilemma, Nash equilibrium, best response functions, Dominated actions, Equilibrium in a single population: symmetric games and symmetric equilibria, Cournot's model of oligopoly, Bertrand's model of oligopoly, Electoral competition, The War of Attrition, Auctions, Accident law.

Module III (12 hours)
Strategic games with randomization, Mixed strategy Nash equilibrium: concept and examples, Correlated equilibrium, Expected Payoffs, Mixed Strategy Equilibrium, Dominated Actions, Formation of Players' beliefs, Information and Bayesian Games: examples, Bayesian game applications, Juries and Information Aggregation, Auctions with Private Information.

Module IV (15 hours)
Definitions, Subgame perfect equilibrium, the ultimatum game and the holdup game, Stackelberg's model of duopoly, buying vote, Extensive Games with Perfect Information: Extensions and Discussion, Coalitional Games and the Core, examples, Bayesian Games, Spence Signaling Game, Crawford and Sobel Cheap Talk Game.

Suggested Readings
1. Fudenberg D. and Tirole J., Game Theory, MIT press, 1991.
2. Osborne, M.J. An Introduction to Game Theory, Oxford University Press, 2004.
3. Mas-Colell, A., Whinston M.D. and J.R. Green, Microeconomic Theory, Oxford University Press, 1995.
4. Gibbons, R.A. Primer in Game Theory,Pearson Education, 1992.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module III
CO 1	H	L	L	L
CO 2		H	M	
CO 3			H	M
CO 4		L	M	H

MARM406T: RESEARCH METHODOLOGY FOR MATHEMATICAL SCIENCES

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s)
This course aims to introduce the idea of research in mathematics, which includes importance, literature surveys, identification of problems and proper execution. It also aims to give proper ideas of writing research reports, articles etc and select appropriate journals for publications.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Learn and understand some basic concepts of research and its methodologies. (Remembering).
CO 2: Compare different results and identify appropriate research topics with the help of literature review. (Understanding).
CO 3: Select and define appropriate research problem and parameters. (Applying).
CO 4: Organize and conduct research (advanced project) in a more appropriate manner. (Evaluating).
CO 5: Design and write a research proposal, research report and thesis. (Creating).

Module I: (10 hours)
Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, literature survey of a research topic, Importance of knowing how Research is done, Research Process, Criteria of good Research, Problems encountered by Researchers in India.
Defining the Research problem: Selecting the Problem, Necessity of Defining the Problem, Techniques involved in defining a problem.

Module II: (12 hours)

Report writing: Significance of Report writing, Difference steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Precautions for Writing Research Reports, publishing a paper, Research proposal writing, Copyright issues, Ethics and plagiarism.

Module III: (8 hours)
Research tools: MathSciNet, Scopus, ISI Web of Science, Impact factor, h-index, Google Scholar, ORCID, JStor, Online and open access journals, Virtual library of various countries.Scientific writing and presentation: LaTeX, Beamer. Software for Mathematics: Mathematica, Matlab.

Suggested Readings:
1. Kothari C.R., Research Methodology, New Age Publishers, 2004.
2. Lamport L., LaTeX, a Document Preparation System, 2nd ed, Addison-Wesley, 1994.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	M		
CO 3	M		M
CO 4		H	
CO 5		M	M

MADS407T: DISCRETE MATHEMATICS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)
The goal of this course is to introduce the student to the fundamentals of discrete mathematics and probability theory, which have uses in computer science and the improvement of logical thought. Algebraic structures, combinatorial mathematics, and graph theory are introduced to students through discrete mathematics. To give the students a foundation for many fundamental computer-related concepts, the necessary abstract mathematical material must be addressed and explained in the context of computer science.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain the concepts of various types of relations, partial ordering and lattices. (Understanding)
CO 2: Develop the concept of logic in mathematics. (Applying)
CO 3: Interpret problems using recurrence relations and recursion to analyse algorithms and programs. (Analysing)
CO 4: Apply knowledge of graph theory in real life problems. (Applying)

Module I: (10 hours)
Sets, set operations; Set identities, Generalized union and intersections. Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations, binary relations. Hasse and lattice diagrams for posets;

Module II: (12 hours)
Propositional logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency. Predicate Calculus.

Module III: (10 hours)
Combinatorics: Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (nth order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of generating functions., solution of recurrence relation using generating functions, solution of combinatorial problem using generating functions).

Module IV: (13 hours)
Introduction to graphs, representation of graphs, graph isomorphisms, subgraphs, directed and undirected graphs; Eulerian paths and circuits; Hamiltonian paths and circuits; Trees, shortest path problem, Matrices of graph.

Suggested Readings
1. Kolman B., Robert.C. Busby and Ross S.C., Discrete Mathematical Structures, Prentice Hall of India, New Delhi, 2002.

2. Trembly and P. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill.
3. Mott J.L., Kandel A. and Baker T.P., Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India New Delhi, 2004.
4. Somasundaram, Discrete Mathematical Structures, , Prentice Hall of India New Delhi, 2003.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3			H	
CO 4				H

MACT408T: CODING THEORY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

This course introduces the basic aspects of coding theory by introducing the linear and nonlinear error correcting codes. Also, the coding theory problem is discussed with the help of minimum distance and Hamming weight in the form of bounds.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Determine minimum distance and weight, error probability. (Evaluating).
CO 2: Classify linear and nonlinear codes, construct error-correcting codes. (Analysing).
CO 3: Develop special codes like Hamming, Golay, MDS, perfect, Reed-Muller etc. (Creating).
CO 4: Apply the main coding theory problem to estimate Hamming, Gilbert-Varshamov-Sacks bound etc. **(**Applying**).**

Module I: (10hours)

Communication channels and transition error probabilities, block codes, maximum likelihood decoding, Hamming distance and weight, nearest neighborhood decoding.

Module II: (12 hours)

Types of codes (linear and nonlinear), generator matrix, encoding and decoding, standard array, equivalence of linear codes, dual codes, parity check matrix.

Module III: (12hours)

Encoding in linear codes, syndrome decoding in linear codes, Hamming codes, extended Hamming codes, decoding of Hamming codes, Golay codes (binary and ternary).

Module IV: (11 hours)

The main coding theory problem, bounds (Hamming, Gilbert-Varshamov-Sacks, Singleton, Plotkin, Griesmer), perfect codes, MDS codes, Reed-Muller codes, some practical examples of codes.

Suggested Readings

1. Raymond Hill, A First Course in Coding Theory, Oxford University Press, 1990.
2. San Ling and Chaoping Xing, Coding Theory: A First Course, Cambridge University Press, 2004.
3. Peterson W.W. and Weldon E.J., Jr., Error-Correcting Codes, M.I.T. Press, Cambridge, Massachusetts, 1972.
4. Huffman W.C. and Vera Pless, Fundamentals of Error-correcting Codes, Cambridge University Press, 2003.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	L	L	
CO 2	M	M	H	
CO 3		M	M	H
CO 4			H	M

MAIC409T: INTRODUCTION TO CRYPTOGRAPHY

(3 Credits – 45 Hours) (L-T-P: 3-0-0)

Objective(s)

The objective of this course is to familiarise the student with the fields of cryptography and cryptanalysis. The purpose of this course is to equip students with a practical understanding of the mathematics used in cryptology.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate different schemes of symmetric and asymmetric key cryptography. (Understanding).

CO 2: Identify the importance of modular arithmetic, modulo operator and algebraic structures in cryptography. (Applying).

CO 3: Examine some primality test algorithms and their efficiencies. (Analysing).

Module I: (15 hours)

Basic of Cryptography: History of cryptography, terminologies used in cryptography, security goals, cryptanalysis. Classical cryptosystem: Substitution Cipher, Play Fair Cipher, Vigenere Cipher, Hill Cipher, Transposition Cipher, Stream and Block Cipher.

Module II: (15 hours)

Block cipher Principles, Shannon theory of diffusion and confusion, Data encryption standard (DES), AES. Fermat's Little Theorem, Euler's theorem, Polynomial Arithmetic, Introduction to finite field of the form GF(p) and GF(2n). Introduction to Public Key Cryptosystem: Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem, El Gamal Cryptosystem.

Module III:(15 hours)

Primality Testing: Probabilities Primality testing, Miller-Rabin Primality testing algorithm; Computing the Order of an element and generating primitive roots (and elements of a certain order); Discrete Logarithms. Digital signature, El Gamal Digital Signature algorithm. Introduction to Elliptic curves cryptography.

Suggested Readings

1. A Neal Koblitz, A Course in Number Theory and Cryptography, (Springer 2006).
2. Jill Pipher, Jeffrey Hoffstein, Joseph H. Silverman, An Introduction to Mathematical Cryptography, (Springer, 2008).
3. Niven, Zuckerman and Montgomery, An Introduction to theory of numbers, (Wiley 2006).
4. Lawrence C. Washington, Elliptic curves: number theory and cryptography, (Chapman & Hall/CRC2003).
5. R.A. Mollin , An Introduction to Cryptography, (Chapman & Hall, 2001).
6. Silverman and Tate, Rational Points on Elliptic Curves, (Springer 2005).
7. Hankerson D., Menezes Scott, Vanstone A, Guide to elliptic curve cryptography (Springer, 2004).
8. Jones G.A., Elementary Number Theory, (Springer, 1998).

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	M	H	M
CO 3			H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	MAPC105T	Programming in C	3
		MALS106T	Logic and Sets	
2	S E Course 2	MAIP107T	Introduction to Python	3
3	S E Course 3	MALM210T	LaTeX for Mathematics	3

MAPC105T: PROGRAMMING IN C (2-0-1)
(2 Credits – 30 hours) (L-T-P: 2-0-1)

Objective(s)
This aims to develop the analytical skills of the students for creative problem-solving using computers. It also discusses the basic concepts of algorithms and programs and enables the students to develop solutions for common problems by familiarizing them with the syntax of C language and teach him/her to translate pseudo-code into C programs, understanding the steps involves in the execution of a C program, make the student well conversant with managing functions, array structures and files in C.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Interpret the concepts of C language's syntax. (Understanding).
CO 2: Choose the loops and the decision-making statements to solve various problems (Applying).
CO 3: Implement standard algorithms and translate pseudo-codes into C programs (Applying).
CO 4: Apply their analytical skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. (Analyzing).

Module I: Introduction to Algorithms and Programming Languages (8 hours)
Introduction to structured programming and problem-solving methods: Algorithms, key features of algorithms, flowcharts, pseudocode, generation of programming languages, structured programming languages. Overview of C: Introduction to C, basic structure of a C program, compiling and executing C programs, comments, characteristics of a good program, character set, identifiers, keywords, data types, constants and variables, I/O statements, operators and expressions, precedence and associativity of operators, type conversion and typecasting.

Module II: Decision Control Statements, Loops and Functions (8 hours)
Decision Control Statements and Loops: Introduction to decision control statements, conditional branching statements, goto statements, while loop, do-while loop, for loop, nested loops, break and continue statements Functions: Need for functions, function declaration and definition, user defined and library functions, passing parameters to function, return statement, scope of variables, storage classes, recursive functions.

Module III: Arrays (7 hours)
Arrays: One-dimensional arrays, passing array to function, multidimensional arrays and their applications, character arrays, dynamic memory allocation. Some algorithms and programs on theory of matrices and numbers like Sieve method for primality test, generation of twin primes, solution of congruence using complete residue system, addition, subtraction and multiplication of matrices, transpose, and determinant.

Module IV: Structures, Files (7 hours)
Structures and Unions: Declaration of structures and simple implementation of structures, unions, enumerated data types. Files: Introduction to files, file managements-open, close, input/output operations, command line arguments.

Suggested Readings

1. Thareja R, Computer Fundamentals and Programming in C, Oxford University Press, New Delhi.
2. Rajaraman V., Computer Programming in C Prentice-Hall of India Pvt. Ltd., 2005.
3. Balagurusamy E., Computer Fundamental and C Programming, Tata McGraw Hill publishing company limited, New Delhi.
4. Gottfried Byron S., Programming with C (Schaum's outlines series), Tata Mcgraw Hill publishing company limited, New Delhi.
5. Goblin P., Primes and Programming – An Introduction to Number Theory with Programming, Cambridge University Press, 1993.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	H
CO 2	M	H	M	M

CO 3	L	M	H	H
CO 4		M	H	M

MALS106T: LOGIC AND SETS

(Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of this course is to acquaint a student with connectives, quantifiers, and the foundations of logic, to teach students about the various approaches to mathematical proof, including direct, indirect, and the method of contradiction and various operations involving sets and collections, equivalence relations, equivalence classes, and the use of these concepts in a variety of other problems.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Relate Mathematical statement into the language of logic. (Remembering).
CO 2: Explain the notion of logic and set which is fundamental in every branch of science. (Understanding).
CO 3: Use the methodologies of sets and logic in problems arising in other branches of Mathematics. (Applying).
CO 4: Examine validity of a given statements by means of principles of logic. (Analysing).

Module I: (15 hours)

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contrapositive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

Module II: (15 hours)

Sets, subsets, Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.

Module III: (15 hours)

Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations, binary relations.

Suggested Readings

1. Grimaldi R.P., Discrete Mathematics and Combinatorial Mathematics, Pearson Education.
2. Halmos P.R., Naive Set Theory, Springer.
3. Kamke E, Theory of Sets, Dover Publishers.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	
CO 2	H	H	M
CO 3	M	L	H
CO 4	M	M	H

MAIP107T: INTRODUCTION TO PYTHON

(3 Credits – 45 hours) (L-T-P: 2-0-1)

Objective(s)

The course provides an introduction to programming language using PYTHON. The course aims to cover programming syntax and constructs that are necessary for programming in PYTHON.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Demonstrate the basic principles of computers, binary computation, programming basics (operations, control structures, data types, etc.), in Python. (Understanding).
CO 2: Readily use the Python programming language and apply various data types and control structure (Applying).
CO 3: Apply the concepts of modularization and classes, file handling and regexusisng packages. (Analysing).
CO 4: Apply the concept of object-oriented program design and development, and begin to implement code (Creating).

Module I: (5 hours)

Introduction: Relationship between computers and programs, Basic principles of computers, File systems, Using the Python

interpreter, Introduction to binary computation, Input / Output

Module II: (8 hours)
Data types and control structures: Operators (unary, arithmetic, etc.), Data types, variables, expressions, and statements, Assignment statements, Strings and string operations, Control Structures: loops and decision

Module III: (5 hours)
Modularization and Classes: Standard modules, Packages, Defining Classes, Defining functions, Functions and arguments.

Module IV: (7 hours)
Exceptions and data structures: Data Structures (array, List, Dictionary), Error processing, Exception Raising and Handling

Module V: (5 hours)
Object oriented design: Programming types, Object Oriented Programming, Object Oriented Design, Inheritance and Polymorphism

Suggested Readings
1. Tony Gaddis ,Starting Out with Python plus MyProgrammingLab with Pearson eText --Access Card Package (3rdnEdition) ISBN-13: 978-0133862256.
2. William Pollock ,"Automate the Boring Stuff with Python", 2015, ISBN: 978-1593275990.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H			
CO2		H	H	M	L
CO3		M	H	H	M
CO4				M	H

MALM210T: LaTeX FOR MATHEMATICS

(2 Credits – 30 hours) (L-T-P: 2-0-1)

Objective(s)
The objective of this course is to familiarize the text writing and editing tool used for Scientific research using LaTeX to the students.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Recall different tools and steps required to write any documents in LaTeX. (Remembering).
CO 2: Use various package and command required for compiling documents in LaTeX. (Understanding).
CO 3: Interpret errors in editing any file in Latex. (Evaluating).
CO 4: Develop research articles and presentations in LaTeX. (Creating).

Module I: (15 Hours)
Installation of LaTeX software and introduction to different offline and online LaTeX editing software, Class and Packages, Commands, Errors, Document class, page style, table of contents, Fonts, symbols, indenting, paragraphs, line spacing, word spacing, titles and subtitles, environments, declarations, comments within text.

Module II: (15 Hours)
Mathematical environments, math mode, mathematical symbols, Graphic package, multivalued functions, drawing matrices Tables, tables with captions, References to figures and tables in text, Drawing with LaTeX, picture environments other drawing packages.

Module III: (15 Hours)
Preparing research article, book, project report in LaTeX. Preparing Beamer presentation in LaTeX.

Suggested Readings:
1. Stefan Kottwiz, LaTeX Beginner's Guide, Packt Publishing Ltd. Birmingham, 2011.
2. Stefan Kottwitz, LaTeX Cookbook, Packt Publishing 2015.
3. David F. Griffths and Desmond J. Higham, Siam, Learning LATEX, second edition, 2016.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO1	M	M	M
CO2	H	M	M

CO3	L	M	H
CO4	L	M	H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	MAIN108I	Internship	4
4	Internship	MAIN211I	Internship	4
5	Internship	MAIN316I	Internship	2

MAIN108I / MAIN211I: INTERNSHIP (Exit of 1st Year or 2nd Year)
(4 Credits: 120 hours)

MAIN316I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)
(2 Credits-60 Hours)

Internship Modalities
Objectives:

1. To produce students with practical experience in problem-solving and working.
2. To facilitate the students' smooth transition from the Institute to the practical world.
3. To improve the students' employability.
4. To encourage Industry Institute interaction and to impart practical exposure to the students.

INTERNSHIP: GUIDELINES

1. Request Letter/ Email from the Department via Registrar office should go to organization/ institutions/ industries to take interns for 4-6 weeks.
2. Organization/ institutions/ industries will confirm the training slots and the number of seats allocated for interns via Confirmation Letter/ Email.
   In case the students arrange the training themselves the confirmation letter will be submitted by the students to the Department.
3. Students on joining Training at the concerned organization/ institutions/ industries, submit the Joining Report/Letters / Email.
4. Students will submit their progress report to the department in every week through Report/ Email.
5. Students will submit Training Report and Completion Certificate obtained from the organization/ institutions/ industries.
6. Students will give a presentation on their learning outcome in presence of the faculty members and the students.
7. List of students who have completed their internship successfully will be notified by the Department.

Requirement:
Students willing to exit the course after completing the first/second year are required to go for 4-6 weeks compulsory internship programme to receive their Certificate/Diploma.

RESEARCH PROJECT /DISSERTATION

BSC MATHEMATICS (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	MADI410P	Research Project Phase I	6
8	Research Project/Dissertation	MADI411P	Research Project Phase II	6
BSC CHEMISTRY (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	MADI412P	Dissertation I	18
8	Research Project/Dissertation	MADI413P	Dissertation II	20

BSC MATHEMATICS (Honours)

MADI410P: RESEARCH PROJECT PHASE I
(6 credits – 180 hours) (L-T-P: 0-0-12)

MADI411P: RESEARCH PROJECT PHASE II
(6 credits – 180 hours) (L-T-P: 0-0-12)

BSC CHEMISTRY (Honours) with Research

MADI412P: DISSERTATION I
(18 Credits -540 Hours) (L-T-P: 0-0-36)

MADI413P: DISSERTATION II
(20 Credits -600 Hours) (L-T-P: 0-0-40)

DEPARTMENT OF PHYSICS

PROGRAMME: BACHELOR OF SCIENCE in PHYSICS (BSC)

DEGREE: BSC PHYSICS (HONOURS)/ BSC PHYSICS (HONOURS) WITH RESEARCH

VISION

To endow the students with profound understanding of physics, the foundation for all natural sciences, and drive them towards critical thought for further study and research, to pave the way for suitable career opportunities and enable them to be of service to the society as responsible human beings.

MISSION

To strengthen the fundamental concepts of physics, to provide advanced understanding of physical phenomena by emphasizing on the correlation between theory and observation, and to spark creative interest towards the pursuit of innovative research in fundamental and applied physics.

FOUR YEAR UNDERGRADUATE PROGRAMME IN PHYSICS (HONOURS/HONOURS WITH RESEARCH)

Programme Outcomes:

PO 1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study.

PO 2: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. Critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO 3: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; communicate with others using appropriate media; confidently share one's views and express herself/ himself; demonstrate the ability to listen carefully; and present complex information in a clear and concise manner to different groups.

PO 4: Social Interaction: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 5: Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 6: Moral and Ethical Awareness: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 7: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO 8: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes. Critical sensibility to life experiences, with self-awareness and reflexivity of both individual and society.

PO 9: Information and Digital Literacy: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 10: Research–related skills: A sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause- and- effect relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Ability to apply one's learning to real life situations.

Programme Specific Outcomes:

PSO 1: Understand the core theoretical concept of physics: Understand the core theoretical principles of physics.

PSO 2: Acquire analytical and logical skill for higher Education: Acquire the ability to analyse critical problems logically.

PSO 3: Excel in experimental physics and learn good laboratory practices and safety: Learn to handle experiments perfectly and safely.

PSO 4: Trained to take up jobs in allied fields: Use the knowledge of physics to seek opportunities in other allied fields.

Mapping of Courses with POs/PSOs:

MAJOR COURSES			
Sl. No.	**Course Code**	**Course Name (L-T-P)**	**Mapping Code**
1	PSMC100T	Mechanics (3-0-0)	100
2	PSMC101L	Mechanics Lab (0-0-1)	101
3	PSMP102T	Introduction to Modern Physics (3-1-0)	102
4	PSMA200T	Mathematical Physics (3-1-0)	200
5	PSEM201T	Electricity and Magnetism (3-0-0)	201
6	PSEM202L	Electricity and Magnetism Lab (0-0-1)	202
7	PSTP203T	Thermal Physics and Statistical Mechanics (4-1-0)	203
8	PSQM204T	Quantum Mechanics (4-1-0)	204
9	PSEN205T	Electronic Circuits, Networks and Devices (3-0-0)	205
10	PSEN206L	Electronic Circuits, Networks and Devices Lab (0-0-1)	206
11	PSCM300T	Condensed Matter Physics (3-1-0)	300
12	PSCM301L	Condensed Matter Physics Lab (0-0-1)	301
13	PSET302T	Electromagnetic Theory (3-1-0)	302
14	PSET303L	Electromagnetic Theory Lab (0-0-1)	303
15	PSSD304T	Semiconductor Devices (3-0-1)	304
16	PSSD305L	Semiconductor Devices Lab (3-0-1)	305
17	PSQM306T	Advanced Quantum Mechanics (3-1-0)	306
18	PSNP307T	Atomic and Nuclear Physics (3-1-0)	307
19	PSCM308T	Classical Mechanics (3-1-0)	308
20	PSMP309P	Minor Project	309
21	PSED400T	Electrodynamics (4-1-0)	400
22	PSPP401T	Particle Physics and Accelerators (4-1-0)	401
23	PSSM402T	Statistical Mechanics (4-1-0)	402
24	PSAM403T	Advanced Mathematical Physics (4-1-0)	403
MINOR COURSES			
25	PSAO103T	Wave - Acoustics and Optics (3-1-0)	103
26	PSMP102T	Introduction to Modern Physics (3-1-0)	102
27	PSEM201T	Electricity and Magnetism (3-0-0)	207
28	PSEM202L	Electricity and Magnetism Lab (0-0-1)	208
29	PSMP209T	Mathematical Physics-II (3-1-0)	209
30	PSAP310T	Introduction to Astrophysics and Plasma Physics(3-1-0)	310
31	PSCM300T	Condensed matter Physics (3-0-1)	300
32	PSCM301L	Condensed matter Physics Lab (0-0-1)	301
33	PSED311T	Electrodynamics (3-1-0)	311
34	PSSD312T	Semiconductor Devices (3-1-0)	312
35	PSST313T	Statistical Mechanics (3-1-0)	313
36	PSMP404T	Materials Physics (3-0-0)	404
37	PSRM405T	Research Methodology	405
38	PSSA406T	Physics of Sensors and Actuators (3-0-0)	406
SKILL ENHANCEMENT COURSES			
39	PSTI104L	Basics of lab tools and Instrumentation (1-0-2)	104
40	PSPC105T	Basics of Programming (C/C++/Fortran) (1-0-2)	105
41	PSPP214L	Computational Physics using Python (1-0-2)	214

Mapping	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4
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104														
105														
214														

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	PSMC100T	Mechanics (3-0-0)	4
		PSMC101L	Mechanics Lab (0-0-1)	
2	Major Course 2	PSMP102T	Introduction to Modern Physics (3-1-0)	4
3	Major Course 3	PSMA200T	Mathematical Physics (3-1-0)	4
3	Major Course 4	PSEM201T	Electricity and Magnetism (3-0-0)	4
		PSEM202L	Electricity and Magnetism Lab (0-0-1)	
4	Major Course 5	PSTP203T	Thermal Physics and Statistical Mechanics (4-1-0)	5
4	Major Course 6	PSQM204T	Quantum Mechanics (4-1-0)	5
4	Major Course 7	PSEN205T	Electronic Circuits, Networks and Devices (3-0-0)	4
		PSEN206L	Electronic Circuits, Networks and Devices Lab (3-0-1)	
5	Major Course 8	PSCM300T	Condensed Matter Physics (3-1-0)	5
		PSCM301L	Condensed Matter Physics Lab (0-0-1)	
5	Major Course 9	PSET302T	Electromagnetic Theory (3-1-0)	5
		PSET303L	Electromagnetic Theory Lab (0-0-1)	
5	Major Course 10	PSSD304T	Semiconductor Devices (3-0-1)	4
		PSSD305L	Semiconductor Devices Lab (3-0-1)	
6	Major Course 11	PSQM306T	Advanced Quantum Mechanics (3-1-0)	4
6	Major Course 12	PSNP307T	Atomic and Nuclear Physics (3-1-0)	4
6	Major Course 13	PSCM308T	Classical Mechanics (3-1-0)	4
6	Major Course 14	PSMP309P	Minor Project	4
7	Major Course 15	PSED400T	Electrodynamics (4-1-0)	5
7	Major Course 16	PSPP401T	Particle Physics and Accelerators (4-1-0)	5
8	Major Course 17	PSSM402T	Statistical Mechanics (4-1-0)	5
8	Major Course 18	PSAM403T	Advanced Mathematical Physics (4-1-0)	5

PSMC100T: MECHANICS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of this course is to provide students with a comprehensive understanding of the fundamental principles and laws that govern the motion of objects and systems. Through theoretical concepts and practical applications, this course aims to develop students' problem-solving skills, analytical thinking, and mathematical reasoning in the context of classical mechanics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concepts of Newtonian Mechanics. (Remembering)
CO 2: Explain the concepts of work, energy and forces. (Understanding)
CO 3: Explain the concepts of rotational and periodic motions. (Understanding)
CO 4: Analyze the concepts of Special Theory of relativity. (Analysis)

Module I: Fundamentals of Dynamics (10 hours)

Reference frames, Inertial frames, Review of Newton's Laws of Motion, Galilean transformations, Galilean invariance, Momentum of variable- mass system: motion of rocket, Motion of a projectile in Uniform gravitational field Dynamics of a system of particles, Centre of Mass, Principle of conservation of momentum, Impulse, Work and Kinetic Energy Theorem, Conservative and non-conservative forces, Potential Energy, Energy diagram, Stable and unstable equilibrium, Elastic potential energy, Force as gradient of potential energy, Work & Potential energy, Work done by non-conservative forces, Law of conservation of Energy, Elastic and inelastic collisions between particles, Centre of Mass and Laboratory frames.

Module II: Rotational Dynamics and Elasticity (8 hours)

Angular momentum of a particle and system of particles, Torque, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of Inertia, Calculation of moment of inertia for rectangular, cylindrical and spherical bodies, Kinetic energy of rotation, Motion involving both translation and rotation, Relation between Elastic constants, Twisting torque on a Cylinder or Wire.

Module III: Fluid Motion, Gravitation and Central Force Motion (8 hours)

Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube, Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere.
Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, The energy equation and energy diagram, Kepler 's Laws, Satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS).

Module IV: Oscillations and Non-Inertial Systems (9 hours)
SHM: Simple Harmonic Oscillations, Differential equation of SHM and its solution, Kinetic energy, potential energy, total energy and their time-average values, Damped oscillation, Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor, Non-inertial frames and fictitious forces, Uniformly rotating frame, Laws of Physics in rotating coordinate systems, Centrifugal force, Coriolis force and its applications, Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.

Module V: Special Theory of Relativity (10 hours)
Michelson-Morley Experiment and its outcome, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Massless Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum.

Suggested Readings

1. An introduction to mechanics, D. Kleppner, R. J. Kolenkow, McGraw-Hill.
2. Mechanics, Berkeley Physics, Vol.1, C. Kittel, W. Knight, et.al., Tata McGraw-Hill.
3. Physics, Resnick, Halliday and Walker, Wiley.
4. Analytical Mechanics, G. R. Fowles and G. L. Cassiday, Cengage Learning.
5. Feynman Hours, Vol. I, R. P. Feynman, R. B. Leighton and M. Sands, Pearson Education.
6. Introduction to Special Relativity, R. Resnick, John Wiley and Sons.
7. University Physics, Ronald Lane Reese, Thomson Brooks/Cole.
8. Mechanics, D. S. Mathur, S. Chand and Company Limited.
9. University Physics, F. W. Sears, M.W. Zemansky and H. D. Young, Addison Wesley.
10. Physics for scientists and Engineers with Modern Phys., J. W. Jewett and R. A. Serway, Cengage Learning.
11. Theoretical Mechanics, M. R. Spiegel, Tata McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**	**Module V**
CO1	H				
CO2	H	L	L		
CO3		H		H	
CO4				M	M

PSMC101L: MECHANICS LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)
The objective of this course is to provide students with hands-on experience in conducting experiments related to classical mechanics. Through practical activities, analysis, and interpretation, this course aims to enhance students' understanding of theoretical concepts and develop their skills in experimental techniques.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Measure distances and angles accurately. (Application)
CO 2: Measure various properties of solid matters. (Application)
CO 3: Measure acceleration due to gravity by different techniques. (Application)

At least 10 Experiments to be performed from the following:
1. Measurements of length (or diameter) using Vernier caliper, screw gauge and traveling microscope.
2. Study the random error in observations.
3. Study the Motion of Spring and calculate (a) Spring constant, (b) *g* and (c) Modulus of rigidity.
4. Determine the Moment of Inertia of a Flywheel.
5. Determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. Determine the Young's Modulus of a Wire by Optical Lever Method.
7. Determine the Modulus of Rigidity of a Wire by Maxwell's needle.

8. Determine the elastic Constants of a wire by Searle's method.
9. Determine the value of g using Bar Pendulum.
10. Determine the value of g using Kater's Pendulum.

Mapping of COs to the syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1	M	M	M							
CO2				M	M		M	M	M	M
CO3						M				L

PSMP102T: INTRODUCTION TO MODERN PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to provide students with a comprehensive understanding of the fundamental principles and concepts that form the basis of modern physics. The students will develop a strong foundation in the theoretical aspects of quantum mechanics, enabling them to analyze and explain the behavior of matter and energy at the atomic and subatomic levels. They will also learn about lasers.

Course / Learning Outcomes

CO 1: Demonstrate an elementary knowledge of quantum mechanics. (Understanding)
CO 2: Explain the physics of an atomic nucleus. (Understanding)
CO 3: Summarize the basic principles of LASER. (Understanding)

Module I: Fundamentals of Quantum Mechanics-I (22 hours)

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions.

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle-application to virtual particles and range of an interaction.

Module II: Fundamentals of Quantum Mechanics–II (14 hours)

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.

Module III: Nuclear Physics (16 hours)

Size and structure of atomic nucleus, Impossibility of an electron being in the nucleus, Nature of nuclear force, N-Z graph, Semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers. Radioactivity, Law of radioactive decay, Mean life and half-life, Alpha decay, Beta decay, Gamma ray emission Fission and fusion, Nuclear reactor: slow neutrons interacting with Uranium 235; Thermonuclear reactions(brief qualitative discussions).

Module IV: Laser (8 hours)

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser. Basic lasing.

Suggested Readings

1. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard and Coop, Tata McGraw Hill.
3. Introduction to Quantum Mechanics, David J. Griffith, Pearson Education.
4. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, Cengage Learning.
5. Modern Physics, G. Kaur and G. R. Pickrell, 2014, McGraw Hill.
6. Quantum Mechanics: Theory & Applications, A. K. Ghatak and S. Lokanathan, Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		

CO2			H	
CO3				H

PSMA200T: MATHEMATICAL PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The main objectives of a course on Mathematical Physics are to provide students with a solid foundation in mathematical methods and techniques that are essential for understanding and solving problems in theoretical physics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Apply the concepts and theorems of vectors to different branches of Physics (Applying)

CO 2: Solve physical problems using the concepts of differential equation and complex analysis. (Applying)

CO 3: Apply the concepts of Beta function, Dirac delta function and curvilinear coordinates. (Applying)

Module I: Vector Calculus (15 hours)

Recapitulation of vectors, Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).

Module II: Differential Equation (15 hours)

First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Particular Integral. Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers.

Module III: Complex Analysis (15 hours)

Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Residues and Residue Theorem.

Module IV: Some Special topics in MP (15 hours)

Beta and Gamma Functions and Relation between them, Expression of Integrals in terms of Gamma Functions.

Orthogonal Curvilinear Coordinates, Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

Definition of Dirac delta function, Properties of Dirac delta function.

Suggested Readings

1. Mathematical Methods for Physicists, G. B. Arfken, H. J. Weber and F. E. Harris, Elsevier.
2. An introduction to ordinary differential equations, E. A. Coddington, PHI learning.
3. Differential Equations, George F. Simmons, McGraw Hill.
4. Mathematical Tools for Physics, James Nearing, Dover Publications.
5. Mathematical methods for Scientists and Engineers, D. A. McQuarrie, Viva Book.
6. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India.
7. Advanced Engineering Mathematics, H. K. Das, S. Chand.
8. Complex Variables, A. K. Kapoor, Cambridge Univ. Press.
9. First course in complex analysis with applications, D. G. Zill and P. D. Shanahan, Jones & Bartlett.
10. Complex Variables and Applications, J. W. Brown and R. V. Churchill, Tata McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

PSEM201T: ELECTRICITY AND MAGNETISM

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of the course is to teach the students about the fundamental concepts concerning electric field, magnetic field, electro-magnetic effects and electrical circuits.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Summarize the fundamental concepts of electric field, electric potential, capacitors and polarization. (Remember)

CO 2: Explain the concept of magnetic field, types of different magnetic materials and its associated phenomena. (Understand)

CO 3: Outline the laws governing electromagnetic induction and electrical circuits (Understand)

Module I: Electric Field and its related phenomena (15 hours)

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere.

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics.

Module II: Magnetic Field (15 hours)

Magnetic force between current elements and definition of Magnetic FieldB. Biot-Savart 's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field. Magnetization vector (M). Magnetic Intensity(H). Magnetic Susceptibility and permeability. Relation between B, H, M. Ferromagnetism. B-H curve and hysteresis.

Module III: Electromagnetic Induction and Electrical Circuits (15 hours)

Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.

AC Circuits: Kirchhoff 's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit. Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping.

Suggested Readings

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, Tata McGraw.
2. Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education.
3. Introduction to Electrodynamics, D. J. Griffiths, Benjamin Cummings.
4. Feynman Hours, R. P. Feynman, R. B. Leighton and M. Sands, Pearson Education.
5. Elements of Electromagnetics, M. N. O. Sadiku, Oxford University Press.
6. Electricity and Magnetism, Vol. I, J. H. Fewkes& J. Yarwood, Oxford Univ. Press.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**
CO1	H		
CO2		H	
CO3			H

PSET303L: ELECTRICITY AND MAGNETISM LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to provide students with hands-on experience in conducting experiments related to electricity and magnetism. Through practical activities, analysis, and interpretation, this course aims to enhance students' understanding of theoretical concepts and develop their skills in experimental techniques.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Measure various parameters of electrical devices, circuits and apparatus. (Evaluating)
CO 2: Measure fields using electrical apparatus. (Evaluating)
CO 3: Demonstrate the validity of various network theorems in practical applications. (Understanding)
CO 4: Utilize the concept of induction to study various AC circuits. (Applying)

At least 5 experiments to be performed from the following:

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. Study the characteristics of a series RC Circuit.
3. Determine an unknown Low Resistance using Potentiometer.
4. Determine an unknown Low Resistance using Carey Foster 's Bridge.
5. Compare capacitances using De'Sauty 's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. Verify the Thevenin and Norton theorems.
8. Verify the Superposition, and Maximum power transfer theorems.
9. Determine self-inductance of a coil by Anderson's bridge.
10. Study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q , and (d) Band width.

Mapping of COs to the syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO 1	H	H	H	H	H					
CO 2						H				
CO 3							H	H		
CO4									H	H

PSTP203T: THERMAL PHYSICS AND STATISTICAL MECHANICS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The objective of the course is to provide students with a comprehensive understanding of the principles and concepts that govern the behavior of systems in equilibrium and non-equilibrium states. This course aims to equip students with the necessary tools and knowledge to analyze and explain the macroscopic properties of matter, as well as to understand the statistical behavior of particles at the microscopic level.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Summarize the various thermodynamical processes. (Understanding)
CO 2: Apply the kinetic theory of gases to different transport phenomena. (Applying)
CO 3: Summarize the various laws governing blackbody radiation. (Understanding)
CO 4: Combine the concepts of thermodynamics and statistical mechanics. (Creating)

Module I: Laws of Thermodynamics (20 hours)

Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

Module II: Thermodynamical Potentials (15 hours)

Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius Clapeyron Equation, Expression for ($C_P - C_V$), C_P/C_V, TdS equations.

Module III: Kinetic Theory of Gases (15 hours)

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

Module IV: Theory of Radiation (15 hours)

Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh- Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Module V: Statistical Mechanics (10 hours)
Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann distribution, Quantum statistics- Fermi-Dirac and Bose-Einstein distributions.

Suggested Readings
1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, Tata McGraw-Hill.
2. A Treatise on Heat, MeghnadSaha, and B. N. Srivastava, Indian Press.
3. Thermodynamics, Enrico Fermi, Courier Dover Publications.
4. Heat and Thermodynamics, M. W. Zemasky and R. Dittman, McGraw Hill.
5. Thermodynamics, Kinetic theory & Statistical thermodynamics, F. W. Sears and G. L. Salinger, Narosa.
6. University Physics, Ronald Lane Reese, Thomson Brooks/Cole.
7. Thermal Physics, A. Kumar and S. P. Taneja, R. Chand Publications.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**	**Module V**
CO1	H	H			
CO2			H		
CO3				H	
CO4					H

PSQM204T: QUANTUM MECHANICS
(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)
The objective of the course is to make students aware of the basic concepts of quantum mechanics such as the state and behavior of a particle moving in space and time that is described by a complex wave function. Through the basic formulation in quantum mechanics, the students will be able to understand different phenomena in nature and recent technologies based on quantum mechanical effects.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Interpret the significance of the Schrödinger wave equation. (Understanding)
CO 2: Solve problems involving bound states in arbitrary potential. (Applying)
CO 3: Examine the quantum behaviour of the one-electron system and many-electron systems. (Analysing)

Module I: Time-Dependent and Independent Schrödinger Equation (26 hours)
Schrödinger equation; Time-dependent Schrodinger equation and dynamical evolution of a quantum state, Properties of Wave Function. Interpretation of Wave Function, Probability and probability current densities in three dimensions, Conditions for Physical Acceptability of Wave Functions. Normalization, Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators. Commutator of position and momentum operators. Ehrenfest theorem, Expectation values of position and momentum.

Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time-independent Schrodinger equation; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle with proof.

Module II: Bound States in an Arbitrary Potential (17 hours)
Continuity of wave function, boundary condition and the emergence of discrete energy levels, application to the one-dimensional problem, infinite and finite rectangular potential well, potential barrier and quantum mechanical tunnelling. Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method; Hermite polynomials; ground state, zero point energy & uncertainty principle.

Module III: Three-dimensional problems (15 hours)
Three-dimensional problems: Separation of variables; orbital angular momentum; spherical harmonics. Harmonic oscillator in Cartesian and polar coordinates. A free particle and a particle in a 3-D box in Cartesian and polar coordinates, Coulomb problem in spherical and parabolic coordinates - regular and irregular solutions.

Module IV: Quantum Theory of One-Electron and Many-Electron Systems (17 hours)

Hydrogen atom, angular momentum operator & quantum numbers; Radial wavefunctions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum, quantum numbers l and m; s, p, d,.. shells. Spin-Orbit Interaction, Identical Particles, Ground State Energy of He atom. Elementary Idea of Hartree's Field. Elementary idea of Heisenberg's picture of quantum mechanics.

Suggested Readings

1. A Textbook of Quantum Mechanics, P. M. Mathews and K. Venkatesan, McGraw Hill.
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, Wiley.
3. Quantum Mechanics, Leonard I. Schiff, Tata McGraw Hill.
4. Quantum Mechanics, G. Aruldhas, PHI Learning of India.
5. Quantum Mechanics, Bruce Cameron Reed, Jones and Bartlett Learning.
6. Quantum Mechanics: Foundations & Applications, Arno Bohm, Springer.
7. Quantum Mechanics for Scientists & Engineers, D. A. B. Miller, Cambridge University Press.
8. Quantum Mechanics, Eugen Merzbacher, John Wiley and Sons, Inc.
9. Introduction to Quantum Mechanics, D. J. Griffith, Pearson Education.
10. Quantum Mechanics, Walter Greiner, Springer.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2		H	H	
CO3				H

PSEN205T: ELECTRONIC CIRCUITS, NETWORKS AND DEVICES

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of this course is to introduce the laws that govern the response of electrical circuits and networks, the various passive and active components used in these circuits. The course focuses on solving simple electrical networks using associated theorems and principles. The objective is also to learn the basic properties and principles of basic semiconductor materials, semiconductor junctions, electronic devices and electronic circuit design. The course will also help in understanding the operation of simple devices such as p-n junctions and optoelectronic devices and more complex devices such as Bipolar Junction Transistors (BJT) through theory and practice.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Describe passive components and DC networks and electronic devices. (Remembering)
CO 2: Discuss the principles of operation of analog and digital electronic devices. (Understanding)
CO 3: Analysis of devices for solving simple mathematical problems. (Application, Analysis)

Module I: Passive Components and DC Networks (15 hours)

a) Passive components: resistors, capacitors and inductors-types, characteristics and applications;
b) DC networks: voltage and current sources, dependent sources, KCL, KVL, current division rule, voltage division rule, Y-Delta conversion, mesh analysis, node analysis, Thevenin's theorem, Norton's theorem, superposition theorem, maximum power transform theorem.

Module II: Electronic Devices and Circuits (20 hours)

a) Semiconductor concepts: Semiconductor material basics, intrinsic semiconductor, extrinsic semiconductor, energy levels, concept of hole and electron, mobility, conductivity, n-type and p-type, majority and minority carriers, mechanism of current flow.
b) Semiconductor diode: PN junction and various biasing conditions, V-I characteristics, diode equation, diode resistance, equivalent circuit, transition capacitance and diffusion capacitance; rectifier circuit with filter, clipper, clamper, voltage multiplier.
c) Bipolar Junction Transistor: BJT: construction, npn, pnp, operation and configuration, V-I characteristics.
d) Special purpose devices: Zener diodes, LED, Solar Cell, photo diode, photo transistor, Schottky diode, varactor diode, tunnel diode.

Module III: Fundamentals of Digital Circuits (10 hours)

Number systems**:** Definition, type and interconversion, Boolean algebra, De-Morgan's law, AND, OR, NOT, Universal gates, combinational logic circuits.

Suggested Readings

1. Electronic Devices and Circuits, S. Salivahanan, McGraw Hill Publications.
2. Networks and Systems, D. Roy Choudhury, New Age International.
3. Electronic Devices and Circuits, David A. Bell, Oxford University Press.
4. Digital electronics, Moris Mano, EEE.

Mapping of COs to Syllabus:

Course Outcomes	**Module I**	**Module II**	**Module III**
CO1	H		
CO2		H	
CO3	H	H	H
CO4	H	H	H

PSEN206L: ELECTRONIC CIRCUITS, NETWORKS AND DEVICES LAB

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to provide students with hands-on experience and practical skills in designing and analyzing electronic circuits and devices in order to complement the theoretical knowledge gained in related coursework.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Analyze electronic devices and tools used in the lab for various applications. (Analysing)

CO 2: Construct and evaluate electronic circuits using different devices and components to perform certain operations. (Creating)

At least 10 Experiments to be performed from the following:

1. Introduction to electronic lab components.
2. Introduction to electronic lab tools and equipment.
3. Verification of KCL using discrete components.
4. Verification of KVL using discrete components.
5. Study the Characteristics of PN junction Diodes.
6. Study the Characteristics of Zener Diodes.
7. Design half wave rectifier using diode and evaluate ripple factor with and without filter.
8. Design full wave rectifier using diodes and evaluate ripple factor with and without filter.
9. Design and study the clipper circuit.
10. Design and study the clamper circuit.
11. Design various multiplier circuits using diodes and capacitors
12. Study Static Characteristics of a Bipolar Junction Transistor (CE Mode)
13. Study Static Characteristics of a Bipolar Junction Transistor (CB Mode)
14. Study the Characteristics of Light Emitting Diodes Diodes.

Mapping of COs to Syllabus:

Course Outcomes	**Expt. 1**	**Expt. 2**	**Expt. 3**	**Expt. 4**	**Expt. 5**	**Expt. 5**	**Expt. 7**	**Expt. 8**	**Expt. 9**	**Expt. 10**	**Expt. 11**	**Expt. 12**	**Expt. 13**	**Expt. 14**
CO1	H	H												
CO2			H	H	H	H	H	H	H	H	H	H	H	H

PSCM300T: CONDENSED MATTER PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to provide the students to deal with the solid state of matter and its various physical properties. It is also required to pursue studies on specialised topic like electronics, nano-sciences, etc. Emphasis shall be laid upon the solution of numerical problems.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain crystal structure and the concepts of lattice vibrations (Understanding)

CO 2: Illustrate the dielectric and magnetic behavior of matter (Applying)

CO 3: Construct band theory and explain superconductivity (Applying)

Module I: Crystal Structure and Lattice Dynamics (17 hours)
Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.
Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law.

Module II: Magnetic and Dielectric Properties of Matter (18 hours)
Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia– and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.
Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mossotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant.

Module III: Ferroelectric Properties of Materials (10 hours)
Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

Module IV: Elementary Band Theory and Superconductivity (15 hours)
Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient.
Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation).

Suggested Readings
1. Charles Kittel, Introduction to Solid State Physics, Wiley India Pvt. Ltd.
2. J. P. Srivastava, Elements of Solid State Physics, Prentice-Hall of India
3. Leonid V. Azaroff, Introduction to Solids, 2004, Tata Mc-Graw Hill.
4. N. W. Ashcroft and N. D. Mermin, Solid State Physics, Cengage Learning.
5. H. Ibach and H. Luth, Solid-state Physics, Springer.
6. Rita John, Solid State Physics, McGraw Hill.
7. M. Ali Omar, Elementary Solid State Physics, Pearson India.
8. M. A. Wahab, Solid State Physics, Narosa Publications.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

PSCM301L: CONDENSED MATTER PHYSICS LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)
The objective of the course is to demonstrate experiments related to basic properties of solid state materials. Also it is aimed to explain few basic experiments related to semiconductors.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Learn about magnetic properties of matter. (Understanding)
CO 2: Analyse dielectric properties of materials. (Applying)
CO 3: Understand and analyse few topics related to semiconductor physics. (Analysing)

At least 5 experiments should be performed from the following:
1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method).
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency.
5. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.

6. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150°C) and to determine its band gap.
7. To determine the Hall coefficient of a semiconductor sample.

Mapping of COs to the syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7
CO1	H	H	M		M		
CO2				H			
CO3						H	H

PSET302T: ELECTROMAGNETIC THEORY

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to provide students with a comprehensive understanding of the fundamental principles and laws governing electricity and magnetism. Through theoretical concepts, mathematical formalism, and practical applications, this course aims to develop students' knowledge and skills in analysing electromagnetic phenomena.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Apply Maxwell's equations in solving problems related to various physical phenomena. (Applying)

CO 2: Explain physical phenomena involving electric charges and currents from the standpoint of electromagnetic theory. (Understanding)

CO 3: Analyze the behavior of physical systems using electromagnetic theory. (Analyzing)

Module I: Maxwell Equations (15 hours)

Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density.

Module II: EM Wave Propagation in Unbounded Media (15 hours)

Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth. Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere.

Module III: EM Wave in Bounded Media (15 hours)

Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection & Transmission coefficients. Total internal reflection, evanescent waves. Metallic reflection (normal Incidence).

Module IV: Polarization of Electromagnetic Waves (15 hours)

Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Babinet Compensator and its Uses. Analysis of Polarized Light.

Suggested Readings

1. Introduction to Electrodynamics, D. J. Griffiths, Benjamin Cummings.
2. Elements of Electromagnetics, M. N. O. Sadiku, Oxford University Press.
3. Introduction to Electromagnetic Theory, T. L. Chow, Jones & Bartlett Learning.
4. Fundamentals of Electromagnetics, M. A. W. Miah, Tata McGraw Hill.
5. Electromagnetic field Theory, R. S. Kshetrimayun, Cengage Learning.
6. Engineering Electromagnetic, Willian H. Hayt, McGraw Hill.
7. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, Springer.
8. Electromagnetic Fields & Waves, P. Lorrain and D. Corson, W.H.Freeman & Co.
9. Electromagnetics, J. A. Edminster and Schaum Series, Tata McGraw Hill.
10. Electromagnetic field theory fundamentals,Guru and H. Hiziroglu, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2		H	H	
CO3				H

PSET303L: ELECTROMAGNETIC THEORY LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to complement theoretical knowledge with practical skills, providing students with a deeper understanding of electromagnetic principles through hands-on experimentation. It encourages students to think critically, analyse data, and draw conclusions based on evidence specific to electromagnetism. The course also fosters skills in teamwork, communication, and laboratory safety awareness relevant to the field of electromagnetism.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: To Know about the physics of polarization of electromagnetic waves. (Understanding)

CO 2: To build a clear concept of wave properties of electromagnetic waves and its application to various systems / media. (Understanding and Applying)

CO 3: Analyze the physics of radiation. (Analyzing)

At least 8 experiments should be performed from the following

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of the sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by using a Babinet's compensator.
4. To study dependence of radiation on angle for a simple Dipole antenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
6. To study the reflection, refraction of microwaves.
7. To study Polarization and double slit interference in microwaves.
8. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
9. To verify the Stefan`s law of radiation and to determine Stefan's constant.
10. To determine the Boltzmann constant using V-I characteristics of PN junction diode.

Mapping of COs to the syllabus

Course Outcomes	**Expt. 1**	**Expt. 2**	**Expt. 3**	**Expt. 4**	**Expt. 5**	**Expt. 6**	**Expt. 7**	**Expt. 8**	**Expt. 9**	**Expt.10**
CO1	H	H	M				H			H
CO2					M	H	H	M	M	M
CO3				M					M	

PSSD304T: SEMICONDUCTOR DEVICES

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of this course is to provide basic analog electronic circuit design techniques and analytical skills using diodes, op-amps, FETs and BJTs. This course also introduces the concepts of digital and binary systems and how these concepts are connected to digital electronics. It also provides fundamental concepts used in the design of digital systems, the basic tools for the design and implementation of digital circuits, modules and subsystems through and practice.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate theoretical concepts related to analog electronics circuit analysis and digital electronics circuit design. (Understanding)

CO 2: Analyze transistors for optimum performance as amplifiers using load line, frequency response and feedback. (Analysing)

CO 3: Apply transistor operational knowledge for high gain operations and various logical and mathematical operations. (Applying)

CO 4: Design simple analog electronic circuits and digital electronic systems for various outcomes. (Applying)

Module I: Bipolar Junction Transistor (18 hours)

a. BJT biasing and stabilization: Load Line analysis of Transistors. DC Load line and Q-point and stability considerations, fixed bias, emitter feedback bias, collector feedback bias, voltage divider bias.
b. BJT modelling: Two port representation of BJT with h-parameter model for BJT for C-E, C-B, C-C configurations, calculation of voltage gain, current gain, input impedance and output impedance.
c. Frequency response of BJT amplifiers: Frequency response, Low frequency and high frequency response of BJT amplifiers, importance of coupling capacitors and bypass capacitors, cascading of amplifiers.
d. Feedback amplifiers: Concept of negative and positive feedback, impact of negative feedback, concept of sinusoidal and non-sinusoidal oscillators, 555 timers.
e. Operational Amplifier: Block diagram, ideal op-amp equivalent circuit, ideal characteristics, transfer curve, open loop and closed loop configuration, Common mode rejection ratio; Op-amp applications: inverting amplifier, non-inverting amplifier, adder, subtractor.

Module II: Field Effect Transistors (15 hours)

a. Introduction: Introduction to FET- JFET, MOSFET and CMOS; structure, operation, characteristic curves and equations.
b. FET biasing: Different biasing methods; self-bias, fixed bias, voltage divider bias, stabilization of Q-point.
c. JFET amplifiers: CS, CD amplifiers; enhancement mode MOSFET amplifier, depletion mode MOSFET amplifiers.

Module III: Digital Circuits (12 hours)

a. Number systems: Signed and unsigned representation, binary arithmetic on signed and unsigned integers and detection of overflow and underflow, weighted binary Codes: BCD, 2421, non- weighted codes: excess-3 codes, gray codes, error detecting codes, error correcting codes, alphanumeric codes: ASCII code, EBCDIC codes.
b. Boolean algebra and Logic Gates: Logic gates (basic and universal), rules of Boolean algebra, sum of products and product of sums forms. Conversion between different forms, conversion between Boolean expression and truth table; implementing logic expressions with logic gates (logic circuits).
c. Combinational logic circuits: Simplification of Boolean expressions using algebraic method, Karnaugh map method and Don't Care conditions. Designing Combinational logic circuits: half-adder, full-adder, encoder, decoder, Multiplexer, demultiplexer.
d. Digital logic families: Elementary idea of DTL, TTL, RTL, ECL, I2L logic family and characteristics.

Suggested Readings:

1. Electronic Devices and Circuit Theory, Robert L. Boylestad andLowisNashelsky, Pearson Education.
2. Millman's Electronic Devices and Circuits, Jacob Millman, Christos C. Halkias and Satyabrata Jit, Tata McGraw Hill.
3. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Tata McGraw- Hill.
4. Solid State Electronic Devices, Streetman and Banerjee, Prentice Hall.
5. Electronic Devices and Circuits, David A. Bell, Prentice Hall of India.
6. Op-amps and Linear Integrated Circuits, Ramakant A. Gayakwad, PHI.
7. Digital Logic and computer Design, M. Mano, PHI.
8. Modern Digital Electronics, R. P. Jain, TMGH.

Mapping of COs to Syllabus:

Course Outcomes	**Module I**	**Module II**	**Module III**
CO1	H	H	H
CO2	H	H	
CO3		H	H
CO4	H		H

PSSD305L: SEMICONDUCTOR DEVICES LAB

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to provide students with hands-on experience and practical skills in designing and analyzing electronic circuits and devices in order to complement the theoretical knowledge gained in related coursework.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Design and evaluate electronic circuits using different devices and components to perform certain operations. (Creating)
CO 2: Design and evaluate electronic circuits using electronic simulation software to perform certain operations. (Creating)

At least 10 Experiments to be performed from the following:

1. Design a CE amplifier using voltage divider biasing and find its Voltage Gain.

2. Design a CE amplifier using voltage divider biasing and plot and understand its frequency response curve.
3. Design Inverting amplifier using op-amp and calculate gain.
4. Design Non Inverting amplifier using op-amp and calculate gain.
5. Design a summing amplifier circuit using op-amp.
6. Design a voltage subtractor circuit using op-amp.
7. Design a signal integrator circuit using op-amp.
8. Design zero crossing detector and positive and negative comparators using op-amp.
9. Design 1st order low pass filters using op-amp.
10. Design 2nd order low pass filters using op-amp.
11. Design 1st order high pass filters using op-amp.
12. Design 2nd order high pass filters using op-amp.
13. Design astable multivibrator using op-amp.
14. Design monostable stable multivibrator using op-amp.
15. Design bistable stable multivibrator using op-amp.
16. Use electronic simulation software like Multisim to design and simulate simple circuits

Mapping of COs to Syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 5	Expt. 7	Expt. 8	Expt. 9	Expt. 10	Expt. 11	Expt. 12
CO1	H	H	H	H	H	H	H	H	H	H	H	
CO2												H

PSQM306T: ADVANCED QUANTUM MECHANICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The main objectives of an advanced quantum mechanics course are to understand the Mathematical Framework, mastering the Principles of Quantum Mechanics, developing Analytical and Critical Thinking, connecting Quantum Mechanics to Applications etc. Good knowledge of advanced quantum mechanics course can serve as a stepping stone for students interested in pursuing research or further studies in quantum mechanics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain different representations and postulates of quantum mechanics (Understanding)
CO 2: Discuss orbital and spin angular momentum (Understanding)
CO 3: Illustrate the concepts of perturbation and scattering theory (Applying)
CO 4: Develop concepts on relativistic quantum mechanics (Applying)

Module I: Representations, Postulates and Symmetries (10 hours)

Dirac notations, Representation in Discrete Bases, Representation in continuous Bases, postulates of quantum mechanics: The State of a System, Observables and Operators, Measurement in Quantum Mechanics, Time Evolution of the System's State.
Symmetry in quantum mechanics. Reflections, time reversal, space inversion, particle exchange. Displacement in space and time, space translation and rotational symmetry.

Module II: Angular Momentum and Spinors (15 hours)

Orbital Angular Momentum, General Formalism of Angular Momentum, Matrix Representation of Angular Momentum, Geometrical Representation of Angular Momentum, Eigenfunctions of Orbital Angular Momentum.
Spinors and their transformation properties. Pauli spin matrices. Identical particles and statistics. Addition of angular momenta. Clebsch-Gorden coefficients. Winger-Eckart Theorem.

Module III: Perturbation Theory (12 hours)

Variational methods for bound states; lower and upper limits in simple cases. WKB approximation; Stationary perturbation theory: Non Degenerate case; first and second order of energy and wave functions,
Time dependent perturbation theory; first order transition probabilities; constant perturbation. Transition to continuum; Harmonic perturbation; Fermi's golden rule; Sudden and adiabatic approximations.

Module IV: Scattering Theory (10 hours)

Scattering theory: asymptotic behaviour of scattering wave function; relation to cross sections, Green's function for scattering problem; Green's function with different boundary conditions; scattering integral equations; Born approximation and its validity criteria; scattering by screened Coulomb potential; Born series. Partial waves and phase shifts. Scattering amplitude; optical theorem; low energy scattering. Effective range; scattering length; resonance.

Module V: Relativistic Quantum Mechanics (13 hours)
Relative wave equations: Klein-Gordon equation. Difficulty with probability interpretation. Dirac equation; four component solutions for free particle; negative energy solutions – particles and antiparticles. Covariant form of Dirac equation; 4-current density. Properties of γ-matrices. Dirac equation in the presence of electromagnetic field; non-relativistic reduction; spin and magnetic moment.

Suggested Readings

1. Quantum Mechanics, E. Merzbacher, John Wiley.
2. Quantum Mechanics, G. Ahruldhas, Prentice Hall.
3. Quantum Mechanics, L. I. Schiff, McGraw Hill.
4. Quantum Mechanics, V. K. Thankappan, New Age Int. Pub.
5. Quantum Mechanics, P. T. Mathews and Venkatesan, Tata McGraw Hill.
6. Principles of Non-Relativistics and Relativistic Quantum Mechanics, K. D. Krori, PHI.
7. Quantum Mechanics (3 volumes), L. D. Landau and E. M. Lifshitz, Pergamon Press.
8. Quantum Mechanics, Albert Messiah, Dover Publications.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**	**Module V**
CO1	H	H			
CO2		H			
CO3			H	H	
CO4					H

PSNP307T: ATOMIC AND NUCLEAR PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)
The objective of the course is to provide students with an advanced understanding of the principles and theories that govern atomic and nuclear phenomena. Through theoretical concepts, experimental techniques, and mathematical formalism, this course aims to develop students' knowledge and skills in analyzing the structure, properties, and interactions of atoms and nuclei.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain atomic spectra for single electron systems and many-electron system in details. (Understanding)
CO 2: Understand interaction of radiation with atoms. (Understanding)
CO 3: Understand the basic properties of nuclei, their reactions and different models to explain nuclear structure. (Understanding)
CO 4: Explain the phenomena of radioactive decays of different nuclei. (Analyzing)

Module I: (12 hours)
Introduction of atomic spectrum; fine structure and hyperfine structure of energy levels. Sommerfeld's relativistic corrections, Quantum mechanical treatment of one electron atom, orbital angular momentum, Gyromagnetic Ratio and Bohr magneton. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Normal and Anomalous Zeeman effect. Stern-Gerlach Experiment. Paschen Back and Stark Effect (Qualitative Discussion only). Spectral Notations for Atomic States; Vector atom Model. Spin-orbit coupling in atoms- L-S and J-J couplings.

Module II: (14 hours)
Quantum mechanical theory of atomic structure; fine structure of hydrogen spectral terms, Zeeman effect, Paschen Back effect. Identical particles, Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Periodic table. Multi electron atoms; Hartree's self consistent field. Hund's Rule. Fine structure of spectral lines in helium and Alkali Atoms (Na etc.). Doublet structure energy levels. Term symbols and fine structure of energy levels of two electron atoms using L-S coupling and j-j coupling schemes; identification of ground state. Interaction of nuclear and electronic magnetic moments and hyperfine structure with examples.

Module III: General Properties of Nuclei (10 hours)
Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, NZ plot, angular momentum, parity, magnetic moment, electric moments, nuclear excited states.

Module IV: Nuclear Models (12 hours)

Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

Module V: Radioactivity Decay and Nuclear Reactions (12 hours)

Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. Gamma decay: Gamma rays emission & kinematics, internal conversion.

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction.

Suggested Readings

1. Introduction to Atomic Spectra, H. E. White, Mc-Graw Hill.
2. Atoms and Molecules, Martin Karplus and Richard N. Porter, W. A. Benjamin.
3. Introductory nuclear Physics, Kenneth S. Krane, Wiley India Pvt. Ltd.
4. Concepts of nuclear physics, Bernard L. Cohen, Tata Mcgraw Hill.
5. Introduction to the physics of nuclei & particles, R. A. Dunlap, Thomson Asia.
6. Introduction to High Energy Physics, D. H. Perkins, Cambridge Univ. Press.
7. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons.
8. Quarks and Leptons, F. Halzen and A. D. Martin, Wiley India.
9. Basic ideas and concepts in Nuclear Physics - An Introductory Approach, K. Heyde, IOP- Institute of Physics Publishing.
10. Radiation detection and measurement, G. F. Knoll, John Wiley & Sons.
11. Physics and Engineering of Radiation Detection, Syed Naeem Ahmed, Academic Press, Elsevier.
12. Theoretical Nuclear Physics, J. M. Blatt & V. F. Weisskopf, Dover Pub.Inc.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**	**Module V**
CO1	H	H		H	
CO2			H		
CO3					H
CO4					H

PSCM308T: CLASSICAL MECHANICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to provide the basic knowledge of classical mechanics in terms of Lagrangian and Hamiltonian instead of Newtonian mechanics. Here the students will learn how to construct Lagrangian and Hamiltonian for a system and hence to obtain equation of motion. The course will also provide deep insights on relativistic mechanics and let the students learn the required mathematical tools and prepare them for higher studies. Emphasis shall be laid upon solving numerical problems.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Construct Lagrangian and Hamiltonian for different physical systems (Apply)
CO 2: Explain small oscillations (Understanding)
CO 3: Solve problems related to special theory of relativity (Analyzing)
CO 4: Apply the laws of fluid dynamics to build technologies (Applying)

Module I: Classical Mechanics of Point Particles (20 hours)

Review of Newtonian Mechanics, Generalized coordinates and velocities, constraints and degrees of freedom, Hamilton's variational principle; Lagrangian and the Euler-Lagrange equations, one-dimensional examples of the Euler-Lagrange equations-one-dimensional Simple Harmonic Oscillations and falling body in uniform gravity; Cyclic coordinates and conservation theorems, Canonical momenta & Hamiltonian, Hamilton's equations of motion, Applications: Hamiltonian for a harmonic oscillator, particle in a central force field- conservation of angular momentum and energy.

Module II: Small Amplitude Oscillations (10 hours)

Minima of potential energy and points of stable equilibrium, expansion of the potential energy around a minimum, small amplitude oscillations about the minimum, normal modes of oscillations example of N identical masses connected in a linear fashion to (N -1) - identical springs.

Module III: Special Theory of Relativity (20 hours)
Postulates of Special Theory of Relativity, Lorentz transformations, Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams, Time-dilation, length contraction and twin paradox, Four-vectors: Four-velocity and acceleration. Four-momentum and energy-momentum relation, Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle.

Module IV: Fluid Dynamics (10 hours)
Density and pressure in a fluid, an element of fluid and its velocity, continuity equation and mass conservation, stream-lined motion, laminar flow, Poiseuille's equation for flow of a liquid through a pipe, Navier-Stokes equation, qualitative description of turbulence, Reynolds number.

Suggested Readings

1. H. Goldstein, C. P. Poole and J. L. Safko, Classical Mechanics, Pearson Education.
2. L. D. Landau and E. M. Lifshitz, Mechanics, Pergamon.
3. L. D. Landau and E. M . Lifshitz, The Classical Theory of Fields, Elsevier.
4. P. S. Joag, N. C. Rana, Classical Mechanics, McGraw Hall.
5. R. Douglas Gregory, Classical Mechanics, Cambridge University Press.
6. Dieter Strauch, Classical Mechanics: An Introduction, Springer.
7. O. L. Delange and J. Pierrus, Solved Problems in Classical Mechanics, Oxford Press.

Mapping of COs to Syllabus:

Course Outcomes	**Module 1**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2		H		
CO3			H	
CO4				H

PSED400T: ELECTRODYNAMICS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)
The main objective of electrodynamics is to provide a comprehensive understanding of the behavior of electric and magnetic fields, as well as their interactions with charged particles and currents. It is a branch of physics that explores the fundamental principles and mathematical formalism underlying electromagnetic phenomena. Overall, the main objective of electrodynamics is to provide a comprehensive understanding of electromagnetic phenomena, enabling students to analyze and solve problems related to electric and magnetic fields and their interactions with matter.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Outline the origin and propagation of electromagnetic waves. (Understanding)
CO 2: Explain the nature of electromagnetic radiation. (Understanding)
CO 3: Infer the extension of classical electrodynamics to the generalized 4-dimensional case. (Analyzing)
CO 4: Apply the laws of electrodynamics to solve various physical problems. (Applying)

Module I: Introduction (16 hours)
Revision of Maxwell's Equations; Electromagnetic waves: linear and circular polarisation; Stoke's parameters; Poynting theorem of complex field vectors; frequency dispersion (normal and anomalous); characteristics of dielectrics, conductors and plasma and their interaction with electromagnetic waves.

Module II: Green's Function and Radiating systems (25 hours)
a) Simple radiating systems: Gauge invariance; Green's function for the wave equation; concept of retarded potential, radiation from an oscillating dipole and its polarisation. Electric dipole fields, magnetic dipole and electric quadrupole fields; centre fed linear antenna, scattering at long wavelengths – viz. by dipoles induced in a small scatterer, scattering by a small dielectric sphere.
b) Diffraction: Scalar diffraction theory; vectorial diffraction theory, Scattering in a short wavelength limit.
c) Guided waves: waveguides, TE waves in a rectangular waveguide, coaxial transmission lines.

Module III: Radiation by an accelerated Charge (17 hours)
Radiation from accelerated charge: Lienard-Wiechart potentials; radiated power from accelerated charge at low velocities. Larmor 's power formula. The fields of a point charge in arbitrary and uniform motion. Radiation from an ultra-relativistic particle. Angular and frequency distribution of radiation from moving charges.

Module IV: Covariant Form of Maxwell's Equations and Relativity (17 hours)
Special theory of relativity: Four dimensional Lorentz transformation, covariance of Maxwell's equations, electromagnetic field tensor; matrix representation of Lorentz transformation; infinitesimal generators; Thomas precession; invariance of electric charge; covariance of electrodynamics; transformation of electromagnetic fields.

Suggested Readings
1. Classical Electrodynamics, J. D. Jackson, John Wiley and Sons.
2. Classical Electrodynamics, S. P. Puri, Tata McGraw Hill Publishing Company Ltd.
3. Electrodynamics, S. L. Gupta, V. Kumar and S. P. Singh, Pragati Prakashan.
4. Introduction to Electrodynamics, D. J. Griffiths, Prentice Hall of India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	H	H		
CO3			H	H
CO4			H	H

PSPP401T: PARTICLE PHYSICS AND ACCELERATORS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)
The main objectives of a course on Particle Physics and Accelerators are to provide students with a comprehensive understanding of the fundamental particles and their interactions, as well as the technology and principles behind particle accelerators. By accomplishing these objectives, the course on Particle Physics and Accelerators aims to equip students with a solid foundation in the field, enabling them to pursue further studies or careers in particle physics, accelerator science, or related disciplines.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Explore different concepts of Linear and Cyclic accelerators (understanding)
CO 2: Explain superconductivity and its application in accelerators (understanding)
CO 3: Learn the basics of particle physics (understanding)

Module I: Introductions to Accelerators (15 hours)
Introduction to DC accelerators, Cockcroft-Walton, Van de Graaff, Tandem, Pelletron accelerators. Ion sources, high voltage generation, voltage stabilization, Charging systems (capacitive and inductive), Magnets, insulating gases and their characteristics.
Control systems, beam handling components, Focussing systems, interlocks, Voltage / Energy calibration, beam optics.

Module II: Introduction to LINACs (15 hours)
Introduction and basic principles of LINACs. Relativistic expressions. Propagation of electromagnetic waves through matter (relevant to LINACs only), boundary conditions, phase velocity, group velocity, wave equation. Generation of modes in a cavity/waveguide.
Application to the different types of LINACs including traveling and standing wave types. Transit time factor and the energy gained in a LINAC. General ideas of surface resistance, power loss, Quality factor, shunt impedance in cavities; Normal conducting LINAC structures.

Module III : Superconductivity in accelerators (10 hours)
Superconductivity in accelerators, advantages of Superconducting cavities, breakdown mechanisms in Superconducting cavities, Superconducting accelerating cavities

Module IV: Dynamics at LINACs (20 hours)
Longitudinal dynamics in LINACs: Longitudinal stability, stability criteria, separatrix, synchronous oscillation with small and large amplitudes. FD, FFDD focusing, Stability criteria, phase advance and stability in LINACs; Space charge effects in high intensity beams. Cyclotrons. Synchrocyclotron. AVF principle and concept of hills and valleys in magnetic field. Different applications of cyclotrons.
Equation of motion in magnetic field and concept of focusing, Weak and strong focusing, Quadrupole magnets, Principle of AG focusing, Edge focusing; particle acceleration , Proton storage ring; Basic concept of space charge and tune shift. Fixed target collision and colliding beams. Luminosity and circular colliders

Module V: Introduction to Particle Physics (15 hours)

Elementary Particle Physics: Fundamental forces, Elementary particles and their classification, characteristics of the elementary particles, quantum numbers, behaviour under charge conjugation, time reversal and parity operation, Isotopic multiplet and Gellmann-Nishijima scheme, SU (3) classification and Quark model, Standard model.

Suggested Readings

1. Particle Accelerators, M.S. Livingston and J.B. Blewett, McGraw-Hill Inc, US (1962)
2. Particle Accelerator Physics, Helmut Wiedemann, Fourth Edition, Springer (2015).
3. Introduction to Accelerator Physics, Arvind Jain, MacMillan India Ltd, (2007).
4. RF Linear Accelerators-second, completely revised and enlarged edition (Wiley 2008) Thomas P. Wangler
5. An Introduction to the Physics of Particle Accelerators - second edition (World Scientific 2008), Mario Conte and William M. MacKay
6. Particle Accelerator Physics - fourth edition (Springer 2015). -Helmut Wiedemann
7. Accelerator Physics - fourth edition (World Scientific 2019) -S. Y. Lee.
8. Principles of Charged Particle Acceleration – Stanley Humphries
9. Helmut Wiedemann, “Particle Accelerator Physics”, Springer
10. A. Edwards and M. J. Syphers, “Physics of High Energy Accelerators”, WILEY-VCH
11. Phillip J. Bryant and Kjell Johnson, “The Principles of Circular Accelerators and Storage Rings”, Cambridge University press
12. S. Y. Lee, “Accelerator Physics”, World Scientific
13. Andrzej Wolski, “Beam Dynamics in High Energy Particle Accelerators”, World Scientific
14. Proceedings of 5th General Accelerator Physics Course, Vol-1 and 2, CERN Accelerator School, Ed. S

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**	**Module V**
CO1	H	H		H	
CO2			H		
CO3					H

PSSM402T: STATISTICAL MECHANICS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The objective of the course is to teach the students about the connection between statistical mechanics and thermodynamics, quantum statistical mechanics, phase transitions and non-equilibrium physics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate the connection between statistical mechanics and thermodynamics. (Analyzing)
CO 2: Explain the concept of quantum statistical mechanics. (Understanding)
CO 3: Outline the physics of phase transition. (Understanding)
CO 4: Explain the importance of non-equilibrium physics. (Understanding)

Module I: Essentials (20 hours)

Probability theory: the random walk problem, binomial, Poisson and Gaussian distributions, central limit theorem; Classical equilibrium statistical mechanics: concept of equilibrium; Ergodic hypothesis; microcanonical, canonical and grand canonical Ensembles; partition functions and their relation to thermodynamics; Classical non-equilibrium statistical mechanics: approach to equilibrium, Liouville’s theorem, Boltzmann’s H theorem

Module II: Quantum Statistics (20 hours)

Quantum statistical mechanics: Schrödinger and Heisenberg Picture; pure and mixed states, the density matrix, quantum mechanical Liouville’s theorem; the fundamental postulates; Quantum statistics: quantum gases of independent particles; partition functions; Bose Einstein and Fermi Dirac’s distributions; electrons in metals; black body radiation; Bose Einstein’s Condensation

Module III: Phase Transitions (18 hours)

Phenomenology: first and second order phase transitions; elementary ideas of critical phenomena; universality of critical exponents; scaling of thermodynamic functions; Theory: the Landau theory of phase transition with examples. c) Exact solutions: Ising model in one dimension.

Module IV: Non Equilibrium Phenomena and Irreversible Processes (17 hours)

Non equilibrium phenomena: transport theory; Boltzmann equation; Maxwell-Boltzmann distribution; Irreversible processes: fluctuations; Brownian motion; Langevin’s equation; Wiener Khintchine relations, Nyquist theorem, Fluctuation-Dissipation theorem; Fokker Planck equation.

Suggested Readings

1. Fundamental of Statistical and Thermal Physics, FederickReif, McGraw Hill, Singapore.
2. Statistical Mechanics, Shang-Keng Ma, World Scientific, Singapore.
3. Statistical Mechanics: Fundamental and Modern Applications, Richard E. Wilde, and Surjit Singh, Wiley-Interscience, John Wiley and Sons Inc., New York.
4. Statistical Physics: Statics, Dynamics and Renormalisation, Leo P.Kadanoff, World Scientific, River Edge, New Jersey.
5. Statistical Mechanics, K. Huang, John Wiley and Sons Inc., New York.
6. Statistical Physics, D. J. Amit and J. Verbin, World Scientific, Singapore.
7. Statistical Physics, L. D. Landau, E. M. Lifshitz, Butterworth-Heinemann.
8. Statistical Mechanics, R. K. Pathria, Academic Press.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2		H		
CO3			H	
CO4				H

PSAM403T: ADVANCED MATHEMATICAL PHYSICS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The main objectives of a course on Advanced Mathematical Physics are to provide students with a deeper understanding of the mathematical methods and techniques used in theoretical physics and to develop their ability to apply advanced mathematical concepts to solve problems in physics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concepts and applications of the Fourier series, Laplace and Integral transformation and special function (Applying)

CO 2: Illustrate some of the basic concepts of tensor analysis and its application to different branches of physics. (Understanding, Applying)

CO 3: Analyse some of the basic concepts of group theory and its application to different branches of physics. (Understanding, Applying)

Module I: Fourier Series (10 hours)

Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions.

Module II: Integrals and Laplace Transforms (20 hours)

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.).

Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT.

Module III: Frobenius Method and Special Functions (15 hours)

Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions ($J_0(x)$ and $J_1(x)$) and Orthogonality.

Module IV: Tensor Calculus (15 hours)

Transformation of coordinates: Galilean and Lorentz transformations. Tangent vectors and gradients, inner and outer products, contraction, symmetric and antisymmetric tensors, metric tensor, covariant and contravariant derivatives. Metric tensor in different curved spaces. Four vectors and physical examples from special relativity and electrodynamics.

Module V: Group Theory (15 hours)

Group axioms, permutation groups (S2 and S3) and symmetry operations of equilateral triangle, multiplication table, subgroup, classes and characters, finite groups (Zn), cosets, factor group, normal subgroup, point symmetry group, direct and semi direct product of groups, homomorphism and isomorphism, direct and semi-direct products, block diagonalisation - reducible and irreducible representation, group representation by matrix [unitary representation and conservation laws], Lie groups and algebras [generators, SO(2), SO(3) and SU(2)]; unitary group, special unitary group.

Suggested Readings

1. Mathematical Methods for Physicists, G. Arfken, H. Weber and F. Harris, Elsevier.
2. Mathematical Methods of Physics, J. Mathews and R. L. Walker, The Benjamin-Cumminngs Publishing Company.
3. Mathematics for Physicists, P. Dennery and A. Krzywicki, Harper and Row
4. A.W.Joshi, Matrices and Tensors in Physics, 3rd Edition, New Age Int. (2005)
5. M. Hamermesh, Group Theory and Its Applications to Physical Problems, Dover (1989)
6. D.B. Lichtenberg, Unitary symmetry and elementary particles, second edition, Academic Press (1978).

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**	**Module V**
CO1	H	H	H		
CO2				H	
CO3					H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	PSAO103T	Waves: Acoustics and Optics (3-1-0)	4
2	Minor Course 2	PSMP102T	Introduction to Modern Physics (3-1-0)	4
3	Minor Course 3	PSEM207T	Electricity and Magnetism (3-0-0)	4
		PSEM208L	Electricity and Magnetism Lab (0-0-1)	
4	Minor Course 4	PSMP209T	Mathematical Physics-II (3-1-0)	4
5	Minor Course 5	PSAP310T	Introduction to Astrophysics and Plasma Physics(3-1-0)	4
		PSCM300T	Condensed matter Physics (3-0-1)	
		PSCM301L	Condensed matter Physics Lab (0-0-1)	
		PSED311T	Electrodynamics (3-1-0)	
6	Minor Course 6	PSSD312T	Semiconductor Devices (3-1-0)	4
		PSST313T	Statistical Mechanics (3-1-0)	
7	Minor Course 7	PSMP404T	Materials Physics (3-0-0)	3
7	Minor Course 8	PSRM405T	Research Methodology	2
8	Minor Course 9	PSSA406T	Physics of Sensors and Actuators (3-0-0)	3

PSAO103T: WAVES: ACOUSTICS AND OPTICS
(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)
The objective of the course is to provide students with a comprehensive understanding of the fundamental principles and properties of waves, with a specific focus on acoustics and optics. This course aims to equip students with the necessary knowledge and skills to analyze and explain the behavior of waves, both in the context of sound and light, and their applications in various fields.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Make use of the superposition principle in different scenarios. (Applying)
CO 2: Classify and illustrate different wave motions. (Understanding)
CO 3: Analyze and interpret the wave nature of light. (Analyzing)

Module I: Superposition of Harmonic Oscillations (10 hours)
Simple harmonic motion, Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences.Lissajous Figures.

Module II: Wave Motion (12 hours)
Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport.Intensity of Wave. Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction.

Module III : Standing Waves (8 hours)
Standing (Stationary) Waves in a String: Fixed and Free Ends.Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String.Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment.Longitudinal Standing Waves and Normal Modes.Open and Closed Pipes.

Module IV: Interference (15 hours)
Electromagnetic nature of light.Wave front.Huygens Principle.Temporal and Spatial Coherence.Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Haidinger and Fizeau Fringes. Newton's Rings. Michelson Interferometer and Fabry-Perot interferometer.

Module V: Diffraction (15 hours)
Kirchhoff 's Integral Theorem, Fresnel-Kirchhoff 's Integral formula. (Qualitative discussion only). Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating.Resolving power of grating. Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire.

Suggested Readings

1. Waves: Berkeley Physics Course, Vol. 3, Francis Crawford, Tata McGraw-Hill.
2. Fundamentals of Optics, F. A. Jenkins and H.E. White, McGraw-Hill.
3. Principles of Optics, Max Born and Emil Wolf, Pergamon Press.
4. Optics, AjoyGhatak, Tata McGraw Hill.
5. The Physics of Vibrations and Waves, H. J. Pain, John Wiley and Sons.
6. The Physics of Waves and Oscillations, N. K. Bajaj, Tata McGraw Hill.
7. Fundamental of Optics, A. Kumar, H. R. Gulati and D. R. Khanna, R. Chand Publications.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H			
CO2			H		
CO3				H	H

PSMP102T: Introduction to Modern Physics

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to provide students with a comprehensive understanding of the fundamental principles and concepts that form the basis of modern physics. The students will develop a strong foundation in the theoretical aspects of quantum mechanics, enabling them to analyze and explain the behavior of matter and energy at the atomic and subatomic levels. They will also learn about lasers.

Course / Learning Outcomes

CO 1: Demonstrate an elementary knowledge of quantum mechanics. (Understanding)
CO 2: Explain the physics of an atomic nucleus. (Understanding)
CO 3: Summarize the basic principles of LASER. (Understanding)

Module I: Fundamentals of Quantum Mechanics-I (22 hours)

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions.

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle-application to virtual particles and range of an interaction.

Module II: Fundamentals of Quantum Mechanics–II (14 hours)

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.

Module III: Nuclear Physics (16 hours)

Size and structure of atomic nucleus, Impossibility of an electron being in the nucleus, Nature of nuclear force, N-Z graph, Semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers. Radioactivity, Law of radioactive decay, Mean life and half-life, Alpha decay, Beta decay, Gamma ray emission Fission and fusion, Nuclear reactor: slow neutrons interacting with Uranium 235; Thermonuclear reactions(brief qualitative discussions).

Module IV: Laser (8 hours)

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser. Basic lasing.

Suggested Readings

1. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard and Coop, Tata McGraw Hill.
3. Introduction to Quantum Mechanics, David J. Griffith, Pearson Education.
4. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, Cengage Learning.
5. Modern Physics, G. Kaur and G. R. Pickrell, 2014, McGraw Hill.
6. Quantum Mechanics: Theory & Applications, A. K. Ghatak and S. Lokanathan, Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2			H	
CO3				H

PSEM201T: ELECTRICITY AND MAGNETISM

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of the course is to teach the students about the fundamental concepts concerning electric field, magnetic field, electro-magnetic effects and electrical circuits.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Summarize the fundamental concepts of electric field, electric potential, capacitors and polarization. (Remember)

CO 2: Explain the concept of magnetic field, types of different magnetic materials and its associated phenomena. (Understand)

CO 3: Outline the laws governing electromagnetic induction and electrical circuits (Understand)

Module I: Electric Field and its related phenomena (15 hours)

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere.

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics.

Module II: Magnetic Field (15 hours)

Magnetic force between current elements and definition of Magnetic FieldB. Biot-Savart 's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field. Magnetization vector (M). Magnetic Intensity(H). Magnetic Susceptibility and permeability. Relation between B, H, M. Ferromagnetism. B-H curve and hysteresis.

Module III: Electromagnetic Induction and Electrical Circuits (15 hours)

Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.

AC Circuits: Kirchhoff 's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit. Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping.

Suggested Readings

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, Tata McGraw.
2. Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education.
3. Introduction to Electrodynamics, D. J. Griffiths, Benjamin Cummings.
4. Feynman Hours, R. P. Feynman, R. B. Leighton and M. Sands, Pearson Education.
5. Elements of Electromagnetics, M. N. O. Sadiku, Oxford University Press.
6. Electricity and Magnetism, Vol. I, J. H. Fewkes& J. Yarwood, Oxford Univ. Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H		
CO2		H	
CO3			H

PSEM208L: ELECTRICITY AND MAGNETISM LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to provide students with hands-on experience in conducting experiments related to electricity and magnetism. Through practical activities, analysis, and interpretation, this course aims to enhance students' understanding of theoretical concepts and develop their skills in experimental techniques.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Measure various parameters of electrical devices, circuits and apparatus. (Evaluating)
CO 2: Measure fields using electrical apparatus. (Evaluating)
CO 3: Demonstrate the validity of various network theorems in practical applications. (Understanding)
CO 4: Utilize the concept of induction to study various AC circuits. (Applying)

At least 5 experiments to be performed from the following:

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. Study the characteristics of a series RC Circuit.
3. Determine an unknown Low Resistance using Potentiometer.
4. Determine an unknown Low Resistance using Carey Foster's Bridge.
5. Compare capacitances using De'Sauty 's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. Verify the Thevenin and Norton theorems.
8. Verify the Superposition, and Maximum power transfer theorems.
9. Determine self inductance of a coil by Anderson's bridge.
10. Study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q , and (d) Band width.

Mapping of COs to the syllabus

Course Outcomes	**Expt. 1**	**Expt. 2**	**Expt. 3**	**Expt. 4**	**Expt. 5**	**Expt. 6**	**Expt. 7**	**Expt. 8**	**Expt. 9**	**Expt. 10**
CO1	H	H	H	H	H					
CO2						H				
CO3							H	H		
CO4									H	H

PSMP209T: MATHEMATICAL PHYSICS II

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The main objectives of a course on Mathematical Physics are to provide students with a solid foundation in mathematical methods and techniques that are essential for understanding and solving problems in theoretical physics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concepts and applications of the Fourier series, Laplace and Integral transformation and special function (Applying)
CO 2: llustrate some of the basic concepts of tensor analysis and its application to different branches of physics. (Understanding, Applying)
CO 3: Analyse some of the basic concepts of group theory and its application to different branches of physics. (Understanding, Applying)

Module I: Fourier Series (8 hours)

Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions.

Module II: Integrals and Laplace Transforms (8 hours)

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral.

Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs.

Module III: Frobenius Method and Special Functions (18 hours)
Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions ($J_0(x)$ and $J_1(x)$) and Orthogonality.

Module IV: Tensor Calculus (12 hours)
Transformation of coordinates: Galilean and Lorentz transformations. Tangent vectors and gradients, inner and outer products, contraction, symmetric and antisymmetric tensors, metric tensor, covariant and contravariant derivatives.

Module V: Introduction to Group Theory (14 hours)
Group axioms, permutation groups (S2 and S3) and symmetry operations of equilateral triangle, multiplication table, subgroup, classes and characters, finite groups (Zn), cosets, factor group, normal subgroup, point symmetry group, direct and semi direct product of groups, homomorphism and isomorphism, direct and semi-direct products, block diagonalisation - reducible and irreducible representation.

Suggested Readings
1. Mathematical Methods for Physicists, G. Arfken, H. Weber and F. Harris, Elsevier.
2. Mathematical Methods of Physics, J. Mathews and R. L. Walker, The Benjamin-Cumminngs Publishing Company.
3. Mathematics for Physicists, P. Dennery and A. Krzywicki, Harper and Row
4. A.W.Joshi, Matrices and Tensors in Physics, 3rd Edition, New Age Int. (2005)
5. M. Hamermesh, Group Theory and Its Applications to Physical Problems, Dover (1989)
6. D.B. Lichtenberg, Unitary symmetry and elementary particles, second edition, Academic Press (1978).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H		
CO 2				H	
CO 3					H

PSAP310T: INTRODUCTION TO ASTROPHYSICS AND PLASMA PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)
The objective of this course is to give a basic understanding of Astrophysics and plasma physics. The course dealing with the stellar properties, the solar system and the fundamentals of plasma are important for the basic as well as advanced level studies in these areas. The knowledge of the fourth state of matter, plasma, is also useful in other branches of physics. Emphasis shall be laid upon the solution of numerical problems.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain the Stellar properties and the solar system (Applying)
CO 2: Explain the fundamentals of cosmology (Understanding)
CO 3: Illustrate the behaviour of a single charged particle in electric and magnetic fields (Applying)
CO 4: Analyse your knowledge of Plasma physics in laboratory (Applying)

Module I: Stellar properties and the solar system (20 Hours)
Radiant flux and Luminosity, Magnitude scale. Measurement of astronomical quantities: Stellar distances(parallax), Radii, Mass and Effective Temperature. Equilibrium of stars, Stellar spectral classification – Hertzsprung-Russell (HR) diagram. Introductory idea of stellar evolution: white dwarf, neutron stars and black holes.
The Sun; properties of photosphere, chromosphere and corona. Solar system's objects: Nebular hypothesis of the formation of the solar system (introductory idea only); physical properties of the planets- their distances, atmospheres, asteroid belt, meteorites and the comets; Introduction to exoplanets.

Module II: Fundamentals of Cosmology (13 hours)
Cosmic distance ladder; standard candles: cepheid variables, type 1a supernovae; cosmic expansion of the universe, Hubble's law. Concept of hot Big Bang; cosmic microwave background radiation; dark matter (qualitative idea only), oscillating universe theory (qualitative idea only).

Module III: Plasma Single Particle Motion (17 hours)
Role of temperature in occurrence of plasma; definition of plasma: quasineutrality and collective behaviour of plasma; concept of temperature; Debye shielding; criteria for plasma
Single Particle Motion in Uniform electric and magnetic fields; non-uniform magnetic field: grad-B drift, curvature drift, magnetic mirrors, the loss cone

Module IV: Laboratory and Space Plasma (10 hours)
Glow discharge plasma; principle of DC, AC and high frequency discharges, RF plasmas, fusion plasma, sun and solar winds, Van Allen belts, the ionosphere, formation of accretion disks.

Suggested Readings

1. An Introduction to Astronomy and Astrophysics, P. Jain, CRC Press.
2. An Introduction to Astrophysics, B. Basu, PHI Learning Pvt. Ltd.
3. Astrophysics: Stars and Galaxies, K. D. Abhayankar, Universities Press.
4. F. F. Chen, Introduction to Plasma Physics and Controlled Fusion, Plenum.
5. J. A. Bittencourt, Fundamentals of plasma physics, Springer.
6. Robert J Goldston and Paul H Rutherford, Introduction to Plasma Physics, Institute of Physics Publishing, Bristol and Philadelphia.

Mapping of COs to Syllabus:

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2		H		
CO3			H	
CO4				H

PSCM300T: CONDENSED MATTER PHYSICS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)
The objective of the course is to quip the students to deal with the solid state of matter and its various physical properties. It is also required to pursue studies on specialized topic like electronics, nano-sciences, etc. Emphasis shall be laid upon the solution of numerical problems.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Explain crystal structure and the concepts of lattice vibrations (Understanding)
CO 2: Illustrate the dielectric and magnetic behavior of matter (Applying)
CO 3: Construct band theory and explain superconductivity (Applying)

Module I: Crystal Structure and Lattice Dynamics (13 hours)
Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.
Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law.

Module II: Magnetic and Dielectric Properties of Matter (13 hours)
Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia– and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.
Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mossotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric Constant.

Module III: Ferroelectric Properties of Materials (7 hours)
Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

Module IV: Elementary Band Theory and Superconductivity (12 hours)

Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient.

Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation).

Suggested Readings

1. Charles Kittel, Introduction to Solid State Physics, Wiley India Pvt. Ltd.
2. J. P. Srivastava, Elements of Solid State Physics, Prentice-Hall of India
3. Leonid V. Azaroff, Introduction to Solids, 2004, Tata Mc-Graw Hill.
4. N. W. Ashcroft and N. D. Mermin, Solid State Physics, Cengage Learning.
5. H. Ibach and H. Luth, Solid-state Physics, Springer.
6. Rita John, Solid State Physics, McGraw Hill.
7. M. Ali Omar, Elementary Solid State Physics, Pearson India.
8. M. A. Wahab, Solid State Physics, Narosa Publications.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

PSCM301L: CONDENSED MATTER PHYSICS LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of the course is to demonstrate experiments related to basic properties of solid state materials. Also it is aimed to explain few basic experiments related to semiconductors.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Learn about magnetic properties of matter. (Understanding)

CO 2: Analyse dielectric properties of materials. (Applying)

CO 3: Understand and analyse few topics related to semiconductor physics. (Analysing)

At least 5 experiments should be performed from the following:

1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method).
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency.
5. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
6. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150°C) and to determine its band gap.
7. To determine the Hall coefficient of a semiconductor sample.

Mapping of COs to the syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7
CO1	H	H	M		M		
CO2				H			
CO3						H	H

PSED311T: ELECTRODYNAMICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to learn how to

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Outline the origin and propagation of electromagnetic waves. (Understanding)

CO 2: Explain the nature of electromagnetic radiation. (Understanding)

CO 3: Infer the extension of classical electrodynamics to the generalized 4-dimensional case. (Analysing)
CO 4: Apply the laws of electrodynamics to solve various physical problems. (Applying)

Module I: Introduction (14 hours)
Revision of Maxwell's Equations; Electromagnetic waves: linear and circular polarisation; Stoke's parameters; Poynting theorem of complex field vectors; frequency dispersion (normal and anomalous); characteristics of dielectrics, conductors and plasma and their interaction with electromagnetic waves.

Module II: Green's Function and Radiating systems (14 hours)
Simple radiating systems: Gauge invariance; Green's function for the wave equation; concept of retarded potential, radiation from an oscillating dipole and its polarisation. Electric dipole fields, magnetic dipole and electric quadrupole fields; centre fed linear antenna, scattering at long wavelengths – viz. by dipoles induced in a small scatterer, scattering by a small dielectric sphere.

Module III: Radiation by an accelerated Charge(18 hours)
Radiation from accelerated charge: Lienard-Wiechart potentials; radiated power from accelerated charge at low velocities. Larmor 's power formula. The fields of a point charge in arbitrary and uniform motion. Radiation from an ultra relativistic particle. Angular and frequency distribution of radiation from moving charges.

Module IV: Covariant Form of Maxwell's Equations and Relativity (14 hours)
Special theory of relativity: Four dimensional Lorentz transformation, covariance of Maxwell's equations, electromagnetic field tensor; matrix representation of Lorentz transformation; infinitesimal generators.

Suggested Readings
5. Classical Electrodynamics, J. D. Jackson, John Wiley and Sons.
6. Classical Electrodynamics, S. P. Puri, Tata McGraw Hill Publishing Company Ltd.
7. Electrodynamics, S. L. Gupta, V. Kumar and S. P. Singh, Pragati Prakashan.
8. Introduction to Electrodynamics, D. J. Griffiths, Prentice Hall of India.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2	H	H		
CO3			H	H
CO4			H	H

PSSD312T: SEMICONDUCTOR DEVICES

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)
The objective of this course is to provide basic analog electronic circuit design techniques and analytical skills using diodes, op-amps, FETs and BJTs. This course also introduces the concepts of digital and binary systems and how these concepts are connected to digital electronics. It also provides fundamental concepts used in the design of digital systems, the basic tools for the design and implementation of digital circuits, modules and subsystems.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Relate principles of operation of semiconductor devices. (Understanding)
CO 2: Design simple logic circuits using principles of logic design. (Applying)
CO 3: Analyze of semiconductor devices for different applications. (Analysis)

Module I: Semiconductor and diodes (20 hours)
a. Semiconductor concepts: Semiconductor material basics, intrinsic semiconductor, extrinsic semiconductor, energy levels, concept of hole and electron, mobility, conductivity, n-type and p-type, majority and minority carriers, mechanism of current flow.
b. Semiconductor diode: PN junction and various biasing conditions, V-I characteristics, diode equation, diode resistance, equivalent circuit, transition capacitance and diffusion capacitance; rectifier circuit with filter, clipper, clamper, voltage multiplier.
c. Special purpose diodes: Zener diodes, LED, Solar Cell, photo diode, Schottky diode, varactor diode, tunnel diode.

Module II: Transistors: (20 hours)
a. Bipolar Junction Transistor: BJT: construction, npn, pnp, operation and configuration, V-I characteristics.

b. BJT biasing and stabilization: Load Line analysis of Transistors. DC Load line and Q-point and stability considerations, fixed bias, emitter feedback bias, collector feedback bias, voltage divider bias.
c. Field Effect Transistors: Introduction to FET- JFET, MOSFET and CMOS; structure, operation, characteristic curves and equations

Module III: Fundamentals of Digital Circuits (20 hours)

a. Number systems: Definition, type and inter-conversion, Signed and unsigned representation, binary arithmetic on signed and unsigned integers and detection of overflow and underflow, weighted binary Codes: BCD, 2421, non- weighted codes: excess-3 codes, gray codes, error detecting codes, error correcting codes, alphanumeric codes: ASCII code, EBCDIC codes.
b. Boolean algebra and Logic Gates: Logic gates (basic and universal), rules of Boolean algebra, sum of products and product of sums forms. Conversion between different forms, conversion between Boolean expression and truth table; implementing logic expressions with logic gates (logic circuits).
c. Combinational logic circuits: Simplification of Boolean expressions using algebraic method, Karnaugh map method and Don't Care conditions. Designing Combinational logic circuits: half-adder, full-adder, encoder, decoder, Multiplexer, demultiplexer.

Suggested Readings

1. Electronic Devices and Circuit Theory, Robert L. Boylestad and Lowis Nashelsky, Pearson Education.
2. Millman's Electronic Devices and Circuits, Jacob Millman, Christos C. Halkias and Satyabrata Jit, Tata McGraw Hill.
3. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Tata McGraw- Hill.
4. Solid State Electronic Devices, Streetman and Banerjee, Prentice Hall.
5. Electronic Devices and Circuits, David A. Bell, Prentice Hall of India.
6. Op-amps and Linear Integrated Circuits, Ramakant A. Gayakwad, PHI.
7. Digital Logic and computer Design, M. Mano, PHI.
8. Modern Digital Electronics, R. P. Jain, TMGH.

Mapping of COs to Syllabus:

Course Outcomes	**Module I**	**Module II**	**Module III**
CO1	H	H	H
CO2			H
CO3	H	H	

PSST313T: STATISTICAL MECHANICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to learn how to

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate the connection between statistical mechanics and thermodynamics. (Analysing)
CO 2: Explain the concept of quantum statistical mechanics. (Understanding)
CO 3: Outline the physics of phase transition. (Understanding)
CO 4: Explain the importance of non-equilibrium physics. (Understanding)

Module I: Essentials (15 hours)

Probability theory: the random walk problem, binomial, Poisson and Gaussian distributions, central limit theorem; Classical equilibrium statistical mechanics: concept of equilibrium; Ergodic hypothesis; microcanonical, canonical and grand canonical Ensembles; partition functions and their relation to thermodynamics;

Module II: Quantum Statistics (15 hours)

Quantum statistical mechanics: Schrödinger and Heisenberg Picture; pure and mixed states, the density matrix, quantum mechanical Liouville's theorem; the fundamental postulates; Quantum statistics: quantum gases of independent particles; partition functions; Bose Einstein and Fermi Dirac's distributions; electrons in metals; black body radiation; Bose Einstein's Condensation

Module III: Phase Transitions (15 hours)

Phenomenology: first and second order phase transitions; elementary ideas of critical phenomena; universality of critical exponents; scaling of thermodynamic functions; Theory: the Landau theory of phase transition with examples. Basic concepts of Ising model in one dimension.

Module IV: Non Equilibrium Phenomena (15 hours)
Non equilibrium phenomena: transport theory; Boltzmann equation; Maxwell-Boltzmann distribution; Irreversible processes: fluctuations; Brownian motion; Langevin's equation.

Suggested Readings

1. Fundamental of Statistical and Thermal Physics, FederickReif, McGraw Hill, Singapore.
2. Statistical Mechanics, Shang-Keng Ma, World Scientific, Singapore.
3. Statistical Mechanics: Fundamental and Modern Applications, Richard E. Wilde, and Surjit Singh, Wiley-Interscience, John Wiley and Sons Inc., New York.
4. Statistical Physics: Statics, Dynamics and Renormalisation, Leo P.Kadanoff, World Scientific, River Edge, New Jersey.
5. Statistical Mechanics, K. Huang, John Wiley and Sons Inc., New York.
6. Statistical Physics, D. J. Amit and J. Verbin, World Scientific, Singapore.
7. Statistical Physics, L. D. Landau, E. M. Lifshitz, Butterworth-Heinemann.
8. Statistical Mechanics, R. K. Pathria, Academic Press.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2		H		
CO3			H	
CO4				H

PSMP404T: MATERIALS PHYSICS
(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)
The objective of this course is to make students aware of the basic concepts of material science and nanotechnology. The students will develop an understanding of the material properties and how to manufacture, study, and control/ manipulate them for specific applications.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Explore the properties of materials at the micro and nano level. (Understanding)
CO 2: Explain different techniques used in the synthesis and characterization of of materials. (Remembering)
CO 3: Illustrate a few applications of materials at the micro and nano level. (Applying)

Module I: Micro and Nanosystems (Properties) (15 hours)
Length scales in physics and scaling law. Quantum confinement: Applications of Schrodinger equation-iInfinite potential well, potential step, potential box. Band structure and density of states, size effects. Crystal structures and mechanical properties; grain and grain boundary, defects, Hall-Patch relations, creep, diffusion and dislocations, and strengthening mechanisms. Magnetic properties; domain theory, hysteresis, and super-paramagnetism, giant magnetoresistance (GMR). Optical and electrical properties; Coulomb interaction in nanostructures. Concept of dielectric constant and dielectric properties. Quasi-particles and excitons. Radiative processes: General formalization-absorption, emission, and luminescence. Non-linear optical processes. Surface Plasmon Resonance. Thermal Proerties. Polymers and their properties (Nano perspective). Hybrid and advanced materials.

Module II: Synthesis of Materials in micro and nano dimensions (10 hours)
Top-down and Bottom-up approach. Ball milling. Gas phase condensation. Physical Vapor Deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition and Sputtering. Chemical Vapor Deposition (CVD) and Plasma Enhanced Chemical Vapor Deposition (PECVD). Sol-Gel. Electro deposition. Sonochemical and Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dots. Green synthesis methods. Lithography and Microfabrication techniques. Hot Working and Cold Working. Molding, Casting and Pelletization Techniques. Composites and Alloy.

Module III: Characterization (10 hours)
Qualitative and Qunantitative Analysis. Optical Microscopy. Scanning Electron Microscopy (SEM and FESEM). Transmission Electron Microscopy (TEM). Atomic Force Microscopy and Scanning Tunneling Microscopy (AFM and STM). Spectroscopic Methods: NMR, ESR, FTIR, Raman, Photoluminescece and UV-Visible spectroscopy. Thermal analysis: Differential Scannig Caloriemetry (DSC) and Thermo Gravimetric Analysis (TGA). Diffraction methods; X-Ray Diffraction, Neutron Diffraction, Positron Anihilation, Synchroton Radiation. X-Ray Photoelectron Spectroscopy and Auger Electron Spectroscopy XPS. Zeta

potential. Vibrating Sample Magnetometry (VSM). Mossbauer Spectrometer. Mechanical Properties; Nanoindentation, Creep and Tensile Test. Metallography (Basic Idea).

Module IV: Applications (10 hours)
Applications of nanoparticles, quantum dots, nanowires, and thin films; for photonic devices (LED, solar cells), and sensors. Nanomaterials for energy and environmental applications. Nanobiotechnology: Nanomaterials for biomedical applications, agriculture, drug delivery, bio-imaging, microfluidics etc. Nanomaterial-based Devices: Quantum well and dot based heterostructures, optical switching, and optical data storage. Magnetic quantum well; magnetic dots, magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS) (preliminary idea). Materials for harsh environment application.

Suggested Readings
1. Introduction to Nanotechnology, C. P. Poole, Jr. and Frank J. Owens, Wiley India Pvt. Ltd.
2. Nanotechnology: Principles & Practices, S. K. Kulkarni, Capital Publishing Company.
3. Introduction to Nanoscience and Technology, K. K. Chattopadhyay and A. N. Banerjee, PHI Learning Private Limited.
4. Nanotechnology, Richard Booker and Earl Boysen, John Wiley, and Sons.
5. Nanoparticle Technology Handbook, M. Hosokawa, K. Nogi and M. Naita, T. Yokoyama, Elsevier.
6. Introduction to Nanoelectronics, V. V. Mitin, V. A. Kochelap and M.A. Stroscio, Cambridge University Press.
7. Springer Handbook of Nanotechnology, Bharat Bhushan, Springer-Verlag.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2		H	H	
CO3				H

PSSA406T: PHYSICS OF SENSORS AND ACTUATORS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)
The objective of this course is to give a fundamental idea about the mechanisms of sensing and actuation. The students will learn about cutting-edge technologies and recent developments in microelectronics and nanoelectronics.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Illustrate the key concept of sensors and actuators. (Analyzing)
CO 2: Explain different techniques and materials used in the fabrication of sensors and actuators. (Understanding)
CO 3: Apply the concepts for design and development of micro and nano-sensors. (Applying)

Module I: Basic Concepts (10 hours)
Energy domain and Transducers. Sensors and Actuators. Conductivity of Semiconductors, and Resistivity. Crystal Orientations and Mechanical Properties of Semiconductors. Resonant frequency and Quality factor. Properties of Polymers and Polymer-based composites. Conductive Polymers.

Module II: Mechanism of Sensing and Actuation (15 hours)
Electrostatic based Sensing and Actuation, Thermal Sensing and Actuation, Piezoelectric and Piezoresistive Sensing and Actuation, Magnetic and Optical Sensing and Actuation. Microfluidics.

Module III: Micro and Nano fabrication (10 hours)
Vacuum and Clean room, Thin film deposition methods. Nanowire/ Nanorod and Nanoparticles for sensors (Synthesis and Properties), Bulk and Surface Micromachining, Wet and Dry etching, DRIE, Optical and E-Beam lithography.

Module IV: Applications (10 hours)
Nanostructured and Nanomaterials-based sensor and Actuators (Strain gauge, Accelerometer, Resonators, RTD, FET, SED etc.). Flexible and Wearable Sensors. Sensors for Biomedical, Agricultural and Environmental Applications.

Suggested Readings
1. Foundation of MEMS. Chang Liu. Pearson Education International.
2. Microsystem Design. Stephen D. Senturia. Springer.
3. Fundamentals of microfabrication : Madou, Marc J. CRC Press.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H	H		
CO2			H	
CO3				H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	PSTI104L	Basics of lab tools and Instrumentation (1-0-2)	3
2	S E Course 2	PSPC105T	Basics of Programming (C/C++/Fortran) (1-0-2)	3
3	S E Course 3	PSPP210L	Computational Physics using Python (1-0-2)	3

PSTI104L: BASICS OF LAB TOOLS AND INSTRUMENTATION

(3 Credits – 75 hours) (L-T-P: 1-0-2)

Objective(s)

The objective of the course is to make students aware of the principle and working of basic lab tools and instruments. The students will develop the skills to use basic tools such as multimeters, slide calipers, and so on in day-to-day life.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concepts of various performance characteristics of measuring instruments. (Remembering)
CO 2: Demonstrate the basic concepts and working behind digital instruments. (Application)
CO 3: Illustrate the underlying principle of CRO and its uses. (Understanding)
CO 4: Demonstrate the underlying principle of the multimeter and its uses. (Application)

Module I: Basic of Measurement (15 hours)

Instruments accuracy, precision, sensitivity, resolution range, etc. Errors in measurements and loading effects. Slide Callipers, and Screw Gauge. Ammeter, and Voltmeter. Measurement of resistance using Colour Codes.

Module II: Digital Instruments and Electronic Voltmeter (20 hours)

Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. An advantage over conventional multimeters for voltage measurement concerning input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications, and their significance.

Module III: Digital Multimeter: (20 hours)

Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current, Capacitance, and resistance. Specifications of a multimeter and their significance. Block diagram and working of a digital multimeter. Working principle of time interval, frequency, and period measurement using universal counter/ frequency counter, time- base stability, accuracy, and resolution.

Module IV: Cathode Ray Oscilloscope (20 hours)

Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing, and acceleration (Explanation only– no mathematical treatment), a brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and the principle of working.

Suggested Readings

1. A textbook in Electrical Technology, B. L. Theraja, S Chand & Co.
2. Performance and design of AC machines, M. G. Say, ELBS Edn.
3. Digital Circuits and systems, Venugopal, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, Springer.
5. Digital Electronics, Subrata Ghoshal, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan& N. S. Kumar, Tata Mc-Graw Hill.
7. Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, Springer.
8. Electronic Devices, Thomas L. Floyd, Pearson India.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2		H		
CO3			H	
CO4				H

PSPC105T: BASICS OF PROGRAMMING (C/C++/Fortran)
(3 Credits – 45 hours) (L-T-P: 1-0-2)

Objective(s)
The objective of this course is to familiarize the students about the basic concepts of FORTRAN programming language, LATEX word processor and Gnuplot.

Course / Learning Outcomes
At the end of this course students will be able to:
CO 1: Make use of FORTRAN programming language for solving problems (Applying)
CO 2: Utilize Gnuplot for plotting graphs. (Applying)

Module I: Basics of FORTRAN Programming (20 hours)
Prerequisites: Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates.

Some fundamental Linux Commands (Internal and External commands). Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Operators: Arithmetic, Relational, Logical and Assignment Operators. Expressions: Arithmetic, Relational, Logical, Character and Assignment Expressions. Fortran Statements: I/O Statements (unformatted/ formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic. Examples from physics problems.

Module II: Loops, Functions, Subroutines and their applications (35 hours)
Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DO- WHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines (Arithmetic Statement Function, Function Subprogram and Subroutine), RETURN, CALL, COMMON and EQUIVALENCE Statements), Structure, Disk I/O Statements, open a file, writing in a file, reading from a file. Examples from physics problems.

Hands on exercises :
1. Exercises on syntax on usage of FORTRAN.
2. Usage of GUI Windows, Linux Commands, familiarity with DOS commands and working in an editor to write source codes in FORTRAN.
3. To print out all natural even/ odd numbers between given limits.
4. To find maximum, minimum and range of a given set of numbers.
5. Calculating Euler number using exp(x) series evaluated at x=1.
6. To find the roots of a quadratic equation.
7. Motion of a projectile under gravity.
8. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs.
9. Motion of particles in a central force field and plot the output.

Module III: Gnuplot for some practical usage (20 hours)
Introduction to graphical analysis and its limitations. Introduction to Gnuplot. importance of visualization of computational and computational data, basic Gnuplot commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with Gnuplot (equations, building functions, user defined variables and functions), Understanding data with Gnuplot.

Hands on exercises:
1. To compile a frequency distribution and evaluate mean, standard deviation etc.
2. To evaluate the sum of finite series and the area under a curve.
3. To find the product of two matrices.
4. To find a set of prime numbers and Fibonacci series.
5. To write a program to open a file and generate data for plotting using Gnuplot.
6. Plotting trajectory of a projectile projected horizontally.
7. Plotting trajectory of a projectile projected making an angle with the horizontally.
8. Creating an input Gnuplot file for plotting data and saving the output for seeing on the screen. Saving it as an eps file and as a pdf file.

Suggested Readings
1. Introduction to Numerical Analysis, S. S. Sastry, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77, V. Rajaraman, PHI.

3. LaTeX–A Document Preparation System, Leslie Lamport, Addison-Wesley.
4. Gnuplot in action: understanding data with graphs, Philip K Janert, Manning.
5. Schaum's Outline of Theory and Problems of Programming with Fortran, SLipsdutz and A Poe, Mc-Graw Hill Book Co.
6. Computational Physics: An Introduction, R. C. Verma, et al., New Age International Publishers.
7. A first course in Numerical Methods, U. M. Ascher and C. Greif, PHI Learning.
8. Elementary Numerical Analysis, K. E. Atkinson, Wiley India Edition.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**
CO1	H	H	
CO2			H

PSPP210L: COMPUTATIONAL PHYSICS USING PYTHON

(3 Credits – 75 hours) (L-T-P: 1-0-2)

Objective(s)

The objective of the course is to familiarize the students about the basic concepts of Python programming language, its applications, and preliminaries of machine learning.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Outline the fundamental concepts of Python (Understanding)
CO 2: Apply Python code for solving numerical methods (Applying)
CO 3: Review the concepts of machine learning using Python(Understanding)

Module I: Elements of Python programming (25 hours)

Computer and Programming languages, types of languages, Operating system types, Python language; Data types, precision, numbers, castings strings, Booleans, Operators, variables; list: indexing, slicing, altering, appending and deleting elements, concatenation; tuples, sets and dictionaries; conditional statements; loops: if-else, while and for loops, nested-for loops; functions, arrays, lambda, classes, Inheritance, modules, Python libraries: installing packages, importing packages; NumPy arrays and matrices, example: eigenvalues and eigenvectors; basics of data handing using Pandas; introduction to SciPy; data visualization using Matplotlib and Seaborn

Module II: Numerical methods using Python I (20 hours)

Fundamental integral evaluation methods: trapezoidal rule, Simpson's rule; error estimation of integrals; Romberg integration; Gaussian quadrature; Random numbers generators and seeds; non-uniform random numbers, Gaussian random numbers; Monte Carlo integration: mean value method, integrals in many dimensions, importance sampling; importance sampling; Markov chain methods numerical differentiation: forward and backward differences, central differences, second derivatives, partial derivatives, differentiation error estimation; Linear equations:

Module III: Numerical methods using Python II (15 hours)

Gaussian elimination, back-substitution, pivoting, LU decomposition, matrix inverse, tridiagonal and banded matrices; nonlinear equations: binary search, Newton's method, secant method; First-order differential equations with one variable: Euler's method, Heun's method, 4^{th} order Runge-Kutta method; differential equations with multiple variables; second-order differential equations; boundary value problems: shooting method, relaxation method; eigenvalue problems

Module IV: Elements of machine learning (15 hours)

Data distribution, Regression types, Scale, Train/Test, Decision Tree, Confusion Matrix, Hierarchical Clustering, Logistic Regression, K-means, Bootstrap aggregation, Cross validation, K-nearest neighbors, Artificial Neural Networks

Suggested Readings

1. Computational Physics, Newman, Mark E.J., Createspace Independent Pub, 2013
2. Computational Physics: Problem Solving with Python, Landau, Rubin H., Paez, Manuel J., Bordeianu, Cristian C. (III Edition) Wiley, 2015
3. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, McKinney, Wes, (II Edition) O'Reilly Media, 2018
4. Python Cookbook: Recipes for Mastering Python 3, Beazley, David and Jones, Brian K., (III Edition) O'Reilly Media, 2013
5. Python Data Science Handbook: Essential Tools for Working with Data, VanderPlas, Jake, (Online Free Edition) O'Reilly Media
6. Mastering Matplotlib, McGreggor, Duncan M., (I Edition) Packt Publishing, 2015

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO1	H			
CO2		H	H	
CO3				H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	PSIN105I	Internship	4
4	Internship	PSIN211I	Internship	4
5	Internship	PSIN314I	Internship	2

PSIN105I/PSIN211I: INTERNSHIP (Exit of 1st Year or 2nd Year)
(4 Credits: 120 hours)

PSIN314I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)
(2 Credits-60 Hours)

Internship Modalities for Physics Department

Objectives:
1. To create students with real-world experience in working and addressing problems.
2. To make the transition for the students from the Institute to the real world as easy as possible.
3. To improve the students' employability.

INTERNSHIP: GUIDELINES
1. Request Letter/ Email from the Department via Registrar office should go to organization/ institutions/ industries to take interns for 4-6 weeks.
2. Organization/ institutions/ industries will confirm the training slots and the number of seats allocated for interns via Confirmation Letter/ Email.
3. In case the students arrange the training for themselves the confirmation letter has to be submitted by the students to the Department.
4. Students on joining Training at the concerned organization/ institutions/ industries, submit the Joining Report/Letters / Email.
5. Students will submit their progress report to the department in every week through Report/ Email. Students will submit Training Report and Completion Certificate obtained from the organization/ institutions/ industries.
6. Students will give a presentation on their learning outcome in presence of the faculty members and the students.
7. List of students who have completed their internship successfully will be notified by the Department.

Requirement:
Students willing to exit the course after completing the first/second year are required to go for 4-6 weeks compulsory internship programme to receive their Certificate/Diploma.

RESEARCH PROJECT /DISSERTATION

BSC PHYSICS (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	PSDI407P	Research Project Phase I	6
8	Research Project/Dissertation	PSDI408P	Research Project Phase II	6
BSC PHYSICS (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	PSDI409P	Dissertation I	18
8	Research Project/Dissertation	PSDI410P	Dissertation II	20

BSC PHYSICS (Honours)

PSDI407P: RESEARCH PROJECT PHASE I
(6 credits – 180 hours) (L-T-P: 0-0-12)

Objective:
The aim of BSc Physics research project is to develop students' analytical, problem-solving, and critical thinking abilities. Students have the opportunity to investigate certain areas of interest in the subject of physics under the direction of knowledgeable academics or researchers.

Course Outcomes: BSc Physics programs primarily focus on building a strong foundation in theoretical and experimental physics. During this phase the student will start a project applying the knowledge acquired during the previous semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

PSDI408P: RESEARCH PROJECT PHASE II
(6 credits – 180 hours) (L-T-P: 0-0-12)

Objective:
The activities Involving research has the power to influence how students pursue their academic and professional goals. They might increase interest in a particular area of Physics. Additionally, exposure to research strengthens students' resumes and increases their ability to compete for roles in research or future employment.

Course Outcomes:
During this phase the student will complete the project started in the previous semester. The final implementation of the project and report writing shall be done in this semester. The student shall be required to make a number of presentations to report on the progress of the project. There will be a viva voce examination which shall follow the final submission of the project report. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

BSC PHYSICS (Honours) with Research

PSDI409P: DISSERTATION I
(18 Credits -540 Hours) (L-T-P: 0-0-36)

Objective: The objective of a dissertation is to conduct original research and contribute new knowledge or insights to a specific field of study. The primary objectives of a dissertation include to showcase original thinking and creativity in the approach to the research problem. To critically evaluate existing literature, theories, and research methodologies related to the topic would be the priority in this 1st phase of this course.

Course Outcome: The outcome of a dissertation is the culmination of the research and writing process. It typically takes the form of a written document that presents the research findings, analysis, conclusions, and contributions to the field of study.

The specific outcome of a dissertation can vary depending on the nature of the research. In this 1st phase, critically evaluate existing literature, theories, and research methodologies would be the priority of the students. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

PSDI410P: Dissertation II
(20 Credits -600 Hours) (L-T-P: 0-0-40)

Objective: The objective of this will be to contribute new knowledge, practical applications, or policy implications that can benefit the academic community, industry, or society as a whole. Additionally, it will strengthens students' resumes and increases their ability to compete for roles in research or future employment.

Course Outcome: During this phase the student will complete the project started in the previous semester. The final implementation of the project and report writing shall be done in this semester. The student shall be required to make a number of presentations to report on the progress of the project. There will be a viva voce examination which shall follow the final submission of the project report. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

DEPARTMENT OF BOTANY

PROGRAMME: BACHELOR OF SCIENCE in BOTANY (BSC)
DEGREE: BSC BOTANY (HONOURS)/ BSC BOTANY (HONOURS) WITH RESEARCH

VISION:
To motivate and encourage the students in effective ways to utilize the knowledge of 'Plant Sciences' in order to solve the future needs of Food, Fuel, Energy and Environment for the betterment of mankind and society.

MISSION:
The department endeavours to make substantial contribution in the field of 'Plant Sciences' by new research innovations and producing competent students who are not only well versed with the subject but are also better adjusted socially, emotionally and intellectually.

PROGRAM OUTCOMES (PO)

PO 1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study.

PO 2: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. Critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO 3: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; communicate with others using appropriate media; confidently share one's views and express herself/ himself; demonstrate the ability to listen carefully; and present complex information in a clear and concise manner to different groups.

PO 4: Social Interaction: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 5: Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 6: Moral and Ethical Awareness: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 7: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO 8: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life- long learning in the broadest context socio- technological changes. Critical sensibility to lived experiences, with self-awareness and reflexivity of both and society.

PO 9: Information and Digital Literacy: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 10: Research related skills: A sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause and affect relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Ability to apply one's learning to real life situations.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1: Acquire the basic knowledge on classical as well as advanced plant science/botany to build up a strong foundation of concepts and basics for future.

PSO 2: Equip the students with the concepts and importance of interdisciplinary fields such as Molecular Biology and Biotechnology, Computational biology, Mathematics, etc and their applications in healthcare, agriculture, environment, and industry.

PSO 3: The students would acquire hands on experience of performing experiments on basic and advanced plant science thereby gaining the knowledge of some sophisticated scientific instruments.

PSO 4: The students would be moulded and well-prepared for national and international competitive examinations through this course.

Mapping of COs to PO/PSO

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BOPM100T	H	M	H	M				L		H	M	H	M	M
BOPM101L	H	M	L					L		H	M	H	H	M
BONV104T	H	M		M							H	L	L	H
BONV105L	H	L			L							L	M	L
MDC 1	H	H	M				M	H		H	H	M	H	H
BOBT107T	M	M	L	H	L	L	M	M	H	M	H	H	L	M
BOBT108L	H	M	L	H	L	L	M	M	H	M	H	H	H	H
BOMY102T	H	M	H	M				L		H	M	H	M	M
BOMY103L	H	M	M	M				L		H	M	H	M	M
BOVP106T	H	H					M	H	L	H	H		M	H
BOVP107L	H	H					M	H	L	H	H		M	H
MDC 2	H	H	M				M	H		H	H	M	H	H
BOEB108T	M	M	L	H	L	L	M	M	H	M	H	H	L	M
BOEB109L	H	M	L	H	L	L	M	M	H	M	H	H	H	H
BOBC200T	H	H	M				M	H		H	H	M	H	H
BOBC201L	H	H	M				M	H		H	H	M	H	H
BOAR202T	H	M		M	L						H		L	H
BOAR203L	H	L	L	M								M	M	L
BOFP210T	H	M	M	M						H	H	H	H	M
BOFP211L	H	M	M	M				M		H	H	H	H	M
MDC 2 T	H	H	M				M	H		H	H	M	H	H
MDC 2 L	H	H	M				M	H		H	H	M	H	H
SEC 3 T	H	H	M	H	H	M	H	H	H	H	L	H	H	H
BOBI214 L	H	H	M	H	H	M	M	H	H	M	L	M	M	H
BOPG204T	H	M										H	H	H
BOPG205L	H	L			L		L	M				H	H	L
BOMA206T	M	M	H	L						H	H	H	M	M
BOMA207L	M	M	H	L				M		M	H	H	M	M
BOPE208T	H	H	M			M	H	H	L	H	H	M	H	H
BOPE209L	H	H	M			M	H	H	L	H	H	M	H	H
BOEB212T	H	H	M				M	H		H	H	M	H	H
BOEB213L	H	H	M				M	H		H	H	M	H	H
BOPP300T	H	H					M	H	M	H	H		M	H
BOPP301L	H	H					M	H	M	H	H		M	H
BOPS302T	M	H	M	H				M		H	H	H	M	M
BOPS303L	M	H	M	H				M		H	H	H	M	M
BORB304T	H	H					L	H	M	H	H		M	H
BORB305L	H	H					L	H	M	H	H		M	H
BOET313T	H	H	M	L						H	H	H	M	M
BOET314L	H	H	M	L				M		H	H	H	M	L
BOPM306T	H	H					L	H	M	H	H		M	H
BOPM307L	H	H					L	H	M	H	H		M	H
BOMO308T	H	M	L	L	M	H	M	L	M	H	H	M	H	M
BOMO309L	M	M	L	L	L	M	L	L	M	M	H	M	M	M
BOEC310T	H	L	L	M	M	M	M	M	M	M	H	L	H	M
BOEC311L	L	L	L	M	M	L	M	L	L	M	M	L	M	M
BOMD315T	H	H	M				M	H		H	H	M	H	H
BOMD316L	H	H	M				M	H		H	H	M	H	H

BOAT400T	H	H	M				M	H		H	H	M	H	H
BOAT401L	H	H	M				M	H		H	H	M	H	H
BOBS402T	M	M	M	M	M	L	M	M	M	H	M	L	M	L
BOBS403L	M	M	M	M	M	M	M	H	M	H	M	L	M	L
BOIM408T	M	H	M	H	L	L		M		H	M	H	H	H
BOIM409L	M	H	M							H	M	H	H	H
BOPL404T	H	H	M				M	H		H	H	M	H	H
BOPL405L	H	H	M				M	H		H	H	M	H	H
BOPA406T	L	H				M		H				M	L	L
BOPA407L	H	H	M				M	H		H	H	M	H	H
BOFM411T	H	H	M				M	H		H	H	M	H	H
BOFM412L	H	H	M				M	H		H	H	M	H	H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	BOPM100T	Phycology and Microbiology	4 (3-0-1)
		BOPM101L	Phycology and Microbiology Lab	
2	Major Course 2	BOMY102T	Mycology	4 (3-0-1)
		BOMY103L	Mycology Lab	
3	Major Course 3	BOBC200T	Biomolecules and Cell Biology	4 (3-0-1)
		BOBC201L	Biomolecules and Cell Biology Lab	
3	Major Course 4	BOAR202T	Archegoniates	4 (3-0-1)
		BOAR203L	Archegoniates Lab	
4	Major Course 5	BOPG204T	Plant Genetics	5 (3-0-2)
		BOPG205L	Plant Genetics Lab	
4	Major Course 6	BOMA206T	Morphology and Anatomy of Angiosperms	5 (3-0-2)
		BOMA207L	Morphology and Anatomy of Angiosperms Lab	
4	Major Course 7	BOPE208T	Plant Ecology	4 (3-0-1)
		BOPE209L	Plant Ecology Lab	
5	Major Course 8	BOPP300T	Plant Physiology	5 (3-0-2)
		BOPP301L	Plant Physiology Lab	
5	Major Course 9	BOPS302T	Plant Systematics	5 (3-0-2)
		BOPS303L	Plant Systematics Lab	
5	Major Course 10	BORB304T	Reproductive Biology of Angiosperms	4 (3-0-1)
		BORB305L	Reproductive Biology of Angiosperms Lab	
6	Major Course 11	BOPM306T	Plant Metabolism	4 (3-0-1)
		BOPM307L	Plant Metabolism Lab	
6	Major Course 12	BOMO308T	Molecular Biology	4 (3-0-2)
		BOMO309L	Molecular Biology Lab	
6	Major Course 13	BOEC310T	Economic Botany	4 (3-0-1)
		BOEC311L	Economic Botany Lab	
6	Major Course 14	BOMP312P	Minor Project	4
7	Major Course 15	BOAT400T	Analytical Techniques in Plant science	5 (3-0-2)
		BOAT401L	Analytical Techniques in Plant science Lab	
7	Major Course 16	BOBS402T	Biostatistics	5 (3-0-2)
		BOBS403L	Biostatistics Lab	
8	Major Course 17	BOPL404T	Plant Biotechnology	5 (3-0-2)
		BOPL405L	Plant Biotechnology Lab	
8	Major Course 18	BOPA406T	Plant Pathology	5 (3-0-2)
		BOPA407L	Plant Pathology Lab	

BOPM100T: PHYCOLOGY AND MICROBIOLOGY
(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes
At the end of this course, student will be able to*:*
CO 1: Compare different microorganisms and their importance (Understanding)
CO 2: Able to identify and characterize different Algae (Applying)
CO 3: Able to explain the morphology and life cycle of various important Algal species (Remembering)
CO 4: To assess the importance of microbial activities in various fields (Analyzing)

Module I: Introduction to Microbial World (4 Hours)
Microbes in Our Lives; History of Microbiology; Modern Microbiology; Scope of Microbiology; Major Groups of the Microbial world. Microbial nutrition, growth and metabolism

Module II: Algae (8 Hours)
Algae General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction; Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only up to groups); Significant contributions of important

phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry

Module III: Cyanophyta and Xanthophyta (5 Hours)
Cyanophyta and Xanthophyta Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of *Nostoc* and *Vaucheria*

Module IV: Chlorophyta and Charophyta (6 Hours)
Chlorophyta and Charophyta General Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Chlamydomonas, Volvox, Oedogonium, Chara*; Evolutionary significance of *Prochloron*

Module V: Phaeophyta and Rhodophyta (6 Hours)
Phaeophyta and Rhodophyta Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Ectocarpus, Fucus* and *Polysiphonia.*

Module VI: Bacteria (8 Hours)
Bacteria Discovery, general characteristics; Types- archaebacterial, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine)

Module VII: Viruses (8 Hours)
Viruses Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV); Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases

Suggested Readings

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition. ll
6. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi

Mapping of COs to syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	2	3	2	2	2	2	1
CO2		3	2	2	2		
CO3		1	3	3	3		
CO4		2				3	3

BOPM101L: PHYCOLOGY AND MICROBIOLOGY LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:
CO 1: Differentiate between cell shapes and structures of microorganisms (Applying)
CO 2: Able to understand reproduction and multiplication processes in microbes (Understanding)
CO 3: Utilize and create basic identification techniques for microbes (Creating)

Microbiology

Expt. 1: Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle
Expt. 2: Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root nodule
Expt. 3: Gram staining
Expt. 4: Endospore staining with malachite green using the (endospores taken from soil bacteria) Phycology
Expt. 5: Study of vegetative and reproductive structures of Nostoc, Chlamydomonas (electron micrographs), Volvox, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus, Fucus and Polysiphonia, Procholoron through electron micrographs, temporary preparations and permanent slides

Mapping of COs to syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5
CO1	1	3	2	2	2
CO2		2	1	2	3
CO3		2	1		3

BOMY102T: MYCOLOGY

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Able to tell and name different fungi, allied fungi and lichens and their classification process/criteria (Remembering)
CO 2: Able to explain fungal cell organization; illustrate their reproduction mechanisms (Understanding)
CO 3: Able to explain the life cycle with reference to various important fungal species (Remembering)
CO 4: Determine the application of fungi in food industries, pharmaceutical preparations and agriculture (Evaluating)

Module I: Introduction to Fungi (4 Hours)

General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification

Module II: Chytridiomycota and Zygomycota (6 Hours)

Characteristic features; Ecology and significance; Thallus organization; Reproduction; Life cycle with reference to *Synchytrium, Rhizopus*

Module III: Ascomycota (10 Hours)

General characteristics (asexual and sexual fruiting bodies); Ecology; Heterokaryosis and Para sexuality; Life cycle and classification with reference to *Saccharomyces, Aspergillus, Penicillium, Alternaria, Neurospora* and *Peziza*

Module IV: Basidiomycota (10 Hours)

General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat *Puccinia* (Physiological Specialization), loose and covered smut (symptoms only), *Agaricus*; Bioluminescence, Fairy Rings and Mushroom Cultivation

Module V: Allied Fungi (4 Hours)

General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies

Module VI: Oomycota (4 Hours)

General characteristics; Ecology; Life cycle and classification with reference to *Phytophthora, Albugo*

Module VII: Symbiotic Associations (7 Hours)

Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza- Ectomycorrhiza, Endomycorrhiza and their significance

Suggested Readings:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
2. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3					2	1
CO2	3		2				
CO3		3	3	3	2	2	
CO4	3			2			

BOMY103L: MYCOLOGY LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Able to recall the general structure of fungi, allied fungi and lichens and show their reproductive structures (Remembering)
CO 2: Able to demonstrate thallus structure of different classes of fungi (Understanding)
CO 3: Examine the methods of reproduction in fungi (Analyzing)

CO 4: Able to formulate control measures of deadly plant pathogens and also develop plans for preparation of herbarium (Creating)

Practical:

Expt.1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps & basidiocarps)

Expt.2. Rhizopus: study of asexual stage from temporary mounts and sexual structures through permanent slides

Expt.3. Aspergillus and Penicillium: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs

Expt.4. Peziza: sectioning through ascocarp

Expt.5. Alternaria: Specimens/photographs and temporary mounts

Expt.6. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts

Expt.7. Agaricus: Specimens of button stage and full-grown mushroom; sectioning of gills of Agaricus, fairy rings and bioluminescent mushrooms to be shown

Expt.8. Study of phaneroplasmodium and aphanoplasmodium from actual specimens and /or photograph

Expt.9. Albugo: Study of symptoms of plants infected with Albugo; asexual phase study through section/ temporary mounts and sexual structures through permanent slides

Expt.10. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs)

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt.10
CO1	2	3	3	2	1			1	3	3
CO2	3				1		3			2
CO3	1	3	2	1		1	2	3		
CO4						3			1	

BOBC200T: BIOMOLECULES AND CELL BIOLOGY

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: To recall the properties and economic importance of enzymes (Remembering)

CO 2: To memorize the general characteristics of carbohydrates, proteins, nucleic acids and lipids and how they are imported/exported to various organelles (Remembering)

CO 3: To acquire comprehensive knowledge on the general structure of proteins (Understanding)

CO 4: To interpret the basics of mode of actions of enzymes (Understanding)

CO 5: To understand the importance of cell cycle and its regulation in controlling diseases (Understanding)

Module I: Biomolecules (20 Hours)

Types and significance of chemical bonds; Structure and properties of water; pH and buffers; Carbohydrates: Nomenclature and classification; Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacylglycerols structure, functions and properties; Phosphoglycerates. Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Protein denaturation and biological roles of proteins. Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA

Module II: Bioenergetics (2 Hours)

Principles of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as an energy currency molecule

Module III: Enzymes (4 Hours)

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity

Module IV: The cell (2 Hours)

Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory)

Module V: Cell wall and Plasma Membrane (4 Hours)

Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis

Module VI: Cell Organelles (10 Hours)

Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus. Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament. Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast. Endomembrane system: Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes

Module VII: Cell Division (3 Hours)

Importance of cell cycle, Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases

Suggested Readings

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
6. Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
7. Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
8. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA. 17
9. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3						
CO2	3	2		3	3	3	
CO3			3				
CO4			3				
CO5							3

BOBC201L: BIOMOLECULES AND CELL BIOLOGY LAB

(1 Credits-30 Hours) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: To recall the properties of carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins (Remembering)
CO 2: To memorize the common tests of carbohydrates, proteins, nucleic acids and lipids and their classification (Remembering)
CO 3: To acquire comprehensive knowledge on the logic behind the cell structure and functions (Understanding)
CO 4: To comprehend the basics of cell structure (Understanding)

Practical:

Expt. 1: Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins
Expt. 2: Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo/Crinum.
Expt. 3: Demonstration of the phenomenon of protoplasmic streaming in Hydrilla leaf.
Expt. 4: Measurement of cell size by the technique of micrometry.
Expt. 5: Counting the cells per unit volume with the help of hemocytometer (Yeast/pollen grains)
Expt. 6: Study of cell and its organelles with the help of electron micrographs.
Expt. 7: Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.
Expt. 8: Study the phenomenon of plasmolysis and deplasmolysis.
Expt. 9: Study the effect of organic solvent and temperature on membrane permeability.
Expt. 10: Study different stages of mitosis and meiosis.

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt.10
CO1	3									
CO2							2		2	
CO3			2	3	3	3		3		3
CO4		3	3			3	3			3

BOAR202T: ARCHEGONIATE

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Recall the unique features of archegoniate (Remembering)
CO 2: Summarize the different land habits and alternation of generation in archegoniates (Understanding)
CO 3: Classify the different archegoniates and demonstrate their morphology, anatomy and reproduction (Understanding)
CO 4: Illustrate the economic importance of bryophytes, pteridophytes and Gymnosperms (Understanding)

Module I: Introduction (2 Hours)

Unifying features of archegoniate; Transition to land habit; Alternation of generations

Module II: Bryophytes (12 Hours)

General characteristics; Adaptations to land habit; Classification; Range of thallus organization Classification (up to family) *Riccia, Marchantia, Pellia, Porella, Anthoceros, Sphagnum and Funaria*; Reproduction and evolutionary trends in Riccia, Marchantia, Anthoceros and Funaria (developmental stages not included)

Module III: Pteridophytes (13 Hours)

General characteristics, classification, early land plants (*Cooksonia*and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Psilotum*, *Selaginella*, *Equisetum* and *Pteris* (Developmental details not to be included) Apogamy, and apospory, heterospory and seed habit, telome theory, stellar evolution

Module IV: Gymnosperms (15 Hours)

General characteristics, classification (up to family), morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum* and *Ephedra*; (Developmental details not to be included)

Module V: Economic Importance (3 Hours)

Ecological and economic importance of bryophytes with special reference to *Sphagnum*; Ecological and economic importance of pteridophytes and gymnosperms

Suggested Readings

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. &Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
5. Vander-Poorteri 2009 Introduction to Bryophytes. COP

Mapping of COs to syllabus

COs	Module I	Module II	Module III	Module IV	Module V
CO1	3				
CO2	3	3			
CO3			3	3	
CO4					3

BOAR203L: ARCHEGONIATE LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Infer the various morphological, anatomical and reproductive features of important bryophytes (Understanding)
CO 2: Interpret the various morphological, anatomical and reproductive features of important pteridophytes (Understanding)
CO 3: Demonstrate the various morphological, anatomical and reproductive features of important gymnosperms (Understanding)

CO 4: Develop the art of preparing slides of various archegoniate specimens and identifying them under the microscope (Applying)
CO 5: Identify different bryophytes, pteridophytes and gymnosperms in their natural habitat (Applying)

Practical:

Expt. 1: *Riccia*– Study of morphology of thallus.
Expt. 2: *Marchantia*- Study of morphology of thallus, whole mount of rhizoids & Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides)
Expt. 3: *Anthoceros*- Study of morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide)
Expt. 4: *Pellia, Porella*- Study of these specimens through permanent slides
Expt. 5: *Sphagnum*- Study of morphology of plant, whole mount of leaf (permanent slide only)
Expt. 6: *Funaria*- Study of morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema
Expt. 7: *Psilotum*- Study of specimen, transverse section of synangium (permanent slide)
Expt. 8: *Selaginella*- Study of morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide)
Expt. 9: *Equisetum*- Study of morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide)
Expt. 10: *Pteris*- To study the morphology, transverse section of rachis, vertical section of sporophyll, wholemount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide)
Expt. 11: *Cycas*- To study the morphology (coralloid roots, bulbil, leaf), whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide)
Expt. 12: *Pinus*- To study the morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle, transverse section of stem, longitudinal section of /transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section and radial longitudinal sections stem (permanent slide)
Expt. 13: *Gnetum*- Study of morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (permanent slide)
Expt. 14: Botanical excursion

Mapping of COs to Syllabus:

COs	Expt.1	Expt.2	Expt. 3	Expt. 4	Expt. 5	Expt.6	Expt.7	Expt.8	Expt.9	Expt. 10	Expt. 11	Expt. 12	Expt. 13	Expt. 14
CO1	3	3	3	3	3	3								
CO2							3	3	3	3				
CO3											3	3	3	
CO4	2	2	2	2										
CO5						2		2	2		2			3

BOPG204T: PLANT GENETICS

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Summarize the concepts of Mendelian genetics (Understanding)
CO 2: Infer the ideas behind extrachromosomal inheritance, linkage and crossing over, numerical and structural chromosomal aberrations (Understanding)
CO 3: Compare the various genetic mutations and explain DNA repair (Understanding)
CO 4: Demonstrate the fine structure of the gene including complementation test (Understanding)
CO 5: Rephrase the Hardy Weinberg Law (Understanding)

Module I: Mendelian Genetics and Its Extension (12 Hours)

Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, lethal alleles, Epistasis,

Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance

Module II: Extrachromosomal Inheritance (6 Hours)
Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast; Maternal effects - shell coiling in snail; Infective heredity - Kappa particles in *Paramecium*

Module III: Linkage, Crossing Over and Chromosome Mapping (10 Hours)
Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage

Module IV: Variation in Chromosome Number and Structure (5 Hours)
Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy

Module V: Gene Mutations (5 Hours)
Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: ClB method. Role of transposons in mutation DNA repair mechanisms

Module VI: Fine Structure of Gene (3 Hours)
Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus

Module VII: Population and Evolutionary Genetics (4 Hours)
Allele frequencies, Genotype frequencies, Hardy – Weinberg Law, role of natural selection mutation, genetic drift Genetic variation and Speciation

Suggested Readings

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. Benjamin Cummings, U.S.A. 10th edition.
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3						
CO2		3	3	3			
CO3					3		
CO4						3	
CO5							3

BOPG205L: PLANT GENETICS LAB

(2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Experiment with meiosis through slide preparation (Applying)
CO 2: Solve problems related to Mendel's laws, probability and chi-square analysis (Applying)
CO 3: Examine test cross data for chromosome mapping and pedigree charts (Analyzing)
CO 4: Demonstrate incomplete dominance and gene interaction (Evaluating)
CO 5: Interpret blood typing, chromosomal aberrations and human genetic traits (Understanding)

Practical:

Expt. 1: Meiosis through temporary squash preparation
Expt. 2: Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square analysis
Expt. 3: Chromosome mapping using test cross data
Expt. 4: Pedigree analysis for dominant and recessive autosomal and sex-linked traits
Expt. 5: Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4)
Expt. 6: Blood Typing: ABO groups & Rh factor
Expt. 7: Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes
Expt. 8: Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge
Expt. 9: Study of human genetic traits: Sickle cell anemia, Xeroderma Pigmentosum, Albinism, red-green Colour blindness, Widow's peak, rolling of tongue, Hitchhiker's thumb and Attached ear lobe

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Exp.8	Expt.9
CO1	3								
CO2		3							
CO3			3	3					
CO4					3				
CO5						3	3	3	3

BOMA206T: MORPHOLOGY AND ANATOMY OF ANGIOSPERMS

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Compere the general morphology and distinguishing characteristics of angiospermic plants (Understanding)
CO 2: Examine the concepts and fundamentals of plant anatomy (Analyzing)
CO 3: Comprehend the concepts of organization and development of shoot and root apices (Understanding)
CO 4: Evaluate the secretory systems in plants (Evaluating)

Module I: Plant morphology (3 hours)

Introduction; Vegetative Characters: Modified Roots and Stems; Leaf (Phyllotaxy), Venation; Trichomes. Reproductive Characters: Floral parts, Arrangements of flowers on the floral axis, Unisexual and Bisexual Flowers, Variation in fruit surface, Placentation, Variation in seed coats

Module II: Tissues (8 Hours)

Classification of tissues; Simple and complex tissues (no phylogeny); cyto-differentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, encrustation and incrustation, Ergastic substances

Module III: Stem, Leaves and Roots (13 Hours)

Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem; Structure of dicot and monocot leaf, Kranz anatomy, Organization of root apex (Apical cell theory, Histogen theory, Korper- Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root

Module IV: Vascular Cambium, Periderm and Wood (13 Hours)

Structure, function and seasonal activity of cambium; Secondary growth in root and stem, Development and composition of periderm, rhytidome and lenticels, Axially and radially oriented elements; Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology

Module V: Adaptive and Protective Systems (8 Hours)

Epidermal tissue system, cuticle, epicuticular waxes, trichomes (uni and multicellular, glandular and non-glandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes; Secretory system

Suggested Readings

1. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
3. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
4. Esau, K. (1977). Anatomy of Seed Plants. John Wiley & Sons, Inc., Delhi

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V
CO1	**3**	**1**			
CO2		**2**	**3**	**3**	**1**
CO3			**3**		
CO4					**3**

BOMA207L: MORPHOLOGY AND ANATOMY OF ANGIOSPERMS LAB

(2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Prepare permanent slides, temporary stain mounts, macerations and museum specimens (Creating)
CO 2: Gain the knowledge about apical meristem of root, shoot and vascular system (Understanding)
CO 3: Apprehend the ideas of the distribution and types of tissues (Understanding)
CO 4: Examine the different aspects of plant adaptations and plant secretory systems (Analyzing)

Practical:

Expt. 1: Study of anatomical details through permanent slides/temporary stain mounts/ macerations/ museum specimens with the help of suitable examples
Expt. 2: Apical meristem of root, shoot and vascular cambium
Expt. 3: Distribution and types of parenchyma, collenchyma and sclerenchyma
Expt. 4: Xylem: Tracheary elements- tracheids, vessel elements; thickenings; perforation plates; xylem fibres
Expt. 5: Wood: ring porous; diffuse porous; tyloses; heart-and sapwood
Expt. 6: Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres
Expt. 7: Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular
Expt. 8: Root: monocot, dicot, secondary growth
Expt. 9: Stem: monocot, dicot. - Primary and secondary growth; periderm; lenticels
Expt. 10: Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy)
Expt. 11: Adaptive Anatomy: xerophytes, hydrophyte
Expt. 12: Secretory tissues: cavities, lithocysts and laticifers

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt. 10	Expt. 11	Expt. 12
CO1	3											
CO2		3		1		1						
CO3		2	3	3		3	3					3
CO4				1	2	1		3	3			3

BOPE208T: PLANT ECOLOGY

(3 Credits: 45Hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Illustrate the concepts of ecology of individual, population, community and ecosystem (Understanding)
CO 2: Extend the knowledge of various factors of environment, its interaction and the structural and functional aspects of ecosystem (Understanding)
CO 3: Apply the concepts of population dynamics and community succession in understanding the composition of a particular area (Applying)
CO 4: Illustrate the principle and concept of phytogeography (Understanding)

Module I: Introduction (4 Hours)

Basic concepts of ecology, Levels of organization, Inter-relationships between the living world and the environment, the components and dynamism, homeostasis

Module II: Abiotic and Biotic Components of Ecosystem (10 Hours)

Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development, Importance: States of water in the environment; Atmospheric moisture; Hydrological Cycle; Water in soil; Water table. Variations; adaptations of plants to their variation in Light, temperature, wind and fire, Host-Pathogen interaction

Module III: Ecosystem, Its Structural and Functional Aspects (8 Hours)

Structure; Processes; trophic organization, Food chains and Food webs; Ecological pyramids, Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus

Module IV: Population Ecology (8 Hours)

Characteristics and Dynamics of population ecology, ecological Speciation

Module V: Plant Communities (8 Hours)

Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts

Module VI: Phytogeography (7 Hours)

Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation

Suggested Readings

1. Odum, E.P. (2005) Fundamentals of ecology, 5th edition Cengage Learning India Pvt. Ltd., New Delhi
2. Singh, J.S., Singh, S.P., Gupta, S. (2006) Ecology Environment and Resource Conservation, Anamaya Publications, New Delhi, India
3. Sharma, P.D. (2010) Ecology and Environment, 8th edition Rastogi Publications, Meerut, India
4. Wilkinson, D.M. (2007) Fundamental Processes in Ecology: An Earth Systems Approach, Oxford University Press. USA
5. Kormondy, E.J. (1996) Concepts of ecology, 4th edition, PHI Learning Pvt. Ltd., Delhi, India

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	3		3	3	3	
CO2	2	3	3			
CO3			3			
CO4						3

BOPE209L: PLANT ECOLOGY LAB

(1 Credit: 30 Hours) (L-T-P: 0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Recall their basic knowledge on ecology in order to use instruments to measure microclimatic variables (Remembering)
CO 2: Illustrate the various physico-chemical properties of soil and water (Understanding)
CO 3: Estimate the DO of water samples from polluted and unpolluted sources (Evaluating)
CO 4: Utilize their knowledge to demonstrate and calculate the plant communities (Applying)
CO 5: Adapt the concepts of ecology and inculcating these ideas in their young minds through field visits (Creating)

Practical

Expt. 1: Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, hygrometer, rain gauge and lux meter.
Expt. 2: Determination of pH of various soil and water samples
Expt. 3: Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.
Expt. 4: Determination of organic matter of different soil samples by Walkley & Black rapid titration method.
Expt. 5: Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats.
Expt. 6: Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
Expt. 7: Study of morphological adaptations of hydrophytes and xerophytes (four each).
Expt. 8: Determination of minimal quadrat size for the study of herbaceous vegetation by species area curve method.
Expt. 9: Quantitative analysis of herbaceous vegetation for frequency and comparison with Raunkiaer's frequency distribution law.
Expt. 10: Quantitative analysis of herbaceous vegetation for density, abundance and IVI
Expt. 11: Field visit

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7	Module 8	Module 9	Module 10	Module 11
CO1	H	L									
CO2	L	L	H	L	M	L					
CO3						H					
CO4							H	H	H	H	
CO5							L	L	L	L	H

BOPP300T: PLANT PHYSIOLOGY

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Explain the concepts of plant water relation, mineral nutrition, nutrient uptake and translocation (Understanding)
CO 2: Interpret the concepts of photoperiodism, phytochrome and vernalization (Understanding)
CO 3: Analyze the functions of growth regulators (Analyzing)
CO 4: Formulate methods to test actions of Plant Growth Regulators in vitro/in vivo (Creating)

Module I: Plant Water Relationship (10 Hours)

Water Potential and its components, water absorption by roots, aquaporins, and pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure, and guttation. Ascent of sap–cohesion-tension theory, transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement

Module II: Mineral Nutrition (4 Hours)

Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents

Module III: Nutrient Uptake (4 Hours)

Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport

Module IV: Translocation in the Phloem (4 Hours)

Experimental evidence in support of phloem as the site of sugar translocation, Pressure–Flow Model; Phloem loading and unloading; Source–sink relationship

Module V: Plant Growth Regulators (12 Hours)

Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene, Brassinosteroids and Jasmonic acid, biosynthesis

Module VI: Physiology of Flowering (6 Hours)

Photoperiodism, flowering stimulus, florigen concept, vernalization, dormancy and germination of seeds

Module VII: Phytochrome (5 Hours)

Discovery, chemical nature, role of phytochrome in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action

Suggested Readings

1. Hopkins, W.G. and Huner, A. (2008) Introduction to Plant Physiology, 4th edition, John Wiley and Sons, USA
2. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A. (2015) Plant Physiology and Development, 6th edition, Sinauer Associates Inc. USA
3. Bajracharya D. (1999) Experiments in Plant Physiology- A Laboratory Manual, Narosa Publishing House, New Delhi

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3	3	3	3			
CO2						3	3
CO3					3		
CO4					3		

BOPP301L: PLANT PHYSIOLOGY LAB

(2 CREDIT-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

At the end of this course, student will be able to:

CO 1: Memorize the basic concept of transpiration and stomata (Remembering)
CO 2: Interpret the concepts of osmotic and water potential (Understanding)
CO 3: Infer the ideas behind seed germination, amylase activity and the effect of different concentrations of plant growth hormones like IAA (Understanding)
CO 4: Calculate stomatal index and frequency and also area and percentage of stoma using the basic knowledge on stomata (Applying)

CO 5: Examine suction pressure due to transpiration, fruit ripening or rooting from cuttings and bolting (Analyzing)

Practical:

Expt. 1: Determination of osmotic potential of plant cell sap by plasmolytic method
Expt. 2: Determination of water potential of given tissue (potato tuber) by weight method
Expt. 3: Study of the effect of wind velocity and light on the rate of transpiration in excised twig/leaf
Expt. 4: Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte
Expt. 5: To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and xerophyte (both surfaces)
Expt. 6: To study the phenomenon of seed germination (effect of light)
Expt. 7: To study the effect of different concentrations of IAA on *Avena* coleoptile elongation (IAA Bioassay)
Expt. 8: To study the induction of amylase activity in germinating barley grains

Demonstration experiments

Expt. 1: Demonstration of suction due to transpiration
Expt. 2: **Expt.2**: Fruit ripening/Rooting from cuttings (Demonstration)
Expt. 3: **Expt.3**: Bolting experiment/Avena coleptile bioassay (demonstration)

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Demo Expts.
CO1	3	3							
CO2		3							
CO3				3	3				
CO4						3	3		
CO5								3	3

BOPS302T: PLANT SYSTEMATICS

(L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Summarize the concepts of plant identification, classification, nomenclature and biosystematics (Understanding)
CO 2: Summarize botanical nomenclature and various systems of classification (Understanding)
CO 3: Explain biometrics, numerical taxonomy and cladistics (Understanding)
CO 4: Summarize the phylogeny in angiosperms (Understanding)

Module I: Introduction to Plant Systematics and Identification (10 Hours)

Plant identification, Classification, Nomenclature; Biosystematics; Evidence from palynology, cytology, phytochemistry and molecular data; Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; Eflora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access

Module IV: Taxonomic Hierarchy (4 Hours)

Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary)

Module V: Botanical Nomenclature (6 Hours)

Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids

Module VI: Systems of Classification (10 Hours)

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification

Module VII: Biometrics, Numerical Taxonomy and Cladistics (5 Hours)

Characters; Variations; OTUs, character weighting and coding; cluster analysis; Phenograms, cladograms (definitions and differences)

Module VIII: Phylogeny of Angiosperms (10 Hours)

Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin & evolution of angiosperms; co - evolution of angiosperms and animals; methods of illustrating evolutionary relationship (phylogenetic tree, cladogram)

Suggested Readings

1. Singh, G. (2012) Plant Systematics: Theory and Practice, 3rd edition, Oxford & IBH Pvt. Ltd., New Delhi
2. Jeffrey, C. (1982) An introduction to Plant Taxonomy, Cambridge University Press, Cambridge.
3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002) Plant Systematics-A Phylogenetic Approach, 2nd edition, Sinauer Associates Inc., USA
4. Maheshwari, J.K. (1963) Flora of Delhi, CSIR, New Delhi
5. Radford, A.E. (1986) Fundamentals of Plant Systematics Harper and Row, New York

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	**3**	**2**	**2**		**1**			
CO2		**3**		**3**				**1**
CO3			**3**				**2**	
CO4					**2**	**3**		

BOPS303L: PLANT SYSTEMATICS LAB

(2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

At the end of this course, student will be able to:

CO 1: Interpret the vegetative characters and systematic position of various angiospermic plants (Understanding)
CO 2: Utilize their knowledge on angiosperms to study the floral characters through slide preparation (Applying)
CO 3: Apply the ideas of plant taxonomy and systematics in identifying different plant specimens in their natural habitat (Applying)
CO 4: Develop the art of preparing herbarium of plant specimens (Creating)

Practical:

Expt. 1: **Expt.1.** Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Ranunculaceae- *Ranunculus, Delphinium,* Brassicaceae- *Brassica, Alyssum / Iberis,* Myrtaceae- *Eucalyptus, Callistemon,* Umbelliferae- *Coriandrum / Anethum / Foeniculum,* Asteraceae- *Sonchus / Launaea, Vernonia / Ageratum, Eclipta/ Tridax,* Solanaceae- *Solanum nigrum / Withania,* Lamiaceae- *Salvia / Ocimum,* Euphorbiaceae- *Euphorbia hirta/ E. milii, Jatropha,* Liliaceae- *Asphodelus / Lilium / Allium* ,Poaceae- *Triticum / Hordeum / Avena*

Expt. 2: **Expt.2.** Field visit (local) – Subject to grant of funds from the university.

Expt. 3: **Expt.3.** Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book)

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3
CO1	3		
CO2	3		
CO3		3	
CO4			3

BORB304T: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

(3 CREDITS - 45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Categorize different reproductive mechanisms in Angiosperm (Analyzing)
CO 2: Explain the concepts of anther, pollen biology and ovule (Understanding)
CO 3: Evaluate the methods for studying pollination, fertilization and self-incompatibility (Evaluating)
CO 4: Infer the concepts of embryo development in monocot and dicot plants (Understanding)
CO 5: Design and improve protocols for transformation (Creating)

Module I: Introduction to Reproductive Biology in Angiosperms (2 Hours)

History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope. Types of reproduction and regeneration in plants: Sexual, asexual / vegetative reproduction.

Module II: Anther and Pollen Biology (12 Hours)
Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance, Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system; Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination; abnormal features: Pseudomonads, polyads, massulae, pollinia

Module III: Ovule (8 Hours)
Structure; Types; Special structures–endothelium, obturator, aril, caruncle and hypostase; Female gametophyte–megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of Polygonum type); Organization and ultrastructure of mature embryo sac

Module IV: Pollination and Fertilization (6 Hours)
Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization

Module V: Self Incompatibility (8 Hours)
Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome selfincompatibility: mixed pollination, bud pollination, stub pollination; Intraovarian and in vitro pollination; Modification of stigma surface, parasexual hybridization; Cybrids, in vitro fertilization

Module VI: Endosperm and Embryo (16 Hours)
Types, development, structure and functions, Six types of Embryogeny; General pattern of development of dicot and monocot embryo; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in Paeonia, polyembryony and apomixes

Module VII: Seed and Germline Transformation (4 Hours)
Structure, importance and dispersal mechanisms, Pollen grain and ovules through pollen tube pathway method/ Agrobacterium/ electrofusion/ floral dip/ biolistic

Suggested Readings
1. Bhojwani, S.S. and Bhatnagar, S.P. (2011) The Embryology of Angiosperms, 5th edition, Vikas Publishing House, Delhi
2. Shivanna, K.R. (2003) Pollen Biology and Biotechnology, Oxford and IBH Publishing Co. Pvt. Ltd., Delhi
3. Raghavan, V. (2000) Developmental Biology of Flowering plants, Springer, Netherlands
4. Johri, B.M. (1984) Embryology of Angiosperms, Springer-Verlag, Netherlands

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3						
CO2		3	3				
CO3		2	2	3	3		
CO4						3	
CO5							3

BORB305L: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS LAB

(1 CREDIT-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes
At the end of this course, student will be able to:
CO 1: CO1: Identify parts of anther and develop pollen viability test and calculation of germination percentage (Applying)
CO 2: CO2: Examine various types of ovules, the female gametophyte and intra-ovarian pollination (Evaluating)
CO 3: CO3: Explain and infer endosperm and embryogenesis (Understanding)
CO 4: CO4: Dissect developing seeds to determine stages of growth (Analyzing)

Practical:
Expt. 1: Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation
Expt. 2: Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, psuedomonads, polyads, pollinia (slides/photographs, fresh material), ultra-structure of pollen wall (micrograph); Pollen viability: Tetrazolium test germination: Calculation of percentage germination in different media using hanging drop method

Expt. 3: Ovule: Types-anatropous, orthotropous, amphitropous / campylotropous, circinotropous, unitegmic, bitegmic; tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs)
Expt. 4: Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus
Expt. 5: Intra-ovarian pollination; Test tube pollination through photographs
Expt. 6: Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria
Expt. 7: Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7
CO1	3	3					
CO2			3	3	3		
CO3						3	3
CO4							3

BOPM306T: PLANT METABOLISM

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Interpret the concepts of metabolism- carbohydrates, nitrogen and lipids (Understanding)
CO 2: Understand the process of photosynthesis and carbon assimilation (Understanding)
CO 3: Explain the pathways involved in respiration and ATP synthesis (Understanding)
CO 4: Rephrase the structure and properties of amino acids and proteins (Understanding)

Module I: Concept of Metabolism (6 Hours)

Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes)

Module II: Carbon Assimilation (10 Hours)

Historical background, role of photosynthetic pigments (chlorophylls and accessory pigments), photosystems (PSI, PSII), antenna molecules and reaction centers, photochemical reactions, electron transport chain and photophosphorylation, mechanism of ATP synthesis

CO2 reduction: C3 and C4 pathways, Crassulacean acid metabolism, photorespiration, Factors affecting CO2 reduction

Module III: Carbohydrate Metabolism (4 Hours)

Structure, properties and importance of mono-, di- and polysaccharides, synthesis and catabolism of sucrose and starch

Module IV: Carbon Oxidation (8 Hours)

Glycolysis and its regulation, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, TCA cycle and its regulation, mitochondrial electron transport, oxidative phosphorylation, substrate level phosphorylation, mechanism of ATP synthesis, ATP synthase, cyanide-resistant respiration, anaerobic conversion of pyruvate into ethanol or lactate, factors affecting respiration

Module V: Lipid Metabolism (6 Hours)

Classification, structure and functions of fatty acids and triglycerides, synthesis and breakdown of triglycerides, α oxidation, β-oxidation, glyoxylate cycle, gluconeogenesis

Module VI: Nitrogen Metabolism (6 Hours)

Nitrogen cycle, nitrate assimilation, ammonium assimilation and transamination, biological nitrogen fixation (examples of legumes and non-legumes), physiology and biochemistry of nitrogen fixation

Module VII: Proteins and Amino acids (5 Hours)

Classification, structure and properties of amino acids and proteins

Suggested Readings

1. Hopkins, W.G. and Huner, A. (2008) Introduction to Plant Physiology, 4th edition, John Wiley and Sons, USA
2. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A. (2015) Plant Physiology and Development, 6th edition, Sinauer Associates Inc., USA
3. Harborne, J.B. (1973) Phytochemical Methods, John Wiley & Sons, New York

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3		3		3	3	
CO2		3					
CO3				3			
CO4							3

BOPM307L: PLANT METABOLISM LAB

(1 CREDIT-30 HOURS) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Utilize the knowledge to separate photosynthetic pigments (Applying)
CO 2: Demonstrate Hill's reaction, fluorescence and absorption spectrum of photosynthetic pigments (Understanding).
CO 3: Interpret the effects of light and carbon dioxide on photosynthesis
CO 4: Compare the rate of respiration in various plant materials (Understanding)
CO 5: Infer the activity of nitrate reductase and lipases (Understanding)

Practical:

Expt. 1: Expt.1. Chemical separation of photosynthetic pigments
Expt. 2: Expt.2. Experimental demonstration of Hill's reaction
Expt. 3: Expt.3. Study of the effect of light intensity on the rate of photosynthesis
Expt. 4: Expt.4. Effect of carbon dioxide on the rate of photosynthesis
Expt. 5: Expt.5. Comparison of the rate of respiration in different parts of a plant
Expt. 6: Expt.6. Demonstration of activity of Nitrate Reductase in germinating leaves of different plant sources
Expt. 7: Expt.7. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids during germination
Expt. 8: Expt.8. Demonstration of fluorescence by isolated chlorophyll pigments
Expt. 9: Expt.9. Demonstration of absorption spectrum of photosynthetic pigments

Mapping of COs to Syllabus

Cos	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9
CO1	3								
CO2		3						3	3
CO3			3	3					
CO4					3				
CO5						3	3		

BOMO308T: MOLECULAR BIOLOGY

(3 Credit-45 Hours)(L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Define the molecular structure of DNA and RNA. (Remembering)
CO 2: Explain the mechanism of DNA replication of both linear and circular DNA as well as protein synthesis including transcription and translation in both prokaryotes and eukaryotes. (Understanding)
CO 3: Illustrate the post-translational modifications and processing of eukaryotic mRNA and prokaryotic and eukaryotic gene regulation. (Understanding)
CO 4: Distinguish the different DNA repair mechanisms with their significance. (Analyzing)
CO 5: Summarize the interdependence of these molecular mechanisms in providing a holistic environment for the smooth functioning of a cell/organism. (Understanding)

Module I: Nucleic Acids (3 Hours)

Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment RNA and its significance in evolution.

Module II: The Structures of DNA and RNA (7 Hours)

DNA Structure: Miescher to Watson and Crick-historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves; Org-anization of DNA-Prokaryotes, Viruses,

Eukaryotes. RNA: Types and Structure, Organelle DNA–mito chondria and chloroplast DNA. The nucleosome, chromatin structure–Euchromatin, Heterochromatin – Constitutive and Facultative heterochromatin.

Module III: DNA Replication (6 Hours)
DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres, Enzymes for replication, process of prokaryotic and eukaryotic replication

Module IV: Central Dogma and Genetic Code (4 Hours)
Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features).

Module V: Transcription (6 Hours)
RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors.

Module VI: Translation (Prokaryotes and eukaryotes) (6 Hours)
Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation.

Module VII: Post Transcriptional Modifications and Processing of Eukaryotic RNA (4 Hours)
Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Module VIII: Regulation of Transcription in prokaryotes and Eukaryotes (5 Hours)
Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting.

Module IX: DNA Repair Mechanisms (4 Hours)
Pyrimidine dimerization and mismatch repair, Regulatory RNAs 3 Ribo-switches, RNA interference, miRNA, siRNA

Suggested Readings

1. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
2. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R (2007) Molecular Biology of the Gene, 6th edition, Pearson Benjamin Cummings, CSHL Press, New York, USA
3. Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V Edition, ASM Press and Sinauer Associates.
4. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
5. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
6. Lewin B. (2008). Gene XI, Jones and Bartlett
7. McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV Edition. GS, Taylor and Francis Group, New York and London.

Mapping of COs to syllabus

COs	M 1	M 2	M 3	Mo 4	M 5	M 6	M 7	M 8	M 9
CO1	3	3							
CO2		2	3	2					
CO3					3	3	3		
CO4									3
CO5							2	3	

BOMO309L: MOLECULAR BIOLOGY LAB

(2 Credit-60 Hours) (L-T-P:0-0-2)

Course Outcomes

At the end of this course, student will be able to:
CO 1: Explain the structure of chromosome. (Understanding)
CO 2: Design the growth medium and estimate growth kinetics. (Creating)
CO 3: Estimation of DNA and RNA using different analytical tools. (Evaluating)

CO 4: Interpret the micrographs of DNA replication and spilt genes. (Understanding)
CO 5: Prepare LB medium for growing bacterial cultures (Creating)

Practical:

Expt. 1: Preparation of LB medium and raising E.Coli and Isolation of genomic DNA from E.Coli
Expt. 2: DNA estimation by diphenylamine reagent/UV Spectrophotometry
Expt. 3: Estimation of the growth kinetics of E. coli by turbidity method
Expt. 4: Preparation of solid culture medium (LB) and growth of E. coli by spreading and streaking
Expt. 5: Quantitative estimation of RNA using Orcinol reaction.
Expt. 6: Study and interpretation of electron micrographs/ photograph showing (a) DNA replication (b) Transcription (c) Split genes
Expt. 7: Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi discontinuous replication)
Expt. 8: Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel &Conrat's experiments)
Expt. 9: Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing
Expt. 10: Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs

Mapping of Cos to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1								3	3	3
CO2		3		3						
CO3					3		3			
CO4			3			3				
CO5	3									

BOEC310T: ECONOMIC BOTANY

(3 Credit-45 Hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 6: Understanding different dimensions of plant identification as a resource for self-sustenance, their domestication, commercialization etc. (Understanding)
CO 7: Understand the cultivation, extraction processes of different economically useful plants. (Understanding)
CO 8: Execute the concepts developed in the class in their daily activities (Applying)
CO 9: Survey the uses of economically important plants. (Analyzing)
CO 10: Induction of modern techniques and processing methods for useful crops (Creating)

Module I: Origin of Cultivated Plants (5 Hours)

Concept of Centres of Origin; their importance with reference to Vavilov's work examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity and commercialization

Module II: Introduction to Nature of Plant Products (7 Hours)

Importance and Nature of Plant Products: Protoplasm and its Activities; Photosynthesis; Plant skeleton; Reserved food (Carbohydrates, Fats and Proteins); Secretions and Excretions (Essential Oils, Pigments, Tannins, Latex, Waxes, Alkaloids, Glycosides, Organic Acids, Enzymes, Vitamins, Hormones). Different Aspects of Economic Botany; Classification of Economically Important Plants

Module III Cereals, legumes and Pulses (5 Hours)

Wheat and Rice (origin, morphology, processing & uses), brief account of millets, General account of legumes, importance to man and ecosystem

Module IV: Oil, Essential oil and Fats (4 Hours)

General account with special reference to Drying oils, semi drying oils; Non-drying oils, essential oil and Vegetables Fats, extraction methods and uses.

Module V: Fibre and rubber yielding Plants (4 Hours)

Classification based on the origin of fibres, Cotton and Jute (morphology, extraction and uses). Para-rubber: tapping, processing and uses

Module VI: Sugars and starches yielding Plants (5 Hours)
Morphology and processing of sugarcane, products and by- products of sugarcane industry. Potato – morphology, propagation & uses

Module VII: Spices (4 Hours)
Listing of important spices, their family and part used, economic importance with Special reference to fennel, saffron, clove and black pepper

Module VIII: Beverages (4 Hours)
Tea, Coffee (morphology, processing & uses)

Module IX: Forest Products and Resources (4 Hours)
Importance and Structures of Wood; Mechanical Properties and Factors of Wood; General account with special reference to Teak, Sal, Pine and Bamboos.

Module X: Other economically Important Plants (3 Hours)
A general accounts on Poisonous Plants, Ceremonial Plants, Herbal Plants, medicinal Plants.

Suggested Readings

8. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
9. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
10. Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Mapping of COs to syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX	Module X
CO1	2									
CO2	2	3	3	3	3	3	3	3	3	3
CO3	2									
CO4		3	2		2	2		2		3
CO5						2	2	2	2	2

BOEC311L: ECONOMIC BOTANY LAB

(1 Credit-30 Hours) (L-T-P:0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Recollect the morphology and anatomy of various economically important plants. (Remembering)
CO 2: Explain the economic importance of crop plants. (Understanding)
CO 3: Execute various micro-chemical tests of cereals, legumes, sugars and starches. (Applying)
CO 4: Able to carry out qualitative and quantitative checking of crop plant products. (Evaluating)

Practical:

Expt. 1: Cereals: Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests)
Expt. 2: Legumes: Soya bean, Groundnut, (habit, fruit, seed structure, micro-chemical tests)
Expt. 3: Sugars & Starches: Sugarcane (habit sketch; cane juice-micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w. m. starch grains, micro-chemical tests)
Expt. 4: Spices: Black pepper, Fennel and Clove (habit and sections)
Expt. 5: Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans)
Expt. 6: Oils & Fats: Coconut-T.S. Nut, Mustard–plant specimen, seeds; tests for fats in crushed seeds
Expt. 7: Essential oil-yielding plants: Habit sketch of Rosa, Vetiveria, Santalum and Eucalyptus (specimens/photographs).
Expt. 8: Rubber: specimen, photograph/model of tapping, samples of rubber products
Expt. 9: Drug-yielding plants: Specimens of *Digitalis*, *Papaver* and *Cannabis*
Expt. 10: Tobacco: specimen and products of Tobacco
Expt. 11: Woods: Tectona, Pinus: Specimen, Section of young stem.
Expt. 12: Fibre-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fibre and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fibre)

Mapping of Cos to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10	Expt. 11	Expt.12
CO1	3			3				3	3	3	3	3
CO2		3			3	3						
CO3			3				3					
CO4							2	2	2	2	2	2

BOAT400L: ANALYTICAL TECHNIQUES IN PLANT SCIENCES

(3 Credit-45 Hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Interpret various microscopic techniques (Understanding)
CO 2: Compare the different centrifugation techniques (Understanding)
CO 3: Apply radioisotopes and spectrophotometry in biological research (Applying)
CO 4: Illustrate the various chromatographic and molecular techniques (Understanding)
CO 5: Application of digitization technologies in plant Science

Module I: Imaging and Related Techniques (12 Hours)

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS): Genome estimation (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching, Digital image processing.

Module II: Radioisotopes and Spectrophotometry (7 Hours)

Use in biological research, auto-radiography, pulse chase experiment, Principle and its application in biological research.

Module III: Chromatography (8 Hours)

Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography

Module IV: Characterization of Proteins and Nucleic Acids (6 Hours)

Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE, native PAGE

Module V: Implication of digitization in Plant Science (12 Hours)

Use of Internet of things, Big Data in Plant study and conservations, Application of spectral signatures in plant distribution, taxonomy, biochemical estimation, vegetation index (NDVI, PVI, SVI), characterize by its size, shape, boundaries and internal structure ETC

Suggested Readings

1. Plummer, D.T. (1996) An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi
2. Ruzin, S.E. (1999) Plant Microtechnique and Microscopy, Oxford University Press, New York. USA
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995) Short Protocols in Molecular Biology, 3rd edition, John Wiley & Sons
4. C Sudhakar Reddy. (2015) Application of remote sensing in plant Sciences. An Overview. SpringerIndia.
5. Charis, G., Danha, G., Muzenda, E., 2019. A review of the application of gis in biomass and solid waste supply chain optimization: gaps and opportunities for developing nations. Waste management 6; 1-11.
6. IoT in Agriculture Investigation on Plant Diseases and Nutrient Level Using Image Analysis Techniques
7. Sathiya S. , Cecil, A., Ghodke. P.K., 2022. Plant disease identification using IoT and deep learning algorithms. Artificial Intelligence for Signal Processing and Wireless Communication. doi.org/10.1515/9783110734652-002.
8. Advanced Remote sensing and GIS. Training Manual Developed by CEGIS, USFS and BFD, 2014-15

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	3	3	3	3	
CO2		2			
CO3		2		3	
CO4					3

BOAT401L: ANALYTICAL TECHNIQUES IN PLANT SCIENCES LAB

(1 Credit-30 Hours)(L-T-P:0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Infer the various blotting techniques as well as PCR (Understanding)
CO 2: Utilize paper chromatography and TLC to separate sugars and nitrogenous bases (Applying)
CO 3: Apply radioisotopes and spectrophotometry in biological research (Applying)
CO 4: Illustrate the various microscopic, biochemical and molecular techniques (Understanding)
CO 5: Application of digitization technologies in plant Sciences (Evaluating)

Practical

Expt. 1: Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs
Expt. 2: Separation of sugars, chloroplast by thin layer/paper chromatography
Expt. 3: Isolation of chloroplast by differential centrifugation
Expt. 4: Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH)
Expt. 5: Study of DNA/protein separation by using AGE/PAGE
Expt. 6: Preparation of permanent slides (double staining)
Expt. 7: Estimation of protein concentration through Lowry's methods
Expt. 8: Study of different spatial imagery, vegetation index and digital image processing through photograph
Expt. 9: Study of different parts and functions of Sensors used in GIS ang IOTs

Suggested Readings

1. Plummer, D.T. (1996) An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi
2. Ruzin, S.E. (1999) Plant Microtechnique and Microscopy, Oxford University Press, New York. USA
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995) Short Protocols in Molecular Biology, 3rd edition, John Wiley & Sons
4. C Sudhakar Reddy. (2015) Application of remote sensing in plant Sciences. An Overview. Springer India.
5. Chloroplast Isolation by differential Centrifugation. https://www.youtube.com/watch?v=6JJBvh-NQZA.
6. Charis, G., Danha, G., Muzenda, E., 2019. A review of the application of gis in biomass and solid waste supply chain optimization: gaps and opportunities for developing nations. Waste management 6; 1-11.
7. IoT in Agriculture Investigation on Plant Diseases and Nutrient Level Using Image Analysis Techniques
8. Sathiya S. , Cecil, A., Ghodke. P.K., 2022. Plant disease identification using IoT and deep learning algorithms. Artificial Intelligence for Signal Processing and Wireless Communication. doi.org/10.1515/9783110734652-002.
9. Advanced Remote sensing and GIS. Training Manual Developed by CEGIS, USFS and BFD, 2014-15

Mapping of COs to Syllabus

COs	Expt 1	Expt 2	Expt 3	Expt 4	Expt 5	Expt 6	Expt 7	Expt 8	Expt 9
CO1	3								
CO2		3							
CO3			3						
CO4				3	3	3	3		
CO5								3	3

BOBS402T: BIOSTATISTICS

(3 Credit-45 Hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Define basic terminologies in Biostatistics. (Remembering)
CO 2: Explain the concepts of biostatistics and its use in biology. (Understanding)
CO 3: Apply the statistics tools for data analysis. (Applying)
CO 4: Design sampling methods to generate significant data. (Creating)

Module I: Introduction (8 Hours)

Biostatistics - definition - statistical methods - basic principles Variables - measurements, functions, limitations and uses of statistics

Module II: Collection of Data (8 Hours)
Collection of data primary and secondary - types and methods of data collection procedures - merits and demerits Classification - tabulation and presentation of data - sampling methods

Module III: Measures of Central Tendency (10 Hours)
Measures of central tendency - mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation -merits and demerits; Co- efficient of variations

Module IV: Correlation & Regression (10 Hours)
Correlation - types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression

Module V: Statistical Inference and Experimental design (9 Hours)
Statistical inference - hypothesis - simple hypothesis - student's t' test - chi square test, Experimental design softwares.

Suggested Readings
1. Danniel, W.W. (1987) Biostatistic, New York, John Wiley Sons
2. Sundarrao, P.S.S, Richards, J. An introduction to Biostatistics, 3rd edition, Christian Medical College, Vellore
3. Selvin, S. (1991) Statistical Analysis of epidemiological data, New York University Press
4. Bishop, O. N. Houghton, Mifflin Statistics for Biology, Boston
5. Freedman, P. The Principles of scientific research, New York, Pergamon Press
6. Campbell, R.C. (1998) Statistics for Biologists, Cambridge University Press

Mapping of Cos to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	3	3	3	3	
CO2		2			
CO3		2		3	
CO4					3

BOBS403L: BIOSTATISTICS LAB

(2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes
At the end of this course, student will be able to:
CO 1: Tell the definitions and formulae of various statistical terms (Remembering)
CO 2: Make use of statistical calculations for data interpretation (Applying)
CO 3: Analyse any given biological data to see their accuracy and importance (Analyzing)

Practical
Expt. 1: Calculation of mean, standard deviation and standard error
Expt. 2: Calculation of correlation coefficient values and finding out the probability
Expt. 3: Calculation of 'F' value and finding out the probability value for the F value
Expt. 4: Demonstration of an experimental trial and statistical optimization using MINITAB/Design Expert.

Mapping of COs to Syllabus

COs	Expt.1	Expt. 2	Expt. 3	Expt. 4
CO1	3	3	3	
CO2	3	3	3	3
CO3	3	3	3	3

BOPL404T: PLANT BIOTECHNOLOGY

(3 Credits-45 HOURS) (3-0-0)

Course outcomes
At the end of this course, student will be able to:
CO 1: Define the terms and concepts of plant tissue culture (Remembering)
CO 2: Explain Plant tissue culture & recombinant DNA Technology (Understanding)
CO 3: Utilize the knowledge of plant tissue culture techniques in their future research works (Applying)
CO 4: Develop/improve protocols for better transgenic products (Creating)

Module I: Plant Tissue Culture (10 Hours)
Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation)

Module II: Recombinant DNA Technology (20 Hours)
Restriction Endonucleases (History, Types, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC and briefly PAC, MAC, HAC).Gene Cloning (Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR-mediated gene cloning); Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; Probes-oligonucleotide, heterologous, PCR; Methods of gene transfer- Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP)

Module III: Applications of Biotechnology (15 Hours)
GMOs, Pest resistant (Bt-cotton); herbicide resistant plants (Roundup Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products–Human Growth Hormone; Humulin; Biosafety concerns.

Suggested Readings

1. Bhojwani, S.S. and Razdan, M. K. (1996) Plant Tissue Culture: Theory and Practice, Elsevier Science Amsterdam, the Netherlands
2. Glick, B.R., Pasternak, J. J. (2003) Molecular Biotechnology- Principles and Applications of recombinant DNA, ASM Press, Washington
3. Bhojwani, S.S. and Bhatnagar, S.P. (2011) The Embryology of Angiosperms, 5th edition, Vikas Publication House Pvt. Ltd., New Delhi
4. Snustad, D.P. and Simmons, M. J. (2010) Principles of Genetics, 5th edition, John Wiley and Sons, UK
5. Stewart, C.N. Jr. (2008) Plant Biotechnology & Genetics: Principles, Techniques and Applications, John Wiley & SonsInc. USA

Mapping of Cos to Syllabus

COs	Module 1	Module 2	Module 3
CO1	3	2	2
CO2	2	3	1
CO3	2	2	2
CO4	1	2	3

BOPL405L: PLANT BIOTECHNOLOGY LAB

(2 Credits-60 HOURS) (0-0-2)

Course outcomes
At the end of this course, student will be able to:
CO 1: Study various media used in Plant tissue culture Laboratory (Remembering)
CO 2: Explain/demonstrate different molecular biology techniques in tissue culture (Understanding).
CO 3: Analyze modern DNA techniques used in plant improvement (Analyzing)
CO 4: Evaluate and compare techniques in plant tissue culture (Evaluating)

Practical
Expt. 1: **a)** Preparation of MS medium **b)** Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc
Expt. 2: Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs
Expt. 3: Isolation of protoplasts
Expt. 4: Construction of restriction map of circular and linear DNA from the data provided
Expt. 5: Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
Expt. 6: Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs
Expt. 7: Isolation of plasmid DNA

Expt. 8: Restriction digestion and gel electrophoresis of plasmid DNA

Mapping of Cos to syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8
CO1	3	2	1	1	1	1	1	1
CO2		1	2	3	3	3	2	2
CO3	1	1	2	1	3	3	3	3
CO4	1	2	2	2	3	3	3	3

BOPA406T: PLANT PATHOLOGY

(3 Credits-45 HOURS) (3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Classify various microorganisms and explain their properties (Understanding)
CO 2: Identify and detect microbial plant diseases and plan control strategies (Applying)
CO 3: Assess and recommend post-harvest controls measures and techniques (Evaluating)

Module I: Plant Microbial diversity (8 Hours)

Bacteria & Archaebacteria: general properties, classification, economic importance; Viruses- general properties, classification and economic importance, nematodes and Mycoplasma-general properties and importance

Module II: An insight into Plant Pathology (10 Hours)

Historical and developmental aspects of plant pathology, mode of infection and role of enzymes and toxins in plant disease, defense mechanisms of plants against infection

Module III: Plant diseases and effects on physiological functions (15 Hours)

Study of plant diseases caused by fungi, bacteria, viruses, nematodes and mycoplasma; identifications and characterizations. Environmental factors on disease development and epidemiology. Effects of diseases on physiological functions of plants.

Module IV: Plant diseases control measures (12 Hours)

Plant disease control measures: cultural, chemical, biological, bio pesticides, breeding for resistant varieties, plant quarantine, integrated pest management; molecular and transgenic approach for crop protection

Suggested readings:

1. Pelczar MJ. Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
2. Prescott L, Harley JP, Klein DA. Microbiology, McGraw Hill, India. 6th edition.
3. Mehrotra RS, Aggarwal A. Plant Pathology, 2 nd Edition, Tata McGraw-Hill Publishing Company Ltd.
4. Singh RP. Plant Pathology, 2nd Edition, Kalyani Publishers.
5. Mehrotra RS, Aggarwal A. Fundamentals of Plant Pathology, Tata McGraw-Hill Publishing Company Ltd.
6. Sambamurty AVSS. A textbook of Plant Pathology, Dreamtech Press, Wiley.
7. Gour HN. Physiological and Molecular Plant Pathology, Scientific Publishers India.
8. George N Agrios. Plant Pathology, Fifth Editions. Elsevier Academic Press. 2005.

Mapping of Cos to Syllabus

COs	Module I	Module 2	Module 3	Module IV
CO1	3	1	1	1
CO2	1	3	3	1
CO3	1	2	2	3

BOPA407L: PLANT PATHOLOGY LAB

(2 Credits-60 HOURS) (0-0-2)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Prepare different media used in microorganism isolation (Applying)
CO 2: Identify various plant pathogens and symptoms in plants (Applying)
CO 3: Formulate control strategies of plant diseases (Creating)

Syllabus

Expt. 1: Preparation of nutrient media (solid/liquid) for microorganisms' isolation

Expt. 2: Staining techniques (Gram's staining, Fungal staining)

Expt. 3: Detailed study of symptoms of representative diseases of plantation crops, Collection and dry preservation of diseased specimens of important crops

Expt. 4: Isolation and characterization of pathogens from diseased plants

Expt. 5: Test of plant disease control using chemicals agent, biological and mechanical means

Mapping of Cos to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5
CO1	3	1			
CO2		3	2	3	1
CO3	1	2	2	2	3

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	BONV104T	Introduction to non-vascular plants	4 (3-0-1)
		BONV105L	Introduction to non-vascular plants Lab	
2	Minor Course 2	BOVP106T	Introduction to vascular plants	4 (3-0-1)
		BOVP107L	Introduction to vascular plants Lab	
3	Minor Course 3	BOFP210T	Morphology and Anatomy of flowering plants	4 (3-0-1)
		BOFP211L	Morphology and Anatomy of flowering plants Lab	
4	Minor Course 4	BOEB212T	Introduction to Economic Botany	4 (3-0-1)
		BOEB213L	Introduction to Economic Botany Lab	
5	Minor Course 5	BOET313T	Ethnobotany	4 (3-0-1)
		BOET314L	Ethnobotany Lab	
6	Minor Course 6	BOMD315T	Microbial diversity	4 (3-0-1)
		BOMD316L	Microbial diversity Lab	
7	Minor Course 7	BOIM408T	Industrial Microbiology	3 (2-0-1)
		BOIM409L	Industrial Microbiology Lab	
7	Minor Course 8	BORM410T	Research Methodology	2
8	Minor Course 9	BOFM411T	Fundamentals of Molecular Biology	3 (2-0-1)
		BOFM412L	Fundamentals of Molecular Biology Lab	

BONV104T: INTRODUCTION TO NON-VASCULAR PLANTS
(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes
At the end of this course, student will be able to:
CO 1: Recall the unique features of non-vascular plants (Remembering)
CO 2: Classify and demonstrate the morphology and reproduction of algae (Understanding)
CO 3: Classify and demonstrate their morphology, anatomy and reproduction of bryophytes (Understanding)
CO 4: Illustrate the economic importance of algae and bryophytes (Understanding)

Module I: Introduction (2 Hours)
Introduction to non-vascular plants; Transition to land habit, Classification of algae and bryophytes.

Module II: Chlorophyta and Charophyta (8 Hours)
General Characteristics of Chlorophyta and Charophyta; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Chlamydomonas*, *Volvox, Oedogonium*, *Chara*.

Module III: Phaeophyta and Rhodophyta (10 Hours)
Phaeophyta and Rhodophyta Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Ectocarpus*, *Fucus* and *Polysiphonia*

Module IV: Bryophytes (20 Hours)
General characteristics; Adaptations to land habit; Classification; Range of thallus organization; Classification (up to family) reproduction of *Riccia, Marchantia, Anthoceros* and *Sphagnum*

Module V: Economic importance of algae and bryophytes (5 Hours)
Role of algae in the environment, agriculture, biotechnology and industry.
Ecological and economic importance of bryophytes with special reference to *Sphagnum*

Suggested Readings.
1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
2. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition. ll
3. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
4. Vander-Poorteri 2009 Introduction to Bryophytes. COP
5. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.

Mapping of COs to syllabus

Cos	Module 1	Module II	Module III	Module IV	Module V
CO1	3				

CO2		3	3		
CO3				3	
CO4					3

BONV105L: INTRODUCTION TO NON-VASCULAR PLANTS LAB

(1 CREDIT-30 HOURS) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Differentiate the vegetative and reproduction structures in algae (Applying)

CO 2: Able to understand reproduction and multiplication processes in bryophytes (Understanding)

CO 3: Utilize and create basic identification techniques for non-vascular plants (Creating)

Practical:

Expt. 1: Study of vegetative and reproductive structures of *Chlamydomonas* (electron micrographs)

Expt. 2: Study the reproduction of *Volvox*, *Oedogonium*, *Coleochaete*, *Chara*, *Vaucheria*, *Ectocarpus*, *Fucus* and *Polysiphonia*, *Procholoron* through electron micrographs, temporary preparations and permanent slides

Expt. 3: *Riccia*– Study of morphology of thallus (temporary/ permanent slides)

Expt. 4: *Anthoceros*- Study of morphology of thallus, dissection of sporophyte (to show stomata, spores,pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).

Expt. 5: *Sphagnum*- Study of morphology of plant, whole mount of leaf (permanent slide only)

Mapping of COs to syllabus

Cos	Expt. 1	Expt.2	Expt. 3	Expt.4	Expt. 5
CO1	3	3			
CO2			3	3	3
CO3	2			2	

BOVP106T: INTRODUCTION TO VASCULAR PLANTS (PTERIDOPHYTES, GYMNOSPERMS, ANGIOSPERMS)

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes:

At the end of this course, students will be able to:

CO 1: Classify Pteridophytes based on their morphology, anatomy, reproduction and life cycles.

CO 2: Classify Gymnosperms based on their morphology, anatomy, reproduction and life cycles.

CO 3: Understand various taxonomical aids for identification of Angiosperms.

CO 4: Analyze the systematic description and economic value of common Angiosperms

Module I: Pteridophytes (12 Hours)

General characteristics of Pteridophytes, classification of Smith (1955) upto division; Occurrence, morphology, anatomy, reproduction (developmental details not to be included); life history of (a) Lycopodium (Lycopsida) and (b) Marsilea (Filicopsida); Stelar evolution, heterospory and seed habit; Ecological and economic importance of Pteridophytes

Module II: Gymnosperms (14 Hours)

General characteristics of Gymnosperms; classification upto class; Occurrence, morphology, anatomy, reproduction (developmental details not to be included) and life history of (a) Cycas, (Cycadopsida), (b) Pinus (Coniferopsida) and (c) Gnetum (Gnetopsida); Ecological and economic importance of Gymnosperms

Module III: Basic aspects of Angiosperm Taxonomy (8 Hours)

Aim and scope of taxonomy; Species concept: Taxonomic hierarchy, species, genus and family; Plant nomenclature: Binomial system, ICBN-rules for nomenclature; Bentham and Hooker system of classification

Module IV: Systematic Taxonomy (11 hours)

Systematic description and economic importance of the following families: (a) Brassicaceae (b) Curcurbitaceae (c) Rutaceae (d) Fabaceae (e) Asteraceae (f) Solanaceae (g) Lamiaceae (h) Euphorbiaceae (i) Orchidaceae and (j) Poaceae

Suggested readings:

1. Sharma,O.P.(2012)Pteridophyta. Tata McGraw-Hill, New Delhi
2. Kramer, K.U.&P. S. Green (1990) The Families and Genera of Vascular Plants, Volume –I: Pteridophytes and Gymnosperms (Ed.K.Kubitzki) Springe-Verlag, New York
3. Bhatnagar, S.P. &AlokMoitra (1996) Gymnosperms. New Age International, New
4. Delhi

5. Coulter, J.M. &C.J.Chamberlain(1910) Morphology of Gymnosperms,The University of Chicago Press, Chicago, Illinois
6. Govil, C.M. (2007) Gymnosperms: Extinct and Extant. KRISHNA Prakashan Media (P) Ltd.Meerut& Delhi
7. Sporne, K.R. (1971) The Morphology of Gymnosperms.Hutchinsons Co. Ltd., London Lawrence, George H.M. (1951) Taxonomy of Vascular Plants. The McMillan Co., New York
8. Heywood, V. H. and D. M. Moore (1984) Current Concepts in Plant Taxonomy. Academic Press, London.
9. Jeffrey, C. (1982) An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London.
10. Sambamurty, A.V.S.S. (2005) Taxonomy of Angiosperms I. K . International Pvt. Ltd., New Delhi
11. Singh, G. (2012). Plant Systematics: Theory and Practice.Oxford & IBH Pvt. Ltd. New Delhi.
12. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA,U.S.A.

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV
CO1	3			
CO2		3		
CO3			3	2
CO4			2	3

BOVP107L: INTRODUCTION TO VASCULAR PLANTS LAB

(1 CREDIT-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Infer the concepts of classification system and identification of few important pteridophytes (Understanding)
CO 2: Summarize the concepts of classification system and identification of few important gymnosperms (Understanding)
CO 3: Differentiate between monocots and dicots (Understanding)
CO 4: Collect, prepare and document herbarium specimens through non-destructive field collection method so as to get acquainted with herbarium technique (Applying)

Practical

Expt. 1: Study of morphology and reproductive structures of the following pteridophytes: *Lycopodium, Selaginella, Equisetum, Adiantum* and *Marsilea*.
Expt. 2: To study the morphology and reproductive features of the following gymnosperms: Cycas and *Pinus*.
Expt. 3: Taxonomic study of selected families of dicots and monocots of angiospermic plants (three of each).
Expt. 4: Collection, preparation and documentation of herbarium specimens through non-destructive field collection method so as to get acquainted with herbarium technique.

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4
CO1	3			
CO2		3		
CO3			3	
CO4				3

BOFP210T: MORPHOLOGY AND ANATOMY OF FLOWERING PLANTS

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to*:*

CO 1: Develop an understanding of concepts and fundamentals of plant morphology and anatomy (Understanding)
CO 2: Examine the morphology and internal anatomy of plant systems and organs (Remembering)
CO 3: Comprehend the concepts of organization and development of shoot and root apices (Understanding)
CO 4: Examine the structure and role of cambium (Analyzing)
CO 5: Evaluate the adaptive, protective and secretory systems of plants (Evaluating)

Module I: Plant morphology (4 hours)

Introduction; Vegetative Characters: Modified Roots and Stems; Leaf (Phyllotaxy), Venation; Trichomes.

Module II: Reproductive Characters (7 hours)

Floral parts, Arrangements of flowers on the floral axis, Unisexual and Bisexual Flowers, Variation in fruit surface, Placentation, Variation in seed coats

Module III: Tissues (14 Hours)
Classification of tissues; Simple and complex tissues (no phylogeny); cyto-differentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, encrustation and incrustation, Ergastic substances

Module IV: Stem, Leaves and Roots (20 Hours)
Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure, function and seasonal activity of cambium; Structure of dicot and monocot stem; Structure of dicot and monocot leaf, Kranz anatomy, Development and composition of periderm, rhytidome and lenticels; Organization of root apex (Apical cell theory, Histogen theory, Korper- Kappe theory); Secondary growth in root and stem; Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root

Suggested Readings
1. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
2. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.
3. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
4. Esau, K. (1977). Anatomy of Seed Plants. John Wiley & Sons, Inc., Delhi

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV
CO 1	3	1	2	2
CO 2	3	2	3	3
CO 3				3
CO 4	1			3
CO 5				3

BOFP211L: MORPHOLOGY AND ANATOMY OF FLOWERING PLANTS LAB
(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes
At the end of this course, student will be able to:
CO 1: Prepare permanent slides, temporary stain mounts, macerations and museum specimens (Creating)
CO 2: Gain the knowledge about apical meristem of root, shoot and vascular system (Understanding)
CO 3: Apprehend the ideas of the distribution and types of tissues (Understanding)
CO 4: Gain an understanding on secondary growth and wood anatomy in plants (Applying)
CO 5: Scrutinize the different aspects of plant adaptations (Analyzing)

Practical:
Expt. 1: Study of anatomical details through permanent slides/temporary stain mounts/ macerations/ museum specimens with the help of suitable examples
Expt. 2: Apical meristem of root, shoot and vascular cambium
Expt. 3: Distribution and types of parenchyma, collenchyma and sclerenchyma
Expt. 4: Xylem: Tracheary elements- tracheids, vessel elements; thickenings; perforation plates; xylem fibres
Expt. 5: Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres
Expt. 6: Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular
Expt. 7: Root: monocot, dicot, secondary growth
Expt. 8: Stem: monocot, dicot. - Primary and secondary growth; periderm; lenticels
Expt. 9: Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy)
Expt. 10: Adaptive Anatomy: xerophytes, hydrophyte

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt. 10
CO1	3									
CO2		3								
CO3		2	3	3		3	3			
CO4			2	3	3	1	2	3	3	
CO5										3

BOEB212T: INTRODUCTION TO ECONOMIC BOTANY
(3 Credit-45 Hours)(L-T-P:3-0-0)

Course Outcomes
At the end of this course, student will be able to:
CO 1: Understanding different dimensions of plant identification as a resource for self-sustenance, their domestication, commercialization etc. (Understanding)
CO 2: Understand the cultivation, extraction processes of different economically useful plants. (Understanding)
CO 3: Execute the concepts developed in the class in their daily activities. (Applying)
CO 4: Survey the uses of economically important plants. (Analyzing)
CO 5: Induction of modern techniques and processing methods for useful crops. (Creating)

Module I: Origin of Cultivated Plants (5 Hours)
Concept of Centres of Origin; their importance with reference to Vavilov's work examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity and commercialization

Module II: Introduction to Nature of Plant Products (7 Hours)
Importance and Nature of Plant Products: Protoplasm and its Activities; Photosynthesis; Plant skeleton; Reserved food (Carbohydrates, Fats and Proteins); Secretions and Excretions (Essential Oils, Pigments, Tannins, Latex, Waxes, Alkaloids, Glycosides, Organic Acids, Enzymes, Vitamins, Hormones). Different Aspects of Economic Botany; Classification of Economically Important Plants

Module III Cereals, legumes and Pulses (5 Hours)
Wheat and Rice (origin, morphology, processing & uses), brief account of millets, General account of legumes, importance to man and ecosystem

Module IV: Oil, Essential oil and Fats (4 Hours)
General account with special reference to Drying oils, semi drying oils; Non-drying oils, essential oil and Vegetables Fats, extraction methods and uses.

Module V: Fibre and rubber yielding Plants (4 Hours)
Classification based on the origin of fibres, Cotton and Jute (morphology, extraction and uses). Para-rubber: tapping, processing and uses

Module VI: Sugars and starches yielding Plants (5 Hours)
Morphology and processing of sugarcane, products and by- products of sugarcane industry. Potato – morphology, propagation & uses

Module VII: Spices (4 Hours)
Listing of important spices, their family and part used, economic importance with Special reference to fennel, saffron, clove and black pepper

Module VIII: Beverages (4 Hours)
Tea, Coffee (morphology, processing & uses)

Module IX: Forest Products and Resources (4 Hours)
Importance and Structures of Wood; Mechanical Properties and Factors of Wood; General account with special reference to Teak, Sal, Pine and Bamboos.

Module X: Other economically Important Plants (3 Hours)
A general accounts on Poisonous Plants, Ceremonial Plants, Herbal Plants, medicinal Plants.

Suggested Readings
1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
3. Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Mapping of COs to syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX	Module X
CO1	2									
CO2	2	3	3	3	3	2	3	3	3	3
CO3	2									

CO4		**3**	**2**		**2**	**2**		**2**		**3**
CO5					**2**		**2**			**3**

BOEB213L: INTRODUCTION TO ECONOMIC BOTANY LAB

(1 Credit-30 Hours) (L-T-P:0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Recollect the morphology and anatomy of various economically important plants. (Remembering)
CO 2: Explain the economic importance of crop plants. (Understanding)
CO 3: Execute various micro-chemical tests of cereals, legumes, sugars and starches. (Applying)
CO 4: Able to carry out qualitative and quantitative checking of crop plant products. (Evaluating)

Practical:

Expt. 1: Cereals: Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests)
Expt. 2: Legumes: Soya bean, Groundnut, (habit, fruit, seed structure, micro-chemical tests)
Expt. 3: Sugars & Starches: Sugarcane (habit sketch; cane juice-micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w. m. starch grains, micro-chemical tests)
Expt. 4: Spices: Black pepper, Fennel and Clove (habit and sections)
Expt. 5: Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans)
Expt. 6: Oils & Fats: Coconut-T.S. Nut, Mustard–plant specimen, seeds; tests for fats in crushed seeds
Expt. 7: Essential oil-yielding plants: Habit sketch of Rosa, Vetiveria, Santalum and Eucalyptus (specimens/photographs).
Expt. 8: Rubber: specimen, photograph/model of tapping, samples of rubber products
Expt. 9: Drug-yielding plants: Specimens of *Digitalis*, *Papaver* and *Cannabis*
Expt. 10: Tobacco: specimen and products of Tobacco
Expt. 11: Woods: Tectona, Pinus: Specimen, Section of young stem.
Expt. 12: Fibre-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fibre and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fibre)

Mapping of Cos to Syllabus

COs	**Expt. 1**	**Expt. 2**	**Expt. 3**	**Expt. 4**	**Expt. 5**	**Expt. 6**	**Expt. 7**	**Expt. 8**	**Expt. 9**	**Expt. 10**	**Expt. 11**	**Expt.12**
CO1	3			3				3	3	3	3	3
CO2		3			3	3						
CO3			3				3					
CO4							2	2	2	2	2	2

BOET313T: ETHNOBOTANY

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Demonstrate the concept, scope and objectives of ethnobotany with reference to tribal lifestyle (Understanding)
CO 2: Interpret different ethnobotanical methodologies (Understanding)
CO 3: Examine the role of various plants in traditional and modern medicine (Analyzing)
CO 4: Infer the legal aspects of ethnobotany (Understanding)
CO 5: Evaluate the different conservational strategies of medicinal plants (Evaluating)

Module I: Ethnobotany (7 Hours)

Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science; the relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses

Module II: Methodology of Ethnobotanical Studies (4 Hours)

a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places

Module III: Role of Ethnobotany in Modern Medicine (14 Hours)

Medico-ethno botanical sources in India; Significance of the following plantsin ethno botanical practices (along with their habitat and morphology) a) Azadiractha indica b) Ocimum sanctum c) Vitex negundo. d) Gloriosa superba e) Tribulusterrestrisf) Pongamia pinnata g) Cassia auriculata h) Indigofera tinctoria. Role of ethnobotany in modern medicine with special example

Rauvolfiasepentina, Trichopuszeylanicus, Artemisia, Withania; Role of ethnic groups in conservation of plant genetic resources.Endangered taxa and forest management (participatory forest management)

Module IV: Ethnobotany and Legal Aspects (8 Hours)
Ethnobotany as a tool to protect interests of ethnic groups; Sharing of wealth concept with few examples from India; Biopiracy, Intellectual Property Rights and Traditional Knowledge

Module V: Conservation Strategies (12 Hours)
Conservation of endangered and endemic medicinal plants Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding

Suggested Readings

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. S.K. Jain (ed.) Glimpses of Indian. Ethnobotany, Oxford and I B H, New Delhi – 1981
3. S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
4. S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
5. Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons- Chichester
6. Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India.Botanical Survey of India.
7. Howrah._8) Rajiv K. Sinha – Ethnobotany the Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur1996_9)

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V
CO 1	3				
CO 2		3			
CO 3			3		
CO 4				3	
CO 5					3

BOET314L: ETHNOBOTANY LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course Outcome

At the end of this course, student will be able to:
CO 1: Execute various collection methods for specimen collection (Applying)
CO 2: Knowledge on preparing and labelling herbarium specimen (Understanding)
CO 3: Able to extract crude extracts from important plants (Applying)
CO 4: Collect information of Ethonobotanically important plants (Evaluating)

Practical

Expt. 1: Collection method of plants from the field
Expt. 2: Preparation and labelling of herbarium specimens (minimum 10 plants)
Expt. 3: Extraction of crude extracts from various ethnobotanically important plant material (minimum 3 plants)
Expt. 4: Field survey and collection of information on ethnobotanical uses from traditional healers
Expt. 5: Knowledge of some plants used in various ceremonies and rituals

Mapping of COs to syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5
CO1	3	1			
CO2	2	3			
CO3			3		
CO4	1			3	3

BOMD315T: MICROBIAL DIVERSITY

(3 Credits-45 HOURS) (3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Tell the differences between microbes (Remembering)

CO 2: Classify various microorganisms and explain their properties (Understanding)

CO 3: Evaluate the importance of microbes in environment and agriculture (Evaluating)

Module I: Introduction to Microorganisms (10 Hours)

Historical developments: Discovery of microorganisms, Spontaneous Generation Controversy, Germ theory of fermentation, Germ theory of disease. Classification of microorganisms

Module II: Prokaryotic Microbes (10 Hours)

Eubacteria, Archaeobacteria, Cyanobacteria–General comparison, Morphology and structures; cell wall chemistry and internal organelles, role in environment

Module III: Eukaryotic Microbes (15 Hours)

Algae and Fungi- General characteristics and classification, cellular structures, modes of reproductions, economic importance and role in environment and agriculture.

Module IV: Viruses (10 Hours)

Origin, classification and nomenclature of viruses, general structures of viruses, bacteriophages- types and uses; prions and viroids-nature and importance

Suggested reading:

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi. 3. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
4. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
5. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV
CO1	3	3	3	3
CO2	3	3	3	3
CO3	1	3	3	3

BOMD316L: MICROBIAL DIVERSITY LAB

(1 Credit-30 Hours) (0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Differentiate between cell shapes and structures of microorganisms (Applying)

CO 2: Able to understand reproduction and multiplication processes in microbes (Understanding)

CO 3: Utilize and create basic identification techniques for microbes (Creating)

Practical

Expt. 1: Types of Bacteria to be observed from temporary/permanent slides/photographs.

Expt. 2: Electron micrographs/Models of viruses and bacteriophages

Expt. 3: Staining of prokaryotic and eukaryotic microbes

Expt. 4: Study of vegetative and reproductive structures of Algae and Fungi through electron micrographs, temporary preparations and permanent slides

Mapping of COs to Syllabus

COs	Expt.1	Expt. 2	Expt. 3	Expt. 4
CO1	3	3	3	3
CO2	1	1	2	3
CO3	1	2	2	2

BOIM408T: INDUSTRIAL MICROBIOLOGY

(2 CREDITS-30 HOURS) (L-T-P:2-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Tell the basics of bioreactors and fermentation process (Remembering)
CO 2: Explain the role of microbes in industry, agriculture and environment (Understanding)
CO 3: Compare various techniques used in waste water treatment (Analyzing)
CO 4: Assess and evaluate pollutants in environment (Evaluating)

Module I: Bioreactors/Fermenters and Fermentation Processes (8 Hours)

Types of Fermentation: Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations, components of a typical bioreactor, Types of bioreactors-laboratories, pilot scale and production fermenters; constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter

Module II: Microbial Production of Industrial Products (8 Hours)

Scope of microorganisms in Industries; Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Industrial process of fermentations for the production Enzyme: amylase, Organic acid (citric acid), alcohol (Ethanol) and antibiotic (Penicillin)

Module III: Microbial Enzymes of Industrial Interest and Enzyme Immobilization (5 Hours)

Microorganisms for industrial applications and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase)

Module IV: Microbial Flora of Water (4 Hours)

Water pollution, role of microbes in sewage and domestic waste water treatment systems; Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and faecal coli form in water samples

Module V: Microbes in Agriculture and Environment and Remediation of Contaminated Soils (5 Hours)

Distribution of microbes in air; Isolation of microorganisms from soil, air and water; Biological fixation; Mycorrhizae; Bioremediation of contaminated soils, isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots

Suggested Readings

1. Pelzar, M.J. Jr., Chen E.C. S., Krieg, N.R. (2010) Microbiology: An application based approach, Tata McGraw Hill Education Pvt. Ltd., Delhi
2. Tortora, G.J., Funke, B.R., Case. C.L. (2007) Microbiology 9th edition, Pearson Benjamin Cummings, San Francisco, USA

Mapping of COs to Syllabus:

COs	Module I	Module II	Module III	Module IV	Module V
CO1	3				
CO2		3	3	2	1
CO3				3	
CO4				3	3

BOIM409L: INDUSTRIAL MICROBIOLOGY LAB

(1 CREDIT-30 HOURS) (L-T-P:0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Tell the principles of laboratory instruments (Remembering)
CO 2: Explain different sterilization techniques and culture media preparation (Understanding)
CO 3: Compare and select best sterilization methods (Evaluating)

Practical:

Expt. 1: Principles and functioning of instruments in microbiology laboratory
Expt. 2: Hands on sterilization techniques and preparation of culture media

Mapping of COs to Syllabus:

COs	Expt.1	Expt.2
CO1	3	

CO2		**3**
CO3		**3**

BOFM411T: FUNDAMENTALS OF MOLECULAR BIOLOGY
(3 Credit-45 Hours) (L-T-P:3-0-0)

Course Outcomes
At the end of this course, student will be able to:
CO 1: Define the molecular structure of DNA and RNA. (Remembering)
CO 2: Explain the mechanism of DNA replication of both linear and circular DNA as well as protein synthesis including transcription and translation in both prokaryotes and eukaryotes. (Understanding)
CO 3: Illustrate the post-translational modifications and processing of eukaryotic mRNA and prokaryotic and eukaryotic gene regulation. (Understanding)
CO 4: Distinguish the different DNA repair mechanisms with their significance. (Analyzing)
CO 5: Summarize the interdependence of these molecular mechanisms in providing a holistic environment for the smooth functioning of a cell/organism. (Understanding)

Module I: Nucleic Acids (3 Hours)
Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment RNA and its significance in evolution.

Module II: The Structures of DNA and RNA (7 Hours)
DNA Structure: Miescher to Watson and Crick-historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves; Org-anization of DNA-Prokaryotes, Viruses, Eukaryotes. RNA: Types and Structure, Organelle DNA–mito chondria and chloroplast DNA. The nucleosome, chromatin structure–Euchromatin, Heterochromatin – Constitutive and Facultative heterochromatin.

Module III : DNA Replication (6 Hours)
DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres, Enzymes for replication, process of prokaryotic and eukaryotic replication

Module IV: Central Dogma and Genetic Code (4 Hours)
Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features).

Module V: Transcription (6 Hours)
RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors.

Module VI: Translation (Prokaryotes and eukaryotes) (6 Hours)
Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation.

Module VII: Post Transcriptional Modifications and Processing of Eukaryotic RNA (4 Hours)
Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Module VIII: Regulation of Transcription in prokaryotes and Eukaryotes (5 Hours)
Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting.

Module IX: DNA Repair Mechanisms (4 Hours)
Pyrimidine dimerization and mismatch repair, Regulatory RNAs 3 Ribo-switches, RNA interference, miRNA, siRNA

Suggested Readings
1. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
2. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R (2007) Molecular Biology of the Gene, 6th edition, Pearson Benjamin Cummings, CSHL Press, New York, USA
3. Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V Edition, ASM Press and Sinauer Associates.

4. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
5. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
6. Lewin B. (2008). Gene XI, Jones and Bartlett
7. McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV Edition. GS, Taylor and Francis Group, New York and London.

Mapping of COs to syllabus

COs	M 1	M 2	M 3	Mo 4	M 5	M 6	M 7	M 8	M 9
CO1	3	3							
CO2		2	3	2					
CO3					3	3	3		
CO4									3
CO5							2	3	

BOFM412L: FUNDAMENTALS OF MOLECULAR BIOLOGY LAB

(1 Credit-30 Hours) (L-T-P:0-0-1)

Course Outcomes

CO 1: At the end of this course, student will be able to:
CO 2: Explain the structure of chromosome. (Understanding)
CO 3: Design the growth medium and estimate growth kinetics. (Creating)
CO 4: Estimation of DNA and RNA using different analytical tools. (Evaluating)
CO 5: Interpret the micrographs of DNA replication and spilt genes. (Understanding)
CO 6: Prepare LB medium for growing bacterial cultures (Creating)

Practical:

Expt. 1: Preparation of LB medium and raising E.Coli and Isolation of genomic DNA from E.Coli
Expt. 2: DNA estimation by diphenylamine reagent/UV Spectrophotometry
Expt. 3: Estimation of the growth kinetics of E. coli by turbidity method
Expt. 4: Preparation of solid culture medium (LB) and growth of E. coli by spreading and streaking
Expt. 5: Quantitative estimation of RNA using Orcinol reaction.
Expt. 6: Study and interpretation of electron micrographs/ photograph showing (a) DNA replication (b) Transcription (c) Split genes
Expt. 7: Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi discontinuous replication)
Expt. 8: Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel &Conrat's experiments)
Expt. 9: Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.
Expt. 10: Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs

Mapping of Cos to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1								3	3	3
CO2		3		3						
CO3					3		3			
CO4			3			3				
CO5	3									

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	BOBT108L	Biofertilizer Technology	3 (1-0-2)
2	S E Course 2	BOEB109L	Essentials of Bioinformatics	3 (2-0-1)
3	S E Course 3	BONS215L	Practical Applications of Nature-Based Solutions for Sustainable Development	3 (2-0-1)

BOBT108L: BIOFERTILIZER TECHNOLOGY
(1 CREDITS-15 HOURS) (L-T-P: 1-0-0)

Course Outcomes
At the end of this course, student will be able to:
CO 1: Explain different microorganisms used as biofertilizers (Understanding)
CO 2: Select microorganisms for making biofertilizers (Applying)
CO 3: Develop strategies for organic farming (Applying)

Module I: Introduction of microbes as fertilizers (10 Hours)
General account about the microbes used as biofertilizer – Rhizobium, Azotobacter, Azospirillum, Azolla and Anabaena, VAM fungi – isolation, identification, mass multiplication, and carrierbased inoculants, influence on growth and yield of crop plants

Module II: Organic Farming (5 Hours)
Organic farming – Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and Industrial wastes – bio compost making methods, types and method of vermi-composting – field Applications

Suggested Readings
1. Sathe, T.V. Vermiculture and Organic Farming. Daya publishers, 2004
2. Subha Rao, N.S., Soil Microbiology, Oxford & IBH Publishers, New Delhi, 2000
3. Vayas, S.C, Vayas, S. and Modi, H.A., Bio-fertilizers and organic Farming AktaPrakashan, Nadiad 55, 1998

Mapping of COs to Syllabus

COs	Module I	Module II
CO1	3	2
CO2	2	2
CO3	1	3

BOBT108L: BIOFERTILIZER TECHNOLOGY LAB
(2 CREDITS-60 HOURS) (L-T-P: 1-0-2)

Course Outcomes
At the end of this course, student will be able to:
CO 1: Develop microbes based biofertilizers (Applying)
CO 2: Formulate bio compost for organic farming (Creating)

Syllabus
Expt. 1: Isolation/selection of microorganisms (Rhizobium, Azotobacter, Azospirillum, BGA, VAM fungi)
Expt. 2: Multiplication/scale up of microorganisms to be used as biofertilizer
Expt. 3: Processing and packing of microorganisms
Expt. 4: Field trials/applications of biofertilizers
Expt. 5: Preparation of bio-compost using microbes and other sources and packaging

Mapping of COs to syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5
CO1	3	3	3	3	1
CO2	2	2	2	1	3

BOEB109L: ESSENTIALS OF BIOINFORMATICS
(2 CREDITS-30 HOURS) (L-T-P: 2-0-0)

Course Outcomes
At the end of this course, student will be able to:

CO 1: Interpret the basic terminology of bioinformatics (Understanding)
CO 2: Illustrate the significance of the biological databases in managing biological data. (Understanding)
CO 3: Apply different bioinformatics tools and software in decoding sequences, their structure and interactions and to correlate these data amongst different species. (Applying)
CO 4: Evaluate various statistical methods in data analysis and interpretation. (Evaluating)

Module I: Introduction to Bioinformatics (7 Hours)
Importance, Goal, Scope; Genomics, Transcriptomics, Functional Genomics, Metabolomics, Systems Biology, Molecular Phylogeny; Applications and Limitations of Bioinformatics.

Module II: Biological Databases (8 Hours)
Introduction to biological databases; Primary, secondary and composite databases; Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB); Metabolic pathway database (KEGG, EcoCyc, and MetaCyc); Small molecule databases (PubChem, Drug Bank, ZINC, CSD)

Module III: Data Generation and Data Retrieval (8 Hours)
Generation of data (Gene sequencing, Protein sequencing, Mass spectrometry, Microarray), Sequence submission tools (BankIt, Sequin, Webin); Sequence file format (flat file, FASTA, GCG, EMBL, Clustal, Phylip, Swiss-Prot); Sequence annotation; Data retrieval systems (SRS, Entrez)

Module IV: Applications of Bioinformatics software (7 Hours)
Structural Bioinformatics (3-D protein, PDB), CN3D, BLAST, Functional genomics (genome wide and high throughput approaches to gene and protein function), Drug discovery method (Basic concepts)

Suggested Readings

COs	Module 1	Module 2	Module 3	Module 4
CO1	3	2		
CO2		3	2	
CO3			3	
CO4				2

BOEB109L: ESSENTIALS OF BIOINFORMATICS LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes
At the end of this course, student will be able to:
CO 1: To developed the understanding of using different software's and database. (Understanding)
CO 2: To execute sequence alignment, primer designing, gene prediction phylogenetic tree construction by utilizing the various biological database and tools (Evaluating)
CO 3: To study 3D Structure of Protein using available softwares. (Applying)
CO 4: Apply bioinformatics tools to archive, retrieve, and analyze biological data. (Analyzing)

Practical
Expt. 1: Introduction to various databases available, their usage in sequence searching, retrieval available in databases and Sequence alignment
Expt. 2: Introduction to Gene prediction tools
Expt. 3: Primer designing and analysis
Expt. 4: Phylogenetic Analysis based on sequence alignment data and RAPD/ protein profile data
Expt. 5: Study 3D Structure using available software's.

Suggested Readings
1. Bioinformatics. A Practical Approach. Shui Qing Ye, Chapman and Hall/CRC
2. A Practical Guide for Basic Bioinformatics and Biostatistics (English, Paperback, Pooja Tiwari, Pallavi Pandey)

Mapping COs to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5
CO1	3				
CO2		3	3	3	3
CO3					
CO4					3

BONS215L: PRACTICAL APPLICATIONS OF NATURE-BASED SOLUTIONS FOR SUSTAINABLE DEVELOPMENT
(3 credits-75 hours) (L-T-P:0-0-3)

Course Outcomes
At the end of this course, student will be able to:
CO1: Develop practical skills in designing and implementing nature-based solutions.
CO2: Gain hands-on experience in ecosystem management and sustainable agricultural practices.
CO3: Analyze and evaluate the effectiveness of NBS projects in mitigating environmental and social challenges.
CO4: Engage with communities to promote and implement NBS initiatives.

Module I: Introduction to Practical Nature-Based Solutions (10 hours)
- Practical Workshop on Ecosystem Services: Hands-on activities to identify and assess ecosystem services.
- Community Engagement Exercises: Techniques for involving local communities in NBS projects.
- Case Study Analysis: Group discussion and analysis of successful NBS projects.
- Mapping and Assessment Tools: Training in the use of GIS and other tools for mapping ecosystem services.

Module II: Sustainable Agriculture Management (20 hours)
- Fieldwork on Sustainable Agriculture: Visits to urban farms, community gardens, and regenerative agriculture sites.
- Practical Exercises in Agroecology and Permaculture: Implementing sustainable farming practices.
- Soil Health Assessment: Techniques for testing and improving soil health.
- Monitoring and Evaluation Techniques: Practical exercises in monitoring and evaluating NBS projects.

Module III: Climate Resilience and Disaster Risk Reduction (15 hours)
- Field Trip to Local Ecosystems: Introduction to local ecosystems and their services.
- Field Exercises in Wetland Restoration: Practical activities in restoring and managing coastal and wetland areas.
- Flood Management Projects: Designing a green infrastructure solution for flood mitigation.
- Carbon Sequestration Techniques: Hands-on activities in carbon storage and sequestration in forests and wetlands.
- Climate-Resilient Infrastructure: Building and evaluating climate-resilient structures using natural materials,
- Policy and Advocacy Workshop: Strategies for promoting NBS at local, regional, and national levels.

Module IV: NBS in Energy and Economy (15 hours)
- Renewable Energy Sources and Ecosystem Integration: Exploring the integration of renewable energy sources such as solar, wind, and biomass with natural ecosystems to enhance ecological benefits.
- Bioenergy and Biomass Production: Hands-on activities and field visits related to bioenergy and biomass production techniques through industrial visit
- Green Economy and Sustainable Finance: Understanding the principles of a green economy and exploring sustainable finance models.
- Case Studies: Analysis of real-world projects including solar, biomass, and wind energy projects with ecological benefits, as well as eco-tourism and sustainable business models.

Suggested Reading:
1. "Nature-Based Solutions to Climate Change Adaptation in Urban Areas: Linkages between Science, Policy and Practice" by Nadja Kabisch, Horst Korn, Jutta Stadler, and Aletta Bonn
2. "Ecosystem-Based Disaster Risk Reduction and Adaptation in Practice" by Fabrice G. Renaud, Karen Sudmeier-Rieux, Marisol Estrella
3. "The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations" edited by Pushpam Kumar

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H		M	
CO2	M	H		M
CO3	L			M
CO4			H	H

INTERNSHIP/APPRENTICESHIP/MINOR PROJECT

Semester	Category	Course Code	Course Name	Credits
2	Internship	BOIN110I	Internship	4
4	Internship	BOIN215I	Internship	4
5	Internship	BOIN317I	Internship	2

BOIN110I/ BOIN215I: INTERNSHIP (Exit of 1st Year or 2nd Year)
(4 CREDITS: 120 HOURS)

BOIN317I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)
(2 CREDITS-60 HOURS)

BOMP312P: MINOR PROJECT
(4 CREDITS-120 HOURS)

GUIDELINES FOR INTERNSHIP/APPRENTICESHIP/MINOR PROJECT

Internship/Apprenticeship/Minor project may be carried out in any reputed and recognized Institutions/Laboratories/Industries/Companies recommended/recognized by Assam Don Bosco University. A written permission for Internship/Apprenticeship/Minor project must be obtained from the Head of the Department/Registrar of the University. All interns will be under the mentorship of the department faculty members and co-mentored by any regular employee (Assistant Professor and above) of the Institutes where the student(s) is/are undergoing internship. All interns must abide by the rules and regulations of the host Institutions/Laboratories/Industries/Companies. After the completion of the Internship/Apprenticeship/Minor project, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in Letterhead clearing mentioning the starting and completion dates of Internship/Apprenticeship/Minor project. A report about the Internship/Apprenticeship/Minor project undertaken by the student will have to be submitted to the concerned department at the end of the Internship/Apprenticeship/Minor project.

Duration: Internship/Apprenticeship/Minor project will be of 8 weeks duration (during summer breaks).

Attendance: Co-mentors of the Institutions/Laboratories/Industries/Companies where the student is undergoing Internship/Apprenticeship/Minor project will have to maintain regular attendance records of the intern.

Assessment: Assessment would be carried out by the mentor and co-mentors based on the regularity of the student; submission of progress report followed by seminar presentation of the report.

Assessment criteria:

Sl no	Criteria	Weightage/Mark	Assessor/Members
1	Attendance	20% (20 marks)	Co-supervisor & supervisor
2	Internship/Project report submission	50% (50 marks)	Co-supervisor & supervisor
3	Seminar presentation of internship/project	30% (30 marks)	Panel constituted by the HoD
	Total marks	**100% (100 marks)**	

RESEARCH PROJECT /DISSERTATION

BSC BOTANY (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	BODI413P	Research Project Phase I	6
8	Research Project/Dissertation	BODI414P	Research Project Phase II	6
BSC BOTANY (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	BODI415P	Dissertation I	18
8	Research Project/Dissertation	BODI416P	Dissertation II	20

BSC BOTANY (Honours)

BODI413P: RESEARCH PROJECT PHASE I
(6 credits – 180 hours) (L-T-P: 0-0-12)

BODI414P: RESEARCH PROJECT PHASE II
(6 credits – 180 hours) (L-T-P: 0-0-12)

BSC BOTANY (Honours) with Research

BODI415P: DISSERTATION I
(18 Credits -540 Hours) (L-T-P: 0-0-36)

BODI416P: DISSERTATION II
(20 Credits -600 Hours) (L-T-P: 0-0-40)

GUIDELINES FOR RESEARCH PROJECT/DISSERTATION (7th and 8th semesters)

Research Project/Dissertation must be carried out in the department under the supervision of faculty members. In case of inter-disciplinary Research Project/Dissertation, a co-supervisor may be opted from within the school or from any other departments within the University for better quality data generation and results. If a student wants to carry out a portion of the Research Project/Dissertation in any Institutions/Laboratories/Industries/Companies outside the University, a written permission has to be obtained by the student from the appropriate authorities of the University. The student involved in the Research Project/Dissertation and Assam Don Bosco University would be the sole proprietor of any publications/patents/commercialization generated out of the Research Project/Dissertation works but due acknowledgement must be given to other faculties involved in the project from partner Departments/Institutions/Laboratories. All Research Project/Dissertation students must abide by the rules and regulations of the host Institutions/Laboratories/Industries/Companies. After the completion of the Research Project/Dissertation, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in letterhead clearing mentioning the starting and completion dates of Research Project/Dissertation. A detail report of the project/works carried out by the student will have to be submitted to the concerned department at the end of the project period.

Duration: Research Project/Dissertation will be carried out for 2 semesters (7^{th} and 8^{th} semester). Written permission from the University authorities must be obtained for extension of the Research Project/Dissertation if need arises.

Attendance: Faculty supervisor/Co-supervisor of the Institutions where the student is carrying out the Research Project/Dissertation will have to maintain regular attendance records of the student.

Assessment: Assessment: The B. Sc student undergoing research project/dissertation would be assessed by the Departmental Research Committee by conducting a progress report seminar. A final report will have to be submitted to the department/University.

Final assessment would be carried out at the end of 8th semester by the supervisor/Co-supervisor based on the regularity of the student and submission of regular progress reports. The student will have to submit a final Research Project/Dissertation thesis in proper formats to the Department, followed by seminar presentation of the project report. The final assessment may be conducted in the presence of an External examiner

.

Assessment criteria:

Sl no	Criteria	Weightage/Mark	Assessor/Members
1	Attendance	20% (20 marks)	Co-supervisor & supervisor
2	Internship/Project report submission	40% (40 marks)	Co-supervisor & supervisor
3	Seminar presentation of internship/project	40% (40 marks)	Panel constituted by the Departmental Research Committee. Minimum one external examiner will be part of the panel members
	Total marks	100% (100 marks)	

DEPARTMENT OF ZOOLOGY

PROGRAMME: BACHELOR OF SCIENCE in ZOOLOGY (BSC)

DEGREE: BSC ZOOLOGY (HONOURS)/ BSC ZOOLOGY (HONOURS) WITH RESEARCH

VISION:

- To develop the Department as an interdisciplinary centre for learning, research, and innovation
- To develop the Department into a hub of biodiversity research while making the surrounding a natural laboratory

MISSION:

- To provide a better understanding of Zoological Sciences through interaction with the natural environment and sensitizing the students about their social responsibilities
- To expose the learners to recent advances in Zoology and to provide high quality education with an emphasis on learning and research.

PROGRAM OUTCOMES (POs)

PO 1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study.

PO 2: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. Critically evaluate practices, policies and theories by following a scientific approach to knowledge development.

PO 3: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; communicate with others using appropriate media; confidently share one's views and express herself/ himself; demonstrate the ability to listen carefully; and present complex information in a clear and concise manner to different groups.

PO 4: Social Interaction: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 5: Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 6: Moral and Ethical Awareness: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 7: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO 8: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life- long learning in the broadest context of socio- technological changes. Critical sensibility to lived experiences, with self-awareness and reflexivity of both and society.

PO 9: Information and Digital Literacy: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 10: Research related skills: A sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause and affect relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Ability to apply one's learning to real life situations.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: Knowledge and Concept: Acquire detailed knowledge on the extensive diversity of organisms inhabiting varied ecological niches of the earth as well as understand the complexity of the various life-systems operating in these organisms.

PSO 2: Applying knowledge for self-sustenance: Build foundations for novel thinking through application-based studies such as sericulture and aquarium fish keeping, thus ensuring better opportunities for self-sustenance in future.

PSO 3: Skills in handling scientific instruments: Develop interest as well as proficiency in handling scientific instruments introduced as part of practical courses, thereby warranting all-around growth.

PSO 4: Conservation strategies: Recognize the importance of conservation and encourage designing effective strategies to address present conservation issues with preference to sustainable development.

MAPPING OF COURSES TO PO and PSO

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO110	PSO1	PSO2	PSO3	PSO4
ZGDN100T		L		L					L	H		L	H	H
ZGDN101L					L		L			H		M	H	
ZGAN104T		L				L		L		H		M		H
ZGAN105L							L		M	H		H		H
MDC 1				H	H	H	M				L	L		
ZGAC108L				L	L		L			H		H	M	H
ZGDC102T				L	L			L		H	H		M	H
ZGDC103L		L					L		M	H	M	H		H
ZGAD106T					L			L		H		H	M	H
ZGAD107L							L			H		H	M	H
MDC 2				H	H	H	M	L				H		L
ZGSC109L	H	L		L	M	H		H		H	H	H	H	M
ZGCB200T	M									M	H		M	
ZGCB201L	M									H	H		H	
ZGBS202T	H	H	H	M	H	H	H	H	H	M	H	H	H	H
ZGBS203L	H	H	M	L	H	H	H	H	H	H	H	H	H	M
ZGPH210T				L		L	H	M						M
ZGPH211L						L	H			H		H		L
MDC-3	M					L	H		L	H	H	H	M	H
ZGAK214L	H	H	M	M	H	H	H	H	H	H	H	H	H	H
ZGCC204T	H									M	H		M	
ZGCC205L	M									H	M		H	
ZGPE206T	H	M	L	L	M	M	H	L		H	H	H	H	H
ZGPE207L	H						H				H		H	H
ZGPG208T	H									M	H		M	
ZGPG209L	M									H	M		H	
ZGAZ212T	H	H		M			H	M		H	H			H
ZGAZ213L	H	H		M			H	M		H	H			H
ZGFB300T	M									H	H		M	
ZGFB301L	M									H	H		M	
ZGLS302T	M									H	H		M	
ZGLS303L	M									H	M		H	
ZGDB304T	M						M			H	H			
ZGDB305L	M						M			H	H			
ZGAY313T	H	H		M			H	M		H	H			H
ZGAY314L	H	H					H	M		H	H			H
ZGMB306T	M									H	H	M	H	
ZGMB307L	M									H	H	H	H	
ZGIM308T	H									H	H		M	
ZGIM309L	M									H	M		H	
ZGBT310T	M						H			H	H	H	H	
ZGBT311L	M						H			H	H	H	H	
ZGMP312P														
ZGPE315T	H	M	L	L	M	M	H	L		H	H	H	H	H
ZGPE316L	H						H					H	H	H
ZGEB400T						L	H			H		H		H
ZGEB401L						L	H			H		H		H
ZGEZ402T	H	H	M	M	H	H	M	H	H	M	H	H	M	M
ZGEZ403L	H	H	M	L	H	M	H	H	H	H	M	H	H	M
ZGAB408T	M						H			H	H	H	H	M
ZGAB409L	M						H			H	H	H	H	M
ZGRM410T	H	H	H	H	M	H	L	H	H	H	H	H	L	M
ZGCA404T		L		L						H	H	H	L	
ZGCA405L		L			L					H	H	H		

ZGMP406T	M									H	H		M	
ZGMP407L	M									H	M		H	
ZGWC411T				H	H	H				H	L			H
ZGWC412L				M	M	H				H	L			H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	ZGDN100T	Diversity of Non-Chordates	4 (3-0-1)
		ZGDN101L	Diversity of Non-Chordates Lab	
2	Major Course 2	ZGDC102T	Diversity of Chordates	4 (3-0-1)
		ZGDC103L	Diversity of Chordates Lab	
3	Major Course 3	ZGCB200T	Cell Biology	4 (3-0-1)
		ZGCB201L	Cell Biology Lab	
3	Major Course 4	ZGBS202T	Biosystematics	4 (3-0-1)
		ZGBS203L	Biosystematics Lab	
4	Major Course 5	ZGCC204T	Animal Physiology: Controlling and Coordinating System	5 (3-0-2)
		ZGCC205L	Animal Physiology: Controlling and Coordinating System Lab	
4	Major Course 6	ZGPE206T	Perspectives in Ecology	5 (3-0-2)
		ZGPE207L	Perspectives in Ecology Lab	
4	Major Course 7	ZGPG208T	Principles of Genetics	4 (3-0-1)
		ZGPG209L	Principles of Genetics	
5	Major Course 8	ZGFB300T	Fundamentals of Biochemistry	5 (3-0-2)
		ZGFB301L	Fundamentals of Biochemistry Lab	
5	Major Course 9	ZGLS302T	Animal Physiology: Life-Sustaining Systems	5 (3-0-2)
		ZGLS303L	Animal Physiology: Life-Sustaining Systems Lab	
5	Major Course 10	ZGDB304T	Developmental Biology	4 (3-0-1)
		ZGDB305L	Developmental Biology Lab	
6	Major Course 11	ZGMB306T	Molecular Biology	4 (3-0-1)
		ZGMB307L	Molecular Biology Lab	
6	Major Course 12	ZGIM308T	Immunology	4 (3-0-1)
		ZGIM309L	Immunology Lab	
6	Major Course 13	ZGBT310T	Biotechnology	4 (3-0-1)
		ZGBT311L	Biotechnology Lab	
6	Major Course 14	ZGMP312P	Minor Project	4
7	Major Course 15	ZGEB400T	Evolutionary Biology	5 (3-0-2)
		ZGEB401L	Evolutionary Biology Lab	
7	Major Course 16	ZGEZ402T	Economic Zoology	5 (3-0-2)
		ZGEZ403L	Economic Zoology Lab	
8	Major Course 17	ZGCA404T	Comparative Anatomy	5 (3-0-2)
		ZGCA405L	Comparative Anatomy Lab	
8	Major Course 18	ZGMP406T	Biochemistry of Metabolic Processes	5 (3-0-2)
		ZGMP407L	Biochemistry of Metabolic Processes Lab	

ZGDN100T: DIVERSITY OF NON-CHORDATES

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To know the general characters and classification of Non-chordates and understand the increasing complexity of body forms.

Course/ Learning Outcomes:

CO 1: Interpret the evolution of body cavity in non-Chordates. (Understanding)

CO 2: Illustrate the morphological structure different larval forms of important representative organisms belonging to these phyla. (Understanding)

CO 3: Identify the distinguishing characters of the pseudocoelomates and coelomates. (Applying)

CO 4: Distinguish the unique physiology of selected representative non-chordates. (Analyzing)

Module I: Protista, Parazoa and Metazoa (4 Hours)

General characteristics and Classification up to classes Study of Euglena, Amoeba and Paramecium Life cycle and pathogenicity of Plasmodium vivax and EntamoebaHistolytica.

Module II: Porifera (3 Hours)
General characteristics and Classification up to classes; Canal system and spicules in sponges

Module III: Cnidaria (4 Hours)
General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals and coral reefs.

Module IV: Ctenophora (2 Hours)
General characteristics and Classification up to Classes.

Module V: Platyhelminthes (4 Hours)
General characteristics and Classification up to classes. Life cycle and pathogenicity of Fasciola hepatica and Taeniasolium

Module VI: Nemathelminthes (4 Hours)
General characteristics and Classification up to classes. Life cycle, and pathogenicity of Ascarislumbricoides and Wuchereriabancrofti.

Module VII: Annelida (4 Hours)
General characteristics and Classification up to classes. Reproduction, Regeneration and Locomotion of Annelida.

Module VIII: Arthropoda (4 Hours)
General characteristics and Classification up to classes. Metamorphosis in Insects; Social life in bees and termites.

Module IX: Onychophora (4 Hours)
General characteristics and Classification up to classes.

Module X: Mollusca (4 Hours)
General characteristics and Classification up to classes, Pearl formation in bivalves; Trochophore larva.

Module XI: Echinodermata (4 Hours)
General characteristics and Classification up to classes, Water-vascular system in Asteroidea, Larval forms in Echinodermata

Module XII: Hemichordata (4 Hours)
General characteristics and classification of Hemichordata up to classes; Study of Balanoglossus.

Note: Classification to be followed from "Ruppert and Barnes (2006) Invertebrate Zoology, 8th edition, Holt Saunders International Edition" CBCS Undergraduate Program in Zoology 2015

Suggested Readings

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
2. Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

Mapping of COs to Syllabus

Course Outcomes	M-I	M-II	M-III	M -IV	M-V	M-VI	M-VII	M-VIII	M-IX	M-X	M-XI	M-XII
CO 1	M			M			H			M	L	L
CO 2	H	H	H	H	H	H		H	H	H	M	M
CO 3	L				L	L			L		H	M
CO 4	H				H				M		M	H

ZGDN101L: DIVERSITY OF NON-CHORDATES LAB

(1 Credits: 30 Hours) (L-T-P: 0-0-1)

Objectives

To know the general characters and classification of Non-chordates and understand the increasing complexity of body forms by doing practical and at field level.

Course/ Learning Outcomes:

CO 1: Examine and investigate different species of non-chordate (Analyzing).
CO 2: Examine various systems of non-chordate species (Analyzing).
CO 3: Differentiate different parts of body thorough prepared slides (Analyzing).
CO 4: Design a project forany related topic (Creating).

Syllabus:

1. Study of whole mount of Euglena, Amoeba and Paramecium
2. Study of the following Specimens- Porifera: *Sycon* (T.S. and L.S.), *Hyalonema, Euplectella, Spongilla;*Cnidaria: *Obelia, Physalia, Millepora, Aurelia, Tubipora, Gorgonia, Metridium, Pennatula, Fungia,*Ctenophora: *Pleurobrachia, Ctenoplana*; Platyhelminthes: *Fasciola hepatica, Taeniasolium*; Nemathelminthes: *Ascarislumbrecoides;* Annlida- *Aphrodite, Nereis, Heteronereis, Pheretima, Hirudinaria;* Arthropoda: *Limulus, Palamnaeus, Palaemon, Daphnia, Philosamia, Periplaneta, Termites and honey bees;* Onychophora-*Peripatus,* Molluscs - *Chiton, Dentalium, Pila, Unio,Sepia,Octopus,Nautilus;* Echinodermates-*Asterias,Ophiura,Echinus,Cucumaria;* Hemichordata- *Balanoglossus*
3. Examination of pond water collected from different places for diversity in protists
4. Dissection of the mouth parts of Cockroach
5. Dissection of digestive system of Coackroach

Suggested Readings

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
2. Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

Mapping of COs to Syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
CO 1	H				
CO 2		H		H	
CO 3			H		
CO 4					H

ZGDC102T: DIVERSITY OF CHORDATES

(3 Credits: 45 Hours)(L-T-P:3-0-0)

Objective(s)

To know the Diversity of Chordata from lower to higher Chordates and their geographical distribution

Course/ Learning Outcomes

Understand the origin and evolution of the phylum Chordata. (Understanding)

CO 1: Distinguish the unique characteristics as well as life functions of different chordate subphylum. (Analyzing)

CO 2: Evaluate the varied morphological, anatomical and physiological complexity in selected chordate organisms. (Evaluating)

CO 3: Analyze the various theories of animal distribution and their geographical realms. (Analyzing)

Module I: Introduction to Chordates (8 Hours)

General characteristics and outline classification

Module II: Protochordata (8 Hours)

General characteristics of Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

ModuleIII: Origin of Chordata (3 Hours)

Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

Module IV: Agnatha (2 Hours)

General characteristics and classification of cyclostomes up to class

Module V: Pisces (8 Hours)

General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes

Module VI: Amphibia (8 Hours)

Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians

Module VII: Reptilia (7 Hours)

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes

Module VIII: Aves (8 Hours)
General characteristics and classification up to order Archaeopteryx- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds

Module IX: Mammals (8 Hours)
General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Suggested readings

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition.Jones and Bartlett Publishers Inc.
5. T.C. Majupuria. Introduction to Chordates, Pradeep Publicartions.
6. Veerbala Rastogi. Vertebrate Zoology, Kedar Nath Ram Nath Publications

Mapping of Cos to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX
CO 1	M	L	M	L					
CO 2		H		H	H	H	H	H	H
CO 3				H	H	H	H	H	H
CO 4	M								

ZGDC103L: DIVERSITY OF CHORDATES LAB

(1 Credits: 30 hours) (L-T-P: 0-0-1)

Objective(s)
To demonstrate the different Chordates from lower to higher Chordates with help of the laboratory specimen.

Course/ Learning Outcomes:
CO 1: Identify distinguishing characteristics of representative museum specimens belonging to different phyla. (Applying)
CO 2: Determine their affinities and evolutionary relationships. (Evaluating)
CO 3: Examine specific organ structures through dissections. (Analyzing)
CO 4: To compare the anatomical structure of different vertebrates. (Applying)

Syllabus
1. Protochordata: Herdmania, Branchiostoma, Colonial UrochordataSections of Balanoglossus through proboscis and branchiogenital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmania spicules
2. Agnatha: Petromyzon, Myxine
3. Pieces: Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish
4. Amphibia: Ichthyophis/Uraeotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra
5. Reptilia: Chelone, Trionyx, Hemidactylus, Varanus, Uromastyx, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus Key for Identification of poisonous and non-poisonous snakes
6. Aves: Study of six common birds from different orders. Types of beaks and claws
7. Mammalia: Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous. Mount of weberian ossicles of Mystus, pecten from Fowl head Dissection of Fowl head (Dissections and mounts subject to permission) Powerpoint presentation on study of any two animalsfrom two different classes by students (may be included if dissections not given permission

Suggested readings

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition.Jones and Bartlett Publishers Inc.
5. T.C. Majupuria. Introduction to Chordates, Pradeep Publicartions.
6. Veerbala Rastogi. Vertebrate Zoology, Kedar Nath Ram Nath Publication

Mapping of Cos to syllabus

Course Outcomes	M 1	2	3	4	5	6	7
CO 1	H	H	H	H	H	H	H
CO 2	M	M	M	M	M	M	M
CO 3							**H**

ZGCB200T: CELL BIOLOGY

(3 credits: 45 Hours)(L-T-P: 3-0-0)

Objective(s)

To appreciate how cell the structural & functional unit of life works.

Course/ Learning Outcomes:

CO 1: Define the composition and function of membrane structure; cytoskeleton and their role in affecting cell shape, function and movement (Remembering).

CO 2: Distinguish the different cell types viz prokaryotes, eukaryotes and infectious agents viz. virus, viroids, prions & mycoplasma. (Understanding)

CO 3: Evaluate the complexity and interaction of the varied organelles, including endoplasmic reticulum, golgi apparatus, mitochondria, nucleus and peroxisomes (Evaluating).

CO 4: Analyze the importance of nucleus in cell division and signaling (Analyzing).

Module I: Overview of Cells (4 Hours)

Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions

Module II: Plasma Membrane (6 Hours)

Models of plasma membrane structure; Transport across membranes: Active and Passive transport, Facilitated transport; Cell junctions: Tight junctions, Desmosomes, Gap junctions

Module III: Endomembrane System (6 Hours)

Structure and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes

Module IV: Mitochondria and Peroxisomes (7 Hours)

Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis Peroxisomes

Module V: Cytoskeleton (5 Hours)

Structure and Functions: Microtubules, Microfilaments and Intermediate filaments

Module VI: Nucleus (7Hours)

Structure of Nucleus: Nuclear envelope, nuclear pore complex, Nucleolus Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome)

Module VII: Cell Division (7 Hours)

Mitosis, Meiosis, Cell cycle and its regulation

Module VIII: Cell Signaling (3 Hours)

GPCR and Role of second messenger (cAMP)

Suggested Readings

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson
6. James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc. New York and London.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	ModuleVI	Module VII	Module VIII
CO 1		H			H			
CO 2	H							
CO 3			H	H		H		
CO 4						M	H	H

ZGCB201L: CELL BIOLOGY LAB

(2 Credits: 60 Hours) (L-T-P:0-0-2)

Objective(s)

To visualised and learn the dynamics of intracellular components of cell while undergoing several vital functions including cell division.

Course/ Learning Outcomes:

CO 1: Create the temporary stained slides of different stages of cell division. (Creating)
CO 2: Investigate various stages of meiotic cell division. (Analyzing)
CO 3: Create the permanent slides to investigate various structural components inside the cell. (Analyzing)
CO 4: CO4: Create temporary slides to demonstrate Barr body.(Evaluating)

Syllabus

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis
2. Study of various stages of meiosis.
3. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.
4. Preparation of permanent slide to demonstrate:
   I. DNA by Feulgen reaction
   II. DNA and RNA by MGP
   III. Mucopolysaccharides by PAS reaction
   IV. Proteins by Mercurobromophenol blue/Fast Green

Suggested Readings

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

Mapping of COs to Syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4
CO 1	H			
CO 2		H		
CO 3				H
CO4			H	

ZGBS202T: BIOSYSTEMATICS

(3 Credits -45 Hours) (L-T-P: 3-0-0)

Objective(s):

- *To acquaint the student with different taxonomic procedures and its application in faunal identification.*
- *To enable the students to identify, classify and name the organisms according to international code of zoological nomenclature.*

Course/ Learning Outcomes:

CO 1: Explain the concept of Biosystematics, Taxonomy and Species. (Understanding)
CO 2: Apply Taxonomy to solve the species problem and construction of a phylogenetic tree. (Applying and Creating)

CO 3: Identify species on the basis of taxonomic keys and utilize the nomenclature codes. (Applying)
CO 4: Apply the techniques of specimen collection and preservation. (Applying)

Module I: Science of Biosystematics (8 hours)
Concept of Biosystematics, Terms used in systematic biology, Historical review of taxonomic philosophies, Future of taxonomic studies, stages of taxonomy, Tasks of taxonomist, Systematics as a profession, Significance of taxonomy.

Module II: Concept of Species (8 hours)
Historical perspective of species concept (Typological, Biological, Nominalistic, Evolutionary & recognition), Difficulties in the application of different species concepts; Kinds of species – sibling, sympatric, allopatric, syntopic, ring species, polytypic and monotypic species; Intraspecific groups (variety, morphs, subspecies, temporal subspecies, race and clines).

Module III: Classification and Phylogenetic analysis (8 hours)
Taxonomic Classification; components, procedure (phenetic & cladistic), and presentation of classification (Linnaean/ Taxonomic hierarchy); Ways of constructing a phylogenetic tree. Phylogenetic analysis – Purpose, terminology, methods of phylogenetic analysis (phenetic method, dendogram method, pairwise distance; Cladistic method, parsimony, maximum likelihood); phylogenetic lineage

Module IV: Taxonomical publications & Techniques (8 hours)
Taxonomic collection – Purpose, value, scope of collection, content of collection, significance of museum collection, legal aspects of collecting animals, post collection processes.
Techniques of preservation – Methods, taxidermy, plastination, factors responsible for the deterioration of museum specimens.
Curating of collection – museum collection policy, preparation of material of study, housing and cataloging, exchangeable and expendable materials and loans.
Identification – Systematic process of sorting and labeling, procedure of identification of species.

Module V: Recent trends in modern taxonomy (7 hours)
Different approaches of taxonomy viz. Morphotaxonomy, Cytotaxonomy, Chemotaxonomy, Numerical taxonomy, Molecular taxonomy etc.

Module VI: Application of Zoological Nomenclature (6 hours)
Taxonomic keys – types and their significance; taxonomic publication – types and procedures; Nomenclature (Bionomial and Trinomial Nomenclature); International code of Zoological Nomenclature (ICZN) and its recent amendments; Process of typification and Zoological types.

Suggested Readings
1. Blackwelder, R.E. (1967): Taxonomy. John Willey & Sons Inc., New York.
2. Dalela, R.C. & Sharma, R.S. (2017): Animal taxonomy and Museology, Jai Prashnath & company.
3. Kapoor V.C. (1998): Principles and Practice of Animal Taxonomy. Science Publisher
a. Kapoor, V.C (2008): Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co. Pvt Ltd
4. Mayer, E. (1991): Principles of Systematic Zoology. Tata Mc Graw Hill Publishing Co. Ltd., USA: New Delhi
5. Quicke, D.L.J. (1992): Principles and techniques of Contemporary taxonomy. Blackie Academic and Professional, London
6. Simpson, G. G. (2012): Principle of animal taxonomy. Scientific Publisher (India)
7. Tripathi, R.C.: Biosystematics and Taxonomy, University Book House, Jaipur.
8. Verma, A. (2015): Principles of Animal Taxonomy, Alpha Science International Ltd, Delhi.

Online Tools and Web Resources:
1. Animal Diversity (https://swayam.gov.in/courses/5686-animal-diversity), Advances in Animal diversity, Systematics and Evolution (https://swayam.gov.in/courses/5300-zoology) Swayam (MHRD) Portal
2. ePG Pathshala (MHRD) Module 184 of the paper on taxonomy (https://epgp.inflibnet.ac.in/ahl.php?csrno=35)
3. International Commission on Zoological Nomenclature (https://www.iczn.org/the-code/the-code-online/)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H					
CO2		H	H			H
CO3						
CO4				H		

ZGBS203L: BIOSYSTEMATICS LAB

(1 Credits -30 Hours) (L-T-P: 0-0-1)

Objective(s):

- *To develop the student on skill of taxonomic identification, classification and nomenclature of fauna.*
- *To acquaint the student on skill of taxonomic sampling and preservation, and analysis through construction of taxonomic keys and phylogenetic tree.*

Course/ Learning Outcomes:

CO 1: Apply the morphometric study and identify different animals. (Applying)
CO 2: Develop the systematic position of different animals. (Applying)
CO 3: Compare various techniques of taxonomic sampling and preservation techniques. (Understanding)
CO 4: Construct taxonomic keys and phylogenetic trees of known species. (Applying)

Syllabus:

1. Recent classification of animals with the help of museum specimens.
2. Identification of animal species with the help of taxonomic keys (identification up to order).
3. Demonstrate the methods of Taxonomic collection and preservations in various taxa.
4. Construction of different types of Taxonomic keys for the identification of animals.
5. Biosystematic position of specimens: 1. Phylum Protozoa to Echinodermata; 2. Cyclostomata to mammals.
6. Morphometric measurements of some locally available fish/ frog.
7. Construction of phylogenetic trees of groups of known species from the museum specimens.

Mapping of COs to Syllabus:

Course Outcomes	CO 1	CO 2	CO 3	CO 4
E1	H			
E2		H		
E3			H	
E4				H
E5		H		
E6	H			
E7				H

ZGCC204T: ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

(3 CREDITS: 45 HOURS) (L-T-P: 3- 0-0)

Objective(s)

To understand the high degree of control and coordination in complex multicellular organism through nervous, endocrine regulation which in turn also help to achieved vital functions like reproduction.

Course/ Learning Outcomes:

CO 1: Define the structure and function of different animal tissues, and the endocrine glands. (Understanding)
CO 2: Distinguish the unique physiological aspects at both the cellular and system levels. (Analyzing)
CO 3: Assess the complexity and co-ordination exhibited by the nervous, muscle and reproductive system. (Evaluating)
CO 4: Compare the histological intricacy of the endocrine glands, their mechanism of action and the coordination demonstrated by the neuroendocrine system. (Analysing)

Module I: Tissues (4 Hours)

Structure, location, classification and functions of epithelial tissue, connective tissue, muscular Tissue and nervous tissue

Module II: Bone and Cartilage (4 Hours)

Structure and types of bones and cartilages, Ossification, bone growth and resorption

Module III: Nervous System (7 Hours)

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc; Physiology of hearing and vision.

Module IV: Muscle (8 Hours)

Histology of different types of muscles; Ultrastructure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and muscle tetany.

Module V: Reproductive System (9 Hours)
Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female

Module VI: Endocrine System (13 Hours)
Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Regulation of their secretion; Mode of hormone action, Signal transduction pathways for steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones.

Suggested Readings:

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
3. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII
4. Edition. Lippincott W. & Wilkins.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1		H			H			
CO 2	H							
CO 3			H	H		H		
CO 4						M	H	H

ZGCC205L: ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS LAB

(2 Credits: 60 Hours) (L-T- P: 0-0-2)

Objective(s)
To visualized the structural architecture of cells, tissues that forms various vital organs, glands etc. which in turn will help understanding their functions.

Course/ Learning Outcomes:
CO 1: Estimate specific physiological functions of muscle tissues (Applying)
CO 2: Compare structural organization of various tissue through temporary and permanent slides. (Evaluating)
CO 3: Utilize the process of microtomy to visualize histological structures in different mammalian tissues. (Applying)
CO 4: Elaborate how neural activity responsible for condition and unconditioned reflex works (Understanding)

Syllabus:
1. *Recording of simple muscle twitch with electrical stimulation (or Virtual)
2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells
4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell,
5. Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
6. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues
   (*Subject to UGC guidelines)

Mapping of Cos to Syllabus

Course Outcomes	Experiment1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
CO 1	H				H
CO 2		H			
CO 3				H	
CO4			H		

ZGPE206T: PERSPECTIVES IN ECOLOGY

(3 Credits: 45 Hours; L-T-P: 3-0-0)

Objective(s)
To understand concepts and the Principles in ecology and wildlife management

Course Outcomes:
CO 1: Distinguish the mechanism of various biological interactions (Understanding).

CO 2: Analyze different population dynamics and interactions (Analysing).
CO 3: Evaluate ecosystem energetics with reference to food chain, food web (Evaluating).
CO 4: Apply conservation and management strategies for local endangered species (Applying)

Module I: Introduction to Ecology (3 Hours)
History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Module II: Population (20 Hours)
Unitary and Modular populations Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors Population interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical responses

Module III: Community (10 Hours)
Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example Theories pertaining to climax community

Module IV: Ecosystem (10 Hours)
Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with one example of Nitrogen cycle Human modified ecosystem

Module V: Applied Ecology (2 Hours)
Ecology in Wildlife Conservation and Management

Suggested Readings:
1. Colinvaux, P. A. (1993). Ecology.II Edition. Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology.VI Edition. Benjamin Cummings.
3. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Robert Leo Smith Ecology and field biology Harper and Row publisher
5. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	M	E	
CO2		H	M	M	
CO3		E	H		
CO4			E		H

ZGPE207L: PERSPECTIVES IN ECOLOGY LAB

(2 Credit: 60 Hours) (L-T-P: 0-0-2)

Objective(s)
To gain knowledge and understand about the status and the diversity of the different ecosystem

Course Outcomes:
CO 1: Investigate life tables and survivorship curves of different types (Analyzing).
CO 2: Estimate and analyse different population dynamics and interactions (Analyzing).
CO 3: Evaluate the aquatic ecosystem (Evaluating).
CO 4: Design a project for any related topic (Creating).

Syllabus
1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon- Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO2, alkalinity and hardness of water
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

SUGGESTED READINGS
1. Colinvaux, P. A. (1993). Ecology.II Edition.Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology.VI Edition. Benjamin Cummings.

3. Odum, E.P., (2008). Fundamentals of Ecology.Indian Edition. Brooks/Cole
4. Robert Leo Smith Ecology and field biology Harper and Row publisher
5. Ricklefs, R.E., (2000). Ecology.V Edition. Chiron Pres

Mapping of COs to Syllabus

Course Outcomes	Experiment I	Experiment II	Experiment III	Experiment IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

ZGPG208T: PRINCIPLES OF GENETICS

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To understand how characters or traits are being inherited in a wide range of organisms & to appreciate how even the minute changes in hereditary material can bring about variation, thereby enriching diversity.

Course outcomes:

CO 1: Define the concept of genes, genomics and inheritance with special reference to Mendelian heredity and inheritance. (Remembering)
CO 2: Describe the mechanism of linkage and crossing-over with models of recombination in prokaryotes, eukaryotes and viruses. (Understanding)
CO 3: Illustrate the different types of mutations and their molecular mechanisms. (Understanding)
CO 4: Analyze and interpret the diverse inheritance patterns. Compare the methods of generation of transposons in bacteria, drosophila, maize and humans. (Understanding, Analyzing)

Module I: Mendelian Genetics and its Extension (6 Hours)

Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex-influenced and sex-limited characters inheritance.

Module II: Linkage, Crossing Over and Chromosomal Mapping (8 Hours)

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.

Module III: Mutations (8 Hours)

Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB methods, attached X method.

Module IV: Sex Determination (4 Hours)

Chromosomal mechanisms of sex determination in Drosophila and Man

Module V: Extra-chromosomal Inheritance (4 Hours)

Criteria for extra-chromosomal inheritance, Mitochondrial mutations in Saccharomyces, Infective heredity in Paramecium and Maternal effects

Module VI: Polygenic Inheritance (3 Hours)

Polygenic inheritance with suitable examples; simple numerical based on it.

Module VII : Recombination in Bacteria and Viruses (7 Hours)

Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

Module VIII: Transposable Genetic Elements (5 Hours)

Transposons in bacteria, Ac-Ds elements in maize and P elements in Drosophila, Transposons in humans

Suggested Readings:

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles ofGenetics. VIII Edition. Wiley India
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. VEdition. John Wiley and Sons Inc
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings

4. Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition Benjamin Cummings
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co
6. Fletcher H. and Hickey I. (2015). Genetics. IV Edition. GS, Taylor and Francis Group, New York and London.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1	H	M				M		
CO 2		H						
CO 3			H		M			
CO 4	H			H	H	H	H	H

ZGPG209L: PRINCIPLES OF GENETICS LAB

(1 Credits: 30 Hours) (L-T-P: 0-0-1)

Objective(s)

To appreciate the use of genetic experimental data in explaining some of the key concepts of genetics viz. linkage map construction, gene interactions as well as analysis of inheritance pattern of certain human trait.

Course Outcomes:

CO 1: Explain the laws of Inheritance. (Evaluating)
CO 2: Analyze organisms trait using Chi Square test. (Analyzing)
CO 3: Construct linkage maps and human karyotype (Applying)
CO 4: Constructing and analyzing pedigree for inherited traits. (Applying)

Syllabus:

1. To study the Mendelian laws and gene interactions.
2. To study the traits using Chi-square analyses [seeds/beads/Drosophila].
3. Linkage maps based on data from conjugation, transformation and transduction.
4. Linkage maps based on data from Drosophila crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.

Suggested Readings:

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles ofGenetics. VIII Edition. Wiley India
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. VEdition. John Wiley and Sons Inc
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings
4. Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition Benjamin Cummings
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co

Mapping of Cos to Syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5	Experiment 6
CO 1	H					
CO 2		H				
CO 3			H	H	H	
CO 4						H

ZGFB300T: FUNDAMENTALS OF BIOCHEMISTRY

(3 CREDITS; 45 HRS) (L-T-P: 3-0-0)

Objective(s)

To acquire knowledge on the building blocks of life and their significance

Course Outcomes:

CO 1: Define the structural and functional aspects of different biomolecules.(understanding)
CO 2: Describe and draw the chemical structures of different biomolecules.(understanding)
CO 3: Evaluate their inter-relationship as evident in the living system.(evaluating)

CO 4: Analyze the mechanism and regulation of enzyme action and their kinetics with reference to bi-substrate, multi-substrate and allosteric enzymatic reactions.(analysing)

Module I: Carbohydrates (5 Hours)
Structure and Biological importance: Monosaccharides, Disaccharides,

Module II: Lipids (6 Hours)
Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids

Module III: Proteins (10 Hours)
Amino acids: Structure, Classification and General properties of α-amino acids; Physiological importance of essential and non-essential α-amino acids Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation of protein

Module IV: Nucleic Acids (12 Hours)
Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic Denaturation and Renaturation of DNA Types of DNA and RNA

Module V: Enzymes (12 Hours)
Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of Km and Vmax

SUGGESTED READING

1. Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
5. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO 2	M	M	M	M	
CO 3				H	H
CO 4				M	H

ZGFB301L: FUNDAMENTALS OF BIOCHEMISTRY LAB

(2 CREDIT: 60 HOURS) (L-T-P: 0-0-2)

Objective(s)
To learn different estimation techniques of biological molecules

Course Outcomes
CO 1: Estimate biochemical functional groups of different macromolecules. (Evaluating)
CO 2: Develop chromatography skills for separation of amino acids (Evaluating)
CO 3: Determine the enzyme kinetics of given enzyme: salivary amylase. (Evaluating)
CO 4: Learn basic laboratory techniques like buffer preparation, solutions and working of instruments (learning)

Syllabus:
1. Study of working principles of different laboratory instruments
2. Preparation of Buffers: phosphate and citrate
3. Preparation of normal and molar solutions
4. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
5. Paper chromatography of amino acids.
6. Effect of Different Temperatures, pH on the Activity of Salivary Amylase on Starch.

Suggested readings:

1. S. Chaykin (1966), Biochemistry Laboratory Techniques, 169 pages. John Wiley & Sons Inc., blew York.

2. S. Sadasivam (1996) . Biochemical MethodsEdition, revised ; Publisher, New Age International, ISBN, 8122409768
3. Geetha K Damodaran (2010). Practical Biochemistry. Jaypee Brothers Medical Publishers Pvt. Limited

Mapping of CO's to syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6
CO 1				H	M	
CO 2					H	
CO 3						H
CO 4	H	H	H	M		

ZGLS302T: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

(3 CREDITS: 45 HOURS) (L-T-P: 3-0-0)

Objectives

To understand how vital metabolic activities like digestion, respiration, excretion, circulation of blood which responsible for life sustenance works.

Course Outcomes:

CO 1: Define the organ systems responsible for maintaining a balanced physiological functioning of the mammalian body (Remembering)
CO 2: Summarize the structure and function of the gastrointestinal tract, the lungs, the kidneys, the heart and other related organs (Understanding)
CO 3: Determine basic blood parameters as a measure of a vigorous physiological system; evaluate the effects of organ systems compromised due to infection, disease or injury (Evaluating)
CO 4: Correlate the inter-relationship of these organ systems to maintain a stable homeostasis in the body (Understanding)

Module I: Physiology of Digestion (9 Hours)

Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Module II: Physiology of Respiration (9 Hours)

Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it; Carbon monoxide poisoning; Control of respiration

Module III: Renal Physiology (9 Hours)

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance

Module IV: Blood (9 Hours)

Components of blood and their functions; Structure and functions of haemoglobin, Haemostasis: Blood clotting system, Kallikrein- Kininogen system, Complement system Fibrinolytic system, Haematopoiesis Blood groups: Rh factor, ABO and MN

Module V: Physiology of Heart (9 Hours)

Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, Frank-Starling Law of the heart, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation

Suggested Readings:

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
3. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
4. Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills
5. https://onlinecourses.nptel.ac.in/noc20_bt42/preview

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M	M		H	H
CO 2	H		H		H
CO 3				H	
CO 4		H	M	M	M

ZGLS303L: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS LAB

(2 CREDITS: 60 Hours) (L-T-P: 0-0-2)

Objective(s)

To appreciate the concept and skill set required for measurement or analysis of certain physiological parameters viz. RBC count WBC count, haemoglobin % etc. which can reflect health status of the individual.

Course Outcomes:

CO 1: Develop skills to determine basic blood parameters as a measure of a vigorous physiological system (Applying)
CO 2: Examine the anatomy of various internal organs. (Analyzing)
CO 3: Determine the percentage of haemoglobin in blood. (Applying)
CO 4: Illustrate the presence of haemoglobin in RBC through preparation of haemin crystal. (Analyzing)

Syllabus

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin and haemochromogen crystals
5. Recording of frog's heart beat under in situ and perfused conditions*
6. Recording of blood pressure using a sphygmomanometer
7. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum liver, trachea, lung, kidney (*Subject to UGC guidelines)

Suggested Readings:

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
3. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
4. Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

Mapping of COs to Syllabus:

Course Outcomes	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp. 6	Exp. 7
CO 1	H	H			M	H	
CO 2							H
CO 3			H				
CO 4				H			

ZGDB304T: DEVELOPMENTAL BIOLOGY

(3 CREDITS: 45 HOURS) (L-T-P: 3-0-0)

Objective(s)

To understand the developmental process of different organism and their gradual evolution

Course Outcomes:

CO 1: Understand the mechanisms underlying the process of development (Understanding)
CO 2: To determine the evolutionary history of living species inferred through the phylogenetic molecular and morphological information using models. (Evaluating)
CO 3: Correlate the effects of different natural and artificial factors leading to developmental anomalies or congenital defects in humans.(Analyzing)
CO 4: Interpret the different stages of development of frog, chick and culture preparation of Drosophila. (Analyzing)

Module 1: Introduction (4 Hours)
Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation,

Module 2: Early Embryonic Development (20 Hours)
Gametogenesis: Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula; Fate maps

Module 3: Late Embryonic Development (6 Hours)
Early development of frog and chick up to gastrulation; Embryonic induction and organizers
Fate of Germ Layers; Extra-embryonic membranes in birds; Placenta (Structure, types and functions of placenta)

Module 4: Post Embryonic Development (10 Hours)
Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, Role of maternal genes in development

Module 5: Implications of Developmental Biology (5 Hours)
Teratogenesis: Teratogenic agents and their effects on embryonic development; In vitro fertilization, Stem cell (ESC), Amniocentesis

Suggested Readings:
1. Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
2. Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press
3. Carlson, R. F. Patten's Foundations of Embryology
4. Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers
5. Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press

Mapping of CO's to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H		
CO 2			M		
CO 3				H	H
CO 4				M	

ZGDB305L: DEVELOPMENTAL BIOLOGY LAB

(1 CREDIT: 30 HOURS) (L-T-P: 0-0-1)

Objective(s)
To gather hands on knowledge on different developmental process

Course outcomes:
CO 1: To demonstrate the mechanisms underlying the process of development. (Understanding).
CO 2: To explain different histological structure of placenta. (Understanding)
CO 3: To prepare drosophila culture media or make a proper environment to study the chick embryo development. (Creating)
CO 4: To apply the knowledge of developmental biology in different fields (Applying)

Syllabus:
1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
3. Study of the developmental stages and life cycle of Drosophila from stock culture
4. Study of different histological structures of placenta (photomicropgraph/ slides)
5. Study of different types of eggs : chicken, lizard, insect, frog
6. Study of chick embryo by vital staining method
7. Phylogenetic tree construction to study the development of animal germinal layers

Suggested Readings:
1. Marí-Beffa, M., & Knight, J. (Eds.). (2005). Key Experiments in Practical Developmental Biology. Cambridge: Cambridge University Press.
2. Gibbs, Melissa A. A practical guide to developmental biology(2003) Oxford ; New York : Oxford University Press
3. Gilbert, S. F. (2010). Developmental Biology, IX Edition, SinauerAssociates,Inc., Publishers, Sunderland, Massachusetts, USA

Mapping of CO's to syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
1	H	H		M	M	M	M
2			H				
3				H			
4				M	H	H	H

ZGMB306T: MOLECULAR BIOLOGY

(3 CREDITS: 45 HOURS) (L-T-P: 3-0-0)

Objective(s)

To understand the biology of organisms at molecular, nucleic acid level and acquire knowledge on their modification and mechanism of action

Course Outcomes:

CO 1: Define the molecular structure of DNA and RNA (Understanding)
CO 2: Describe the mechanism of DNA replication of both linear and circular DNA as well as protein synthesis including transcription and translation in both prokaryotes and eukaryotes. (Understanding)
CO 3: Illustrate the post-translational modifications and processing of eukaryotic mRNA and prokaryotic and eukaryotic gene regulation. (Analyzing)
CO 4: Distinguish the different DNA repair mechanisms with their significance. (Analyzing)

Module I: Nucleic Acids (4 Hours)

Salient features of DNA and RNA Watson and Crick model of DNA and molecular structure of DNA

Module II: DNA Replication (8 Hours)

DNA Replication in prokaryotes and eukaryotes, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres

Module III: Transcription and Translation (12 Hours)

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes, Difference between prokaryotic and eukaryotic translation

Module 4: Post Transcriptional Modifications and Processing of Eukaryotic RNA (8 Hours)

Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Module 5: Gene Regulation (8 Hours)

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements

Module 6: DNA Repair Mechanisms (5 Hours)

Pyrimidine dimerization and mismatch repair Regulatory RNAs 3 Ribo-switches, RNA interference, miRNA, siRNA

Suggested Readings:

1. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts,• Peter Walter: Molecular Biology of the Cell, IV Edition.
3. Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, VEdition, ASM Press and Sinauer Associates.
4. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and MolecularBiology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
5. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
6. Lewin B. (2008). Gene XI, Jones and Bartlett
7. McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV Edition. GS, Taylor and Francis Group, New York and London.

Mapping of CO's to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M		M	M	M

CO 2	H	H	H			
CO 3			H	H	H	
CO 4				H	H	H

ZGMB307L: MOLECULAR BIOLOGY LAB

(1 CREDIT: 30 HOURS) (L-T-P: 0-0-1)

Objective(s)

To learn the usage of different analytical tools and techniques

Course Outcome:

CO 1: Explain the structure of chromosome. (Understanding)
CO 2: Preparation and analysis of different growth medium. (Creating)
CO 3: Estimation of DNA and RNA using different analytical tools. (Evaluating)
CO 4: Interpret the micrographs of DNA replication and spilt genes. (Understanding)

Syllabus:

1. Study of Polytene chromosomes from Chironomous / Drosophila larvae
2. Preparation of liquid culture medium (LB) and raise culture of E. coli
3. Estimation of the growth kinetics of E. coli by turbidity method
4. Preparation of solid culture medium (LB) and growth of E. coli by spreading and streaking
5. Demonstration of antibiotic sensitivity/resistance of E. coli to antibiotic pressure and interpretation of results
6. Quantitative estimation of DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A260 measurement)
7. Quantitative estimation of RNA using Orcinol reaction Isolation of gDNA
8. Agarose gel electrophoresis of sample DNA
9. RNA purification from blood using TriZol
10. Study and interpretation of electron micrographs/ photograph showing (a) DNA replication (b) Transcription (c) Split genes

Suggested readings:

1. Robert F. Schleif , Pieter C. Wensink (1981). Practical Methods in Molecular Biology
2. Paddock SW (ed) (1999) Methods in Molecular Biology, vol 122: Confocal Microscopy Methods and Protocols. Totowa, NJ: Humana Press.
3. Celis JE (ed) (1998) Cell Biology: A Laboratory Handbook, 2nd edn. San Diego: Academic Press.

Mapping of CO's to syllabus

Course Outcomes	Expt 1	Expt 2	Expt 3	Expt 4	Expt 5	Expt 6	Expt 7	Expt 8	Expt 9	Expt 10
CO 1	H				M					
CO 2		H	H	H						
CO 3			H	H	H	H	H	H	H	
CO 4				H	H					H

ZGIM308T: IMMUNOLOGY

(3 CREDITS; 45 HRS) (L-T-P: 3-0-0)

Objecive(s)

To understand and appreciate the intricate and robust mechanism by which components of innate and adaptive immunity works to neutralized, killed or eliminate the pathogens or their products.

Course Outcomes:

CO 1: Define the basic concepts of immunology and distinguish the two important facets of immunity, innate and adaptive; how different components of innate and adaptive collaborate to neutralize or eliminate pathogen. (Understanding)
CO 2: Develop critical definition of the antigen and the self, Immunoglobilin, antigen-antibody interactions, complement, hypersensitivity, cytokines; (Understanding)
CO 3: Apply the concepts of immunology through various laboratory techniques and vaccine development; (Applying)
CO 4: Analyze the importance of the Major Histocompatibility Complex proteins and their role in transplantation immunology. (Analyzing)

Module I: Overview of Immune System (5 Hours)

Historical perspective of Immunology, Early theories of Immunology, Cells and organs of the Immune system

Module II: Innate and Adaptive Immunity (10 Hours)
Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral), Passive: Artificial and natural Immunity, Active: Artificial and natural Immunity, Immune dysfunctions (brief account of autoimmunity with reference to Rheumatoid Arthritis and tolerance, AIDS).

Module III: Antigens (5 Hours)
Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes

Module IV: Immunoglobulins (6 Hours)
Structure and functions of different classes of immunoglobulins, Antigenantibody interactions, Immunoassays (ELISA and RIA), Polyclonal sera, Hybridoma technology: Monoclonal antibodies in therapeutics and diagnosis

Module V: Major Histocompatibility Complex (5 Hours)
Structure and functions of MHC molecules. Endogenous and exogenous pathways of antigen processing and presentation Module

Module VI: Cytokines (4 Hours)
Properties and functions of cytokines, Therapeutics Cytokines

Module VI: Complement System (4 Hours)
Components and pathways of complement activation.

Module VIII: Hypersensitivity (3 Hours)
Gell and Coombs' classification and brief description of various types of hypersensitivities

Module IX: Vaccines (3 Hours)
Vaccine preparations and types of vaccines.

Suggested Readings
1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.
2. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication.
3. Abbas, K. Abul and Lechtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.

Mapping of Cos to Syllabus:

Course Outcomes	Mod I	Mod II	Mod III	Mod IV	Mod V	Mod VI	Mod VII	Mod VIII	Mod IX
CO 1	H	H							
CO 2			H	H		H	H	H	
CO 3				M					H
CO 4					H				

ZGIM309L: IMMUNOLOGY LAB

(1 CREDITS: 30 HRS) (L-T-P: 0-0-1)

Objective(s)
To learn and develop skill to carried out some of the key immunotechniques having wide clinical applications.

Course Outcomes:
CO 1: To describe the structure and function of the lymphoid organ, spleen, thymus, lymph node. (Understanding)
CO 2: To prepare blood smear for various blood cell studies and develop methods for blood group determination. (Creating)
CO 3: Demonstration of cell viability test. (Creating)
CO 4: Demonstration of various immunological techniques. (Creating)

Syllabus
1. *Demonstration of lymphoid organs.
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. Ouchterlony's double immuno-diffusion method.
5. ABO blood group determination.
6. *Cell counting and viability test from splenocytes of farm bred animals/cell lines.
7. Demonstration of:

a) ELISA
b) Immunoelectrophoresis
*The experiments can be performed depending upon usage of animals in UG courses.

Mapping of Cos to Syllabus:

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
CO1	M	H					
CO2			H		H		
CO3						H	
CO4				H			H

ZGBT310T: BIOTECHNOLOGY
(3 CREDITS: 45 Hours) (L-T-P: 3-0-0)

Objective(s)
To gather knowledge on the concept, techniques and applications of Biotechnology

Course Outcomes:
CO 1: Define the concept and scope of biotechnology. (Understanding)
CO 2: Understand the basic molecular technique for gene manipulation. (Understanding)
CO 3: Analyze animal cell culture and gene therapy procedure in molecular diagnosis of various genetic diseases. (Analysing)
CO 4: Apply the practical concepts of basic techniques in biotechnology. (Applying)

Module I: Introduction (8 Hours)
Concept and scope of biotechnology

Module II: Molecular Techniques in Gene manipulation (18 Hours)
Outline of Recombinant DNA technology, Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage
Restriction enzymes: Nomenclature, types of restriction enzymes
Transformation techniques: Calcium chloride method and electroporation, Construction of genomic and cDNA libraries, screening by colony and plaque hybridization Southern, Northern and Western blotting
DNA sequencing: Sanger method, Pyro-sequencing
Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

Module III: Genetically Modified Organisms (12 Hours)
Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection
Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice.

Module IV: Applications of Biotechnology (7 Hours)
Animal cell culture, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)
Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy.

Suggested Readings:
1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.
2. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.
3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.
4. Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.
5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y.,USA.
6. Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.

Mapping of CO's to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	L	L
CO 2		H		
CO 3			H	
CO 4				H

ZGBT311L: BIOTECHNOLOGY LAB
(1 CREDIT: 60 HOURS) (L-T-P: 0-0-1)

Objective(s)
To learn different tools and techniques of basic research in Biotechnology

Course Outcomes:
CO 1: Explain and perform the process of DNA isolation (Understanding, Applying)
CO 2: Experiment with DNA with different enzymes (Applying)
CO 3: Construct restriction maps and analyse transformation efficiency (Creating)
CO 4: Explain and interpret different biological techniques (Understanding)

Syllabus:
1. **Dry Lab:** Retrieval of Gene/Protein sequences from the databases.
2. **Wet Lab:** Genomic DNA isolation from sample.
3. **Wet Lab:** Plasmid DNA isolation from *E. coli*
4. **Wet Lab:** Restriction digestion of plasmid DNA.
5. **Wet Lab:** Agarose gel electrophoresis of the isolated DNA
6. **Dry Lab:** Design Primers for PCR Experiment and analysis.
7. **WetLab:** Polymerase chain reaction (demonstration)
8. **Dry Lab:** Download 3D protein structure and visualize the (3D) structure.
9. **Dry Lab:** To perform Sequence alignment (BLAST) and interpret the output.
10. **Dry Lab:** Use a gene prediction tool to identify potential genes in a given DNA sequence.

Suggested Readings:
1. . Sambrook, Joseph. 2001. Molecular Cloning: A Laboratory Manual. Cold Spring Harbor, N.Y.:Cold Spring Harbor Laboratory Press
2. Wilson, K. and Walker, J. 2010. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press, Cambridge.
3. S. Janarthanan and S, Vincent. 2007. Practical Biotechnology: Methods and Protocols World Universities Press.
4. 4.Janusz M. Bujnicki. 2007. Practical Bioinformatics. Springer Berlin, Heidelberg. 978-3-540-74268-5
5. 5.Zvelebil, Marketa and Baum O. Jeremy 2008. Understanding Bioinformatics, Garland Science, Taylor and Francis Group, USA.

Mapping of CO's to syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6
CO1	H	H				
CO2			H			
CO3						H
CO4				H	H	

ZGMP312P: MINOR PROJECT: 4 Credit

ZGEB400T: EVOLUTIONARY BIOLOGY
(3 CREDITS: 45 HOURS) (L-T-P: 3-0-0)

Objective(s)
To provide adequate knowledge about Micro-evolutionary changes, Speciation and Adaptive Radiation, and Origin and Evolution of Man.

Course Outcomes:
CO 1: Explain the basic evolutionary processes and concept of extinction. (Understanding)
CO 2: Interpret the evolutionary history of living species through the phylogenetic analysis of molecular and morphological information. (Understanding)
CO 3: Explain the basics of evolution of population in the light of population genetics. (Understanding)
CO 4: Apply evolutionary principles in their research. (Applying)

Module I: Life's Beginnings (6 Hours)
Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes

Module II: Historical review of evolutionary concept (3 Hours)
Lamarckism, Darwinism, Neo-Darwinism

Module III: Evidences of Evolution (8 Hours)
Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesizing machinery, neutral theory of molecular evolution, molecular clock.

Module IV: Source of Variations (2 Hours)
Heritable variations in evolution

Module V: Population genetics (12 Hours)
Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium; Natural selection (concept of fitness, selection coefficient, derivation of one unit of selection for a dominant allele, genetic load, mechanism of working, types of selection, density-dependent selection, heterozygous superiority, adaptive resemblances, sexual selection. Genetic Drift (mechanism, founder's effect, bottleneck phenomenon; Role of Migration and Mutation in changing allele frequencies.

Module VI: Product of evolution (7 Hours)
Micro evolutionary changes (inter-population variations, clines, races, Species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches

Module VII: Extinctions (2 Hours)
Back ground and mass extinctions (causes and effects), detailed example of K-T extinction

Module VIII: Origin and evolution of man (3 Hours)
Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens.

Module IX: Phylogenetic trees (2 Hours)
Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees

Suggested Readings:

1. Ridley,M (2004). Evolution, 3rd Edition, Blackwell publishing.
2. Hall, B.K. and Hallgrimson, B (2008). Evolution, 4th Edition, Jones and Barlett Publishers.
3. Campbell, N.A. and Reece J.B (2011). Biology, 9th Edition, Pearson, Benjamin, Cummings.
4. Douglas, J. Futuyma (1997). Evolutionary Biology, Sinauer Associates.
5. Snustad, D.P. and Simmons, M.J. (2015). Principles of Genetics, 7th edition, Wiley.
6. Pevsner, J (2009). Bioinformatics and Functional Genomics, 2nd Edition, Wiley Blackwell.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	ModuleVI	Module VII	ModuleVIII	ModuleIX
CO 1	M	M		M			M	M	
CO 2			M						
CO 3					M	M			
CO 4									H

ZGEB401L: EVOLUTIONARY BIOLOGY LAB

(2 CREDITS: 60 HOURS) (L-T-P: 0-0-2)

Objective(s)
To demonstrate understanding of ecological and evolutionary processes including the role of genetic variation, heredity, and natural selection.

Course/ Learning Outcomes:
CO 1: Explain in details about fossils from models/pictures and fossil age determination techniques. (Understanding)
CO 2: Demonstrate the concept of homology and analogy and Hardy Weinberg Law. (Understanding)
CO 3: Explain various phenomenon of evolution. (Understanding)
CO 4: Construct and interpret phylogenetic trees. (Creating and understanding)

Syllabus:

1. Study of fossils from models/ pictures.
2. Study of radiometric dating techniques used in determination of fossil age.
3. Study of homology and analogy from suitable specimens.
4. Study and verification of Hardy-Weinberg Law by chi square analysis.
5. Demonstration of role of natural selection and genetic drift in changing allele frequencies using simulation studies.
6. Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to their age and sex.
7. Construction of phylogenetic trees with the help of bioinformatics tools (Clustal X, Phylip, NJ) and its interpretation.
8. Study of molecular analysis of human origin.

Suggested Readings:

1. Ridley,M (2004). Evolution, 3rd Edition, Blackwell publishing.
2. Hall, B.K. and Hallgrimson, B (2008). Evolution, 4th Edition, Jones and Barlett Publishers.
3. Campbell, N.A. and Reece J.B (2011). Biology, 9th Edition, Pearson, Benjamin, Cummings.
4. Douglas, J. Futuyma (1997). Evolutionary Biology, Sinauer Associates.
5. Snustad, D.P. and Simmons, M.J. (2015). Principles of Genetics, 7th edition, Wiley.
6. Pevsner, J (2009). Bioinformatics and Functional Genomics, 2nd Edition, Wiley Blackwell.

Mapping of COs to Syllabus:

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8
CO 1	H	H						
CO 2			M	M				
CO 3					M	M		
CO 4							H	M

ZGEZ402T: ECONOMIC ZOOLOGY

(3 credits – 45 Hours) (L-T-P: 3-0-0)

Objective(s):

- *To develop the students for understanding on various culture system for the uplift of rural economy.*
- *To acquaint the students about the skill of various farming systems and management for future entrepreneurship.*

Course/ Learning Outcomes:

CO 1: Understand the experiential and significance of learning on lac culture, aquaculture, poultry and animal husbandry for the uplift of rural economy. (Understanding)
CO 2: Develop the skill to identify the agricultural pests and insect vectors, their role and control measures to extension services to the common people. (Evaluating)
CO 3: Create the self-employment opportunities to students through poultry, animal husbandry, aquaculture and Vermiculture. (Creating)
CO 4: Develop an overall idea of fish farming, the scientific management of different species in aquaculture and fish diseases. (Applying)
CO 5: Identify the different types of parasites, their role in human health and prophylactic measures to curve them. (Applying)

Module I: Beneficial and harmful insects (12 Hours)

Agricultural pest: Types of agricultural; Common pest's of paddy, grams and stored grains (Damage and control), Common pest's of Tea, Coconut, Cashew, sugarcane, Banana (Damage and control); Biological and integrated pest control methods.
Insect vectors: *Anopheles, Culex, Aedes* and *Xenopsylla* as vectors for yellow fever, chikungunya, malaria, filariasis, pasteurella and rickettsia; their life cycle, pathogenicity and control.
Lac Culture: Types of Lac; Life cycle of Lac insect; Harvesting and Extraction of Lac; Uses and Enemies of Lac; Economic importance.

Module II: Poultry & Animal Husbandry (8 Hours)

Poultry: Types of birds for poultry (indigenous and exotic breeds); Quail and duck farming- advantages, housing and management, economic importance– egg and meat production; Bio-security measures followed in Poultry farms, Diseases and pests.
Animal husbandry: Types of breeds rearing in animal husbandry (Cow, Sheep and Goats, Pigs); Disease and parasites of animal husbandry; Economic importance.

Module III: Aquaculture (12 Hours)

Aquaculture: Diversity of aquaculture and significance; Pisciculture- importance, construction and management of pond; Common culturable fish, seed collection, breeding and types of culture; Modern fish farming techniques- Aquaponics, RAS, Biofloc, Aquascaping; Integrated fish farming; Fish utilization- Nutritive value and fish byproduct; Ornamental fish farming and potentials, diseases.

Prawn culture: Importance, culturable species, methods of prawn farming and marketing potential.

Pearl culture & mollusk culture: Importance, culturable species, farming techniques and marketing potential.

Module IV: Vermiculture (5 Hours)

Vermiculture: Species of earthworm used in vermiculture; Raw materials for vermiculture; Compost Production. Natural enemies and their control measures; Harvesting of vermicompost and worms; Role of vermicompost in agriculture.

Module V: Parasitology (8 Hours)

Parasitism in relation to human health: Classification of Parasites & hosts and mode of infection; Morphology, life cycle, pathogenicity & control of *Entamoeba histolytica, Taenia solium, Schistosoma haematobium, Ancylostoma duodenale, Wuchereria bancrofti, Enterobius vermicularis*.

Suggested Reading:

1. Ahmed N., Dawson M., Smith C. & Wood Ed. (2007) *Biology of Disease.* Taylor and Francis Group.
2. Arora, D. R. & Arora, B. (2001) *Medical Parasitology. II Edition.* CBS Publications and Distributors
3. Arumugam N., Murugan T., Ram Prabhu R. & Johnson Rajeshwar J. (2015) *Applied Zoology*. Saras publication
4. Independent Pub.
5. Khan A.A. (2007) *Encyclopedia of Economic Zoology. 2 vols.* Anmol Publications Pvt. Ltd., New Delhi.
6. Metcalf R.W. & Luckmann H. (2011) *Introduction to Insect Pest Management.* Wiley India Pvt Ltd.
7. Noble E.R. & Noble G.A. (1982) *Parasitology: The biology of animal parasites. V Edition.* Lea & Febiger.
8. NPCS Board of Consultants & Engineers. The Complete Technology Book on Vermiculture and Vermicompost.
9. Packer B. (2014) *Aquaponics System: A Practical Guide to Building and Maintaining Your Own Backyard Aquaponics*.
10. Parija S. C. (2013) *Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition.* All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi
11. Shukla G.S. & Upadhya, V.B. (2005) *Economic Zoology*. Rastogi Publications, Meerut, India.
12. Srivastava K.P. & Dhaliwal G.S. (2010) *A Text Book of Applied Entomology, Vol. II & III*. Kalyani Publishers.
13. Tomar B.S. (2004) *Introduction to Economic Zoology*. Emkay Publications, New Delhi.
14. Upadhyay V.B. (2006) *Economic Zoology.* Rastogi Publications, Meerut, India.

Mapping COs to syllabus:

Course Outcomes	Module-I	Module-II	Module-III	Module-IV	Module-V
CO1	M	H	L	L	
CO2	H				
CO3			M	H	M
CO4			H	H	
CO5					H

ZGEZ403L: ECONOMIC ZOOLOGY lab

(2 credits: 60 Hours) (L-T-P: 0-0-2)

Objective(s):

- *To acquaint the students for identification of various insect pests.*
- *To develop the skill of field survey on various farming systems and management for future entrepreneurship*

Course/ Learning Outcome:

CO 1: Identify the insect vectors and the agricultural pest of tea, coconut, cashew and cotton through survey and field observation. (Applying)

CO 2: Identify the structure and biological functioning of insect vectors with preparation of permanent slides. (Applying & creating)

CO 3: Develop the skill of dissection and study the anatomy of earthworm. (Applying)

CO 4: Develop the skill of field survey to different farming systems to provide a way to entrepreneurship. (Understanding)

Syllabus

1. Collection and identification of pest of tea, Coconut, Cashew and cotton.
2. Identification of insect vectors through whole mount – *Anopheles, Culex, Aedes* and *Xenopsylla*
3. Dissection of earthworm and study of its digestive and nervous system.

4. Morphology and life history of lac insect.
5. Identification of food and ornamental fishes of Northeastern India.
6. Study on prepared slides/ specimens of *Anopheles, Culex, Aedes,*
7. Field visit to a modern fish farming/ poultry/ cattle farming centre and write a report on it.

Suggested Reading:

1. Ahmed N., Dawson M., Smith C. & Wood Ed. (2007) *Biology of Disease.* Taylor and Francis Group.
2. Arora, D. R. & Arora, B. (2001) *Medical Parasitology. II Edition.* CBS Publications and Distributors
3. Arumugam N., Murugan T., Ram Prabhu R. & Johnson Rajeshwar J. (2015) *Applied Zoology*. Saras publication
4. Independent Pub.
5. Khan A.A. (2007) *Encyclopedia of Economic Zoology. 2 vols.* Anmol Publications Pvt. Ltd., New Delhi.
6. Metcalf R.W. & Luckmann H. (2011) *Introduction to Insect Pest Management.* Wiley India Pvt Ltd.
7. Noble E.R. & Noble G.A. (1982) *Parasitology: The biology of animal parasites. V Edition.* Lea & Febiger.
8. NPCS Board of Consultants & Engineers. The Complete Technology Book on Vermiculture and Vermicompost.
9. Packer B. (2014) *Aquaponics System: A Practical Guide to Building and Maintaining Your Own Backyard Aquaponics*.
10. Parija S. C. (2013) *Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition.* All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi
11. Shukla G.S. & Upadhya, V.B. (2005) *Economic Zoology*. Rastogi Publications, Meerut, India.
12. Srivastava K.P. & Dhaliwal G.S. (2010) *A Text Book of Applied Entomology, Vol. II & III*. Kalyani Publishers.
13. Tomar B.S. (2004) *Introduction to Economic Zoology*. Emkay Publications, New Delhi.
14. Upadhyay V.B. (2006) *Economic Zoology.* Rastogi Publications, Meerut, India.

Mapping of COs to syllabus

Course Outcomes	Exp. 1	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6	Exp.7
CO 1	M	H	M				
CO 2	H					M	
CO 3	M	M	M	H			H
CO 4			H				
CO 5					H		

ZGCA404T: COMPARATIVE ANATOMY OF VERTEBRATES

(3 Credits: 45 Hours)(L-T-P:3-0-0)

Objective(s)

To know the differences and similarities between the different organ structure of different vertebrate to predict whether they are related to a common ancestor or not.

Course/ Learning Outcomes:

At the end of the course, students will be able to:

CO 1: Identify the distinct anatomical structures that comprise the vertebrate body. (Understanding)

CO 2: Demonstrate the structural and functional similarities and differences of these organ systems amongst different vertebrate groups. (Applying)

CO 3: Evaluate the pattern of organ development in various vertebrate groups. (Evaluating)

CO 4: Compare the functioning of these organ systems from lower to higher vertebrates. (Analyzing)

Module I: Integumentary System (8 Hours)

Structure, functions and derivatives of integument

Module II: Skeletal System (8 Hours)

Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches

Module III: Digestive System (8 Hours)

Alimentary canal and associated glands, dentition

Module IV: Respiratory System (8 Hours)

Skin, gills, lungs and air sacs; Accessory respiratory organs

Module V: Circulatory System (8 Hours)

General plan of circulation, evolution of heart and aortic arches

Module VI: Urinogenital System (6 Hours)

Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

Module VII: Nervous System (8 Hours)
Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in mammals

Module VIII: Sense Organs (6 Hours)
Classification of receptors Brief account of visual and auditory receptors in man

Suggested readings
1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies
3. Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons
4. Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House

Mapping of Cos to Syllabus:

Course Outcomes	Mod I	Mod II	Mod III	Mod IV	Mod V	Mod VI	Mod VII	Mod VIII
CO 1	H	H	H	H	H	H	H	H
CO 2	M	M	M	M	M	M	M	M
CO 3	H	H	H	H	H	H	H	H
CO 4	M	M	M	M	M	M	M	M

ZGCA405L: COMPARATIVE ANATOMY OF VERTEBRATES LAB

(2 Credits: 60 Hours)(L-T-P: 0-0-2)

Objective(s)
To demonstrate the differences and similarities between the different organ structure of different vertebrate at laboratory.

Course Outcomes:
CO 1: Compare the different types of scales. (Analyzing)
CO 2: Demonstrate the structural and functional similarities and differences of the organ systems amongst different vertebrate groups (Applying)
CO 3: Compare the functioning of these organ systems from lower to higher vertebrates (Applying)
CO 4: Explain the arterial and urogenital system. (Understanding)

Syllabus:
1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
2. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit
3. Carapace and plastron of turtle /tortoise
4. Mammalian skulls: One herbivorous and one carnivorous animal
5. Dissection of rat to study arterial and urogenital system(subject to permission)
6. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)
7. Project on skeletal modifications in vertebrates (may be included if dissection not permitted)

Mapping of Cos to Syllabus:

Course Outcomes	Exp. 1	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6	Exp.7
CO 1	H						
CO 2			H	H			H
CO 3							
CO 4					H		

ZGMP406T: BIOCHEMISTRY OF METABOLIC PROCESSES

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)
To understand how macromolecules like carbohydrate, protein, lipids metabolized for providing energy and structural component of the cells.

Course/ Learning Outcomes:
CO 1: Define characteristic features of catabolic and anabolic pathways of metabolism (Remembering)
CO 2: Demonstrate the differences of carbohydrate, lipid and protein metabolism and their inter-relationships (Understanding)
CO 3: Infer the significance of the electron transport system in metabolic pathways (Analyzing)
CO 4: Interpret the biochemistry of metabolic disorders (Evaluating)

Module I: Overview of Metabolism (9 Hours)
Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as " Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms

Module II: Carbohydrate Metabolism (12 Hours)
Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis

Module III: Lipid Metabolism (8 Hours)
β-oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis

Module IV: Protein Metabolism (8 Hours)
Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids

Module V: Oxidative Phosphorylation (8 Hours)
Redox systems; Review of mitochondrial respiratory chain, Inhibitors and uncouplers of Electron Transport System

Suggested Readings:
1. Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
5. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	M
CO 2		H	H	H	
CO 3					H
CO 4	M	M	M	M	M

ZGMP407L: BIOCHEMISTRY OF METABOLIC PROCESSES LAB

(2 Credits: 60 Hours) (L-T-P: 0-0-2)

Objective(s)
Develop skill to measure and trace biochemical pathways as well as enzyme activities etc. and to interpret its results.

Course Outcomes:
CO 1: Estimation of protein content (Evaluating)
CO 2: Interpretation of enzyme activity (Evaluating)
CO 3: Determination of metabolic pathways (Evaluating)
CO 4: Tracing metabolic pathway using bioinformatics (Applying)

Syllabus:
1. Estimation of total protein in given solutions by Lowry's method.
2. Detection of SGOT and SGPT or GST and GSH in serum/ tissue
3. To study the enzymatic activity of Trypsin and Lipase.
4. Study of biological oxidation (SDH) [goat liver]
5. To perform the Acid and Alkaline phosphatase assay from serum/ tissue.
6. Dry Lab: To trace the l 13 abeled C atoms of Acetyl-CoA till they evolve as CO2in the TCA Cycle Mapping of Cos to Syllabus

Suggested Readings:
1. Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
4. Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
5. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview

Mapping of Cos to Syllabus

Course Outcomes	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6
CO 1	H					
CO 2		H	H		H	
CO 3				H		
CO4						H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	ZGAN104T	Animal Diversity I	4 (3-0-1)
		ZGAN105L	Animal Diversity I Lab	
2	Minor Course 2	ZGAD106T	Animal Diversity II	4 (3-0-1)
		ZGAD107L	Animal Diversity II Lab	
3	Minor Course 3	ZGPH210T	Environment and Public Health	4 (3-0-1)
		ZGPH211L	Environment and Public Health Lab	
4	Minor Course 4	ZGAZ212T	Applied Zoology I	4 (3-0-1)
		ZGAZ213L	Applied Zoology I Lab	
5	Minor Course 5	ZGAY313T	Applied Zoology II	4 (3-0-1)
		ZGAY314L	Applied Zoology II Lab	
6	Minor Course 6	ZGPE315T	Principles of Ecology	4 (3-0-1)
		ZGPE316L	Principles of Ecology Lab	
7	Minor Course 7	ZGAB408T	Animal Biotechnology	3 (2-0-1)
		ZGAB409L	Animal Biotechnology Lab	
7	Minor Course 8	ZGRM410T	Research Methodology	2
8	Minor Course 9	ZGWC411T	Wildlife Conservation and Management	3 (2-0-1)
		ZGWC412L	Wildlife Conservation and Management Lab	

ZGAN104T: ANIMAL DIVERSITY-I

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To know the general characters and classification of Non-chordates and understand the increasing complexity of body forms.

Course/ Learning Outcomes:

CO 1: Interpret the evolution of body cavity in non-Chordates. (Understanding)
CO 2: Illustrate the morphological structure different larval forms of important representative organisms belonging to these phyla. (Understanding)
CO 3: Identify the distinguishing characters of the pseudocoelomates and coelomates. (Applying)
CO 4: Distinguish the unique physiology of selected representative non-chordates. (Analyzing)

Module I: Protista, Parazoa and Metazoa (4 Hours)

General characteristics and Classification up to classes Study of Euglena, Amoeba and Paramecium Life cycle and pathogenicity of Plasmodium vivax and Entamoeba Histolytica.

Module II: Porifera (3 Hours)

General characteristics and Classification up to classes; Canal system and spicules in sponges

Module III: Cnidaria (4 Hours)

General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals and coral reefs.

Module IV: Ctenophora (2 Hours)

General characteristics and Classification up to Classes.

Module V: Platyhelminthes (4 Hours)

General characteristics and Classification up to classes. Life cycle and pathogenicity of Fasciola hepatica and Taeniasolium

Module VI: Nemathelminthes (4 Hours)

General characteristics and Classification up to classes. Life cycle, and pathogenicity of Ascarislumbricoides and Wuchereriabancrofti.

Module VII: Annelida (4 Hours)

General characteristics and Classification up to classes. Reproduction, Regeneration and Locomotion of Annelida.

Module VIII: Arthropoda (4 Hours)
General characteristics and Classification up to classes. Metamorphosis in Insects; Social life in bees and termites.

Module IX: Onychophora (4 Hours)
General characteristics and Classification up to classes.

Module X: Mollusca (4 Hours)
General characteristics and Classification up to classes, Pearl formation in bivalves; Trochophore larva.

Module XI: Echinodermata (4 Hours)
General characteristics and Classification up to classes, Water-vascular system in Asteroidea, Larval forms in Echinodermata

Module XII: Hemichordata (4 Hours)
General characteristics and classification of Hemichordata up to classes; Study of Balanoglossus.

Note: Classification to be followed from "Ruppert and Barnes (2006) Invertebrate Zoology, 8th edition, Holt Saunders International Edition" CBCS Undergraduate Program in Zoology 2015

Suggested Readings

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
2. Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

Mapping of COs to Syllabus

Course Outcomes	M-I	M-II	M-III	M -IV	M-V	M-VI	M-VII	M-VIII	M-IX	M-X	M-XI	M-XII
CO 1	M			M			H			M	L	L
CO 2	H	H	H	H	H	H		H	H	H	M	M
CO 3	L				L	L			L		H	M
CO 4	H				H				M		M	H

ZGAN105L: ANIMAL DIVERSITY-I LAB

(1 Credits: 30 Hours)(L-T-P: 0-0-1)

Objective(s)
To know the general characters and classification of Non-chordates and understand the increasing complexity of body forms by doing practical and at field level.

Course/ Learning Outcomes:
CO 1: Examine and investigate different species of non-chordate (Analyzing).
CO 2: Examine various systems of non-chordate species (Analyzing).
CO 3: Differentiate different parts of body thorough prepared slides (Analyzing).
CO 4: Design a project for any related topic (Creating).

Syllabus:
1. Study of whole mount of Euglena, Amoeba and Paramecium
2. Study of the following Specimens- Porifera: *Sycon* (T.S. and L.S.), *Hyalonema, Euplectella, Spongilla;*Cnidaria: *Obelia, Physalia, Millepora, Aurelia, Tubipora, Gorgonia, Metridium, Pennatula, Fungia,*Ctenophora: *Pleurobrachia, Ctenoplana*; Platyhelminthes: *Fasciola hepatica, Taeniasolium*; Nemathelminthes: *Ascarislumbrecoides;* Annlida- *Aphrodite, Nereis, Heteronereis, Pheretima,Hirudinaria;* Arthropoda: *Limulus, Palamnaeus, Palaemon, Daphnia, Philosamia, Periplaneta, Termites and honey bees;* Onychophora-*Peripatus,* Molluscs - *Chiton, Dentalium, Pila, ,Unio,Sepia,Octopus,Nautilus;* Echinodermates-*Asterias,Ophiura,Echinus,Cucumaria;* Hemichordata- *Balanoglossus*
3. Examination of pond water collected from different places for diversity in protists
4. Dissection of the mouth parts of Cockroach
5. Dissection of digestive system of Coackroach

Suggested Readings

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
2. Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

Mapping of Cos to Syllabus

	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
CO 1	H				
CO 2		H		H	
CO 3			H		
CO 4					H

ZGAD106T: ANIMAL DIVERSITY II

(3 Credits: 45 Hours)(L-T-P: 3-0-0)

Objective(s)

To know the Diversity of Chordata from lower to higher Chordates and their geographical distribution

Course/ Learning Outcomes:

CO 1: Understand the origin and evolution of the phylum Chordata. (Analyzing)
CO 2: Distinguish the unique characteristics as well as life functions of different chordate subphylum. (Applying)
CO 3: Evaluate the varied morphological, anatomical and physiological complexity in selected chordate organisms. (Understanding)
CO 4: Analyze the various theories of animal distribution and their geographical realms. (Analyzing)

Module I: Introduction to Chordates (8 Hours)

General characteristics and outline classification

Module II: Protochordata (8 Hours)

General characteristics of Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

Module III: Origin of Chordata (3 Hours)

Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

Module IV: Agnatha (2 Hours)

General characteristics and classification of cyclostomes up to class

Module V: Pisces (8 Hours)

General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes

Module VI: Amphibia (8 Hours)

Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians

Module VII: Reptilia (7 Hours)

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes

Module VIII: Aves (8 Hours)

General characteristics and classification up to order Archaeopteryx- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds

Module IX: Mammals (8 Hours)

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Suggested readings

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition.Jones and Bartlett Publishers Inc.
5. T.C. Majupuria. Introduction to Chordates, Pradeep Publicartions.
6. Veerbala Rastogi. Vertebrate Zoology, Kedar Nath Ram Nath Publication

Mapping of Cos to syllabus

	Mod I	Mod II	Mod III	Mod IV	Mod V	Mod VI	Mod VII	Mod VIII	Mod IX

CO1	M	L	M	L					
CO2		H		H	H	H	H	H	H
CO3				H	H	H	H	H	H
CO4	M								

ZGAD107L: ANIMAL DIVERSITY II LAB

(1 credits: 30 Hours)(L-T-P: 0-0-1)

Objective(s)

To demonstrate the different Chordates from lower to higher Chordates with help of the laboratory specimen.

Course/ Learning Outcomes

CO 1: Identify distinguishing characteristics of representative museum specimens belonging to different phyla. (Applying)

CO 2: Determine their affinities and evolutionary relationships. (Evaluating)

CO 3: Examine specific organ structures through dissections. (Analyzing)

Syllabus

1. Protochordata: Herdmania, Branchiostoma, Colonial UrochordataSections of Balanoglossus through proboscis and branchiogenital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmania spicules
2. Agnatha: Petromyzon, Myxine
3. Pieces: Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish
4. Amphibia: Ichthyophis/Uraeotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra
5. Reptilia: Chelone, Trionyx, Hemidactylus, Varanus, Uromastyx, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus Key for Identification of poisonous and non-poisonous snakes
6. Aves: Study of six common birds from different orders. Types of beaks and claws
7. Mammalia: Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous. Mount of weberian ossicles of Mystus, pecten from Fowl head Dissection of Fowl head (Dissections and mounts subject to permission) Powerpoint presentation on study of any two animalsfrom two different classes by students (may be included if dissections not given permission

Suggested readings

1. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition.Jones and Bartlett Publishers Inc.
5. T.C. Majupuria. Introduction to Chordates, Pradeep Publicartions.
6. Veerbala Rastogi. Vertebrate Zoology, Kedar Nath Ram Nath Publication

Suggested Readings

1. Campbell & Reece (2005).Biology,Pearson Education,(Singapore) Pvt. Ltd.
2. Kardong, K.V.(2002).Vertebrates Comparative Anatomy. Function and Evolution. Tata Mc Graw Hill Publishing Company. New Delhi.
3. Raven, P.H. and Johnson, G.B.(2004). Biology, 6th edition, Tata McGraw Hill Publications. NewDelhi.

Mapping of COs to syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
CO1	H	H	H	H	H	H	H
CO2	M	M	M	M	M	M	M
CO3							**H**

ZGPH210T: ENVIRONMENT AND PUBLIC HEALTH

(3 Credits: 45 Hours)(L-T-P:3-0-0)

Objective(s)

After completion of the course, students will be able to explain the critical importance of evidence in advancing public health knowledge, effects of environmental factors on a population's health, and global burdens of disease.

Course/ Learning Outcomes:

CO 1: Illustrate the effects of air, water and noise pollution with regards to human health. (Understanding)
CO 2: Identify different types and sources of environmental hazards, their persistence, dose and exposure. (Applying)
CO 3: Distinguish the different factors contributing to climate change and their effect in human health. (Analyzing)
CO 4: Compile the various types of waste generated, their disposal and management. (Creating)

Module I: Introduction (5 Hours)
Definition of Environmental Health and Environmental Hazards; Categories of Environmental Hazard; Principles of hazard management; Inharaent Capacity of Environment; Categories of Pollution.

Module II: Pollution: (20 hours)
Air Pollution: Types, Sources, Effects and Control. Greenhouse effects, Global warming, Acid rain and Ozone layer depletion.
Water Pollution: Types, Sources, Effects and Control; Minamata diseases.
Noise pollution: Types, Sources, Effects and Control of Noise Pollution.

Module III: Case histories: (5 hours)
Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and Three Mile Island accident and their aftermath.

Module IV: Solid Waste Management: (10 hours)
Definition of Solid Waste, Types of Solid Waste, Sources of waste, Management of Solid waste. Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants.

Module V: Diseases (5 Hours)
Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid

Suggested Readings:
1. Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
2. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.
3. Kofi Asante Duah "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998.
4. Kasperson, J.X. and Kasperson, R.E. and Kasperson,R.E., Global Environmental Risks, V.N.University Press, New York, 2003.
5. Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1		M	H		
CO 2	H			L	
CO 3	L	H			H
CO 4				H	L

ZGPH211L: ENVIRONMENT AND PUBLIC HEALTH LAB

(1 Credits: 30 Hours) (L-T-P: 0-0-1)

Objective(s):
To demonstrate the physical and chemical properties of water and soil.

Course/ Learning Outcomes:
CO1. To learn the procedure to find out the pH, Cl, SO4 and NO3 of soil of different location. (Applying)
CO2. To learn the procedure of determination of pH, DO and CO2 in pond water. (Applying)

Syllabus
1. To determine pH, Cl, SO4, NO3 in soil samples from different locations.
2. To determine pH, CO2, DO, Transparency and NO3 in water samples from different locations.

Mapping of COs to Syllabus

Course Outcomes	Exp.1	Exp.2
CO1	H	
CO2		H

ZGAZ212T: APPLIED ZOOLOGY I

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To gain knowledge and get acquainted with major aspects of Sericulture, Apiculture, Vermiculture and Aquaculture.

Course/ Learning Outcomes:

CO 1: Gain a thorough knowledge about different kinds of silkmoths, study of different host plants of the silkworms, cultivation of silkworm, seed technology, treatment of silk cocoons and silk reeling. (Applying)

CO 2: Learn about the various skills that are necessary for self-employment in the muga and eri silk cultivation, seed production and vermiculture. (Applying)

CO 3: Understand the basic life cycle of the honeybee. Learn about beekeeping tools and equipment; manage beehives for honey production and pollination. (Evaluating)

CO 4: Gain an overview of fish farming, the scientific management of different species in aquaculture, aquarium keeping and fish diseases. (Applying)

Module I: Sericulture (15 hours)

Introduction to Sericulture: Types of silkworms, Biology of Silkworm: Life cycle of *Samia ricini* and *Antheraea assamensis*, Structure of silk gland and secretion of silk, Rearing of silkworms and management practices.

Disinfectants: Formalin, bleaching powder, Silkworm rearing technology: Early age and Late age rearing, Types of mountages Spinning, harvesting and storage of cocoons, treatment of cocoons, Pests and Diseases of silkworms.

Entrepreneurship in Sericulture: Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

Module II: Apiculture (8 hours)

Different species of honey bees, bee plants, pollen calendar, bee keeping and management practices, bee products, Bee enemies and diseases.

Module III: Vermiculture (7 Hours)

Species of worms, condition for efficient vermiculture (domestic and commercial level), Economics of Vermiculture

Module IV: Aquaculture (15 hours)

Aquarium fish keeping: Ornamental Fishes of India special reference to North East India, common aquarium fishes; Aquarium Maintenance, Fisheries management: Composite fish culture, induced breeding and hybridization; Prawn and Pearl Culture, Exotic and Indigenous food Fishes of NE India, Fish and shellfish diseases and their control measures. Fish genetic resource conservation; Aquaphonics–prospect and future

Suggested Readings

1. Venkitaraman: Economic Zoology, Sudarsana Publishers
2. Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers
3. Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.
4. Ananthakrishnan, T. N. and K.G. Shivaramakrishnan. Ecological entomology: Insect life in odd environment. Scientific Pub.: India
5. David, B. V and T.N. Ananthakrishnan. General and Applied Entomology. 2nd Edition. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi
6. Fenemore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)
7. Packer, B. Aquaponics System: A Practical Guide to Building and Maintaining Your Own BackyardAquaponics
8. Jayashree, K.V., C.S. Tharadevi& N. Aurumugam.Apiculture.Saras Publication
9. Chandra Girish. Apiculture & the Honey Bee (Know about the species of honey bees, beekeeping, pollination, beehives, entomology, beekeepers, honey making
10. Arumugam, N., T. murugan , R. Ram Prabhu, J. Johnson Rajeshwar. Applied Zoology.Saras publication

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M		H	
CO 3		H		
CO 4				H

ZGAZ213L: APPLIED ZOOLOGY I LAB:

(1 CREDITS: 30 HOURS) (L-T-P: 0-0-1)

Objective(s)

To be acquainted with hands on training on the biology of silkmoths, worms used in Vermiculture, the different life cycles of honey bees and to be able to identify economically important fishes

Course Outcomes:

CO 1: Develop knowledge regarding cultivation of silkworm, maintenance of the farm, selection of disease free eggs, silkworm rearing and silk reeling. (Applying)
CO 2: Learn about the various skills that are necessary for self-employment in the cultivation of muga and eri silkworms and vermiculture. (Applying)
CO 3: Understand the basic life cycle of the honeybee. Learn about beekeeping tools and equipment; manage beehives for honey production and pollination. (Evaluating)
CO 4: Identification of different types of fishes and their economic importance. (Identifying)

Syllabus:

1. Field Visit to any Sericulture Department to study about silkworm rearing
2. To study the life cycle of *Antheraea assama* and *Samia ricini*
3. Identification of different types of worms used for Vermiculture
4. To study the different types of caste of honeybees
5. Maintenance of freshwater aquarium
6. Identification of economically important fishes

Suggested Readings

1. Venkitaraman: Economic Zoology, Sudarsana Publishers
2. Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers
3. Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.
4. Ananthakrishnan, T. N. and K.G. Shivaramakrishnan. Ecological entomology: Insect life in odd environment. Scientific Pub.: India
5. David, B. V and T.N. Ananthakrishnan. General and Applied Entomology. 2nd Edition. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi
6. Fenemore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)
7. Packer, B. Aquaponics System: A Practical Guide to Building and Maintaining Your Own BackyardAquaponics

Mapping of COs to Syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6
CO 1	M					
CO 2		H	M			
CO 3				M		
CO 4					M	H

ZGAY313T: APPLIED ZOOLOGY II

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s):

- *To impart knowledge regarding management of poultry and economically important pest.*
- *To understand the importance of biodiversity and their conservation.*

Course Outcomes:

CO 1: Learn basic concepts of poultry farming, housing, biosecurity measures, prevention of outbreaks and economics of poultry sciences. (Applying)
CO 2: Identify and understand the different types of parasites, their life cycles and the diseases caused by them. Identifying viruses carrying vectors, like Aedes, Culex and Anopheles; Learn about the economic importance and biodiversity of different insects. (Evaluating)
CO 3: Learn about the different types of pests and their hosts; and apply the latest knowledge in management of pest population. (Applying)
CO 4: Analyze the importance of biodiversity and threats to biodiversity and design steps to protect and conserve biodiversity. (Analyzing and Creating)

Module I: Poultry management (6 hours)

Poultry rearing / farming: housing and equipments, breeds of fowls, nutritional requirements, poultry diseases, poultry products: Broilers, meat processing and meat products, poultry by-products.

Module II: Parasitology (18 hours)
Introduction to Parasitology: Types of parasites, Types of Host, Zoonosis, Host-parasite Relationship, Sources of Infection, Mode of infection, Pathogenesis.
Vibrio cholera and *Clostridium tetani*- Life Cycle, mode of transmission, infection and treatment.
Dengue and Bird flu - Life cycle, mode of transmission, infection and treatment.
Life history and mode of transmission of *Entamoeba histolytica*, *Plasmodium vivax, Trypanosoma gambiense, Ancylostoma duodenale* and *Wuchereria bancrofti* and the diseases caused by them.

Module III: Insect pest management, Public Health and Forensic Entomology (8 hours)
Concept of Pest, different kinds of pest, concept of integrated pest management (IPM)
Mosquito (*Aedes, Culex, Anopheles*): Taxonomy, Life cycle, Biology, Behavior and their control. Life cycle of Calliphora and Scrophaga, determination of death and causes of death.

Module IV: Biodiversity (7 hours)
Components of Biodiversity, Threats to biodiversity, biodiversity conservation, hot spots and heritage sites, IUCN Red List Categories, keystone species, habitat diversity of Indian wildlife, endemic and threatened species of North East India, National parks and wildlife sanctuaries present in North East India, Ethnozoology with special reference to North East India

Module V: Insects of Economic Importance (6 hours)
Biology, Control and damage caused by *Helicoverpa armigera, Pyrilla perpusilla* and *Papilio demoleus, Callosobruchus chinensis, Sitophilus oryzae* and *Tribolium castaneum*

Suggested Readings

1. Venkitaraman: Economic Zoology, Sudarsana Publishers
2. Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers
3. Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.
4. Ananthakrishnan, T. N.and K.G. Shivaramakrishnan.Ecological entomology: Insect life in odd environment. Scientific Pub.: India
5. David, B.VandT.N. Ananthakrishnan.General and Applied Entomology. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi
6. Dent, D. R.Insect pest management.Westville Publishing House: Delhi
7. Eldridge B Medical entomology (Springer)
8. Fenemore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	H		M
CO 3			M		M
CO 4				H	

ZGAY314L: APPLIED ZOOLOGY II Lab

(1 Credit: 30 Hours) (L-T-P: 0-0-1)

Objective(s)
To impart latest knowledge in pest management techniques, management of disease carrying vectors and poultry farming

Course Outcomes:
CO 1: Learn about the different types of pests and apply the latest knowledge of pest management techniques. (Applying)
CO 2: Creating awareness regarding virus carrying vectors, like Aedes, Culex and Anopheles etc. (Understanding)
CO 3: Learn about the insects of economic importance and biodiversity. (Applying)
CO 4: Learn about basics of poultry farming and advances in housing and equipments. (Applying)

Syllabus
1. Visit to poultry farm or animal breeding centre. Submission of visit report
2. Study of Life Cycle of Aedes, Culex and Anopheles through Photographs
3. Study of *Plasmodium vivax, Entamoeba histolytica, Trypanosoma gambiense, Ancylostoma duodenale* and *Wuchereria bancrofti* and their life stages through photographs
4. Study of vectors associated with human diseases: Pediculus, Culex, Anopheles, Aedes and Xenopsylla.
5. Study of insect damage to different plant parts/stored grains through damaged products/photographs; Identifying feature and economic importance of pest of stored grains and tea pest

Suggested Readings

1. Venkitaraman: Economic Zoology, Sudarsana Publishers
2. Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers
3. Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.
4. Ananthakrishnan, T. N.and K.G. Shivaramakrishnan.Ecological entomology: Insect life in odd environment. Scientific Pub.: India
5. David, B.VandT.N. Ananthakrishnan.General and Applied Entomology. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi
6. Dent, D. R.Insect pest management.Westville Publishing House: Delhi

Mapping of COs to Syllabus

Course Outcomes	1	2	3	4	5
CO 1					M
CO 2		H	H	H	
CO 3					M
CO 4	M				

ZGPE315T: PRINCIPLES OF ECOLOGY

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To understand concepts and the Principles in ecology and wildlife management

Course Outcomes:

CO 1: Distinguish the mechanism of various biological interactions (Understanding).
CO 2: Analyse different population dynamics and interactions (Analysing).
CO 3: Evaluate ecosystem energetics with reference to food chain, food web (Evaluating).
CO 4: Apply conservation and management strategies for local endangered species (Applying)

Module I: Introduction to Ecology (3 Hours)

History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Module II: Population (20 Hours)

Unitary and Modular populations Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors Population interactions, Gause's Principle with laboratory and field examples

Module III: Community (10 Hours)

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example Theories pertaining to climax community

Module IV: Ecosystem (10 Hours)

Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with one example of Nitrogen cycle Human modified ecosystem

Module V: Applied Ecology (2 Hours)

Ecology in Wildlife Conservation and Management

SUGGESTED READINGS

1. Colinvaux, P. A. (1993). Ecology.II Edition.Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology.VI Edition. Benjamin Cummings.
3. Odum, E.P., (2008). Fundamentals of Ecology.Indian Edition. Brooks/Cole
4. Robert Leo Smith Ecology and field biology Harper and Row publisher
5. Ricklefs, R.E., (2000). Ecology.V Edition. Chiron Pres

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	M	E	
CO2		H	M	M	
CO3		E	H		
CO4			E		H

ZGPE316L: PRINCIPLES OF ECOLOGY LAB
(1 Credit: 30 Hours) (L-T-P: 0-0-1)

Objective(s)
To gain the knowledge and understand about the status and the diversity of the different ecosystems

Course Outcomes
CO 1: Investigate life tables and survivorship curves of different types (Analyzing).
CO 2: Estimate and analyse different population dynamics and interactions (Analyzing).
CO 3: Evaluate the aquatic ecosystem (Evaluating).
CO 4: Design a project for any related topic (Creating).

Syllabus
1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon- Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO2, alkalinity and hardness of water
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

SUGGESTED READINGS
1. Colinvaux, P. A. (1993). Ecology.II Edition.Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology.VI Edition. Benjamin Cummings.
3. Odum, E.P., (2008). Fundamentals of Ecology.Indian Edition. Brooks/Cole
4. Robert Leo Smith Ecology and field biology Harper and Row publisher
5. Ricklefs, R.E., (2000). Ecology.V Edition. Chiron Pres

Mapping of COs to Syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4
CO1	H			
CO2		H		
CO3			H	
CO4				H

ZGMP312P: MINOR PROJECT: 4 Credit

ZGAB408T: ANIMAL BIOTECHNOLOGY
(2 Credits: 30 Hours) (L-T-P: 3-0-0)

Objective(s)
To study the techniques and application of animal biotechnology and their relevance in today's world

Course Outcomes:
CO 1: Define the concept and scope of animal biotechnology.(Understanding)
CO 2: Understand the basic molecular technique for gene manipulation.(Understanding)
CO 3: Analyze animal cell culture and gene therapy procedure in molecular diagnosis of various genetic diseases. (Analyzing)
CO 4: Apply the practical concepts of basic techniques in animal biotechnology.(Applying)

Module1. Introduction (2 Hours)
Concept and scope of animal biotechnology

Module2. Molecular Techniques in Gene manipulation (12 Hours)
Outline of Recombinant DNA technology, introduction to Cloning vectors and Restriction enzymes. Techniques used in animal biotechnology: DNA isolation, PCR, Sanger Sequencing, DNA microarray.

Module 3. Genetically Modified Organisms (10 Hours)

Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection .Applications of transgenic animals

Module 4. Applications of Biotechnology (6 Hours)
Animal cell culture, application of animal biotechnology in healthcare and medicine.

Suggested Readings:

1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.
2. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA
3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.
4. Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.
5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y.,USA.
6. Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.

Mapping of CO's to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	L	L
CO2		H		
CO3			H	M
CO4				H

ZGAB409L: ANIMAL BIOTECHNOLOGY LAB

(1 Credit: 30 Hours) (L-T-P: 0-0-1)

Objective(s)
To acquaint oneself with basic biotechnology experiments

Course Outcomes:
CO 1: Explain and perform the process of DNA isolation (Understanding, Applying)
CO 2: Experiment with DNA with different enzymes (Applying)
CO 3: Learn PCR technique and analysis (Analysing)
CO 4: Explain and interpret different biological techniques (Understanding**)**

Syllabus:
1. Genomic DNA isolation from sample
2. Restriction digestion of plasmid DNA.
3. Polymerase chain reaction (demonstration)
4. To study following techniques through photographs: Southern Blotting, Northern Blotting Western Blotting , DNA fingerprinting

Suggested Readings:

1. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.
2. Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.
3. Sambrook, Joseph. 2001. Molecular Cloning : A Laboratory Manual. Cold Spring Harbor, N.Y. :Cold Spring Harbor Laboratory Press
4. S , Janarthanan and S, Vincent. 2007. Practical Biotechnology: Methods and Protocols World Universities Press.

Mapping of CO's to syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4
1	H			
2		H		
3			H	
4				H

ZGRM410T: RESEARCH METHODOLOGY

(2 Credits: 30 Hours)(L-T-P: 2-0-0)

Objective(s):

- *To develop the students to understand about various aspect of research and its significance.*
- *To create the analytical thinking and judicious solving on any activities in their future.*

Course outcomes:

CO 1: Define various skinds of research, objectives of doing research,research process, research designs and sampling. (Remembering)
CO 2: Demonstrate basic knowledge on research techniques. (Understanding)
CO 3: Analyze the data collected in research through the use of analytical research tools. (Analyzing)
CO 4: Design solutions to varied biological problems. (Creating)

Module I: Foundations of Research (5 Hours)

Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vsApplied

Module II: Research Design (8 Hours)

Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs

Module III: Data Collection, Analysis and Report Writing (12 Hours)

Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis writing, Preparation of Tables and Bibliography. Data Presentation using digital technology

Module IV: Ethical Issues (5 Hours)

Intellectual property Rights, Commercialization, Copyright, Royalty, Patent law, Plagiarism, Citation, Acknowledgement

Suggested readings

1. Anthony, M, Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry, Allynand Bacon.
2. Walliman, N. 2011.Research Methods- The Basics. Taylor and Francis, London, New York.
3. Wadhera, B.L.: Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, 2002, Universal Law publishing
4. C.R.Kothari: Research Methodology, New Age International, 2009
5. Coley, S.M. and Scheinberg, C.A. 1990, “Proposal writing”. Stage Publications.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H	M	
CO 2	H			
CO 3	M	M	M	H
CO 4			H	

ZGWC411T: WILDLIFE CONSERVATION AND MANAGEMENT

(2 Credits: 30 Hours) (L-T-P: 2-0-0)

Objective(s)

To impart the knowledge on modern concepts of management and conservation of Wildlife and the related Government Act.

Course Outcome:

CO 1: Explain the importance of evaluation and management of wildlife and their habitat. (Understanding)
CO 2: Analyze various characteristics of population. (Analyzing)
CO 3: Explain the management strategies to protect/unprotected areas. (Understanding)
CO 4: Apply conservation and management strategies for local endangered species. (Applying)

Module I: Introduction (7 Hours)

Introduction to Wild Life, evaluation of wild life Habitat, remote sensing and GIS in evaluation of wildlife habitat; Depletion of Wildlife; Importance of conservation; Conservation ethics, World conservation strategies.

Module II: Management of habitats (6 Hours)

Setting back succession; Grazing logging; Mechanical treatment; Advancing the succession process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats

Module III: Population estimation (6 Hours)
Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.

Module IV: Management and planning (9 Hours)
Protected areas National parks & sanctuaries, Community reserve; Important features of protected areas in India; Management planning of wild life in protected areas; Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbence.

Module V: Management of excess population (2 Hours)
Bio- telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal

Suggested Readings:
1. Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
2. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflictor Co-existence? Cambridge University.
3. Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5 th edition. The Wildlife Society, Allen Press.
4. Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
5. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	M		H
CO2			H	M	
CO3	L			H	
CO4	M	L		H	M

ZGWC412L: WILDLIFE CONSERVATION AND MANAGEMENT LAB

(1 Credits: 30 Hours) (L-T-P: 0-0-1)

Objective(s)
To identify the different wildlife species and demonstration of wildlife census.

Course Outcomes:
CO 1: Identify different fauna species. (Applying)
CO 2: Apply the equipment used for wildlife studies. (Understanding, applying)
CO 3: Analyze animal signs (Analyzing)
CO 4: Apply different field and survey techniques (Applying)

Syllabus:
1. Identification of mammalian fauna, avian fauna, herpeto-fauna.
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
4. Demonstration of different field techniques for flora and fauna
5. PCQ, Ten tree method, Circular, Square & rectangular plots, Parker's 2 Step and other methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.
6. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)

Suggested Readings:
1. Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
2. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflictor Co-existence? Cambridge University.
3. Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5 th edition. The Wildlife Society, Allen Press.
4. Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
5. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

Mapping of COs to Syllabus

Course Outcomes	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6
CO1	H					
CO2		H				
CO3			H			
CO4				H	H	H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	ZGAC108L	Apiculture	3 (0-0-3)
2	S E Course 2	ZGSE109L	Sericulture	3 (0-0-3)
3	S E Course 3	ZGAK214L	Aquarium Fish Keeping	3 (2-0-1)

ZGAC108L: APICULTURE

(3 credits: 45 Hours)(L-T-P: 3-0-0)

Objective(s)

The students will be able to understand the basics knowledge of beekeeping, beekeeping tools, equipment, and managing beehives.

Course Outcomes:

CO 1: The learner will be able to manage beehives for honey production and pollination. (Applying)
CO 2: The course will be useful for providing self-employment to the learner. (Understanding)
CO 3: The learner will be able to understand the marketing of various bee products. (Understanding)
CO 4: The learner will be able to apply the basics knowledge of beekeeping tools, equipment, and managing beehives. (Applying)

Module I: (3 Hours)

Introduction to Apiculture: Importance and History

Module II: (6 Hours)

Different Species of Honey bee. Species and Sub-Species of Hive Bees, General morphology and anatomical features.

Module III: (Hours)

Colony Organization and Life cycle of honey bee. Dances of honey bees

Module IV: (7 Hours)

Bee Hive and other Equipment, Selection of Apiary site and bee Species, Examination of bee colony, Maintenance of Apiary records

Module V: (10 Hours)

Principles of Bee Management, Spring management, Swarming and control, Summer management, Monsoon and Autumn management, Winter management, Swarming and control, Migratory bee keeping

Module VI: (5 Hours)

Dividing, Uniting and Shifting of bee colonies, Robbing and Absconding, Supplementary feeding, Economics of Bee Keeping

Module VII: (3 Hours)

Queen Management, Queen rearing, Mass Queen rearing

Module VIII: (5 Hours)

Bee enemies and diseases: Predatory wasps, Wax moths, Ectoparasite mites and other bee enemies. Different diseases of honey bees.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	M			E	M			
CO2		E			H		E	M
CO3	M			M		E		
CO4			E				M	

ZGSC109L: SERICULTURE

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To inculcate the skills in Sericulture with special emphasis on the rearing of silkworms, diseases and pest and entrepreneurship in Sericulture

Course Outcomes:

CO 1: Outline various kinds of silkworms, their life cycles, the silk they produce and the present status of silk production in India as well as abroad (Understanding)
CO 2: Examine silkworm rearing techniques, with special importance given to those extensively reared in North East India (Analyzing)
CO 3: Inspect the loss in silk production due to increased silkworm mortality as a result of pests and diseases (Analyzing)
CO 4: Design start-ups or entrepreneur proposals to enhance the economy of the Sericulture industry thereby boosting the younger generation to develop skill in uplifting this indigenous industry (Creating)

Module I: Introduction (4 Hours)

Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture

Module II: Biology of Silkworm (6 Hours)

Life cycle of *Philosamiaricini, Antheraeaassama and Bombyxmori,* Structure of silk gland and secretion of silk

Module III: Rearing of Silkworms (15 Hours)

Selection of a non-mulberry variety and establishment of garden, Rearing of Eri, Muga and Bombyxmori silkworm, Rearing house and rearing appliances Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types ofmountages Spinning, harvesting and storage of cocoons.

Module IV: Pests and Diseases (5 Hours)

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases

Module V: Entrepreneurship in Sericulture (15 Hours)

Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

Suggested Readings:

1. Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
2. Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhana CSB, Bangalore
3. Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn.& Pub. Govt. Press, Bangalore
4. Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
5. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan1972.
6. Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
7. Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
8. A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
9. Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M	H	H		
CO2	M	M	M		
CO3			E	E	H
CO4		E	E		

ZGAK214L: AQUARIUM FISH KEEPING

(2 Credits: 30 Hours) (L-T-P:2-0-0)

Objective(s):

- *To understand the scope of aquarium fish industry.*
- *To develop entrepreneurship skills on aquarium fish keeping as a future career.*

Course/ Learning Outcomes:

CO 1: Explain the scope of aquarium fish industry and the biology of aquarium fishes, both freshwater and marine. (Understanding)
CO 2: Compare food formulation and feeding techniques of aquarium fish. (Analyzing)
CO 3: Analyze the scope of the aquarium fish Industry as a means of livelihood (Analyzing)
CO 4: Identify techniques and skills in fish transportation (Applying)

Module I: Introduction to Aquarium Fish (2 Hours)

Introduction to aquarium fish, the scope of aquarium fish industry based on endemic and exotic species.

Module II: Biology of Aquarium Fishes (10 Hours)
Common characters and sexual dimorphism of Freshwater and Marine fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.

Module III: Food and feeding of Aquarium fishes (8 Hours)
Use of live fish feed organisms. Preparation and composition of formulated fish feeds.

Module IV: Fish Transportation (4 Hours)
Live fish transport - Fish handling, packing and forwarding techniques.

Module V: Maintenance of Aquarium (6 Hours)
General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry.

Suggested Readings

1. Brymer, J.H.P. (1967): Guide to tropical fish keeping. Ilifie, London.
2. Col, G.I. (1971): Tropical marine aquaria. Harmlyn
3. Dutta, R. (1972): Tropical fish setting up & maintaining fresh water & marine aquarium. Octopus Books, Ltd.
4. Amita Saxena (2011): Aquarium Management. Daya Publishing House.
5. Himlins, A.D. (Ed.) (1981): Aquarium system. Academic Press.
6. Hunnam F. Ward Lock (1981): Living aquarium. Littlehampton Book Services Ltd.
7. Rataj, K. & Zukal, R. (1971): Aquarium fishes & plants. Littlehampton Book Services Ltd.
8. Spotte, S. (1979): Sea water aquariums: The Captive Environment. John Wiley & Sons.
9. Ray L.P. (1956): Ornamental fish for Garden ponds and home aquarium.
10. Vagi, D. and Thomas, H.W. (1963): Complete aquarium.

Mapping of COs to Syllabus:

Course Outcomes	CO 1	CO 2	CO 3	CO 4	CO 5
Module I	H		M		
Module II	H				
Module III		H			
Module IV				H	
Module V			H		H

INTERNSHIP/APPRENTICESHIP/MINOR PROJECT

Semester	Category	Course Code	Course Name	Credits
2	Internship	ZGIN109I	Internship	4
4	Internship	ZGIN215I	Internship	4
5	Internship	ZGIN317I	Internship	2

ZGIN109I/ ZGIN215I: INTERNSHIP (Exit of 1st Year or 2nd Year)
(4 Credits: 120 Hours)

BOIN317I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)
(2 Credits-60 Hours)
Objectives:
1. Understanding of the world of work: To provide undergraduate students with an opportunity to improve their understanding of the experiences, challenges, and opportunities of the real world of work as well as to set their expectations and behavior in accordance with the demands, culture and values of current and emerging jobs.
2. **Developing research aptitude:** To create and facilitate conditions that allow students in their quest for knowledge, its discovery, learn, understand and sharpen research acumen, familiarizing with analytical tools and techniques with appropriate usage, research methodologies, data analysis, integrity and ethical behaviour, manuscripts preparations, identification of appropriate journals, patent and intellectual property rights, and their application in solving research/complex/real-life problems.

3. To get exposure to the emerging technologies which can improve work processes/ job roles for a better employability in job sector.
4. Enhance entrepreneurial capabilities: Understand how organizations / enterprises are formed for sustainable progress so that start-ups and entrepreneurial capabilities are strengthened among students and encouraged them to be job creators.
5. Development of decision-making and teamwork skills: To facilitate the development of problem-solving and decision-making skills, enable teamwork and collaboration culture to promote research, academic and professional development.
6. Cultivate a sense of Social imagery and citizenship responsibility, and enhancing professional competency.

Duration: Internship/Apprenticeship may be of 1 month duration (full time) and 3 months duration (part time).
Attendance: Co-Supervisor of the Institutions/Laboratories/Industries/Companies where the student is undergoing Internship/ Apprenticeship will have to maintain regular attendance records of the intern.
Assessment: Assessment would be carried out by the Supervisor and Co-supervisor based on the regularity of the student; submission of progress report followed by seminar presentation of the report.
The intern will be evaluated through a seminar/viva voce on his work, by a duly constituted expert committee (One Internal and One external), on the following suggestive aspects.

Component		Weightage
i.	Activity logbook and evaluation report of Internship Supervisor	20
ii.	Format of presentation and the quality of the intern's report	30
iii.	Acquisition of skill sets by the intern	20
iv.	Originality and any innovative contribution	10
v.	Significance of research outcomes	10
vi.	Attendance	10
	Total	100

GUIDELINES FOR INTERNSHIP
1. Any kind of Internship may be carried out by the students of the Department of Zoology in any reputed and recognized Institutions/Laboratories/Industries/Companies which is recognized by Assam Don Bosco University.
2. A written permission for Internship/Apprenticeship must be obtained from the Head of the Department/ Registrar of the University. All interns must be under the supervision of the faculty members of the Department of Zoology and may be Co-supervised by other of that institution who is a regular employee at the level of Assistant Professor and above.
3. All interns must abide by the rules and regulations of the host Institutions. After the completion of the Internship, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in Letterhead clearing mentioning the starting and completion dates of Internship/ Apprenticeship.
4. A report about the Internship/ Apprenticeship undertaken by the student will have to be submitted to the concerned department at the end of the Internship/Apprenticeship.

ZGMP312P: MINOR PROJECT
(4 CREDITS-120 HOURS)

GUIDELINES FOR INTERNSHIP AND MINOR PROJECT:
Any kind of Internship or Minor project may be carried out by the students of the Department of Zoology in any reputed and recognized Institutions/Laboratories/Industries/Companies which is recognized by Assam Don Bosco University. A written permission for Internship/Apprenticeship/Minor project must be obtained from the Head of the Department/ Registrar of the University. All interns must be under the supervision of the faculty members of the Department of Zoology and may be Co-supervised by other of that institution who is a regular employee at the level of Assistant Professor and above. All interns must abide by the rules and regulations of the host Institutions. After the completion of the Internship/Apprenticeship/Minor project, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in Letterhead clearing mentioning the starting and completion dates of Internship/Apprenticeship/Minor project. A report about the Internship/Apprenticeship/Minor project undertaken by the student will have to be submitted to the concerned department at the end of the Internship/Apprenticeship/Minor project.
Duration: Internship/Apprenticeship/Minor project may be of 2 months duration (full time) and 6 months duration (part time).
Attendance: Co-Supervisor of the Institutions/Laboratories/Industries/Companies where the student is undergoing Internship/Apprenticeship/Minor project will have to maintain regular attendance records of the intern.
Assessment: Assessment would be carried out by the Supervisor and Co-supervisor based on the regularity of the student; submission of progress report followed by seminar presentation of the report.

RESEARCH PROJECT /DISSERTATION

BSC ZOOLOGY (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	ZGDI413P	Research Project Phase I	6
8	Research Project/Dissertation	ZGDI414P	Research Project Phase II	6
BSC ZOOLOGY (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	ZGDI415P	Dissertation I	18
8	Research Project/Dissertation	ZGDI416P	Dissertation II	20

BSC ZOOLOGY (Honours)

ZGDI413P: RESEARCH PROJECT PHASE I
(6 credits – 180 hours) (L-T-P: 0-0-12)

ZGDI414P: RESEARCH PROJECT PHASE II
(6 credits – 180 hours) (L-T-P: 0-0-12)

BSC ZOOLOGY (Honours) with Research

ZGDI415P: DISSERTATION I
(18 Credits -540 Hours) (L-T-P: 0-0-36)

ZGDI416P: DISSERTATION II
(20 Credits -600 Hours) (L-T-P: 0-0-40)

GUIDELINES FOR RESEARCH PROJECT/DISSERTATION:
Research Project/Dissertation must be carried out in the department under the supervision of faculty members. In case of inter-disciplinary Research Project/Dissertation, a co-supervisor may be opted from within the school or from any other departments within the University for better quality data generation and results. If a student wants to carry out a portion of the Research Project/Dissertation in any Institutions/Laboratories/Industries/Companies outside the University, a written permission has to be obtained by the student from the Head of the Department or Registrar of the University. The student involved in the Research Project/Dissertation, Assam Don Bosco University will be the sole proprietor of any publications/patents/commercialization generated out of the Research Project/Dissertation works but due acknowledgement must be given to other faculties involved in the project from partner Departments/Institutions/Laboratories. All Research Project/Dissertation students must abide by the rules and regulations of the host Institutions/Laboratories/Industries/Companies. After the completion of the Research Project/Dissertation, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in letterhead clearing mentioning the starting and completion dates of Research Project/Dissertation. A detail report of the project/works carried out by the student will have to be submitted to the concerned Department and Library of Assam Don Bosco University at the end of the project period.

Duration: Research Project/Dissertation will be carried out for 2 semesters (7^{th} and 8^{th} semester). Written permission from the University authorities must be obtained for extension of the Research Project/Dissertation if need arises.

Attendance: Faculty Supervisor/Co-supervisor of the Institutions where the student is carrying out the Research Project /Dissertation will have to maintain regular attendance records of the student.

Assessment: The B. Sc student undergoing research project/dissertation would be assessed by the Departmental Research Committee by conducting a progress report seminar.
A final report will have to be submitted to the department/University.Final assessment would be carried out at the end of 8^{th} semester by the supervisor/Co-supervisor based on the regularity of the student and submission of regular progress reports. The student will have to submit a final Research Project/Dissertation thesis in proper formats to the Department, followed by seminar presentation of the project report.The final assessment maybe conducted in the presence of an External examiner.

DEPARTMENT OF ECONOMICS

PROGRAMME: BACHELOR OF ARTS in ECONOMICS (BA)

DEGREE: BA ECONOMICS (HONOURS)/ BA ECONOMICS (HONOURS) WITH RESEARCH

VISION

- To envision excellence in quality education and molding intellectually competent persons in economics for creating novel ideas through innovative teaching and research contributing to the modern society.

MISSION

- Empower the students with critical understanding of economic theory, analytical treatment and empirical interpretations of economic issues.
- Make the students aware of recent and ongoing developments in the field of economics.
- Enhance the skill and efficiency of the students for better employability in competitive job markets.

POs – BA Economics

PO 1: **Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

PO 7: **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PSOs – BA Economics

PSO 1: **Knowledge of Economic System:** An ability to understand economic theories and functioning of basic microeconomic and macroeconomic systems.

PSO 2: **Statistical and Mathematical Skills:** Acquaint with collection, organization, tabulation and analysis of empirical data. Ability to use basic mathematical and statistical tools to solve real economic problems.

PSO 3: **Econometric Applications:** Acquaint with basic and applied econometric tools and methods used in economics. The aim of this course is to provide a foundation in applied econometric analysis and develop skills required for empirical research in economics. It also covers statistical concepts of hypothesis testing, estimation and diagnostic testing of simple and multiple regression models.

PSO 4: **Understanding Development Perspectives:** Delineate the developmental policies designed for developed and developing economics. The course is also acquainted with the measurement of development with the help of theories along with the conceptual issues of poverty and inequalities.

PSO 5: **Environmental Strategy and Management:** This course emphasizes on environmental problems emerging from economic development. Economic principles are applied to valuation of environmental quality, quantification of environmental damages, tools for evaluation of environmental projects such as cost-benefit analysis and environmental impact assessments.

PSO 6: **Perspectives on Indian Economy:** Acquaint with basic issues of Indian economy and learn the basic concept of monetary analysis and financial marketing in Indian financial markets. This course reviews major trends in economic indicators and policy debates in India in the post-Independence period.

PSO 7: **Research and Internship**: The course gives impetus to develop the analytical skill of research among the students through dissertation and project works. The internship programme provides the students with the exposure to explore various institutions where they can earn the experience of working in the field of their interest.

Mapping of POs & PSOs

Sl.	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7

1	ENMI100T	H	M	H	M	M	M	H	H	M	H	M		H	H
2	ENMA101	H	M	M	M	H	H	M	H	M	M	H		H	H
3	ENIC200T	H		M				H	H	H				M	
4	ENSM201T	H	M		M			H	L	H	H				H
5	ENIA202T	H	M	M		M	L	H	H			H		H	
6	ENIE203T	H	M		M	M	H	M	H	M	H		M		M
7	ENFE204T	H	M		M			H	L	H	H				H
8	ENDE300T	M	M			H	H	H	M	M		H	H	H	H
9	ENEE301T	H		H		M	H	M	H			H	H	H	M
10	ENIF302T	H			M	H		H	L			M		H	H
11	ENPO303T	H		M	H	M		H	L			M		H	H
12	ENPB304T	H		H		H		M	H		M	H		H	H
13	ENLE305T	H	M	M	M	M		H	H	M	M	H		H	M
14	ENPR306P	H	M	M	M			H	M			M	M	M	H
15	ENAE400T	M	M		M			H	M	H	H	M			H
16	ENAG401T	M				H		M				H	M	H	
17	ENHE402T	H	M	H	M		H	M	H	H	M	H		H	H
18	ENED403T	H	M		H			M	H	M			H	M	H
19	ENIN102T	H				M		M				H	M	H	
20	ENNE103T	H		M	H	M		H	H		M	H	M	H	H
21	ENET205T	H		M		H	H	M	M	M		H	M	M	M
22	ENGE206T	H	M	H	H	H	M	M	M	M		M	H	H	H
23	ENPU307T	M			H	M		H	L			M		H	H
24	ENRD308T	M		H	H	M	H	H	H	M		H	H	H	H
25	ENID404T	H	H			M	M	M	H			H	M		H
26	ENRM405T	H	H	M	H	M		H	M	H	H	H	L	M	H
27	ENCD406T	M				H		M				H	M	H	
28	ENME104L	H	M	L	M			M	L	H	H	L			H
29	ENDA105L	M	H					H	M	H	M				H
30	ENSP207L	M	M		M			H	L	H	H				H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	ENMI100T	Introductory Microeconomics	4
2	Major Course 2	ENMA101T	Introductory Macroeconomics	4
3	Major Course 3	ENIC200T	Intermediate Microeconomics	4
3	Major Course 4	ENSM201T	Statistical Methods for Economics	4
4	Major Course 5	ENIA202T	Intermediate Macroeconomics	5
4	Major Course 6	ENIE203T	International Economics	5
4	Major Course 7	ENFE204T	Fundamentals of Econometrics	4
5	Major Course 8	ENDE300T	Development Economics	5
5	Major Course 9	ENEE301T	Environmental Economics	5
5	Major Course 10	ENIF302T	Indian Financial System	4
6	Major Course 11	ENPO303T	Population Economics	4
6	Major Course 12	ENPB304T	Public Economics	4
6	Major Course 13	ENLE305T	Labour Economics	4
6	Major Course 14	ENPR306P	Project on Resource Mapping (Rural/Urban)	4
7	Major Course 15	ENAE400T	Applied Econometrics	5
7	Major Course 16	ENAG401T	Agricultural Economics	5
8	Major Course 17	ENHE402T	Health Economics	5
8	Major Course 18	ENED403T	Economics of Education	5

ENMI100T: INTRODUCTORY MICROECONOMICS
(4 credit- 60 hours) (L-T-P: 4-0-0)

Objective(s)
This course is designed to expose the students to the basic principles of microeconomic theory. The emphasis of the course will illustrate how microeconomic concepts can be applied to analyze real-life situations. Thus, it provides a sound understanding in microeconomic theory to formally analyze the behavior of individual agents. This course looks at the behavior of the consumer and the producer and also covers the behavior of a competitive firm.

Course/ Learning Outcomes
At the end of this course students will be able to:
CO 1: Classify microeconomics from the perspective of individual decision making as consumers and producers. (Remembering and understanding)
CO 2: Apply the microeconomic tools in factor markets and how firms work (Applying)
CO 3: Interpret the characteristics of firms and input markets in perfect competition. (Analyzing)
CO 4: Justify the use of microeconomic tools for analyzing real time situations. (Evaluating)

Module I: Consumer Behavior (18 hours)
The Economic Problem – Scarcity and Choice, Utility – Cardinal vs. Ordinal Utility; Cardinal Utility Theory – Marginal and Total Utility, Equi-marginal Utility; Consumers' Equilibrium; Marginal Valuation; Consumers' Demand Curve; Ordinal Utility Theory - Preference of Consumers; Indifference Curve; Budget Constraint; Consumer Surplus and Producer Surplus; Utility Maximization; Consumers' Equilibrium; Income Effects and Substitution Effects of a Price Change; Price Consumption Curve; Income Consumption Curve; Derivation of Demand Curve from Price Consumption Curve

Module II: Production and Costs (15 hours)
Technology and Production Function; Isoquants; Production with One and More Variable Inputs; Law of variable Proportion; Returns to Scale; Economies and Diseconomies of Scale; Short Run and Long run Costs; Cost Curves in the Short Run and Long Run; Equilibrium of the Firm

Module III: The Firm and Input Market in Perfect Competition (15 hours)
Review of Perfect Competition - Equilibrium of the Firm and Industry in the Short Run and Long Run; The Derivation of Long Run Industry Supply Curve; Constant, Increasing, and Decreasing Cost Industry; Perfect Competition and Allocative Efficiency; Labour Markets – Basic Concepts; Demand for Labour; Shifts in Labour Demand Curves; Equilibrium in Labour market; Input Demand Curves; Labour Markets and Public Policy

Module IV: Market Failures (12 hours)
Externalities and Inefficiency; A Simple Bilateral Externalities; Public Goods and Free Riders Problems; Imperfect Markets; Asymmetric Information and Markets for Lemons; Moral Hazard; Adverse Selection; Signaling, Role of the State

Suggested Readings

1. Karl E. Case & Ray C. Fair, Principles of Economics, Pearson Education Inc., 8th Edition, 2007.
2. N. Gregory Mankiw, Economics: Principles and Applications, India edition by South Western, a part of Cengage Learning, Cengage Learning India Private Limited, 4th edition, 2007.
3. Joseph E. Stiglitz and Carl E. Walsh, Economics, W.W. Norton & Company, Inc., New York, International Student Edition, 4th Edition, 2007.
4. G.S. Maddala& Ellen Miller, Microeconomics: Theory and Applications, McGraw Hill Education, Tenth Reprint, New Delhi Edition, 2013.
5. A. Koutsoyinnis, Modern Microeconomics, International Edition, Macmillan Press Ltd.
6. D. Salvator, Principles of Microeconomics, 5th Edition, OUP.
7. R. S. Pindyck, D. N. Rubinfeld& P. L. Meheta, Microeconomics, 7th Edition, Pearson, New Delhi, 2009.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2		M	H	H
CO3			M	M
CO4			M	M

ENMA101T: INTRODUCTORY MACROECONOMICS

(4 credits- 60 Hours) (L-T-P: 4-0-0)

Objective(s)
The course aims to introduce and explain the preliminary concepts associated with the determination and measurement of aggregate macroeconomic variables like GDP, consumption, savings, investment, and balance of payments. Further, this course introduces the students to formal modeling of a macro-economy in terms of analytical tools. It discusses various alternative theories of output and employment determination in a closed economy in the short run as well as medium run, and the role of policy in this context.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define and understand the basic concepts of macroeconomics including national income, money, business cycle and related concepts of closed economy (Remembering and Understanding).
CO 2: Apply some basic principles of macroeconomics. (Applying)
CO 3: Analyze the quantity theory of money, Keynesian model of income determination, IS-LM model and its application for real life economic decision making. (Analyzing)
CO 4: Interpret the various roles of monetary and fiscal policy in credit control and inflation. (Evaluating)

Module I: Introduction to Macroeconomics and National Income Accounting (15 hours)
Basic Issues Studied in Macroeconomics; Concepts of National Income- GNP, NNP, NI at Factor Cost and Market Prices; Measurements of Gross Domestic Product; Income, Expenditure and the Circular Flow; Real vs. Nominal GDP; Price Indices; National Income Accounting for an Open Economy; Limitations of the GDP concept

Module II: Money (18 hours)
Functions of Money; Quantity Theory of Money – Classical and Modern Approach; Post-Keynesian theories of Demand for Money- Patinkin, Baumol, Tobin; Determinants of Money Supply in India; High Powered Money; Credit Creation; Tools of Monetary Policy- RBI

Module III: Cyclical Fluctuation (8 hours)
Characteristics of Cyclical Fluctuation; Business Cycle in Market Economies; Short-Term vs. Long-Term Growth Trend; Theories of Business Cycles – Hawtrey, Samuelson, Hicks, Kaldor, Schumpeter; Impact of Recession on Trade Imbalances

Module IV: The Closed Economy in the Short Run (20 hours)
Classical and Keynesian Systems; Simple Keynesian Model of Income Determination; IS-LM Model; Fiscal Policy in Keynesian Model; Fiscal and Monetary Multipliers; Comparative study of Monetary and Fiscal Policies.

Suggested Readings

1. Dornbusch, Fischer &Startz, Macroeconomics, McGraw Hill, 11th edition, 2010.

2. N. Gregory Mankiw, Macroeconomics, Worth Publishers, 7th edition, 2010.
3. Olivier Blanchard, Macroeconomics, Pearson Education, Inc., 5th edition, 2009.
4. Richard T. Froyen, Macroeconomics, Pearson Education Asia, 2nd edition, 2005.
5. Andrew B. Abel & Ben S. Bernanke, Macroeconomics, Pearson Education, Inc., 7th edition, 2011.
6. Errol D'Souza, Macroeconomics, Pearson Education, 2009.
7. Paul R. Krugman, Maurice Obstfeld& Marc Melitz, International Economics, Pearson Education Asia, 9th edition, 2012.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		M	H	M
CO 3	H	H		
CO 4			M	H

ENIC200T: INTERMEDIATE MICROECONOMICS

Total Credit: 4 (60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course presents a logical and coherent framework in which to organize observed economic phenomena. Microeconomic theory is based on the notion that individuals (and firms) have well-defined objectives (such as maximizing utility or profits) and behave systematically according to the incentives and constraints of their economic environment. It is this framework the course has been designed to gain a fundamental understanding of the choices people make in an economic setting.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Identify the concepts and terms of microeconomics. And classify the role of economic agents and their interdependence (Remembering and Understanding)

CO 2: Apply the basic principles of microeconomics. (Applying)

CO 3: Illustrate the behavior of consumer and producer in different situations.Analyzing)

CO 4: The production techniques under perfect markets and discuss the use of microeconomic tools for examining real life problems(Evaluating)

Module I: Consumer Choice under Risk and Uncertainty (15 hours)

Choice Under Risk and Uncertainty – Uncertainty and Probability Distributions; Expected Value and Expected Utility; Maximizing Expected Utility; Expected Utility Hypothesis; Expected Utility Functions and Attitudes towards Risk – Risk Neutral, Risk Averse Risk Preference, Certainty Equivalent and Risk Premium; Demand for Risky Assets; Reducing Risks; Intertemporal Choice – Saving and Borrowing

Module II: Market Structure (15 hours)

Derivation of Long Run Industry Supply Curve; Constant, Increasing, and Decreasing Cost Industry; Monopoly Equilibrium; Pricing with Market Power; Degree of Monopoly Power; Price Discrimination under Monopoly; Equilibrium of Multi-plant Monopoly; Monopolistic Competition – Price and Output Determination; Excess Capacity under Monopolistic Competition; Duopoly Model- Cournot, Bertrand, Stackelberg; Oligopoly – Basic Structure; Kinked demand curve, Collusive and Non-collusive Oligopoly

Module III: Welfare Economics (15 hours)

Pareto Optimality; Social Welfare Functions – Bergson & Samuelson, Arrow; Maximization of Social Welfare; Grand Utility Frontier; Compensation Criteria- Kaldor and Hicks; Arrow's Impossibility Theorem; Edgeworth Box; The Theory of Second Best; Social vs. Private Costs and Benefits

Module IV: Game Theory (15 hours)

Game Theory – Basic Ideas; Two-person Zero-Sum Game; Dominant Strategy; Prisoners' Dilemma; Nash Equilibrium; Tit-for-tat Strategy; Non-Zero Sum Game – Basic Ideas, Examples; The Concept of Repeated Game; Competitive Strategy

Suggested Readings

1. Karl E. Case & Ray C. Fair, Principles of Economics, Pearson Education Inc., 8th Edition, 2007
2. N. Gregory Mankiw, Economics: Principles and Applications, India edition by South Western, a part of Cengage Learning, Cengage Learning India Private Limited, 4th edition, 2007
3. Joseph E. Stiglitz and Carl E. Walsh, Economics, W.W. Norton & Company, Inc., New York, International Student Edition, 4th Edition, 2007

4. G.S. Maddala& Ellen Miller, Microeconomics: Theory and Applications, McGraw Hill Education, Tenth Reprint, New Delhi Edition, 2013
5. Koutsoyinnis, Modern Microeconomics, International Edition, Macmillan Press Ltd
6. D. Salvator, Principles of Microeconomics, 5th Edition, OUP
7. R. S. Pindyck, D. N. Rubinfeld& P. L. Meheta, Microeconomics, 7th Edition, Pearson, New Delhi, 2009

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			M
CO2		M	M	
CO3	H		M	H
CO4		M		H

ENSM201T: STATISTICAL METHODS FOR ECONOMICS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course will provide a solid foundation in probability and statistics for students in economics and other social sciences. Students will learn topics including elements of probability theory, sampling theory, statistical estimation, and hypothesis testing. The course is designed to enhance the decision making process. Moreover, the course emphasizes topics needed for further study of econometrics and helps in developing research hypotheses for research projects.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define and understand simple concepts of statistics. (Remembering and Understanding)
CO 2: Apply the statistical techniques to calculate various measures of central tendency, dispersion and probability. (Applying)
CO 3: Analyze the sampling and economic data and draw inferences from it. (Analyzing)
CO 4: Evaluate the statistical inferences in understanding real economic problem (Evaluating)

Module I: Probability Theory (15 Hours)

Sample Spaces and Events; Probability Axioms and Properties; Addition and Multiplication Theorem of Probability, Counting Techniques; Conditional Probability and Bayes' Rule; Independence of Events

Module II: Random Variables and Probability Distributions (20 hours)

Defining Random Variables; Probability Distributions; Expected Values of Random Variables and of Functions of Random Variables; Properties of Commonly used Discrete and Continuous Distributions (Uniform, Binomial, Normal, Poisson and Exponential Random Variables); Joint Distribution; Covariance and Correlation Coefficients

Module III: Statistical Distributions and Hypothesis Testing (15 hours)

Normal Distribution; $\chi 2$, t and F Distributions; Parameters and Statistics; Estimation of Parameters; Properties of Estimators; Testing of Hypotheses - Steps and decision making process; Distributions of Test Statistics; Testing Hypotheses related to Population Parameters; Type I and Type II Errors; Power of a Test

Module IV: Sampling and Parameter Estimation (15 hours)

Principal Steps in a Sample Survey; Methods of Sampling; Role of Sampling Theory; Properties of Random Samples; Errors in Statistics - Sampling vs. Non-sampling Errors; Estimation of Population Parameters; Properties of Estimators; Confidence Intervals for Population Parameters

Suggested Readings

1. Jay L. Devore, Probability and Statistics for Engineers, Cengage Learning, 2010
2. John E. Freund, Mathematical Statistics, Prentice Hall, 1992.
3. Richard J. Larsen & Morris L. Marx, An Introduction to Mathematical Statistics and its Applications, Prentice Hall, 2011.
4. William G. Cochran, Sampling Techniques, John Wiley, 2007.
5. Gupta S.C, Fundamentals of Statistics, Himalaya Publishing House, 2018.

Mapping of COs

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M		M
CO2	M	H	M	M
CO3		H	H	H
CO4			H	M

ENIA202T: INTERMEDIATE MACROECONOMICS

(5 credit - 75 Hours) (L-T-P: 3-0-0)

Objective(s):

This course introduces the students to formal modeling of a macro-economy in terms of analytical tools. It also provides the macro-foundations to the various aggregative concepts used in the previous course. It introduces various theoretical issues related to an open economy. It also introduces the concept of inflation, its relationship with unemployment and some basic concepts in an open economy.

Course /Learning Outcomes

At the end of the course students will be able to:

CO 1: Understand macroeconomics from the perspective of policy making. (Understanding)
CO 2: Apply some basic principles of macroeconomics. (Applying)
CO 3: Draw Inferences from interactions between macroeconomic thoughts and real life situations. (Analyzing)
CO 4: Interpret the links between the domestic economy and the rest of the world. (Evaluating)

Module I: Aggregate Demand and Aggregate Supply Curves (15 hours)

Derivation of aggregate demand and aggregate supply curves; interaction of aggregate demand and supply; Multiplier analysis with AD curve and changes in price levels; Aggregate supply in the SR and LR

Module II: Macroeconomic Foundations (20 hours)

Consumption: Keynesian Consumption Function; Fisher's Theory of Optimal Intertemporal Choice; Life-cycle and Permanent Income Hypothesis; Rational Expectations and Random-walk hypothesis of Consumption Expenditure; Investment: Determinants of Business Fixed Investment; Residential Investment and Inventory Investment; Marginal Efficiency of Capital and Investment

Module III: Inflation, Unemployment and Expectations (25 hours)

Inflation – Types, Causes, Effects; Measures to Control Inflation; Pull and Cost Push; Inflationary Gap; Inflation and its Social Costs; Anti-inflationary Measures; Structural Theories of Inflation; Inflation in Developing Countries; Inflation-unemployment Trade-off – Phillips Curve; Hyperinflation; Deflation – Meaning, Effects; Inflation vs. Deflation; Adaptive Expectations; Rational Expectations.

Module IV: Open Economy Models (15 hours)

Short-run Open Economy Models; Mundell-Fleming Model; Exchange Rate Determination; Purchasing Power Parity; Dornbusch's Overshooting Model; Monetary Approach to Balance of Payments; International Financial Markets; Inflation and Unemployment in the Open Economy

Suggested Readings

1. Dornbusch, Fischer &Startz, Macroeconomics, McGraw Hill, 11th edition, 2010.
2. N. Gregory Mankiw, Macroeconomics, Worth Publishers, 7th edition, 2010.
3. Olivier Blanchard, Macroeconomics, Pearson Education, Inc., 5th edition, 2009.
4. Charles I. Jones, Introduction to Economic Growth**,** W.W. Norton & Company, 2nd edition, 2002.
5. Andrew B. Abel & Ben S. Bernanke, Macroeconomics, Pearson Education, Inc., 7th edition, 2011.
6. Errol. D'Souza, Macroeconomics, Pearson Education, 2009.
7. Robert J. Gordon, Macroeconomics, Prentice-Hall India Limited, 2011.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	H
CO2		H	H	
CO3	M	H		M
CO4				H

ENIE203T: INTERNATIONAL ECONOMICS

(5 Credit- 75 Hours) (L-T-P: 5-0-0)

Objective(s)

This course develops a systematic exposition of models that try to explain the concept, subject matter, direction, and consequences of international trade, and the determinants and effects of trade policy. Students will be exposed to various theories of international trade and their application. It concludes with an analytical account of the causes and consequences of

the rapid expansion of international financial flows in recent years. Although the course is based on abstract theoretical models, students will also be able to learn the real-world examples and case studies.

Course/ Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the key principles and the main theories of international economics. (Remembering and Understand)
CO 2: Apply the theories and models of international trade for economic growth and global welfare. (Applying)
CO 3: Analyze the links between trade, international finance, economic growth and globalization, with a particular emphasis on the experiences of developing countries. (Analyzing)
CO 4: Evaluate international trade policies regarding increase in exports, international debt, and international institutions to solve domestic economic problems. (Evaluating)

Module I: Introduction (15 hours)

International Economics – Meaning, Importance and Subject Matter; Gains from Trade; Overview of World Trade; Globalization of the World Economy; International capital flows – significance and limitations of foreign capital; Foreign direct investment-factors affecting direct investment, effects of direct investment; Current International Economic Problems and Challenges

Module II: Theories of International Trade (20 hours)

Offer Curves; Terms of Trade; The Ricardian Theory of Trade; Specific Factor Model of Trade; Heckscher-Ohlin Models; Leontief Paradox; New Trade Theories; Rybczinski and Stolper-Samuelson Theorem; The International Location of Production; Firms in the Global Economy – Outsourcing and Multinational Enterprises

Module III: Trade Policy (20 hours)

Instruments of Trade Policy; Trade Restrictions – Tariffs and Optimum Tariff; Nontariff Trade Barriers; Partial and General Equilibrium Analysis of a Tariff; Inward looking and outward looking trade policy; Economic Integrations – Free Trade Areas, Customs Unions, Common Markets, Optimum Currency Area, Economic Union; Dumping; Political Economy of Trade Policy; Controversies in Trade Policy

Module IV: International Macroeconomic Policy (20 hours)

Balance of Payments – Current and Capital Account; Foreign Exchange Markets – Types and Functions; Exchange Rates – Fixed vs. Flexible Exchange Rates, Spot and Forward Exchange Rates; Determination of equilibrium Exchange Rate; Foreign Exchange Risks – Hedging, Speculation, Interest Arbitrage; International Monetary Systems; WTO and International Trade; International Debt Crisis; Financial Globalization and Financial Crises

Suggested Readings

1. Salvatore, D., International Economics, Wiley, 11th Edition, 2013
2. Krugman, Paul R., & Maurice Obstfeld. International Economics. Harlow: Pearson Education, 2011
3. Chacholiades, M., International Trade: Theory and Policy, McGraw Hill, 1988
4. Cherunilam, F., International Economics, McGraw Hill India, 5th Edition, 2008
5. Södersten, Bo, & Geoffrey Reed., International Economics. Basingstoke: Macmillan, 2004

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H		M	H
CO2		H		H
CO3	M	H		M
CO4	M		H	

ENFE204T: FUNDAMENTALS OF ECONOMETRICS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course is an undergraduate level introduction to econometrics, a powerful tool applied to the analysis of economic phenomena. Students will learn the core concepts of estimation of economic parameters, prediction of economic outcomes, and statistical inference in this course. Moreover, the course covers the statistical tools needed to understand empirical economic research and to plan and execute independent research projects in future.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the basic concepts like definition, scope and nature of econometrics. (Remembering and Understanding)
CO 2: Apply various statistical tools in hypothesis testing and econometric research. (Applying)
CO 3: Analyze the results of regression models using the OLS method and make decisions with hypothesis testing. (Analyzing)

CO 4: Evaluate the regression models for violations of classical assumptions and design regression models to test hypotheses of real economic problems. (Evaluating and Creating)

Module I: Introduction to Econometrics (10 Hours)
Basics of Econometrics – Meaning and Methodology; Relation with Mathematical Economics and Statistics; Applications of Econometrics; Nature of Econometrics; Scaling and Units of Measurement

Module II: Estimation of Regression Model (20 hours)
Regression-Concepts and Functional forms; Classical Linear Regression and its Assumptions; Estimation of Simple Linear Regression models; Properties of Estimators; Goodness of Fit; Tests of Hypotheses; Confidence Intervals; Forecasting; Multiple Linear Regression-Adjusted R^2; Partial Regression Coefficients; Testing Hypotheses – Individual and Joint

Module III: Violations of Classical Assumptions (15 hours)
Multicollinearity – Consequences, Detection, Remedies; Heteroscedasticity – Consequences, Detection, Remedies; Serial Correlation – Consequences, Detection, Remedies

Module IV: Simultaneous-Equation Models and its Identification (15 hours)
Nature and Problems of Simultaneous-equation models; Structural, Reduced-form and Recursive Models; Estimation through ILS and 2SLS methods; Identification of Simultaneous-equation models

Suggested Readings

1. Jay, L. Devore, Probability and Statistics for Engineers, Cengage Learning, 2010
2. John E. Freund, Mathematical Statistics, Prentice Hall, 1992.
3. Richard J. Larsen & Morris L. Marx, An Introduction to Mathematical Statistics and its Applications, Prentice Hall, 2011.
4. Madnani, G.M.K., Introduction to Econometrics: Principles and Applications, CBS Publishers & Distributors, 2009.
5. Dougherty, C., Introduction to Econometrics, 4th ed., Oxford University Press, 2011.
6. Gujarati, D., & Porter, D., Essentials of Econometrics, 4th ed.,McGraw-Hill, 2010.
7. Kmenta, J., Elements of Econometrics, Khosla Publishing House, 2008.

Mapping of COs

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	
CO2	H	H	H	M
CO3	M	H	H	H
CO4			H	H

ENDE300T: DEVELOPMENT ECONOMICS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)
This subject will help the students to define and understand the different concepts of development. The course will help in comparing the changes in the process of development and compare among developed, developing and under-developed countries. The course will include different economic theories related to growth and development. Finally, the subject will learn to criticize and appraise different economic policies towards economic development.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define and describe the different concepts of Economic growth and development (Remembering and Understanding)
CO 2: Demonstrate the changes in Classical, Neo-classical and modern theories of economic development (Applying)
CO 3: Compare and criticize the different strategies of economic development (Analysing)
CO 4: Evaluate and Explain the different sectoral problems and policies for development (Evaluating and Creating)

Module-I: Economic Growth and Development (15 hours)
Meaning of Economic Growth and Development; Scope; Measures of Development-GDP, PCI, HDI- Gender Index-PQLI (including adjusted indices); Characteristics of Under-developed, Developing and Developed Countries; Factors determining Economic growth; Capital formation ; Technological process and economic development; Hicks Neutral Technological Change; Harrods Neutral

Module-II: Classical, Neo-Classical and Modern Theories of Economic Growth (20 hours)
Adam Smith's Theory of Economic Development; Malthus's Theory; Marx Theory; Shumpeter theory of development; Rostow's Theory of Growth; Solow Neoclassical Growth Model; Harrod-Domar Growth Model; The Neo-colonial Dependency Model;

Endogenous Growth Models-AK Model and Romer's Model; Meade's neoclassical model of economic growth-Joan Robinson's Model of Growth

Module-III: Strategies of Development (10 hours)
Lewis's theory of Economic Development; Big-Push Theory; Balanced and Unbalanced Growth Strategies; Critical Minimum Effort Theory; Social Dualism-Higgin's Technology Dualism; Mahalanobis Growth Model; Wage Good Model; Michael Kremer's O-Ring Theory

Module-IV: Sectoral Problems and Policies (15 hours)
Agriculture, Productivity and Economic Development; Land Reforms; Industrialization- Measuring Inequality- Lorenz Curve, Gini-Coefficient and Aggregate measures of inequality; Gender Inequality; Human Capital; Education and Health; Poverty; Kuznet's Inverted U Hypothesis; Poverty- MPI- Policy Options on Income Inequality and Poverty in India- Unemployment- Problems and Policies in India

Suggested Readings

1. Todaro& Smith, Economic Development, Pearson Education
2. A P. Thirlwall, Growth and Development, Macmillan Press Ltd.
3. M. L. Taneja& R. M. Myer, Economics of Development and Planning, Vishal Publishing Company.
4. Mishra &Puri, Growth and Development, Himalaya Publishing House.
5. Debraj Ray, Development Economics, Princeton University Press.
6. Abhijit Banerjee, Roland Benabou&DilipMookerjee, Understanding Poverty, Oxford University Press, 2006.
7. H.L Ahuja, Development Economics: A critical Study of Economic Growth, Development and Environment, S. Chand, 2018.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	M		M
CO2	M	H	M	M
CO3	H		M	H
CO4	M	H	H	M

ENEE301T: ENVIRONMENTAL ECONOMICS (5-0-0)

(5 Credit: 75 Hours) (L-T-P: 5-0-0)

Objective(s)
The course designed to understand the fundamental concepts, subject matter, nature and scope of environmental economics and key environmental issues and problems. The concept of market failure and externalities, Pareto efficiency, maximum social welfare and perfect competition, measures to control pollution and externalities, Pigouvian tax and subsidies, Compensation criterion, social choice and justice, property rights and Coase theorem etc. will be thoroughly discussed. Environmental concerns like climate change: global warming, ozone depletion and Biodiversity loss, policy instruments for environmental protection are the areas where serious discussion will be conducted

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define the basic concepts of environmental economics. (Remembering)
CO 2: Understand the environmental issues in relation to the theory of externalities. (Understanding)
CO 3: Analyze environmental problems using economic principles. (Applying/Analyzing)
CO 4: Evaluate the diverse methods of environmental valuation for sustainable development. (Evaluating)

Module I: Introduction (15 hours)
Environmental Economics - Meaning, Nature, Scope; Interlinkage between Economy and Environment; Population and Environment; Poverty and Environment

Module II: The Theory of Externalities (15 hours)
Pareto Optimality and Market Failure in the Presence of Externalities; Property Rights and the Coase Theorem

Module III: The Design and Implementation of Environmental Policy and Environmental Problems (20 hours)
Overview; Pigouvian Taxes and Effluent Fees; Tradable Permits; Choice between Taxes and Quotas under Uncertainty; Market base and Non Market base instrument of Environmental pollution control; Implementation of Environmental Policy; Trans-Boundary Environmental Problems; Economics of Climate Change; Trade and Environment

Module IV: Environment Valuation and Sustainable Development (20 hours)

Non-Market Values: Use Value, Option Value, Bequest Value; Measurement Methods - Willingness to Pay and Willingness to Accept Compensation; Risk Assessment and Perception. Sustainable Development - Basic Concepts and Measurement; Perspectives from Indian Experience

Suggested Readings

1. Kolstad, Charles D., Environmental Economics, Oxford University Press, New Delhi, 1999.
2. Robert N. Stavins (ed.), Economics of the Environment: Selected Readings, W.W. Norton, 5th edition, 2005.
3. Roger Perman, Yue Ma, James McGilvray and Michael Common, Natural Resource and Environmental Economics, Pearson Education/Addison Wesley, 4th edition, 2011.
4. Maureen L. Cropper & Wallace E. Oates, Environmental Economics: A Survey, Journal of Economic Literature, 1992.
5. Bhattacharya, Rabindra N., Environmental Economics: An Indian Perspective. New Delhi: Oxford University Press, 2002.
6. Hanley N., J.F. Shogren& B., White. Environmental Economics in Theory and Practice, Macmillan, 1997.
7. Lewis, Lynne, & Thomas Harry Tietenberg, Environmental Economics and Policy, Routledge, 2020.
8. Shankar, U., Environmental Economics, Oxford University Press, New Delhi, 2001.
9. Tietenberg, T., Environmental Economics and Policy, Harper Collins, New York, 1994.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			M
CO2		H		H
CO3	M		H	
CO4		H		H

ENIF302T: INDIAN FINANCIAL SYSTEM

(4 Credit - 60 Hours) (L-T-P: 4- 0-0)

Objective(s)

This course aims at providing the basic knowledge of the Indian Financial system and its components, institutions and their functions. It also helps to understand the workings of the financial institutions and their role in economic development. This also helps to understand the operation of the financial market and capital market.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Understand the basic ideas and developments of the Indian financial system. (Understanding)
CO 2: Demonstrate the workings of the Indian financial institutions. (Applying)
CO 3: Analyze the basic operation of the financial market and capital market. (Analyzing)
CO 4: Evaluate various roles and functions played by the Indian financial system in economic development. (Evaluating)

Module I: Introduction of Financial System (10 hours)

Financial System-meaning, concept, basic functions; Financial System and Economic Development; Components of Financial system; Overview of Indian Financial System

Module II: Money Market and Capital Market (15 hours)

Financial market; Classification of Financial Markets; Money Market- its constitutions, functions of Money Market, Money Market Institution; Money Market Instruments; Capital Market-Primary Market, Secondary Market, Functions of Capital Market and its significance; Methods of issue of Stock Market in Primary Market.

Module III: Financial Institution, Instruments and Services (20 hours)

Financial Institution; Banking and Non-Banking Financial Institution, Distinction between Banking and Non-Banking Financial Institutions; Structure of Banking in India; Commercial bank, Co-operative Bank, Rural Bank- their features, types of Non-Banking Financial Institution; Financial Instruments and Services- concepts and characteristics, features of various Financial Instruments, emerging Financial Service- leasing, hire-purchase, merchant banking, depository, credit rating, mutual funds; Insurance Companies and Pension Funds

Module IV: Regulatory Institutions (15 hours)

Regulatory framework; Overview of Regulatory Framework of Financial System, functions of RBI, SEBI- objectives, scope of securities Contract (Regulation) Act 1956, relevant provision of India Companies Act 1956 in regard to securities market; Insurance Regulatory and Development Authority of India; Pension Fund Regulatory and Development Authority; Small Industries Development Bank of India (SIDBI); Ministry of Corporate Affairs

Suggested Readings

1. Indian Financial System, M.Y Khan, McGraw Hill Companies.

2. Financial Institution and Markets, Structure, Growth and Innovations, L.M. Bhole, The McGraw Hill Companies.
3. The Indian Financial System, Markets, Institutions and Service, Bharati V. Pathak, Pearson Education
4. Banking Theory and Practices, K.C Shekhar, Lakshmi Shekhar, Vikas Publishing House Pvt. Ltd
5. Indian Financial System- P.N Varshney& D.K. Mittal- Sultan Chand & Sons, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		M	H	
CO3		H		
CO4	M		M	H

ENPO303T: POPULATION ECONOMICS

(4 Credit - 60 Hours) (L-T-P: 4- 0-0)

Objective(s)

The course will examine the economic determinants of population change and demographic behavior including household formation, marriage, child bearing and rearing, mortality (and especially infant mortality) and key forms of human capital investment including schooling and migration. We will apply analytical tools of economics to investigate various economic and social consequences of population change.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the different theories related with population growth and development (Remembering and Understanding)
CO 2: Examine the changes in social and political economy due to demographic changes. (Applying)
CO 3: Identify the factors responsible for internal and international Migration. (Analyzing)
CO 4: Evaluate the population growth and trends of different states in India. (Evaluating)

Module I: Population theories and Development (10 hours)

Demography –Meaning and Scope; Theories of Population – Malthus, Optimum Theory of Population; Theory of Demographic Transition – Views of Meadows; Population and Development – Demographic Dividend; Concepts of Stable Population; Methods of Population Projection

Module II: Fertility, Nuptiality and Mortality (15 hours)

Fertility – Emerging Issues in Fertility Control; Fertility Analysis; Theories of Fertility; Nuptiality Concept and Analysis of Marital Status – Single Mean Age at Marriage, Synthetic Cohort Methods, Trends in Age at Marriage; Mortality – Death Rates, Crude Age-specific; Mortality at Birth and Infant Mortality Rate; Sex and Age Pattern of Mortality; Levels and Trends of Mortality rate; Life Table Construction and Uses

Module III: Distributional Pattern of Population (20 hours)

Population Trends in the Twentieth Century; Population Distribution; Population Explosion and its Dynamics; Pattern of Age and Sex Structure; Determinants of Age and Sex Structure; Demographic Effects of Sex and Age Structure; Economic and Social Implications; Age Pyramids Projections, Measures of Population Change; Evolution of Population Policy in India– The Shift in Policy from Population Control to Family Welfare

Module IV: Migration and Urbanization (15 hours)

Internal and International Migration Flows; Internal Migration its Effect on Population Growth and Pattern; Factors Affecting Migration; Theories of Migration Related to Internal Migration; International Migration Flows; Dynamics of the International Migration Process; Urbanization Growth and Distribution of Rural-urban Population in Developed and Developing Countries; Gravity Model

Suggested Readings

1. Bogue, D.J., Principles of Demography, John Wiley, NY, 1971
2. Chenery, H. & N. Srinivasan (eds.), Handbook of Development Economics, Vol. I & II, Elsevier, Amsterdam, 1989
3. Chiang, C.L., Life Tables and Mortality Analysis, W.H.O., Geneva, 1974
4. John, R. W., Population: An Introduction to Concepts and Issues, (7th ed.), New York: Wadsworth Publishing Company, 2002
5. Shryock, H. S. et. al., The Methods and Materials of Demography, New York: Academic Press, 1976
6. Srinivasan, K., Basic Demographic Techniques and Applications, New Delhi: Sage Publications, 1998
7. Thompson, W. S. & Lewis, D. T., Population Problems, New Delhi: Tata McGraw Hills Publishing Co., 1976

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M		M
CO2		H	H	
CO3				H
CO4	M	M	H	

ENPB304T: PUBLIC ECONOMICS

(4 Credit- 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The course covers theory and evidence on government taxation policy. Topics include tax incidence, optimal tax theory, the effect of taxation on labor supply and savings, taxation and corporate behavior, and tax expenditure policy. The course also discusses the evolution of public choice theories and public expenditure theories. The impact of social safety net on productivity of the human capital, cost benefit analysis of government policies will be thoroughly covered.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the main concepts in public economic policies relating to public goods, public expenditures (Remembering/Understanding)

CO 2: Identify the main issues of budgeting and fiscal policies in context of income redistribution (Applying/ Analyzing)

CO 3: Evaluate the public investment projects and decision making in the public sector. (Evaluating)

CO 4: Examine the usefulness and problems related to government subsidies and income support (Creating)

Module I: Government Activity and Public Economic Policies (15 hours)

Efficiency, Markets and Governments – Markets, Prices, Efficiency Conditions; Market failure – A Preview of the Basis for Government Activity and the Functions of the Government; Equity vs. Efficiency – Positive and Normative Analysis; Externalities and Government Policy – Market Failures, Externalities and Efficiency; Public Choice Theory – Meaning, Outcomes of Collective Choice; The Choice Process – Unanimity, Majority Rule and the Voting Paradox, Arrow's Theorem

Module II: Theories of Public Goods, Public Expenditures and Taxation (15 hours)

The Theory of Public Goods; Provision of Private Goods and Public Goods – Markets and Government; The Demand for a Pure Public Good; Efficient Output of a Pure Public Good – Partial and General Equilibrium Analysis; Individual Action; Voluntary Cooperation and Efficiency; Local Public Goods; Voting Models of Public Goods; The Theory of Public Expenditure –Tiebout, Samuelson, Buchanan.

Module III: Budgeting, Fiscal Policies and Income Redistribution (15 hours)

Program Budgeting – It's Application; Zero-Based Budgeting; Budgeting Policies; Fiscal Policy with Special Reference to Under-developed Countries; Federal-Fiscal Relation in India; Income Redistribution – Taxes, Government Expenditures and the Distribution of Income, Welfare, Social Security and the Social Safety Net; Demographic Changes and the Future of Social Security; The Impact of Social Security on Savings and Work Incentives.

Module IV: Public Investment Projects and the Public Sector (15 hours)

Public Utilities and Project Evaluation – Cost-Benefit Analysis; Problem of Government Failure – Privatization, Devolution, Rules vs. Discretion; Public and Private Sectors – Lack of Residual Claimant, Citizens and Rational Ignorance, Collective vs. Individual Consumption.

Suggested Readings

1. Browning E K & Browning J M, Public Finance and the Price System, Pearson Education, Singapore
2. Hyman D N, Public Finance: A Contemporary application of Theory to Policy, Thomson South Western
3. Jha, Raghbendra, Modern Theory of Public Finance, Wiley Eastern, Delhi, 1987
4. Ulbrich, H., Public Finance in Theory and Practice, Thompson South Western
5. Mukherjee, S., Ghose, A. & Nag, N. N., Analytical Public Finance. Public Economics – Public Choice - Public Policies, New Central Book Agency (P), Kolkata
6. Musgrave, Richard A., The Theory of Public Finance, Tata McGraw Hill, N.Y., 1959
7. Ghosh A & Ghosh C, Public Finance, PHI Learning Private Limited, Delhi
8. Ursula, H., Public Finance, James Nisbet and Co., London, 1968

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			

CO2		H	M	
CO3		M		H
CO4		M	H	

ENLE305T: LABOUR ECONOMICS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The main objective of the course is to introduce students to core topics in the field of labour economics. The course covers topics such as wage and employment determination, immigration, unemployment, wage differentials and discrimination among many others. This course will encourage the students to develop independent research in labour economics and related fields.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define and relate the main concepts of labour economics. (Remembering and Understanding)
CO 2: Identify the main issues of wage determination. (Applying)
CO 3: Analyze the theoretical issues in labour economics. (Analyzing)
CO 4: Explain the practical applicability of theories related to labour productivity and labour mobility and evaluate the key issues of the Indian labour market to solve the problems in the labour market. (Evaluating & Creating)

Module I: Introduction to Labour Economics (10 Hours)

Concept, Nature and Scope of Labour Economics; Labour Market – Concept, Labour Supply, Labour Demand; Measuring the Labour Force, Workers Preferences, Time and Budget Constraints, Hours of Work Decision; Production Function; Imperfect Information in Labour Market; Labour Flexibility

Module II: Wage Determination, Wage Differentials, Labour Efficiency and Discrimination (20 Hours)

Theories of Wage – Classical, Neoclassical, Modern; Employment Decision in the Short Run and Long Run; Homogeneous and Heterogeneous Workers and Jobs; The Hedonic Wage Function; Theory of Optimal Fringe Benefits; Labour Efficiency – Education in the Labour Market, Schooling Model; Efficiency Wage Models; Segmentation and Discrimination in Labour Market- The Crowding Model, Measuring Discrimination – The Oaxaca Decomposition; Impact of Trade Union and Collective Bargaining on Employers

Module III: Labour Productivity, Unemployment and Migration (15 Hours)

Labour Productivity – Concept, Measurement; Wages, Prices and Employment; Unemployment – Frictional, Structural, Demand-deficient Unemployment; Measurement of Unemployment – The Stock-Flow Model; Reducing Unemployment – Public Policies; Labour Mobility; Migration as an Investment in Human Capital; Determinants of Migration; Consequences of Migration; The Economic Benefits of Immigration

Module IV: Issues in Indian Labour Market (15 Hours)

Features of Indian Labour Market – Size and Composition in the Organized and Unorganized Labour Market; Major issues in the Indian Labour Market; Labour Productivity in India; Women and Child Labour in India; Agricultural and Rural Labour; Labour Market Institutions of Minimum Wage; Employment and Wage Policy in India; Informal Labour and Social Security Measures; Globalization and Labour Market

Suggested Readings

1. Butler, A.D., Labor Economics and Institutions, American Publishing Company, ND, 1972
2. Datt, G., Bargaining Power, Wages and Employment: An Analysis of Agricultural Labour Market in India
3. George J. Borjas, Labour Economics, McGrawhill, New York, 2000
4. Marshall, F.R., V.M. Briggs, & A.G. King, Labour Economics, Richard D. Irwin Inc., Homewood, Illinois, 1984
5. McConnell, C.R., S.L. Brue & D.A. Macpherson, Contemporary Labour Economics, McGraw Hill, NY, 2009
6. Michael Hopkins, Labour market planning revisited, Palgrave Macmillan, 2002
7. Rees, A., Economics of Work and Pay, Harper and Row, NY, 1973

Mapping of COs

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	H	M
CO2	H	H	M	M
CO3	M	H	M	H
CO4		M		H

ENAE400T: APPLIED ECONOMETRICS

(5 Credits - 75 Hours) (L-T-P: 5-0-0)

Objective(s)

The main objective of this course is to introduce the students to the various econometric techniques under regression analysis that would help them in the decision making process. The course teaches the theory and application of contemporary econometric tools including time series analysis and panel data models. It also caters to the interest in econometric research applying various econometric tools to data in a variety of real life economic problems.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define advanced topics like empirical research, regression diagnostics. (Remembering and Understanding)
CO 2: Apply estimation methods to determine parameters of dynamic and panel data models. (Applying)
CO 3: Analyze the results of dynamic and panel data models along with regression diagnostics. (Analyzing)
CO 4: Evaluate the dynamic regression models and design dynamic regression models and panel data models to test hypothesis of real economic problems (Evaluating and Creating)

Module I: Stages in Empirical Econometric Research (15 hours)

Statement of the Problem; Review of Literature; Research Design and Methodology; Data Collection; Data Analysis; Interpretation

Module II: Regression Diagnostics and Specification (20 hours)

Functional Forms; Model Selection; Tests for Multicollinearity; Tests for Heteroscedasticity; Tests for Autocorrelation; Misspecification and Specification Bias

Module III: Advanced Topics in Regression Analysis (20 hours)

Dynamic Econometric Models: Distributed Lag Models; Autoregressive Models; Instrumental Variable Estimation; Simultaneous Equation Models

Module IV: Panel Data Models (20 hours)

Methods of Estimation; Fixed Effects Model; Random Effects Model; Applications of Statistical Package in parameter estimations for panel data models

Suggested Readings

1. Jeffrey M. Wooldridge, Econometrics, CENGAGE learning, India Edition, 2009
2. DimitriosAsteriou& Stephen Hall, Applied Econometrics: A Modern Approach, Palgrave Macmillan, 2007.
3. Damodar Gujarati, Econometrics by Example, Palgrave Macmillan, 2011.
4. Madnani, G.M.K. Introduction to Econometrics: Principles and Applications, CBS Publishers & Distributors, 2009.
5. Dougherty, C. Introduction to Econometrics, 4th Ed., Oxford University Press, 2011.
6. Gujarati, D., & Porter, D. Essentials of Econometrics, 4th Ed.,McGraw-Hill, 2010.
7. Kmenta, J. Elements of Econometrics, Khosla Publishing House, 2008

Mapping of COs

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2	H	H	M	
CO3		H	H	H
CO4		H	M	H

ENAG401T: AGRICULTURAL ECONOMICS

(5 Credits-75 Hours)(L-T-P: 5-0-0)

Objective(s)

The objectives of this course are to familiarize students with policy issues that are pertinent to Indian agriculture economics, to provide students with the tools necessary to analyze those issues, to raise students' awareness of the challenges facing agricultural productivity, and to encourage students to consider potential solutions to those challenges.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall distinctive features of agriculture and the limited available resources which can influence the whole economy (Remembering & Understanding)

CO 2: Identify the new investment opportunities in agriculture to challenge economic problems like unemployment, inequality etc. (Applying)
CO 3: Examine the role of agricultural finance and marketing to achieve harmonious development (Analyzing)
CO 4: Elaborate the concept of globalization and agricultural policy and their implication on the society as a whole.(Evaluating and Creating)

Module I: Agricultural Resources and Allocation (15 hours)
Resources in Agriculture; Land as a Resource; Land Capability; Issues in Utilization of Land; Competition for Agricultural Land; Effects of Urbanization; Land Degradation; Water as a Resource; Institutional Arrangements and Issues in Water Allocation; Managing Disasters – Drought, Flood, Famine; Production Function in Agriculture; Watershed Management and Water Budgeting

Module II: Agricultural Production and Market (20 hours)
Supply Response in Agriculture; Issues Relating to Specification of Supply Response Function – Distributed Lags; Rigidities in Farm Supply Response – Supply Response of Individual Crops and Aggregate Production; Market Supply of Subsistence and Perennials Crop; Barriers to Internal Trade; Marketing Reforms; Behaviour of Agricultural Prices – Cobweb Cycles and Demand and Supply of Agricultural Products; Marketed and Marketable Surplus; Terms of Trade between Agriculture and Non-agriculture

Module III: Agricultural Finance (13 hours)
Role of Agencies; Inter-linked Markets; Subsidy and Taxation in Agriculture; Regulated Markets; Crop and Livestock Insurance; Food Security and Public Distribution System; Infrastructural Development; Rural Credit and Rural Indebtedness; Need for State Intervention, NABARD and Cooperative Societies

Module IV: Globalization and Agricultural Policy (12 hours)
Concept of globalization and the relevance of agricultural policies in India; Role of agriculture in economic development; Development Issues – Population, Food Security, Rural Poverty, Inequality and Environmental Concerns; Agricultural Policies-National Agriculture Policy, National Water Policy, National Seed Policy, National Fertilizer Policy, Credit Policy, Price Policy, Crop Insurance Policy

Suggested Readings
1. Soni, R., Leading Issues in Agricultural Economics, New Delhi: Vishal Publishing, 2004
2. Kahlon, A.S. & Singh, K., Managing Agricultural Finance: Theory and Practice, Allied Publisher Ltd., New Delhi, 1984.
3. Lekhi, R. K. & Singh, J., Agricultural Economics: An Indian Perspective, Ludhiana: Kalyani Publishers, 2015.
4. Penson, Capps, Rosson& Woodward, Introduction to Agricultural Economics, 7th Edition
5. R. S. Despandey& Arora, S., Agrarian Crisis and Farmer Suicide, (eds.), Sage India Publications, 2010.
6. Reddy, S.S. & Ram, P.R., Agricultural Finance and Management, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.
7. Reddy, S.S., Ram, P.R., Sastry, T.V.N, & Devi, I.B., Agricultural Economics, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India, 2015.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H		M	
CO2		H	M	
CO3	M			H
CO4		H	M	

ENHE402T: HEALTH ECONOMICS

(5 Credit: 75 Hours) (L-T-P: 5-0-0)

Objective(s)
This course is designed to obtain adequate knowledge on health economics theory and application in order to enable students to provide health policy analysis and make better decisions in the areas of health care. This course includes different subsets of health economics such as public health, global health policy, and economic evaluation of health care and government intervention in the healthcare delivery system. This course provides foundations to analyze contemporary health problems from an economic perspective to support healthcare professionals and policymakers.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define and explain the concepts of health economics and application of economic concepts in the health sector. (Remembering and Understanding).

CO 2: Identify the demand and supply gap in the healthcare system to suggest healthcare professionals and policymakers.(Applying)
CO 3: Analyze the role of government in the health care delivery system and identify the scope of health financing to suggest healthcare professionals and policymakers. (Analyzing)
CO 4: Evaluate the health care progammes and policy to provide decisions concerning the allocation of resources. (Evaluating)

Module I: Microeconomic Foundations of Health Economics (20 hours)
Concepts, Definition of Health Economics; Measures of Health Status; Topics in Health Economic Theory – Production Function of Health, Grossman's Model of Demand for Health; Supply-side Health Economics; Theory of Health Behavior; Market of Health Insurance; Causes of Market Failure in the Provision of Health Services – Moral Hazard, Adverse Selection, Supplier-induced Demand, Externalities; Issues of Equity and Efficiency in Healthcare Market

Module II: Economic Evaluation in Healthcare (20 hours)
Economic Evaluation in Healthcare – Concepts, Importance; Types of Economic Evaluation in Healthcare – Cost Minimization Analysis, Cost Effectiveness Analysis, Cost Benefit Analysis, Cost Utility Analysis; Health Technology Assessment – Basic Concept, Importance of HTA in Health Economics

Module III: Public Policy on Health (15 hours)
Public Policy in Health Care Delivery – Role of State, Rationale for Government Intervention in the Health Sector – Public and Private sector; Health Financing; Concept and Calculating Methods of Burden of Disease- HALE, QALYs and DALYs

Module IV: Health Sector in India (20 hours)
Overview of Health Care in India; Health System of India – Post Reform Scenario; Socio-economic Determinants of Health; Indicators of Health Outcomes; Health and Nutrition; Different Dimension of Health - Poverty, Malnutrition, Gender Perspectives in Indian context; Public Health Expenditure in India

Suggested Readings
1. Henderson, J. W., Health Economics & Policy, (3e), Thomson South-Western, Latest Edition, 2007.
2. David Wonderling, Reinhold Gruen& Nick Black, Introduction to Health Economics, Open University Press, 2005.
3. Sherman Folland, Allen Goodman &MironStano, Economics of Health and Health Care, Routledge, 8th edition, 2017
4. Stephen Morris, Nancy Devlin, David Parkin& Anne Spencer, Economic Analysis in Healthcare, 2nd Edition, Wiley, 2012.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2	M		H	
CO3		M	H	
CO4			M	H

ENED403T: ECONOMICS OF EDUCATION

(5 Credit: 75 Hours) (L-T-P: 5-0-0)

Objective(s)
This course discusses the economic aspects of current issues in education, using both economic theory and econometric and institutional readings. Topics include discussion of basic human capital theory, the growing impact of education on earnings and earnings inequality, statistical issues in determining the true rate of return to education, the labor market and manpower planning. In addition, various policies of the government and the budget to address the issues of inclusivity in education will be discussed.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Understand the concept of welfare economics and its applicability in education sector (Remembering/Understanding)
CO 2: Evaluate the policy for improvement of the education sector from an economics perspective. (Applying)
CO 3: Examine the investment pattern in education and interpret the direct and indirect benefits of education in the development of society. (Analyzing)
CO 4: Evaluate the educational financing from the point of view of public and private expenditure (Evaluating)

Module I: Economics of Education (20 hours)
Human Capital – Types, Components; Human Capital Theory; Education as an Instrument for Economic Growth; Demand for Education; Supply of Education; Determinants of Demand for Education; Costs of Education – Private Costs, Social Costs;

Benefits of Education – Direct, Indirect, Social; Wastage and Stagnation in Education – Causes and Measures; Manpower Planning –Meaning, Techniques of Forecasting

Module II: Education and Budget Allocation (15 hours)
The Concept of Knowledge Economy – The Spread of Education across the World; Budgetary Allocations across Space and Time; Institutional Design; Alternative Systems for Service Delivery; Role of Imperfect Information, Incentives and Contracts

Module III: Education and Planning (20 hours)
Approaches to Educational Planning – Production Function Models, Manpower Requirement Approach, Input-Output Model, Gender Based Approach; Educational Planning in Developing Countries with Special Reference to India; Vocational Education in India; New Education Policy

Module IV: Discrimination and Inequality in Education (15 hours)
Models of Preference-based and Statistical Discrimination; Effective Policies to Address Historical Inequalities; Evaluating Policy Impact – The Estimation of Treatment Effects in Randomized Experiments and in Observational Data

Suggested Readings

1. Banerjee, A. &Somanathan, R., The Political Economy of Public Goods, 2007.
2. Becker G.S., Human Capital (2nd Edition), National Bureau of Economic Research, New York, 1974.
3. Becker, G., Investment in Human Capital: a Theoretical Analysis, The Journal of Political Economy, 70(5), 9-49, 1962.
4. Benabou, R., Workings of a City, Quarterly Journal of Economics, 108(3), 619-652, 1993.
5. Cohn E. & T. Gaske, Economics of Education, Pergamon Press, London.
6. Galanter, M., Competing Equalities: Law and the Backward Classes in India, University of California Press, 1984.
7. McMohan, W.W., Education and Development: Measuring the Social Benefits, Oxford University Press. 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	M	M
CO3		M	H	
CO4	M	H		H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	ENIN102T	Indian Economy	4
2	Minor Course 2	ENNE103T	Economy of North East India	4
3	Minor Course 3	ENET205T	History of Economics Thoughts	4
4	Minor Course 4	ENGE206T	Gender Economics	4
5	Minor Course 5	ENPU307T	Public Finance	4
6	Minor Course 6	ENRD308T	Rural Development	4
7	Minor Course 7	ENID404T	Industrial Economics	3
7	Minor Course 8	ENRM405T	Research methodology in social sciences	2
8	Minor Course 9	ENCD406T	Contemporary Development Policies	3

ENIN102T: INDIAN ECONOMY

(4 Credits-60 Hours)(L-T-P: 4-1-0)

Objective(s)

The students will gain a better understanding of the economy of India as a whole with the completion of this course. Students will get an understanding of the myriad issues and components that make up the Indian economy, and they will do research into a variety of interconnected themes that are connected to the expansion and maturation of the Indian economy.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the Macroeconomic Policies and their Impact on the Indian Economy. (Remembering & Understanding)

CO 2: Explain the growth and trends of population and its impact on human resources. (Applying)

CO 3: Identify the issues and measures related to various social-economic factors in the economy. (Creating)

CO 4: Evaluate the impact of various development policies in the Agriculture Industry & Service Sector in the Indian Scenario. (Analyzing and Evaluating)

Module I: Economic Development since Independence (20 hours)

Major Features of the Indian Economy on the eve of Independence – An Overview; Economic Planning in India – History of Indian Economic Planning, Objectives, Achievements and Failure of Indian Planning, Shortcomings of Planning in India; NITI Aayog vs. Planning Commission; New Economic Policy-Critical Evaluation of Liberalization, Privatization and Globalization; Look East Policy to Act East Policy

Module II: Population and Human Development (19 hours)

Demographic Trend and Issues – Meaning and Scope of Demography; Density of Population; Measures of Population Change; Structure and Distribution; Population as a Factor of Economic Development; National Population Policy; Demographic Dividend; Human Development Index- Concepts and Measurements; India‘s Human Development Record in Global Perspective; Education in India – Features, Trends, Issues; Health – Trends and Issues; Malnutrition in India

Module III: Growth and Income Distribution (20 hours)

Poverty – Concept and Incidence of Poverty in India, Poverty Estimates, Growth and Poverty, Strategy of Poverty Alleviation; Trends and Policies in Poverty; Income Inequality in India – Magnitude and Nature, Growth and Inequality, Causes of Income Inequality, Government Policies and Measures; Unemployment – Nature and Types of Unemployment in India, Magnitude, Changing Dimensions of Unemployment and Employment, Causes of Unemployment, Government Policies and Measures

Module IV: Agriculture, Industry and Service Sector in India (17 hours)

Changing structure of Indian agriculture; Sustainable agriculture-concept & constraint; Green Revolution-features and impact; Agricultural marketing and regulated market; Industrial Policies in India; Disinvestment and Privatization; Development of MSME sector; Growth & Composition of service sector; Role of service sector in Indian economy

SUGGESTED READINGS

1. Shankar Acharya, Macroeconomic Performance and Policies 2000-8, in Shankar Acharya and Rakesh Mohan (Editors), India’s Economy: Performances and Challenges: Development and Participation, Oxford University Press, 2010.
2. Rakesh Mohan, India‘s Financial Sector and Monetary Policy Reforms, in Shankar Acharya and Rakesh Mohan, editors, India’s Economy: Performances and Challenges: Development and Participation, Oxford University Press, 2010.
3. PulapreBalakrishnan, Ramesh Golait&Pankaj Kumar, 2008, —Agricultural Growth in India Since 1991, RBI DEAP Study No. 27.
4. B.N. Goldar& S.C. Aggarwal, Trade Liberalisation and Price-Cost Margin in Indian Industries, The Developing Economics, September, 2005.

5. P. Goldberg, A. Khandelwal, N. Pavcnik& P. Topalova, —Trade Liberalisation and New Imported Inputs, American Economic Review, Papers and Proceedings, May, 2009.
6. KunalSen, Trade, Foreign Direct Investment and Industrial Transformation in India, in PremachandraAthukorala, editor, The Rise of Asia, Routledge, 2010.
7. DipakMazumdar& Sandeep Sarkar, The Employment Problem in India and the Phenomenon the Missing Middle, Indian Journal of Labour Economics, 2009.
8. J. Dennis Rajakumar, Size and Growth of Private Corporate Sector in Indian Manufacturing, Economic and Political Weekly, April, 2011.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			M
CO2		M	H	
CO3	M		H	
CO4		M		H

ENNE103T: ECONOMY OF NORTH EAST INDIA

(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course is designed to expose the students to the overview of the North East Economy. It explains the trend and performance of agriculture, industry and service sector in the context of the North East scenario. It also includes the evaluation of various developmental policies for structural transformation of the region.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define and understand macroeconomics policies and their impact on the North East Economy. (Remembering and Understanding)

CO 2: Identify the policies and performance in Industry and analyze the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Applying)

CO 3: Explain the trends and performance in service sectors and the scope of growth of enterprises in the North Eastern region and the role of various policies in it. (Analyzing)

CO 4: Evaluate the various development policies and the different development initiatives in the North Eastern region along with some of the reasons for its failure. (Evaluating)

Module I: Overview and Characteristics of North East Economy (15 hours)

North Eastern Region as an economy; Characteristics of the economy; Trend and Pattern of GDP growth in NER; Demographic features of the NE economy; Poverty and Inequality in NER comparison with the Indian economy; Trends of Employment and Unemployment; Recent Developments in Human Resource; Regional disparities and Northeast India, Status of Development and Urbanization

Module II: Agriculture in North East Economy (12 hours)

Agriculture: features and challenges; Growth of Agricultural Sector in NE; Agricultural Finances-Sources and Limitations; Agricultural Policies of NE States; Agriculture-Industry linkage especially in NER, Problems of Agricultural Marketing in NE

Module III: Industry and Service Sectors in North East Economy (18 hours)

Industry: growth, composition and challenges, Growth of Micro Small and Medium Enterprises (MSME); North East Industrial and Investment Promotion Policy (NEIIPP) 2007 and 2017; Causes of Industrial Backwardness and their Remedies; Services sector- growth and challenges; Diversification of rural employment; Infrastructure and regional economic development

Module IV: Structural Transformation and Institutions in North East (15 hours)

Institutions and economic Development; Governance and development-government failure and its correction; Local self-government and development; Community participation and development, community failure; Role of DONER and NEC; New development initiatives in NER, Vision Document 2020 and Act East Policy

Suggested Readings

1. Banerjee and Kar (1999): Economic Planning and Development of North-Eastern States, Kanishka, New Delhi
2. Deb, B.J & B. Dutta Ray (2006): Changing Agricultural Scenario in North-East India, Concept Publication, New Delhi

3. Dikshit, K. R and J K Dikshit (Eds.) (2014): North East India Land People and Economy, Springer
4. Menon, S. (Ed.) (2007): India's North East Economy-Problems and Prospects, ICFAI Univ. Press, Hyderabad
5. Mishra, B. (2006): Fiscal Policy in North-East India, Akansha Publishing House, New Delhi
6. Nayak. P. (Ed.) (2010): Growth and Human Development in North- East India, Oxford University Press.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H		M	H
CO2		H		H
CO3	M	H		
CO4	M		H	M

ENET205T: HISTORY OF ECONOMIC THOUGHTS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course will help to relate and understand the evolution of different economic theories led by classical, neo-classical and modern economists. Through philosophical foundations, the student will be able to relate different positions of economic thoughts. It will help to explain the policy implications of the theories and their usefulness in the context of current world scenarios in general and Indian Economy in particular.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Relate, understand and explain the contributions on themes of economic analysis (Remembering, Understanding)
CO 2: Identify their texts and link the different positions of economic thought. (Applying)
CO 3: Evaluate political implications and link the different positions of economic thought to philosophical foundations. (Analyzing)
CO 4: Explain and discuss the political implications and usefulness of their texts in context to the current World Scenario and Indian Economy in particular (Evaluating, Creating)

Module I: Pre-Classical and Classical Economic Thought (10 hours)

Mercantilism: Tenets, Rise & Fall; Physiocracy; Tableau Economique of Quesnay; concept of Natural Order, Produit Net, Taxation, Trade; Contributions of Adam Smith, David Ricardo, T.R. Malthus, J.B. Say, J.S. Mill's Restatement of Classicism.

Module II: Reaction against Classicism and the reconstruction of Economic Science (20 hours)

Positive and Critical ideas of the Historical School; State Socialism – Ideas of J.K. Rodbertus and F. Lassalle; Scientific Socialism-Chief, tenets of Marxian Thought, Dialectical Materialism; The Labour Theory of Value; Theory of Surplus Value; The Law of Concentration of Capital; Marx and Modern Economists; Subjectivism and Marginalism – Factors giving rise to Subjectivism and Marginalism; Economic ideas of Walras and Carl Menger; Neoclassicism – Contributions of Alfred Marshall, Knut Wicksell and BohmBawerk

Module III: Keynesian Economics (10 hours)

Keynes departure from Classical Economics; Salient Features of the General Theory of Employment, Interest and Money; Theory of Employment; Theory of Prices; Keynes and International Economics; Keynes Influence on Public Policy; Keynesian Economics and Underdeveloped Countries; Keynesianism Vs. Monetarism.

Module IV: Indian Economic Thought (20 hours)

Main themes of Kautilya's Arthashastra; Modern Economic Ideas: Dada Bhai Naoroji, Ranade, Gokhle; M.K. Gandhi's ideas on — Village, Swadeshi, Khadi, Cottage Industries and place of Machine; Welfare of Labour; Non-violent Economy; Decentralisation; Trusteeship; Sarvodaya

Suggested Reading

1. Guide, C. & C. Rist, A History of Economic Doctrine
2. Roll, Eric, A History of Economic Thought
3. Hajela, T.N., History of Economic Thought
4. Bhatia, H.L., History of Economic Thought
5. Vohra, Munish, History of Economic Thought

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	M	H	M
CO2	M			H

CO3	H	H	M	M
CO4	H	M		H

ENGE206T: GENDER ECONOMICS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The current subject will help us understand the concepts of gender economics. It includes knowing the different concepts of gender indicators, demographic profile of female population and gender development measures. It will also throw light on the role of women in decision making at different levels, focusing on visible and invisible work of women. Further the subject will cover women in the labor market and various economic issues and policy implications on improving gender equality in India.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Relate the demography concepts to understand the demography of a nation with special reference to women (Remembering and Understanding)

CO 2: Examine the various gender indices to understand the framework of policy relating to gender issues. (Applying)

CO 3: Inspect the factors responsible for gender discrimination in India (Analyzing)

CO 4: Evaluate and analyze the role of technology and institutions in addressing the problem of gender inequalities and women empowerment. (Evaluating and Creating)

Module I: Concept and Importance of Gender Economics (15 hours)

Importance of Gender Economics; Women in Patriarchal and Matriarchal Societies and Structures; Gender Bias in the Theories of Values; Demography of Female Population; Causes of Declining Sex Ratios and Fertility Rates; Women and their Access to Nutrition, Health and Education; Gender Planning Frameworks and Tools; Gender Inequality Indices – GII,MPI, WEIA, SIGI, GDI, GEM

Module II: Decision Making, Economic Activity and Women (15 hours)

Factors Affecting Decision Making by Women; Property Rights; Power of Decision Making at Household, Class, Community Level; Economic Status of Women and its Effect in WPR, Income Level, Health and Education in Developing Countries; Concept and Analysis of Women's Work – Visible and Invisible Work, Economically and Socially Productive Work

Module III: Labour Market, Technology, Environment and Women (15 hours)

Factors Affecting Female Entry in Labor Market; Studies of Female work Participation in Agricultural and Non-agricultural Rural Activities; Wage Differentials in Female Activities; Structure of Wage Across Regions and Economic Sectors; Impact of Technological Development and Modernization on Women's Work Participation; Women and Environment – Female Activities and Environmental Concerns

Module IV: Social Security, Gender Planning and Development Policies (15 hours)

Effectiveness of Collective Bargaining; Schemes for Safety net for Women; Need for Female Labour Unions; Gender Mainstreaming in Development Policies; Gender Sensitive Governance – Gender Budgeting, Democratic Decentralization (Panchayats) and Women's Empowerment in India; The Kudumbashree Experience in Kerala, A comparative assessment on Gender policies between developed and developing countries (with special reference to Asian countries)

Suggested Readings

1. Amsden, A.H., The Economics of Women and Work, Penguin, Harmondsworth, 1980
2. Beneria, L. & M. Roldan, The Crossroads of Class and Gender, University of Chicago Press, Chicago, 1987
3. Beneria, Lourdes, GunseliBerik, and Maria Floro, Gender, Development and Globalization: Economics as if all People Mattered, Second Edition, Routledge, London, 2015
4. Bonnie G Smith, Women's Studies: The Basics, Routledge, London, 2013
5. Borerup, E., Women's Role in Economic Development, George AlleandUnwin, London, 1970
6. Irene Tinker, Persistent Inequalities: Women and world development, New York: Oxford University Press, 1990

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	M	M	M
CO2		M		M
CO3	M	M	M	H
CO4	H	H	H	H

ENPU307T: PUBLIC FINANCE

(4 Credit - 60 Hours) (L-T-P: 4- 0-0)

Objective(s)

This course is a non-technical overview of government finances with special reference to India. The course does not require any prior knowledge of economics. It will look into the efficiency and equity aspects of taxation of the centre, states and the local governments and the issues of fiscal federalism and decentralization in India. The course will be useful for students aiming towards careers in the government sector, policy analysis, business and journalism.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Discuss the nature and scope of public finance and its functions. (Understanding)
CO 2: Demonstrate the different types of taxation and the effects of taxation. (Applying)
CO 3: Analyze the effects of public expenditure and welfare aspects. (Analyzing)
CO 4: Explain the types of public budget and deficits and its significance. (Evaluating)

Module I: Introduction (10 hours)

Public Finance and Private Finance; Public Finance –Nature and Scope: Allocation Function, Distribution Function and Stabilization Function; Public Goods and their characteristics; Types of Public goods; Free Rider Problem and Market Failure; Externalities vis-à-vis Public Good

Module II: Public Revenues and Receipts (20 hours)

Revenue and Non-Revenue Receipts; Sources of Tax Revenue and Non-tax Revenue; Direct and Indirect Tax; Goods and Service tax in India; New Direct tax code; Concepts of taxation: tax rate, buoyancy & elasticity of a tax: Proportional, Progressive and Regressive Taxation; Neutral and Non- Neutral Taxes; Taxable Capacity; Principles of Taxation; Objectives and Effects of Taxation; Impact, Shifting and Incidence of Tax

Module III: Public Expenditure (20 hours)

Canons of Public Expenditure; Plan and Non Plan Expenditure; Effects of Public Expenditure and Welfare Aspects, Theories of Public Expenditure: Maximum Social Advantage, Maximum Aggregate Benefit, Lindahl Model of Voluntary Exchange; Crowding out effect; Tiebout Model; Wagner's Law of Increasing State Activities; Wiseman-Peacock Hypothesis; Cost-Benefit Analysis

Module IV: Budget and Deficit Financing (10 hours)

Structure of the Public Budget; Kinds of Budgets; Types of Deficits and their significance: Revenue Deficit, Fiscal Deficit and Primary Deficit; Fiscal Federalism in India and the Finance Commission; Fiscal Responsibility and Budget Management(FRBM) Act 2003; Recent Amendments to FRBM Act

Suggested Readings

1. Buchanan, J. M., & Musgrave, R. A., Public Finance and Public Choice: Two contrasting visions of the state, Cambridge, Massachusetts: MIT Press, 1990.
2. Musgrave, R.A., & Musgrave, P.B., Public Finance in Theory and Practice, New York: McGraw Hill Book Company, 1989
3. Atkinson, A.B., &Stiglitz, J.E., Lectures on public economics. New Jersey: Princeton University Press, 2007.
4. Basu, K., &Maertens, A., The new Oxford companion to economics in India, New York: Oxford University Press, 2012.
5. Bhatia, H. L., Public Finance, Vikas Publishing House Private Ltd., 2006.
6. Cullis, J., Jones, P., & Jones, P.R., Public Finance and Public Choice: Analytical perspectives, New York: Oxford University Press, 2009.
7. Rao, M.G., & Sen, T. K., Fiscal Federalism in India: Theory and Practice, Macmillan India, 1996.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3		M	H	
CO4				H

ENRD308T: RURAL DEVELOPMENT

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course will help understand the rural economy and its features and its scope for development. The course will also help describe the financial system for agriculture and the credit and marketing system for the development of rural areas. Also, through this course, various development policies towards inclusive development will be illustrated.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Draw distinctive features of rural economy which can influence the economy of rural sector and understand the prevailing problems of rural economy and identify the scope for development of rural areas. (Remembering, Understanding)

CO 2: Elucidate the Agricultural Finance and rural credits system and marketing system. (Analyzing)

CO 3: Identify the new development strategies for development of rural economy. (Applying)

CO 4: Assess the various policy and programmes of rural development and use of economic prospective for the development of rural economy. (Evaluating, Creating)

Module I: Basic Concept of Rural Economy (15 hours)

Definition and Features of Rural Economy; Characteristics of Rural Sector; Rural Economic Structure in Indian context; Indicators of Rural Development; Causes of Rural Backwardness; Rural Demography – Size, Growth, Distribution of Rural Population; Rural-Urban Migration – Types, Pull and Push Factors; Rural Poverty and Poverty Alleviation Programmes

Module II: Transformation of Rural Economy (15 hours)

Transformation of Rural Economy – Sectoral Approach, Multi-sectoral Approach, Territorial Approach, Local Approach; Rural Development Strategies; Policies for Rural Economy Development – Land Policy, Agriculture Policy, Rural Industrialization Policy, Employment Policy

Module III: Agriculture and Rural Industrialization (20 hours)

Importance and Problems of Agriculture in Rural India; Agriculture Marketing – Problems and Prospects, Marketing of Agricultural Product, Co-operative Marketing; Concept of Agricultural Credit; Need for Agriculture Credit; Sources of Agricultural Finance; Role of NABARD in Rural Development; Allied Agricultural Activities – Dairy, Fishery, Horticulture, Sericulture; Development of Agro-based Industry; Role of Village Industry; Growth of MSME in Rural Economy; Appropriate Technology for Rural Industries Development; Government Policy and Programme for Entrepreneurship Development in Rural India

Module IV: Rural Governance (10 hours)

Concept of Decentralization and its Significance in Rural Development; Role of Panchayat Raj Institutions in Rural Development; Rural Development Institutions and Administration- SIRD, DRDA; e-Governance and its Impact on Rural Development

Suggested Readings

1. A N Agarwal &KundanaLal, Rural Economy of India: Problems, Progress and Prospects, Vikas Publication, New Delhi, 1990
2. Satyasundaram, Rural Development, Himalaya Publishing House, New Delhi, 1997
3. S. Maheswari, Rural Development in India, - A Public Policy Approach, Sage publication, New Delhi, 1985
4. Katar Sing, Rural Development, Principles, Policies, and Management, Sage publication, New Delhi, 1986
5. N. Lalitha, Rural Development, Emerging issues and Trends (Vol.I and II) dominate Publications, New Delhi, 2004
6. Kalipada Deb, The challenge of Rural Development, M.D. Publications Pvt. Ltd., New Delhi, 1997

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	M	M	M
CO2	M			M
CO3	M	M	M	
CO4		H	H	H

ENID404T: INDUSTRIAL ECONOMICS

(3 Credits - 45 Hours) (L-T-P: 3-0-0)

Objective (s)

This course provides an introduction to current theory and empirical work in Industrial economics. It starts by examining the internal structure of firms. It then moves on to the analysis of various aspects of strategic interaction between firms and the determinants of industrial structure. Finally, it discusses the role of policy in the context of competition and industrial policies and regulation. The emphasis will be throughout on understanding how the theoretical tools can be used to analyze real world issues.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define various concepts of Non-Price Competition and Imperfect Market Structure (Remembering/ Understanding)

CO 2: Apply the different concepts of game theory to understand strategic behaviour in imperfectly competitive markets (Applying).

CO 3: Examine the impact of price and non-price barriers on competition. (Analyzing)
CO 4: Discuss the role of regulation on efficiency in imperfectly competitive markets. (Evaluating/Creating)

Module I: Market Structure and Strategic Interaction (10 Hours)
Introduction to Industrial Economics –Type of organizational form; Industrial location analysis, Static and Dynamic models of oligopolistic competition; Monopolistic competition and dominant firm models

Module II: Entry Costs, Barriers, Mergers and Vertical Integrations (10 Hours)
Entry costs and market structure; Free entry and social welfare; Barriers to entry - Limit price theory; Pricing Decision - overinvestment in capacity, product proliferation; Mergers and Vertical Integration

Module III: Non- Price Competition (15 Hours)
Product differentiation - Horizontal vs. vertical; Price competition with differentiated products, Market structure and advertising - Informative and pervasive advertising, Effects on competition; Determination of the monopolist optimal advertising expenditure, Market concentration

Module IV: Regulation (10 Hours)
Introduction to competition policy and regulation - effects of government actions on firms and market structure; The natural monopoly case; Competition policy; Price regulation mechanisms

Suggested Readings
1. Carlton, D. W. & J. M. Perloff, Modern Industrial Organization, HarperCollins, New York, 1994.
2. Tirole, J., The theory of industrial organization, The MIT press, 1988.
3. Cabral, L., Introduction to Industrial Organization, The MIT press, Cambridge, 2000.
4. Barthwal., R., Industrial Economics, New Age International Publishers fourth edition 2022

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2	H			
CO3		M		H
CO4		H	H	

ENRM405T: RESEARCH METHODOLOGY IN SOCIAL SCIENCES

(2 Credits - 30 Hours) (L-T-P: 2-0-0)

Objective(s)
The main aim of this course is to introduce the research methodology for scientific research including economics and other social sciences. Students will learn the meaning and importance of research along with the philosophical perspective of it. Topics covered in this course are formulation of research proposals, reviewing the literature and choosing appropriate methodologies for data collection and analysis. This course is intended to prepare students for research projects during their graduation program.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: CO1: Understand the basic concepts of research including meaning, types, importance, and philosophical perspectives. (Remembering and Understanding)
CO 2: CO2: Apply the various philosophical perspectives in social science research along with the ontological and epistemological issues in it. (Applying)
CO 3: CO3: Analyze the different stages of research in social science enhancing better research in social science. (Analyzing)
CO 4: CO4: Evaluate research in social science and its trend with greater reflection of plausible philosophical perspectives. (Evaluating and Creating)

Module I: Introduction (10 Hours)
Meaning and Purpose of Research; Types of Research- Pure and Applied, Historical and Futuristic, Analytical and Synthetic, Descriptive and Prescriptive, Survey and Experimental Researches; Significance of research; Scientific Method- Inductionism and Deductionism; Ethics in Research

Module II: Philosophical Perspectives of Social Science Research (10 Hours)
Philosophical Foundations- Ontological and Epistemological Issues in Social Science Research; Nature of Science and Social Science; Methodological Perspective- Positivism, Hermeneutics, Reflexivity, and Feminist methodology

Module III: Stages of Research (20 Hours)

Research Problem- Identification, Selection and formulation of research Problem; Literature Review- Importance and types of literature review; Identifying Research Gaps; Hypothesis Testing- Meaning, Sources and Formulation of Hypothesis; Research Design; Data Collection; Analysis and Interpretation; Research Reports- Types, Contents; Principles of good report writing; References and Annotation

Suggested Readings

1. Ahuja, R., Research Methods, Rawat Publications, Jaipur (India), 2001
2. Kothari C., R. Research Methodology: Methods and Techniques, New Delhi: New Age International (P) Limited, Publishers, 2004
3. Babbie, E., The Practice of Social Research, Belmont: Wadsworth, 11th Edition, 2007
4. Crotty, M., The Foundations of Social Research: Meaning and perspective in the research process. London: Sage, 1998
5. Neuman, W. L., Social Research Methods, Qualitative and Quantitative Approaches, (4th Ed.), Boston: Allyn and Bacon, 2000
6. Bhandarkar, P.L. and T.S. Wilkinson, Methodology and Techniques of Social Research, Himalaya Publishing, 1999

Mapping of COs

Course Outcomes	Module I	Module II	Module III
CO1	H	M	
CO2	H	H	M
CO3	M	H	H
CO4		M	H

ENCD406T: CONTEMPORARY DEVELOPMENT POLICIES

(3 Credits- 45 Hours)(L-T-P: 3-0-0)

Objective(s)

The main objective of the course is to inform readers on recent developments in the Indian economy in an understandable way. The course lays a heavy emphasis on giving students simply accessible information because knowledge is necessary to arrive at the optimal solution. Students will get a fundamental grasp of the concerns, difficulties, and challenges that the economy is currently facing.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the socio-economic issues and India's macroeconomic problems (Understanding & Remembering)
CO 2: Explain the recent economic reforms in the Indian economy since 1991. (Applying)
CO 3: Examine the impact of various development policies in Agriculture, Industry and Service Sector in the Indian Scenario. (Analyzing)
CO 4: Discuss their understanding of the usefulness of various development policies. (Evaluating and Creating)

Module I: Contemporary Socio-Economic Policies (13 Hours)

National Pension Scheme for Traders and The Self-employed Persons (NPS); Pradhan Mantri Jeevan JyotiYojana (PMJJBY); Pradhan Mantri Suraksha Bima Yojana (PMSBY); Atal Pension Yojana; Janani Shishu Suraksha Karyakaram (JSSK); Universal ImmunisationProgramme; Mission Indradhanush (MI); Janani Suraksha Yojana (JSY); Rashtriya Madhyamik Shiksha Abhiyan (RMSA); Sarva Shiksha Abhiyan; Mid Day Meal; Pradhan Mantri Awas Yojana (Gramin); Pradhan Mantri Gram SadakYojana (PMGSY); Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA)

Module II: Agricultural Sector Schemes in India (10 Hours)

Soil Health Card Scheme; Paramparagat Krishi Vikas Yojana (PKVY); Pradhan Mantri Krishi Sinchayee Yojana (PMKSY); National Agriculture Market (e-NAM); Pradhan MantriFasalBimaYojana (PMFBY); Interest Subvention Scheme (ISS); National Mission For Sustainable Agriculture (NMSA); Gramin Bhandaran Yojna; Livestock insurance Scheme; Micro Irrigation Fund (MIF); PM KisanMaanDhanYojana; Krishi UDAN scheme; Agriculture Infrastructure Fund

Module III: Programmes and Initiatives for Industries in India (12 Hours)

Make in India; Industrial Corridor Development Programme; Ease of Doing Business; National Single Window System; PM Gati Shakti National Master Plan; National Logistics Policy; Production Linked Incentive Scheme; Credit Guarantee Trust Fund for Micro & Small Enterprises; A Scheme for Promoting Innovation, Rural Industry & Entrepreneurship (ASPIRE); National Manufacturing Competitiveness Programme; Market Promotion & Development Scheme; Revamped Scheme of Fund for Regeneration of Traditional Industries (SFURTI); Trade and Industry Related Functional Support Services (TIRFSS); Welfare Measures (Pradhan MantriSurakshaBimaYojana (PMSBY)

Module IV: Contemporary Schemes for the Service Sector (10 Hours)

Future Skills PRIME; Next Generation Incubation Scheme (NGIS); Production Linked Incentive (PLI) Scheme; National Broadband Mission; Pradhan Mantri Jan DhanYojana; Mahatma Gandhi National Fellowship; PM Ayushman Bharat Health Infrastructure Mission; Pradhan MantriKaushalVikasYojana (PMKVY);Skill India Mission;Digital India Mission

Suggested Readings

1. Dutt Rudder & K.P.M Sunderam, Indian Economy, S Chand & Co. Ltd. New Delhi, 2017
2. Mishra S.K & V.K Puri, Indian Economy and – Its Development Experience, Himalaya Publishing House, 2017
3. KaushikBasu, The Oxford Companion to Economics of India, Oxford University Press, 2007
4. Kapila U, Indian economy since independence, Academic foundation, New Delhi
5. Government of India, Economic Survey (Annual), Economic Division, Ministry of Finance, New Delhi
6. Ahluwalia,I.J. & I.M.D. Little (Eds.), India's Economic Reforms and Development(Essays in honour of Manmohan Singh), Oxford University Press, New Delhi, 1999

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1		H		M
CO2		M	M	
CO3	M		H	
CO4		M		H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	ENME104L	Fundamentals of Mathematical Economics	3
2	S E Course 2	ENDA105L	Data Analysis and Interpretation	3
3	S E Course 3	ENSP207L	Hands-on training on Data Analysis with a Statistical Package	3

ENME104L: FUNDAMENTALS OF MATHEMATICAL ECONOMICS

(3 Credits - 45 Hours) (L-T-P: 3-0-0)

Objective(s)

The main purpose of this rudimentary course in mathematical economics is to provide students the necessary mathematical skills to understand advanced courses in economics. The course is devised to enhance the technical skills in the areas of algebra and calculus and other rudimentary knowledge in mathematics. The course aims to provide both the analytical and computational skills that are required for the analysis of economic problems.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define and explain the basic concepts of mathematics including set, functions, determinants and matrices. (Remembering and Understanding)

CO 2: Apply the mathematical techniques to elucidate the problems of economic theory. (Applying)

CO 3: Analyze economic theory and draw inferences in context of mathematical techniques. (Analyzing)

CO 4: Explain the need of mathematical techniques in understanding real economic theory and develop mathematical models to solve numerical problems in real life economics. (Evaluating and Creating)

Module I: Mathematical Foundations (10 hours)

Number System; Set Theory; Solutions to Simple Equations; Determinants and Matrices; Elementary Types of Functions - Quadratic, Polynomial, Power, Exponential, Logarithmic; Algebraic Properties and Applications

Module II: Differentiable Functions (15 hours)

Limits and Continuous Functions-Operations and Applications; Differentiations- Operations and Applications; Marginal functions and economic applications; Single-variable Optimization; Economic applications- Profit maximization, Cost minimization; Second and Higher Order Derivatives – Properties and Applications; Convex Functions; Local and Global Optima; Multi-variable Optimization

Module III: Integration (10 hours)

Meaning and Significance; Basic Rules of Integration; Applications in Economics; Indefinite and Definite Integrals; Integration by Parts and Partial Fraction

Module IV: Difference Equations (10)

Basic forms; Finite Differences; Linear Difference Equations- Homogenous and Non-homogenous; Solution of First Order Difference Equation; Applications

Suggested Readings

1. K. Sydsaeter& P. Hammond, Mathematics for Economic Analysis, Pearson Educational Asia: Delhi, 2002
2. Chiang A.C. & K. Wainwright, Fundamental Methods of Mathematical Economics, McGraw Hill International Edition
3. Baruah S.N., Basic Mathematics and its Economic Applications, MacMillan
4. T. Yamane, Mathematics for Economist: An Elementary Survey, second edition, Prentice Hall of India Pvt. Ltd., New Delhi

Mapping of COs

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	
CO2	M	M	H	H
CO3	M	H	H	M
CO4			H	M

ENDA105L: DATA ANALYSIS AND INTERPRETATION

(3 Credits-45 Hours) (L-T-P: 4-1-0)

Objective(s)

The objective of this course is for the purpose of providing an introduction to the underlying concepts and vocabulary that are essential to statistical analysis. The goal of the course is to increase the student's grasp of how to effectively apply statistical

techniques. In the context of multivariate analysis, students will be able to explain the concepts of correlation and regression analysis.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the key statistical terms related to data the principles of statistical measures (Remembering and Understanding)

CO 2: Apply the various statistical measures and their forecasting techniques in real life problems. (Applying)

CO 3: Analyze the various statistical results like hypothesis testing and forecasting in practice. (Analyzing)

CO 4: Evaluate the statistical results employing various hypothesis testing tools with various statistical packages (Evaluating and Creating)

Module I: Basic Statistical Tools in MS Excel (15 hours)

Measures of Central tendency - Arithmetic Mean (Simple and Weighted), Geometric Mean, Harmonic Mean, Median, Mode, Quartiles, Measures of Dispersion; Correlation – Karl Pearson's Correlation Coefficient and its Properties, Spearman Rank Correlation Coefficient; Regression – Simple Linear Regression Line, Interpretation of Regression Coefficients, Time Series Analysis, Additive and Multiplicative Models, Determination of Trend

Module II: Statistical Inferences (15 hours)

Population Parameter and Sample Statistic; Point and Interval Estimation; Hypothesis – Concept of Null And Alternative Hypothesis, Simple and Composite Hypothesis, Characteristics of Good Hypothesis; Statistical Errors – Type I and Type II Errors; Critical Region, Size and Power of a Test; Level of Significance and P-value; Hypothesis Testing – Formulation of Statistical Hypotheses, Testing Hypotheses Related to Population Parameters; Sampling Distribution of a Statistic; Important Statistical Test and Inference – Z Test, T Test, F Test and X^2 Test

Module III: Introduction to Statistical Packages (15 hours)

Introduction to Statistical Package (Open Sourced); Working - Preparing the Data File, Creating Data File and Entering Data, Defining the Variables, Entering Data, Modifying Data File, Import File, Screening and Cleaning Data; Frequency and Cross Tabulation, Descriptive/Summary Statistics, Estimating Correlation Coefficient and Regression Coefficients, Constructing Basic Diagrams

SUGGESTED READINGS

1. Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House, 2018.
2. Agarwala, B.L., Basic Statistics, New Age International, 2019
3. Salvatore, D. &Reagle, D., Statistics and Econometrics, TMH, 2011.
4. Yamane, T., Statistics: An Introductory Analysis, 2nd Edition, New York: Harper and Row, 1967.
5. Hooda, P.R., Statistics for Business and Economics, Macmillan, 2004.
6. Nagar, A.L., and Das, R.K. Basic Statistics, Oxford, 1997.
7. Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House, 2018.
8. Field, A., Discovering statistics using IBM SPSS Statistics (5th Ed.). Thousand Oaks, Sage Publication, 2017.
9. Ulrich, K. &Kreuter, F., Data Analysis Using Stata, Third Edition, Stata Press, 2012.
10. Michael, N.M., Data Management Using Stata: A Practical Handbook, Second Edition, Stata Press, 2020

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H	M	
CO2		H	M
CO3	H	M	M
CO4		H	M

ENSP207L: HANDS-ON TRAINING ON DATA ANALYSIS WITH A STATISTICAL PACKAGE

(3 Credits - 45 Hours) (L-T-P: 3-0-0)

Objective(s)

The purpose of this course is to provide students the necessary hand-on skills to use at least one statistical package to analyze data. This course aims to provide both the digital and analytical skills that are required for the analysis of data mainly employed in social science research.

PREREQUISITES

- Personal laptop or tablet (own device) for this course is mandatory.

- Familiarity with basic concepts in statistics, such as measurement levels, mean, median, mode and standard deviation.
- Firm grasp of MS Word and MS Excel is helpful.
- Basic understanding of the purpose and functions of statistical softwares is helpful.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define and understand the key terms related to data and data analysis. (Remembering and Understanding)

CO 2: Apply the MS Excel for data entry and calculation of various measures of central tendency, dispersion. (Applying)

CO 3: Analyze the computer generated output provided by any open-source statistical package and draw inferences from it. (Analyzing)

CO 4: Evaluate the statistical inferences from the outputs provided by statistical software in understanding real economic problem (Evaluating)

Module I: Introduction to Data and Statistical Packages (25 Hours)

Data – Meaning and Nature; Types of Data – Nominal, Ordinal, Interval and Ratio; Sources of Data – Primary and Secondary Data; Analysis of Data – Quantitative and Qualitative Data; Time Aspect of Data – Cross Sectional, Time Series and Pooled Data; Accuracy of Data; Concept of Variable; Applications of MS-Excel in data analysis - File, Edit, View, Data, Data Set Creation and Management; Data entry and Data Cleaning; Introduction to statistical packages

Module II: Calculations of Descriptive Statistics (10 Hours)

Frequency; Summation; Maximum; Minimum; Mean; Median; Mode; Standard Deviation; Skewness; Covariance; Correlation – Bivariate, Partial, Rank, Correlation Matrix; Simple Linear Regression

Module III: Graphical Presentation of Data (10 Hours)

Diagrammatic Presentation; One Dimensional – Single, Subdivided, Multiple Deviation; Two Dimensional –Histogram, Pie Diagram; Three Dimensional – Rectangular, Cube; Pictograms and Cartograms; Scatter; Line and Radar Diagrams; Tabular Presentation – Single, Double, Multiple

Suggested Readings

1. Field, A. (2013): Discovering Statistics Using IBM SPSS Statistics, Sage Publication
2. Field, A. (2017). Discovering statistics using IBM SPSS Statistics (5th Ed.). Thousand Oaks, CA, USA
3. Gupta S.C, Fundamentals of Statistics, Himalaya Publishing House, 2018

Mapping of COs

Course Outcomes	Module I	Module II	Module III
CO1	H	M	M
CO2	H	H	H
CO3	M	H	
CO4		H	M

INTERNSHIP/APPRENTICESHIP/MINOR PROJECT

Semester	Category	Course Code	Course Name	Credits
2	Internship	ENIN106I	Internship	4
4	Internship	ENIN208I	Internship	4
5	Internship	ENIN309I	Internship	2

ENIN106I / ENIN208I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 Hours)

ENIN309I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours)

Internship Course

The student will be required to join for internship during the tenure. The student can find institutes providing internships on their own or through online portals such as Internshala. Internshala provides opportunities for students to have hands-on experience with organizations and also earn some remuneration along with certificates of participation.

ENPR306P: PROJECT ON RESOURCE MAPPING (RURAL/URBAN)

(4 Credits-120 Hours)

Resource Mapping is a method for collating and plotting information on the occurrence, distribution, access and use of resources within the economic and cultural domain of a specific community. Resource maps may be used by the community itself (with or without facilitators) for internal discussions or to relate to outsiders; are essential inputs both for insiders and outsiders for planning and monitoring purposes; and support researchers in the conduct of in-depth assessments of particular resources.

The aim of this course is to equip the students with the practical knowledge of the various resources (Human resource, natural resource, financial resource etc.), of a specific geographical location and analysis the problem and prospect of the utilization of the resources in the selected geographical area. The students will work as team and frame their project related to resource mapping of a selected geographical area under the supervision of an allotted supervisor from the Department.

RESEARCH PROJECT /DISSERTATION

BA ECONOMICS (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	ENDI407P	Research Project Phase I	6
8	Research Project/Dissertation	ENDI408P	Research Project Phase II	6
BA ECONOMICS (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	ENDI409P	Dissertation I	18
8	Research Project/Dissertation	ENDI410P	Dissertation II	20

BA ECONOMICS (Honours)

ENDI407P: RESEARCH PROJECT PHASE I
(6 credits – 180 hours) (L-T-P: 0-0-12)

The work for the Research project is spread over Semester VII and Semester VIII as Research project Phase-I and Research project -II respectively.
This course will enable the students to develop independent critical thinking abilities as well as oral and written communication skills when a research project is included in a course that also provides a strong academic basis. The research project has an impact on worthwhile learning goals that have a long-term impact as undergraduates get ready for professional service.
In the first phase of the research project the student has to select an acceptable study topic and properly articulate and state a research question in his/her chosen area of specialization. They have to assemble the pertinent literature for a chosen research topic and, where appropriate, frame research hypotheses. Students have to plan a research design for a chosen research topic, including any necessary sampling, observational, statistical, and operational designs.

ENDI408P: RESEARCH PROJECT PHASE II
(6 credits – 180 hours) (L-T-P: 0-0-12)

The work for the Research project is spread over Semester VII and Semester VIII as Research project Phase-I and Research project -II respectively.
This course is a continuation of the phase I of Research project, in Phase II the students have to give a final touch to the research project and bring it to a presentable form.
In the phase II of the research project base on the selected research topic in phase I, the students have to compile relevant data, interpret & analyze it and test the hypotheses wherever applicable. Based on the analysis and interpretation of the data collected, student manager will be able to arrive at logical conclusions and propose suitable recommendations on the research problem. The students have to create a logically coherent project report and will be able to defend his / her work in front of a panel of examiners

BA ECONOMICS (Honours) with Research

ENDI409P: DISSERTATION I
(18 Credits -540 Hours) (L-T-P: 0-0-36)

The students would be required to submit dissertation. Dissertation submitted by the students would be evaluated by External Examiners appointed by the University. The work for the Research project is spread over Semester VII and Semester VIII as Dissertation Phase-I and Dissertation Phase-II respectively. The total dissertation grades are distributed between the two semesters i.e. 18 credits in Semester VII and 20 credits in Semester VIII equaling 38 credits in total. The aim of the course is to equip the students with presentation skills and develop academic writing skill. Moreover, the students will also be able to apply the statistical research training acquired in the taught element of the program by designing an appropriate research strategy and research methodology to carry out the research.

In Dissertation Phase-I, the students have to independently think of a research idea and, by the end of the semester, has to defend a research proposal based on the idea i.e. need to present the Synopsis by the end of the VII semester.

Structure of Dissertation Phase-I

Sl. No.	Tentative Stages to be completed
1.	Research idea or concept note, i.e., Statement of the Problem
2.	Review of Literature
3.	Research Methodology Sampling, Sample size determination, Selection of sample, Analytical tools to be used, Questionnaire preparation, Preliminary exploration of data i.e. Pilot Survey
4.	a) Synopsis Presentation b) Submission of Modified Synopsis to the Department
5.	Students have to collect all the required data during the semester

ENDI410P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

The students would be required to submit dissertation. Dissertation submitted by the students would be evaluated by External Examiners appointed by the University. The work for the Dissertation is spread over Semester VII and Semester VIII as Dissertation Phase-I and Dissertation Phase-II respectively. The total dissertation grades are distributed between the two semesters i.e. 18 credits in Semester VII and 20 credits in Semester VIII equaling 38 credits in total.

The aim of the course is to fine-tune the dissertation he/she working in the Phase-I and during the work, the students will also learn how to apply the statistical and econometric tools in their own research.

In Dissertation Phase-II, the student has to carry out data analysis and write the dissertation and defend it by the end of the fourth semester. The dissertation will include original research question(s) if any, critical review of the relevant literature, analytical tools employed in response to the research questions, data analysis and interpretation. Finally, the students need to submit the dissertation to the university authority maintaining all instructions provided by the university. Under the process, the students will be guided by an assigned supervisor of the department to do the work

Structure of Dissertation Phase-II

Sl. No.	Tentative Stages to be completed
1.	Validation of data, data entry and preliminary analysis of data (drawing graphs, trend lines, etc.)
2.	Main data analysis
3.	Dissertation writing and Proof reading
4.	Submission and Viva Voce

DEPARTMENT OF EDUCATION

PROGRAMME: BACHELOR OF ARTS in EDUCATION (BA)

DEGREE: BA EDUCATION (HONOURS)/ BA EDUCATION (HONOURS) WITH RESEARCH

VISION:

To build a pool of intellectually competent educational leaders and teacher educators leading on the process of education in general, and teacher education in particular, which nurtures individual autonomy and social development by ensuring quality with peace across the globe

MISSION:

To facilitate the expression of leaders hidden within the students developing some cognitive, affective and psychomotor abilities and making them a sound citizen of the country and the world as a whole

PROGRAM OUTCOMES

PO 1: **Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Effective Citizenship**: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

PO 7: **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes**.**

PROGRAM SPECIFIC OUTCOMES

PSO 1: To inculcate the sense of self and lifelong learning among the students with an appropriate critical thinking and managerial skill.

PSO 2: To inculcate an effective social interaction and ethical values among the students.

PSO 3: To enable the students to be effective in cognitive and psychomotor abilities in different situations.

PSO 4: To create the skills of teaching and research among the students.

COURSE LIST

3 Year UG Degree		
Semester 1	**Credit**	**Course Name**
Major, Introductory level	4	FOUNDATIONS OF EDUCATION
Minor	4	GUIDANCE AND COUNSELLING IN EDUCATION
Multi-disciplinary	3	
Ability Enhancement	2	
Skill Enhancement	3	LIFE SKILLS EDUCATION
Common Value Added	1	ENVIRONMENTAL EDUCATION
Common Value Added	1	HEALTH AND WELLNESS,YOGA EDUCATION AND SPORTS & FITNESS
Community Engagement	2	SERVICE LEARNING (THEORY)
	20	
Semester 2		
Major, Introductory level	4	PHILOSOPHICAL FOUNDATIONS OF EDUCATION
Minor	4	TEACHER AND TEACHING SKILLS
Multi-disciplinary	3	
Ability Enhancement	2	

Skill Enhancement	3	REFLECTIVE JOURNALING- A TECHNIQUE FOR PERSONAL AND ACADEMIC GROWTH
Common Value Added	1	DIGITAL AND TECHNOLOGICAL SOLUTIONS
Common Value Added	1	UNDERSTANDING INDIA
Community Engagement	2	SERVICE LEARNING (PRACTICUM)
	20	
Semester 3		
Major	4	PSYCHOLOGICAL BASES OF EDUCATION
Major	4	EDUCATION AND SOCIETY
Minor	4	EDUCATIONAL THINKERS
Multi-disciplinary	3	
Ability Enhancement	2	
Skill Enhancement	3	PSYCHOLOGICAL TESTING
	20	
Semester 4		
Major	5	EDUCATIONAL ADMINISTRATION AND MANAGEMENT
Major	5	TEACHING LEARNING METHODS AND PEDAGOGY
Major	4	DEVELOPMENT OF EDUCATION IN INDIA
Minor	4	HUMAN RIGHTS EDUCATION
Ability Enhancement	2	
	20	
Semester 5		
Major	5	HUMAN GROWTH AND DEVELOPMENT
Major	5	EDUCATIONAL TECHNOLOGY
Major	4	ELEMENTARY STATISTICS IN EDUCATION
Minor	4	PEACE EDUCATION
Internship	2	INTERNSHIP
	20	
Semester 6		
Major	4	MEASUREMENT AND EVALUATION IN EDUCATION-PART-I
Major	4	TEACHER EDUCATION
Major	4	EARLY CHILDHOOD CARE AND EDUCATION
Field based learning/Minor project	4	INSTITUTIONAL VISIT NATIONAL/ ACADEMIC
Minor	4	WOMEN EMPOWERMENT
	20	
4 Year UG Degree (Honours)		
Semester 7		
Major	5	CURRICULUM STUDIES
Major	5	INCLUSIVE EDUCATION
Minor	3	EDUCATION FOR SUSTAINABLE DEVELOPMENT
Research Methodology	2	ELEMENTS OF RESEARCH IN EDUCATION-I
Research Project/ Dissertation	6	DISSERTATION-I
	21	
Semester 8		
Major	5	ADVANCED STATISTICS IN EDUCATION
Major	5	MEASUREMENT AND EVALUATION IN EDUCATION-PART-II
Minor	3	EDUCATIONAL SEMINAR
Research Project/ Dissertation	6	DISSERTATION-II
	19	
4 Year UG Degree (Honours with Research)		
Semester 7		
Research Methodology	2	Research Methodology
Research Project/Dissertation	18	Dissertation Phase – I
Total Credit	**20**	
Semester 8		
Research Project/Dissertation	**20**	Dissertation Phase – II

U.G-PO-PSO-COURSE MAPPING

BA 1ST SEMESTER												
Course	**Code**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
FOUNDATIONS OF EDUCATION	EDFE100T	H	M	M	H	M	L	H	H	H	H	H
GUIDANCE AND COUNSELLING IN EDUCATION	EDGC102T	H	H	H	M	H	H	H	H	H	H	M
LIFE SKILLS EDUCATION	EDLS103L	H	H	H	M	H	L	H	H	H	H	H
BA 2ND SEMESTER												
Course	**Code**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
PHILOSOPHICAL FOUNDATIONS OF EDUCATION	EDPF101T	H	M	M	H	H	L	H	M	H	H	H
TEACHER AND TEACHING SKILLS	EDTT103T	M	H	H	H	H	M	H	H	H	H	H
REFLECTIVE JOURNALING- A TECHNIQUE FOR PERSONAL AND ACADEMIC GROWTH	EDJD104L	H	M	H	H	H	M	H	H	H	H	H
BA 3RD SEMESTER												
Course	**Code**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
PSYCHOLOGICAL BASES OF EDUCATION	EDPB200T	H	H	H	M	M	M	H	H	H	H	H
EDUCATION AND SOCIETY	EDES201T	H	H	H	H	H	M	H	H	H	H	M
EDUCATIONAL THINKERS	EDTH205T	M	H	H	M	H	H	H	H	H	H	H
PSYCHOLOGICAL TESTING	EDPT206L	M	M	M	H	M	M	M	H	H	H	M
BA 4TH SEMESTER												
Course	**Code**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
EDUCATIONAL ADMINISTRATION AND MANAGEMENT	EDEA202T	H	H	H	H	H	M	M	H	H	M	M
TEACHING LEARNING METHODS AND PEDAGOGY	EDTL203T	H	H	H	M	H	H	H	H	H	H	H
DEVELOPMENT OF EDUCATION IN INDIA	EDDE204T	H	M	M	M	M	M	H	M	H	M	M
HUMAN RIGHTS EDUCATION	EDHE206T	H	H	H	H	H	H	H	H	H	M	M
BA 5TH SEMESTER												
Course	**Code**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
HUMAN GROWTH AND DEVELOPMENT	EDHG300T	H	M	M	M	L	H	H	H	L	H	L
EDUCATIONAL TECHNOLOGY	EDET301T	H	M	H	M	M	L	H	M	H	H	M
ELEMENTARY	EDEL302T	H	L	L	L	H	H	H	H	M	H	H

STATISTICS IN EDUCATION												
PEACE EDUCATION	EDPE307T	H	M	H	H	H	H	M	H	H	M	L
INTERNSHIP	EDIN309I	H	H	H	H	H	M	H	H	H	H	H
BA 6TH SEMESTER												
Course	Code	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
MEASUREMENT AND EVALUATION IN EDUCATION-PART-I	EDME303T	H	H	M	M	H	M	M	M	H	H	H
TEACHER EDUCATION	EDTE304T	M	H	H	H	H	M	H	H	H	H	H
EARLY CHILDHOOD CARE AND EDUCATION	EDEC305T	M	H	H	H	H	M	H	H	H	H	H
INSTITUTIONAL VISIT NATIONAL/ ACADEMIC	EDIV306P	H	H	H	H	H	H	H	H	H	H	M
WOMEN EMPOWERMENT	EDWE308T	M	M	H	H	M	M	M	M	H	M	M
BA 7TH SEMESTER												
Course	**Code**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CURRICULUM STUDIES	EDCS400T	H	M	M	H	H	M	H	H	H	M	H
INCLUSIVE EDUCATION	EDIE401T	H	M	M	H	H	M	M	M	H	H	M
EDUCATION FOR SUSTAINABLE DEVELOPMENT	EDSD404T	H	H	H	H	H	H	M	M	H	H	H
ELEMENTS OF RESEARCH IN EDUCATION-I	EDER405T	H	H	M	H	H	M	M	M	H	H	H
DISSERTATION-I	EDDI407P	H	H	M	H	H	M	M	M	H	H	H
BA 8TH SEMESTER												
Course	**Code**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
ADVANCED STATISTICS IN EDUCATION	EDAS402T	H	H	M	M	H	M	M	M	H	H	H
MEASUREMENT AND EVALUATION IN EDUCATION-PART-II	EDEE403T	H	H	M	M	H	M	M	M	H	H	H
EDUCATIONAL SEMINAR	EDES406T	H	H	M	M	H	M	H	H	H	M	H
DISSERTATION-II	EDDI408P	H	H	M	H	H	M	M	M	H	H	H
BA 7TH SEMESTER												
Course	**Code**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
RESEARCH METHODOLOGY	EDDI409P	H	H	M	H	H	M	M	M	H	H	H
DISSERTATION PHASE – I	EDDI410P	H	H	M	H	H	M	M	M	H	H	H
BA 8TH SEMESTER												
Course	**Code**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
DISSERTATION PHASE – II		H	H	M	H	H	M	M	M	H	H	H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	EDFE100T	Foundations of Education	4
2	Major Course 2	EDPF101T	Philosophical Foundations of Education	4
3	Major Course 3	EDPB200T	Psychological Bases of Education	4
3	Major Course 4	EDES201T	Education and Society	4
4	Major Course 5	EDEA202T	Educational Administration and Management	5
4	Major Course 6	EDTL203T	Teaching Learning Methods and Pedagogy	5
4	Major Course 7	EDDE204T	Development of Education in India	4
5	Major Course 8	EDHG300T	Human Growth and Development	5
5	Major Course 9	EDET301T	Educational Technology	5
5	Major Course 10	EDEL302T	Elementary Statistics in Education	4
6	Major Course 11	EDME303T	Measurement and Evaluation in Education-Part-I	4
6	Major Course 12	EDTE304T	Teacher Education	4
6	Major Course 13	EDEC305T	Early Childhood Care and Education	4
6	Major Course 14	EDIV306P	Institutional Visit National/ Academic	4
7	Major Course 15	EDCS400T	Curriculum Studies	5
7	Major Course 16	EDIE401T	Inclusive Education	5
8	Major Course 17	EDAS402T	Advanced Statistics in Education	5
8	Major Course 18	EDEE403T	Measurement and Evaluation in Education-Part-II	5

EDFE100T: FOUNDATIONS OF EDUCATION
(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Objective
To help students in developing a fundamental knowledge of the educational process.

Course Outcomes
At the end of the course students will be able to:
CO 1: Describe the concept, objective, functions of education (Remembering)
CO 2: Identify the forms and bases of education (Understanding)
CO 3: Analyze the curriculum and dimensions of education (Analyzing)
CO 4: Apply different methods for teaching and creating learning among the students (Applying)

Module I: Meaning, Aims and Objective of Education (15 Hours)
Education: meaning, concept, nature and Functions - Narrow and broader concepts of education. Education as a process, a product and a discipline. Aims of education – individual, social and national aims. Objectives of Education – Four pillars of education (Delor 's Report: Learning to Know, Learning to Be, Learning to Do, and Learning to Live Together)

Module II: Forms and Bases of Education (15 Hours)
a. Forms of Education: Formal education, Informal education and non-formal Education – Meaning, concepts, nature and importance
b. Bases of Education: philosophical, psychological, sociological and biological

Module III: Dimensions of Education (15 Hours)
The learner, the teacher-qualities and responsibilities; curriculum and co-curricular activities- meaning and modern concept, need and importance; Educational Institutions – school, family and social institutions, religious institutions, state, etc. – their roles in education.

Module IV: Child-Centrism in Education and Educational Methods (15 Hours)
Practices and significance of child centered education; Play and play-way in education - Kindergarten, Montessori, basic education and project method.

Suggested Readings
1. Aggarwal, J. C. Theory and Principles of Education. New Delhi: Vikas Publishing (2017)
2. Chakraborty. J.C. Modern Education: Its aims and principles. Calcutta: S. Chakraborty (1982)
3. Chandra, S.S. and Sharma, R.K. Principles of Education. New Delhi: Atlantic Publisher.(2004)
4. Chaube. S.P and Chaube, A. Foundations of Education. Noida: Vikas Publication. (2007)

5. Daly. A. J. Social Network Theory and Educational Change. California: Harvard Education Press. (2010)
6. Gutek, G. L.The Montessori method. London: Rowman and Littlefield. (2004)
7. Hayden, M. and Thompson, J. (eds.). International Education: Principles and Practice. London: Routledge Falmer Taylor & Francis Group. (1998)
8. Isaacs, B. Understanding the Montessori approach: Early years' education in practice. New York: Routledge (2012)
9. Kundu, D. and Tarun, R.M. Modern theory and principle of education. New Delhi: The world press Pvt. Ltd (1990)
10. Saxena, N.R. S. Philosophical and sociological foundations of education. Meerut: Vinay Rakheja (2014)

Mapping of COs to Modules

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDPF101T: PHILOSOPHICAL FOUNDATIONS OF EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objective

To help students learn the contribution of philosophy and philosophers in shaping the different aspects of education.

Course Outcomes

At the end of the course students will be able to:

CO 1: Define, explain, relate, and analyze the relationship between philosophy and education. (Remembering, Understanding, Application, Analysis)

CO 2: Reflect upon the biography, philosophical and educational ideologies of Western and Indian thinkers. (Remembering, Understanding, Application, Analysis)

CO 3: Gain insight into the educational implications of the different Indian and Western schools of philosophy. (Remembering, Understanding, Application, Analysis, Evaluation)

CO 4: Comprehend the basics of Philosophy of Knowledge and Value as a part of Education. (Remembering, Understanding, Application, Analysis, Evaluation)

Module I: Philosophy and Education (10 Hours)

Meaning and nature of Education and philosophy; Concept of educational philosophy, Objectives of studying educational philosophy, relationship and influence of philosophy on education

Module II: Western and Indian Philosophical ideologies (20 Hours)

a. Indian: Aurobindo Ghosh, Sarvepalli Radhakrishnan, Amartya Sen and his capability approach to education
b. Western: Socrates, Plato, Ivan Illich

Module III: Schools of Philosophy (20 Hours)

a. Indian schools of Philosophy: Vedic philosophies and Buddhism - in terms of knowledge, reality and value.
b. Western Schools of Philosophy: Idealism, Naturalism, Pragmatism, Realism, Humanism: special reference to principles, aims of education, curriculum, teaching methods, teacher, discipline, role and place of student.

Module IV: Epistemology and Axiology in Education (10 Hours)

a. Knowledge - Nature, role of knowledge, Sources of knowledge
b. Values – concept, need, types and importance, Core values enshrined in the constitution of India. Fostering values among students

Suggested Readings

1. Ayer, A.J. The Problem of Knowledge. Penguin.
2. Dewey, J. Democracy and Education. Macmillan, New York.
3. Dewey, J. Experience and Education. Macmillan, New York.
4. Durkheim, E. Education and Sociology. Free Press, Chicago.
5. Froebel, F. The Education of Man. Fairfield, Kelley, New Jersey.
6. Gajardo, M. (1993). Ivan Illich. http://schoolofeducators.com/wp-content/uploads/2008/09/illiche.pdf
7. Hirst, P.H. Knowledge and the Curriculum. Routledge and Kegan Paul.
8. Hirst, P.H. and Peters. The Logic of Education. Routledge and Kegan Paul.
9. Illich, I. (1970). Deschooling Society. https://monoskop.org/images/1/17/Illich_Ivan_Deschooling_Society.pdf
10. Kant, I. Critique of Pure Reason. Dent.
11. Moore, T.W. Educational Theory: An Introduction. Routledge and Kegan Paul.

12. Peters, R.S., Ethics and Education. Allen and Unwin.
13. Suryanarayana, S. (n.d.). Ivan Illich. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000033SO/P000300/M013095/ET/145258826709ET.pdf

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDPB200T: PSYCHOLOGICAL BASES OF EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objective

To help students learn to apply the knowledge of psychological principles and theories to improve students' learning.

Course Outcomes

At the end of the course students will be able to:

CO 1: Understand the implications of psychological concepts and principles in the field of culturally diversified classrooms. (Remembering, Understanding, Application, Analysis, Evaluation)

CO 2: Develop critical insight into the process of human learning and factors responsible. (Remembering, Understanding, Application, Analysis, Evaluation, Creating)

CO 3: Create awareness about intelligence and its assessment. (Remembering, Understanding, Application, Analysis, Evaluation)

CO 4: Create awareness about adjustment and its methods. (Remembering, Understanding, Application, Analysis, Evaluation, Creating)

Module I: Educational Psychology and Cultural Diversity in Classrooms (20 Hours)

Educational Psychology-its meaning, nature, scope and aims, Relationship between Education and psychology, Importance of knowledge of educational psychology for the teacher, creating positive learning environments

Cultural Diversity: Concept and types; Low Socio Economic students and their achievement, teaching students living in poverty; Gender and its stereotyping- inherent threats, avoiding gender biases in teaching; multicultural education and culturally relevant pedagogy/teaching

Module II: Learning and transfer of learning (15 Hours)

Meaning, Nature of, learning and maturation, types of learning, Laws of learning, theories of learning: Trial and Error learning, Classical Conditioning, Operant Conditioning; Factors affecting Leaning

Transfer of learning: Concept, types, Educational implications

Module III: Intelligence and its assessment (15 Hours)

Intelligence: Definition, Nature and Theories: Two Factor Theory of Intelligence, Guildford structure of Intellect; Intelligent Quotient (IQ), Emotional Intelligence, Assessment of Intelligence

Module IV: Psychology of Adjustment (10 Hours)

Concept, Adjustment as achievement or process, Characteristics of a well-adjusted person, Methods of adjustment- direct and indirect

Suggested Readings

1. Chauhan, S. S. (2004). Advanced Educational Psychology, Vikas Publishing House Pvt. Ltd, New Delhi.
2. Chatterjee, S. K. (2017). Advanced Educational Psychology, Books and allied Pvt. Ltd. Calcutta
3. Dandapani, S. (2013): A textbook of Advanced Educational Psychology, Anmol Publications Pvt. Ltd.
4. Kuppuswami, B. (Ed.) (1963): Advanced Educational Psychology, Jalandhar: University Publications
5. Mangal, S. K., Advanced Educational Psychology, Prentice hall of India, Pvt. Ltd. New Delhi
6. Morgan, C.T (1961): Introduction to Psychology, New York: McGraw-Hill.
7. Skinner, C. E. (2007). Educational Psychology. Prentice hall of India, Pvt. Ltd. New Delhi
8. Woolfolk, A. (2015). Educational Psychology. Pearson India Education Pvt. Ltd. India.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		

CO 3			H	
CO 4				H

EDES201T: EDUCATION AND SOCIETY

(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Objective

To assist students in comprehending the role of sociological elements in creating education and society.

Course Outcomes

At the end of the course students will be able to:

CO 1: Discuss the concept of sociology of education and agencies of education. (Remembering)

CO 2: Describe the role of education in transmission and preservation of culture, cultural change and social change. (Understanding)

CO 3: Analyze the types of social group and the importance of national integration, international understanding and democracy in a diverse social context. (Analyzing)

CO 4: Evaluate the role of education solving social problems. (Evaluating)

Module I: Sociology and Education and Agencies of Education (20Hours)

Meaning of educational sociology and sociology of education; relationship between sociology and education; sociological determinants of education; agencies of education-family, school, community, religious institutions, state

Module II: Education, culture and social change (20Hours)

Meaning, concept, nature and components of culture, their role in transmission and preservation of culture; cultural lag and cultural change; social change–social mobility, stratification and the roles of education in bringing about change in social change

Module III: Education and Society (20Hours)

Education and social groups-types of groups, social interaction and its educational implications, socialization concept, factors and implications; education for national integration, international understanding and democracy

Module IV: Current Social Problems in India (15 Hours)

Equalization of educational opportunities; role of education in solving social problems such as Illiteracy, nutrition, sanitation and unemployment; lifelong education

Suggested Readings

1. Dash, B. N. Teacher and Education in Emerging Society. New Delhi: NeelKamal Publication (2004).
2. Gul, S.B. and Khan, Z. N. Philosophical and sociological foundations of education. Create Space (2010).
3. Khanna, S.D. Education in the Emerging Indian Society. Delhi: Doaba House (2000).
4. Kumar, T. P. and Talawar, M. S. Philosophical and sociological foundations of education. Mumbai: Himalaya publishing house (2010).
5. Sachdeva, M. S. and Sharma , K.K.. Contemporary India and Education. United States: Twenty first century publications (2015).
6. Saxena, N.R.S.. Philosophical and sociological foundations of education. Meerut: Vinay Rakheja (2014).
7. Sharma, M. Philosophical And Sociological Foundation Of Education. Guwahati: Eastern Book House (2011).
8. Sharma, R.S. Perspective in Modern Education. Delhi: Neel Kamal Publication (1998).
9. Singh, Y. K. Sociological foundations of education. New Delhi: APH Publishing Corporation (2008)
10. Singh, Y.K. Education in Modern India. New Delhi: Deep and Deep Publications (2000)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDEA202T: EDUCATIONAL ADMINISTRATION AND MANAGEMENT

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objective

To help students learn the importance of a good administrator and enhance the various skills required to become an effective educational administrator.

Course Outcomes

At the end of the course students will be able to:

CO 1: Define and explain the concept of educational administration, its types, elements, characteristics, functions and factors influencing educational administration. (Remembering, Understanding, Analysis)

CO 2: Explain the concept of school and school management and analyze the qualities and role of school personnel and their professional ethics. (Remembering, Understanding, Application, Analysis)

CO 3: State and explain the concept of institutional planning and identify the different steps and approaches of institutional planning.(Remembering, Understanding, Application, Analysis)

CO 4: Define and explain educational supervision, and its types and apply the principles of supervision in educational management and administration. (Remembering, Understanding, Application, Analysis)

Module I: Introduction to Educational Administration (15 Hours)

Meaning, Definition, Nature of EA, Scope of EA; Objectives of EA; Types of EA, Elements of EA, Characteristics of Administration; Functions of EA, Factors influencing EA. Autocratic and Democratic administration

Module II: School Management (20 Hours)

Concept of School, Need of School, Meaning and Definitions of School management; Process of School Management, Qualities of a Headmaster/Principal; Role of teachers in school management; Essential Qualities of Teachers, Professional ethics

Module III: Institutional planning (20 Hours)

Meaning of Planning; Concept of Institutional Planning; Importance of Institutional Planning; Aims of Institutional Planning; Steps and Preparation of Institutional planning; Approaches of Educational Planning – Man Power and Rate of return approach.

Module IV: Educational Supervision (20 Hours)

Meaning and Nature of Educational Supervision; Concept of Inspection; Difference between Inspection and Supervision; Aims, Types, Scope of Educational Supervision; Educational Supervision Procedures; Principles of Educational Supervision; Problems in Educational Supervision; Effective supervision; Functional basis of supervision.

Suggested Readings

1. Sindhu (2012). Educational Administration and Management, Noida: Dorling Kindersley.
2. Jain and Jain,. School Management, Ludhiana: Tandon Publications
3. Adams,H.P&Duckey,F.G. Basic Principles of supervision.
4. Donahoo, S. & Hunter, R. Teaching Leaders to Lead Teachers: Educational Administration in the Era of Constant Crisis.
5. Advances in Educational Administration, Volume 10, 1–4. Elsevier Ltd.
6. English, F. (ed.). Encyclopedia Educational leadership and Administration (Vol. 1). Sage Publication: Thousand Oaks.
7. Stanley, A. G. &Samier, E. A.Political Approaches to Educational Administration and Leadership. Routledge: New York.
8. Starratt, R. Centering Educational Administration: Cultivating Meaning, Community, and Responsibility. Lawrence Erlbaum Associates, Publishers: New Jersey.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDTL203T: TEACHING LEARNING METHODS AND PEDAGOGY

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objective

To help students develop insight into the different elements of teaching learning process to be able to create and organize their own approaches to teaching.

Course Outcomes

At the end of the course students will be able to:

CO 1: Analytical insight into the various concepts of teaching phenomenon. (Remembering, Understanding, Application, Analysis, Evaluation)

CO 2: Analyze the classroom implications of theories, principles and maxims of teaching. (Remembering, Understanding, Application, Analysis, Evaluation)

CO 3: Become aware of organizing purposeful and child centered teaching. (Remembering, Understanding, Application, Analysis, Evaluation)

CO 4: Examine the importance of teaching models for directing classroom instruction. (Remembering, Understanding, Application, Analysis, Evaluation)
CO 5: Develop the skills of lesson planning. (Application)

Module I: Concepts of teaching (20 Hours)
- Meaning of teaching-Authoritative, democratic, laissez-faire
- Teaching from a descriptive point of view; Teaching from a success point of view.
- Variables and functions of teaching,
- Levels and phases of teaching
- Modalities of teaching and their differences: Conditioning, training, instruction and indoctrination

Module II: Theories and Principles of Teaching (15 Hours)
- Nature of theory of teaching
- Significance of theory of teaching;
- Types-Formal, descriptive and normative
- Principles and maxims of teaching.

Module III: Instructional Objectives and Methods of Teaching (20 Hours)
- Concept of instructional objectives and learning outcomes
- Taxonomy of instructional objectives with special reference to cognitive objectives
- Methods of teaching: lecture method, discussion method, demonstration method, play way method, activity method, problem solving method, Heuristic method, project method

Module IV: Models of teaching and Lesson Plan (20 Hours)
- Meaning of models of teaching
- Discussion of one model from each of the four categories of models of teaching
- Techno-pedagogy
- Meaning and significance of lesson plan
- Types of lesson plan- knowledge, skill and appreciation
- Approaches of lesson plan
- Elements of a good lesson plan
- Preparation of lesson plan
- Disadvantages of lesson plan

Suggested Readings:
1. Chauhan, S. S. (2008). *Innovations in Teaching Learning process*. New Delhi: Vikas Publishing House Pvt. Ltd.
2. Mangal & Mangal. (2016). *Essentials of Educational Technology.* . New Delhi: Prentice Hall of India Pvt. Ltd.
3. Paintal, I. (1980). *Microteaching-A handbook for Teachers*. Delhi: Oxford University Press
4. Passi, B. K. (1976). *Becoming Better Teacher*. Baroda: CASE
5. Singh, L. C. & Joshi, A. N. (1990). *Microteaching in India-A Case Study*. New Delhi: NCERT
6. Joyce, Bruce, Marsha Weil and Emily Calhoun (2008). *Models of Teaching*. New Delhi: Prentice Hall of India Pvt. Ltd.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H
CO 5				H

EDDE204T: DEVELOPMENT OF EDUCATION IN INDIA

(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Objectives

To familiarize students with the past and present developmental initiatives taken in the field of education, and to understand the present issues and concerns of education.

Course Outcomes

At the end of the course students will be able to:
CO 1: Review the Ancient and Medieval system of Education in India (Remembering)
CO 2: Identify the different educational policies adopted during the British Rule (Understanding)

CO 3: Analysis the development of Education in Independent India and Assam (Analysis)
CO 4: Evaluate the contemporary concerns and issues of Indian Education through various initiatives of the Government of India (Evaluation)

Module I: Education in Ancient India (15 Hours)
Vedic system of Education--Aims, Methods of Teaching, Curriculum, Teacher-pupil relationship, Discipline, Education of Women; Buddhist Period--Aims, Methods of Teaching, Curriculum, Teacher-Pupil Relationship, Discipline, Education of Women; Medieval Period---Aims, Methods of Teaching, Curriculum, Teacher- Pupil Relationship, Discipline, Education of Women

Module II: Education during the British Period in India (15 Hours)
A brief introduction to the Educational Activities of East India Company and Christian Missionary in India; Educational Reforms and Recommendations of: Charter Act of 1813, Macaulay's Minute 1835, Wood's Despatch; Hunter Commission, 1882, Lord Curzon's Educational Policy, 1904, Sadler's Commission, 1917, Wardha Scheme of Education,1937, Sargent Report, 1944

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

Module III: Education in Post-Independence India (15 Hours)
Educational Reforms and Recommendations of: University Education Commission (1948-1949), Secondary Education Commission (1952-53), Kothari Commission (1964-1966), National Policy on Education (1968,1986 and1992), Development of Education in Assam-Primary, Secondary, University and Women Education

Module IV: Issues and Challenges in Indian Education at School Stage (15 Hours)
Concept of UEE and its problems; Operation Blackboard (OBB), District Primary Education Programme (DPEP), Sarva Shiksha Abhiyan (SSA) and RTE-Act2009; Rashtriya Madhyamik Shiksha Abhiyan (RMSA), Concept, Scope and need of Vocational Education; Objectives of Vocational education; NPE-1986, POA-1992, and NEP 2020 with reference to Vocational Education; Use of ICT

Suggested Readings
1. Goswami, S. & Das Sarma, P (2012). Development of Education in India, Shanti Prakashan.
2. GOI (1964-1966):'Education and National Development". Ministry of Education, Government of India 1966.
3. Govt. of India, Ministry of Human Resource Development, Policy of Action, 1992, New Delhi
4. Mohanty, J., (1986). School Education in Emerging Society, Sterling Publishers
5. Mukerjee, S.N., (1966). History of Education in India, Acharya Book Depot.
6. NCERT (1986). School Education in India – Present Status and Future Needs, New Delhi.
7. Nurullah, S. & Naik, J.P. (1974) History of Education in India, Mc. Millan Company. India.
8. Rawat, P.L (2006). History of Indian Education, Ram Prasad & Sons, Bhopal.

Mapping of COs to Modules

EDHG300T: HUMAN GROWTH AND DEVELOPMENT

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objective
To help students realize the importance of the knowledge of human growth and development in various stages of human life and ensuring effective learning.

Course Outcomes
At the end of the course students will be able to:
CO 1: Explain the concept of Growth and Development and its associated variables(Understanding)
CO 2: Explain the concepts of maturation and individual differences, their effect on human growth and development (Application)
CO 3: Describe childhood and adolescence as stages of development along with their developmental characteristics and role of the teacher in addressing their needs(Evaluate)
CO 4: Critically analyze the theories of development and use the knowledge of the various theories of growth and development and its associated variables in addressing the diversity of the classroom (Analyze)

Module I: Introduction to Growth and Development (20 Hours)

Concept and characteristics of Growth and Development, Difference between growth and development, Principles of growth and development and its implications for education; Dimensions of Development; Factors that influence growth and development: Heredity and Environment; Stages of Human growth and development (characteristic features):Prenatal Development, Post-natal Development

Module II: Maturation and Individual Differences (20 Hours)
Maturation:Concept, Effect of Maturation on Human growth and development, Educational implications of maturation; Individual Differences:Concept, Dimensions/ Types of individual differences, Causes of individual differences, Educational implications of Individual differences, Strategies to accommodate individual differences in the classroom

Module III: Childhood and Adolescence (15 Hours)
Childhood: Concept, Developmental Characteristics and role of teacher in addressing their needs; Adolescence: Concept, Developmental characteristics, problems encountered by adolescents, role of the teacher in addressing adolescent problems

Module IV: Theories of Development and their Educational Implications (20 Hours)
Piaget's Cognitive Theory: Freud's Psycho-sexual Theory: Erickson's Psycho-social Theory: Bronfrenbrenner's Bio-ecological Theory: Kohlberg's theory of Moral Development; Chomsky's theory of Language Development; Havighursts' Developmental Tasks throughout one's life span

Suggested Readings

1. Acero, V. O, Javier, E. S. and Castro, H. O. (2004). Human Growth Development and Learning. Rex Book Store: Manila Philippines
2. Hurlock, E. B. (2018). Developmental Psychology: A Life Span Approach. Mc. Graw Hill Education Pvt. Ltd., Chennai.
3. Hurlock, E. B. (2016). Child Development. Mc. Graw Hill Education Pvt. Ltd., New Delhi.
4. Mangal, S. K. (2017). Advanced Educational Psychology. PHI Learning Pvt. Ltd., New Delhi.
5. Mangal&Mangal. (2019). Psychology of Learning and Development. PHI Learning Pvt. Ltd., New Delhi.
6. Erickson, E. (1950). Childhood and Society. Norton: New York.
7. Kuppuswami, B. (Ed) (1971). Educational Psychology: A Cognitive Developmental Approach. New Delhi.
8. Crow, L. D. & Crow, A. (1969). Child Psychology. Barney and Noble, New York.
9. Singh, A. (Ed.) (2015). Human Development: A life span Approach. Orient Black Swan: Delhi.
10. Cole, M & Coley, S. (1989). The Development of Children. Scientific American Books, New York.
11. Chauhan, S. S. (2004). Advanced Educational Psychology. Vikash Publishing House Pvt. Ltd. New Delhi.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2		H		
CO 3		H	H	
CO 4		H		

EDET301T: EDUCATIONALTECHNOLOGY

(5 Credits – 75 Hours) (L-T-P: 4-0-1)

Objectives

To inculcate in students the skill of utilising technology in the teaching learning process.

Course Outcomes

At the end of the course students will be able to:

CO 1: Become aware of the contribution of educational technology to the teaching-learning process. (Remembering, Understanding, Application, Analyze, Evaluate)
CO 2: Explain the process of communication and various instructional technology (Remembering, Understanding, Application, Analyze, Evaluate)
CO 3: Understand the implications of behavioural technology for improved teacher behaviour. (Remembering, Understanding, Application, Analyze, Evaluate)
CO 4: Identify the various emerging trends in technology and the multimedia approach in the classroom for the purpose of teaching (Remembering, Understanding, Application, Analyze, Evaluate)

Module I: Introduction to Educational Technology (20 Hours)
Emergence of educational technology, different views on educational technology, definition, meaning, nature and scope of educational technology, educational technology in formal and non-formal education, educational technology and quality education, problems of educational technology in the Indian context

Module II: Communication and Instruction (20 Hours)
Concept and need of communication; Forms of communication; Barriers of communication Model of communication process; Classroom communication: Verbal and Nonverbal; Instructional Technology: Programmed Instruction (PI), Personalized system of Instruction (PSI), Computer Assisted Instruction (CAI)

Module III: Behavioural Technology (20 Hours)
Need and Nature of behavioral technology; Features of teaching behavior; Concept of teaching skills and their identification; Need, nature and steps of Micro-teaching; Interaction Analysis with special reference to Flanders; Simulated Social Skill Training (SSST)

Module IV: Practicum in Emerging Trends of Educational Technology (30 Hours)

- Preparing videos using various applications
- Creation of e-content in alignment with MOOCs
- Learning Management System

Suggested Readings

1. Aggarwal, J.C. (2014) : Essentials of Educational Technology, Vikash Publishing House Pvt Ltd, New Delhi
2. Bruner, J. S (1966) :Toward a Theory of instruction, New York
3. Flanders, Ned A (1972) : Analyzing Teacher Behaviour, California ,Addison Wesley
4. Mangal, S. K & Mangal, U (2014) : Essentials of Educational Technology PHI Learning Pvt. Ltd, Delhi
5. Mitra, S.K (1968) : Proceedings of symposium on educational Technology, IPAL, NCERT, New Delhi
6. Sharma, R. A (1988) : Technology of Teaching, Loyal Book Depot, Meerut

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDEL302T: ELEMENTARY STATISTICS IN EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objectives
To create ability among the students for handling quantitative data and interpreting computed results.

Course Outcomes
At the end of the course students will be able to:
CO 1: To acquaint the students with the concept, nature, and relevance of statistics to educational studies. (Remembering, Understanding, Application, Analysis, Synthesis)
CO 2: To make the students well aware of the organization, presentation of data and finding out central values. (Remembering, Understanding, Application, Analysis, Synthesis, Evaluation)
CO 3: To create understanding among the students about the variations of the scores in any distribution. (Remembering, Understanding, Application, Analysis, Synthesis, Evaluation)
CO 4: To create understanding among the students about the conceptual framework of normal probability curve and the relationship of variables. (Remembering, Understanding, Application, Analysis, Synthesis, Evaluation)

Module I: Nature of Statistics (15Hours)
Meaning and nature of Statistics; Utility of statistics in education;Organization of data in frequency table; Graphical representation of data- frequency, polygon, histogram, cumulative frequency curve and ogive; Functions and limitations of statistics.

Module II: Measures of Central Tendency (15Hours)
Meaning and importance of Measures of Central Tendency; Three common measures of central tendency: Mean, Median and Mode; Definition of mean, computation of mean from ungroup data and grouped data. Incase of grouped data-long and short method; Merits and demerits of mean; Definition of median, computation of median from ungrouped and grouped data; Merits and demerits of median; Definition of mode, computation of mode from ungrouped data and grouped data, merits and demerits of mode; When to use mean, median and mode

Module III: Measures of Variability (15Hours)
Meaning and importance of Measures of Variability; Types of measures of variability: Range, average deviation, standard deviation, and quartile deviation; Computation of Range and its merits and demerits; Computation of Average Deviation(AD)

from ungrouped and grouped data, merits and demerits of AD; Computation of SD from ungrouped and grouped data, merits and demerits of SD; Computation of Quartile Deviation from ungrouped and grouped data, merits and demerits of QD; Percentile and Percentile Ranks; When to use range, AD, SD, and QD

Module IV: Relationship between Variables (15Hours)
Definition of Correlation, Correlation and causation; Types of correlation; Meaning of linear correlation and degree of correlationship; Methods of determining correlation- Graphic methods and Mathematical method; Product Moment Method and rank Difference Method; Factors affecting correlation; Nature and features of Normal Probability Curve

Suggested Readings
1. Garrett, H.E Statistics in Psychology and Education, Vakuls, Feffera and Sumon, Bombay (1971)
2. Guilford, J.P. Fundamentals Statistics in Psychology and Education, McGraw-Mill,New York(1967):
3. Gupta, B.N Statistics, Theory and Practice, Sahitya Bhawan, Agra (1993).
4. Koul, L. Methodology of Educational Research, Vikas Publishing House,Pvt.Ltd,New Delhi(2009)
5. Mangal, S.K.: Statistics in Psychology and Education, PHI Pvt. Ltd, Delhi (2018)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDME303T: MEASUREMENT AND EVALUATION IN EDUCATION: I

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objectives
To help students develop insight and skill of measuring and evaluating students learning.

Course Outcomes
At the end of the course students will be able to:
CO 1: To create understanding among the students about concept and nature of educational measurement and evaluation. (Remembering, Understanding, Analysis)
CO 2: To make the students well aware of the nature of objective cum outcome based education with special reference to taxonomy of educational objectives. (Remembering, Understanding, Application, Analysis, Synthesis)
CO 3: To make the students well aware of the types of evaluation. (Remembering, Understanding, Application, Analysis)
CO 4: To create understanding about the measurement of different dimensions and their interpretations. (Remembering, Understanding, Application, Analysis)

Module I: Introduction to Measurement and Evaluation in Education (15Hours)
- Concept and historical background of measurement
- Types of measurement and scales of measurement
- Functions of measurement in education
- Concepts of assessment and evaluation
- Relationship between assessment and evaluation
- Principles and steps of evaluation
- Scope of measurement and evaluation in education

Module II: Nature of Educational Objectives and Outcome Based Education (15Hours)
- Meaning and need of educational objectives
- Educational aims, educational objectives and instructional objectives
- Purpose of Taxonomy of educational objectives
- Cognitive, affective, and psychomotor objectives and their taxonomy
- Writing instructional objectives in behavioural form
- Concepts of objective cum outcome based education for ensuring quality education

Module III: Measurement and Evaluation of an Individual (15Hours)
- Types of evaluation
- Measurement of intelligence, interest, and aptitude of students
- Measurement of achievement of students

- Tools/ tests of intelligence, interest, aptitude, and achievement
- Teacher made achievement test and standardized achievement test
- Characteristics of a good test
- Educational diagnosis

Module IV: Planning and Execution of Evaluation Programme (15Hours)

- Features of an effective evaluation programme
- Functions of evaluation programme
- Steps for planning a good evaluation programme
- Execution of the evaluation programme
- Recording and reporting date
- Use of data for guidance and counseling

Suggested Readings

1. Adams, G. S. (1964). Measurement and Evaluation in Education, Psychology, and Guidance. Holt, Rinehart Winston. New York.
2. Annastasi, A. (1976): Psychological Testing, McMillan Publication Co. New York
3. Ebel, R. L & Fresbie, D. A. (1991). Essentials of Educational Measurement. Prentice Hall of India Pvt. Ltd. New Delhi.
4. Edwards, A. L. (1966) : Techniques of Attitude Scale Construction, New York
5. Frank, S. Freeman (1990) : Theory and Practice of Psychological Testing, IH Publishing Co. Bombay
6. Granlund, N.E (1976): Measurement and Evaluation in Teaching, McMillan Publishing Co. New York
7. Linn, R. L. & Miller, M. D. (2008) : Measurement and Assessment in Teaching, Darling Kindersley, Pvt.Ltd
8. Sharma, R. A. (1998) : Essentials of Measurement in education and Psychology, R. Lall Book Depot, Meerut

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

EDTE304T: TEACHER EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objective

To inculcate in students the qualities of being an effective teacher and the various scopes associated with it.

Course Outcomes

At the end of the course students will be able to:

CO 1: Explain the meaning, nature, features and scope of teacher education (Remembering)
CO 2: Describe the concept of Pre-service and In-service Teacher education and its various dimensions. (Understand)
CO 3: Identify the various approaches to Teacher Education programme(Analyse)
CO 4: Evaluate the current trends in the field of Teacher Education (Application)

Module I: Introduction to Teacher Education (15 Hours)

Meaning, nature and scope of Teacher Education; Historical background of Teacher Education in India; Objectives of Teacher Education; Paradigm shifts in education and preparation of teachers

Module II: Pre-Service and In-Service Teacher Education (10 Hours)

Concept of Pre-service & In-service Teacher Education; Features of Pre-service & In-service Teacher Education; Terms and conditions for Pre-service & In-service Teacher Education Programs as per NCTE

Module III: Approaches to Teacher Education (15 Hours)

Behaviouristic and constructivist approaches; Disciplinary and Inter-disciplinary approach; Modification of teaching behaviour: Simulated teaching, Flanders' Interaction Analysis Category System; Integrated Teacher Education Programme; Information Literacy and using ICT in classroom.

Module IV: Emerging Trends and Research in Teacher Education (20 Hours)

Modes of Transaction; Micro Teaching and SSST Team Teaching; Practice Teaching and Internship; Research in Teacher Education; Process of Action Research Technology in Teacher Education; Emerging trends in Teacher Education; Issues and challenges in teacher education

Suggested Readings

1. Aggarwal, J. C. Teacher Education, Theory and Practices, New Delhi, Daoba Home(2010)
2. Harvilas, S. and Naik, J.P. A History of Education in India, Bombay, McMillan & Co. (2016)
3. Jangaiah, C. Teacher Education, APH Publishing Corporation (2016)
4. Jangira, N.K. Teacher Training and Teacher Effectiveness –An experience in Teaching, New Delhi, National Publishing House (2002)
5. Kumar, T.P. Teacher Education, APH Publishing Corporation (2010)
6. NCERT: The Third Indian Year Book on Education, New Delhi, NCERT (1968)
7. NCTE : Teacher Education Curriculum-A Framework, New Delhi, NCERT (1978)
8. Mohanty, R. K . Teacher Education, R. Lal Book Depot, Raj Printers (2012)
9. Shirmali, K.L: Better Teacher Education, New Delhi, Ministry of Education, Govt. of India

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

EDEC305T: EARLY CHILDHOOD CARE AND EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objectives

To help students understand the importance of stimulating environment, nutritious food and care during the early stages of human growth and development.

Course Outcomes

At the end of the course students will be able to:

CO 1: State and explain the concept, need, significance and principles guiding the framework of ECCE. (Remembering, Understanding)

CO 2: Explain and analyze the underlying philosophies of ECCE. (Understanding, Analysis)

CO 3: State the various policies, programmes and initiatives on ECCE and evaluate the accuracy and relevance of these policies, programmes and initiatives (Remembering Understanding, Evaluation)

CO 4: State the meaning and approaches of the curriculum and apply the play-way approach in teaching the learners of ECCE stage. (Remembering, Understanding, Application)

Module I: Nature of ECCE and Principles of Development in Early Years (14 Hours)

Meaning, Definitions and Significance of ECCE in the context of Universalization of Elementary Education; Objectives and principles guiding the framework of ECCE; Developmental milestone goals of ECCE centres; Meaning of Growth and Development; Principles guiding growth and development; Characteristics of children at ECE stage.

Module II: Philosophies on ECCE (12 Hours)

Philosophy of John Dewey; Friedrich Froebel; Maria Montessori; Gijubhai Badeka; Tarabai Modak

Module III: Policies, Programmes and Initiatives on ECCE in India (17 Hours)

Development of ECCE in India; National Children's Policy 2013; NPE-1986 and its Programme of Action (POA)1992; NEP-2020 and ECCE; Convention on Rights of the child, 1989; Providers of ECCE- government, private and NGOs; ICDS and SSA.

Module IV: Curriculum of ECCE (17 Hours)

Meaning of Curriculum; Approaches of the curriculum; Play Way Approach- Meaning of play; benefits of play; Types of Play; Importance of integrating play into the curriculum; Enhancing Communication Skills through play way approach; Teacher's Role and activities to promote communication; Literacy and Numeracy Meaning of Literacy; Meaning of numeracy; Components of literacy and numeracy for an early years curriculum; Play-centred activities for literacy and numeracy; Play way method in supporting reading skills Pre-reading Activities and games.

Suggested Readings

1. Braun, S.J & Edwards, E.P (1972): History and Theory of Early childhood Education, Ohio, Charles, A.Ones Publishing Co.
2. Desai, K.G.(1976): Effectiveness of kindergarten Education : Allahabad, United Publishers.
3. Koul, V.(et.al)(1993): Early Childhood Care and Education: An Assessment, New Delhi, NCERT.
4. MHRD (1986): A Guide Book for Anganwadi Workers Dept. Of Women & Child Development, MHRD,Govt. of India
5. Montessori Maria (1969): The Montessori Method, New York, Shockan Book
6. Montessori Maria (1986): The child in the Family, New York, Avon Books

7. Thakur, A. (1972): Perspectives in Pre-School Education, Bombay, Poplr Pradhan Pvt Ltd.
8. Upadhay, G. C. (1999): A study of Pre-school component and its perception and extent ofUtilization by Community, New Delhi, NCERT
9. Viruru, R. (2001): Early Childhood Education, New Delhi, Sage Publications
10. Sue Bredekamp (2014): Effective Practices in Early Childhood Education: Building a Foundation (3rd Edition), Pearson Publications
11. Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birththrough age eight, 3rd Edition, Editors - Carol Copple and Sue Bredekamp
12. Kaul. V., (2009). Early Childhood Education Programme. National Council of Educational Research andTraining, New Delhi.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDCS400T: - CURRICULUM STUDIES

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Objective

To inculcate in the learners the skill of developing an effective curriculum.

Course Outcomes

At the end of the course students will be able to:

CO 1: Identify the components, principles, goals and objective of curriculum development (Remembering)
CO 2: Demonstrate the different bases of the curriculum construction (Understanding)
CO 3: Analyze the different dimensions, approaches of curriculum designing and the role of teachers in bringing about changes and modification in the curriculum (Analyzing)
CO 4: Apply the methods and process of curriculum development and examine the relevance of the existing curriculum (Application)

Module I: Nature of Curriculum (15 Hours)

Defining curriculum, Components of curriculum, Principles of curriculum, Goals and objectives for curriculum development, Characteristics of a good curriculum

Module II: Bases of Curriculum Construction (15 Hours)

Philosophical bases: Naturalism, Idealism, Pragmatism, Sociological bases: Society, education and schooling, social change and curriculum, Psychological bases: Learning theories and curriculum, humanistic psychology

Module III: Approaches to Curriculum Development (15 Hours)

Major approaches: subject-centred, broad fields/ life-centred, learner-centred approaches, Models of curriculum development: Technical/Scientific model- Tyler Model and Taba Model, Non- technical/ non- scientific model – Open class model, Weinstein and Fantini's Model

Module IV: Process of Curriculum Development and the role of teachers in Curriculum Development (15 Hours)

Process of curriculum development: Assessment of educational needs, Formulation of objectives Selection and organisation of content, Selection and organisation of learning experiences, Evaluation Role of teachers in curriculum development and some issues in curriculum development, Irrelevant curriculum, Emerging curriculum.

Suggested Readings

1. Beane, A. J., Topfer, Jr. and Alessi, S.J. . Curriculum Planning and Development. London: Allyn and Bacon. (1986)
2. Dewey, J. (1966). The Child and the Curriculum- The School and Society. USA: Phoenix
3. Olivia, P. F. (1988). Developing the Curriculum. London: Scott Foreman and Company
4. Seethaeramu, A.S. (1989). Philosophies of Education. New Delhi: Ashish Publishing House
5. Sharpes, D.K. (1988). Curriculum Tradition and Practices. London: Routledge.
6. Shivarndrappa. G. (1985). Philosophical Approaches to Education. New Delhi: Himalaya Publishing House.
7. Taneja, V.R. and Taneja. S. (1980). Educational Thinkers. New Delhi: Atlantic Publishers
8. Tyler. R. (1949). Basic Principles of Curriculum and Instruction. Chicago: University of Chicago Press.
9. Weinstein, G and Fantini, M. (1970). Towards Humanistic Education: A Curriculum of Affect. New York: Praeger.
10. Wheeler, D.K. (1976). Curriculum Process. London: University of London
11. Wiles, J and Bondi, J (1989). Curriculum Development. Ohio: Merrill Publishing Company.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDIE401T: INCLUSIVE EDUCATION

(5 Credits – 75 Hours) (L-T-P: 4-0-1)

Objective

To create empathy and a scientific attitude among the students towards the education of special needs children.

Course Outcomes

At the end of the course students will be able to:

CO 1: To create awareness among the students regarding the concept of Inclusive Education and its evolution. (Remembering, Understanding, Application, Analysis)

CO 2: To make the students aware about the prevailing legal provisions and policies available for inclusion. (Remembering, Understanding, Application, Analysis)

CO 3: To create awareness about the required infrastructural facilities, pedagogical strategies, Teacher's role and competencies, and assistive and adaptive technologies available for inclusive classroom. (Remembering, Understanding, Application, Analysis, Evaluation)

CO 4: To familiarize the students with the barriers to inclusive Education and its interventions. (Remembering, Understanding, Application, Analysis, Evaluation)

Module I: Introduction to the concept of Inclusive Education and its evolution (15 Hours)

- Concept and Definitions
- Principles of Inclusive Education
- Scope and Target Group: Diverse learners, Marginalized groups and learners with disabilities.
- Evolution of the philosophy of Inclusive Education: Special, Integrated and Inclusive Education.
- Types / Models of Inclusive Education:
  - Full Inclusion
  - Partial Inclusion
- Benefits of inclusion:
  - For children with Disabilities
  - For children without Disabilities
- Need and importance of Inclusive Education.
- Factors affecting Inclusion

Module II: Legal Provisions: Policies and Legislations for Inclusive Education (18 Hours)

- National Policy of Education 1986
- Programme of Action 1992
- Persons with Disabilities Act 1995
- National Policies of Disabilities 2006
- Concession and facilities to Diverse learners: Academic and Financial (Rehabilitation Council of India Act 1992)
- Features of United Nations Convention on the Rights of Persons with Disabilities
- New Education Policy 2020

Module III: Planning and management of Inclusive Classrooms (15 Hours)

- Infrastructure
- Inclusive pedagogy:
  - Social learning
  - Activity based learning
  - Multisensory teaching
  - Reflective teaching
  - Collaborative and cooperative teaching
  - Team teaching
  - Peer tutoring
  - Remedial instruction
  - Individualized Educational Programme

- Teacher in an Inclusive Classroom: Role and competencies
- Assistive and adaptive technology for diverse learners

Module IV: Barriers to Inclusive Education and Interventions (12 Hours)

- Attitude
- Labelling
- Peer Rejection
- Accountability
- Traditional Oriented Teaching etc.

Interventions:

- Environmental Intervention
- Social Intervention
- Academic Intervention

Module V: Practicum: (Assignment- any one) (30 Hours)

i. Survey the nearby schools and present a report on its inclusive settings.
ii. Survey the nearby schools and present a report on the attitude of teachers and students (both differently-abled and normal) towards Inclusive Education.
iii. Survey the nearby schools and identify the inclusive pedagogy as adopted by them and present a report.
iv. Organize awareness camps on the benefits of inclusive education.

Suggested Readings:

1. Basha, Sayed Hayath. (2017). *Inclusive Education: Policies and practices*. New Delhi Publishers: New Delhi.
2. Rehabilitation Council of India. (2018). *Integrated and Inclusive Education: DSE VI Manual.* Kanishka Publishers: New Delhi.
3. Mangal, S. K. (2017). *Educating Exceptional Children: An introduction to Special Education*. PHI Learning Pvt. Ltd. New Delhi.
4. Fuchs, Douglas and L. S. Fuchs. (1994). *Inclusive School Movement and the Radicalization of Special Education Reform: Exceptional Children*. 60, 294- 309.
5. Manivannan, M. (2001). *Inclusive Education for Disabled Children.* htpp://www.dinf.ne.jp/doc/English/asia/resource.
6. Stainback, S. and Stainback, W. (Edns.) (1996). *Inclusion a Guide for Educators*. (2nd ed.), Baltimore: Brookes.
7. Mangal, S. K. and Mangal, S. (2019). *Creating an Inclusive School*. PHI Learning Pvt. Ltd. New Delhi.
8. Dash, N. (2006). *Inclusive Education for Children with special Needs*. Atlantic publishers and Distributers Pvt. Ltd.: New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDAS402T: ADVANCED STATISTICS IN EDUCATION (5-0-0)

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objective

To make the students capable of dealing with quantitative data by using varieties of advanced statistical techniques.

Course Outcomes

At the end of the course students will be able to:

CO 1: To create understanding among the students about the applications of inferential statistics at higher levels in research (Remembering, Understanding, Application, Analysis, Evaluation)
CO 2: To enable the students to make use of correlation for testing hypothesis in case of grouped data, regression analysis, and factor analysis(Remembering, Understanding, Application)
CO 3: To acquaint the students with the concepts of non-parametric tests and their application in the field of educational research. (Remembering, Understanding, Application, Analysis)
CO 4: To create interest, motivation and critical thinking in the process of quantitative type of research studies in education (Remembering, Understanding, Application, Analysis, Evaluation)

Module I: Introduction to Normal Probability Curve and Correlation (20 Hours)

- Nature, principles, and theories of probability, and Bionomical Distribution

- Normal probability curve and its properties
- Areas under normal probability curve
- Skewness and kurtosis
- Applications of normal probability curve
- Measures of relationship with grouped data: product moment through scatter gram
- Biserial, point biserial, tetrachoric correlation, Phi coefficient
- Partial and multiple correlation
- Regression and prediction

Module IL: Introduction to Inferential Statistics (20 Hours)

- Meaning of inferential statistics
- Concepts of statistics and parameter and standard error
- Levels of significance and confidence limits, degree of freedom
- Concepts of one tailed and two tailed tests
- Concepts of type I and type II errors
- Application of z test and t test for testing hypotheses

Module III: Analysis of Variance (20 Hours)

- Concept and need of ANOVA
- Use of one way, two way, and three way Analysis of variance
- Assumptions of ANOVA
- Analysis of co-variance (ANCOVA) and its assumptions
- Experimental designs and relevance of ANOVA and ANCOVA
- Factor analysis with important methods
- Linear regression analysis

Module IV: Non-Parametric Tests in Educational Research (15 Hours)

- Meaning and need of non-parametric tests
- Assumptions of non-parametric tests
- Difference between parametric and non-parametric tests
- Chi-square test
- Sign test, median test

Suggested readings

1. Edwards, A. L. (1968). *Experimental Designs in Psychological Research.* New York: Holt, Rinehart and Winston, Inc.
2. Ferguson, G. A. (1981). *Statistical Analysis in Psychology and Education.* Tokyo: Mc. Graw Hill.
3. Garrett, H. E. (1986). *Statistics in Psychology and Education.* New York: David Mckay Co. Inc.
4. Guilford, J. P. (1965). *Fundamental Statistics in Psychology and Education.* New York: Mc Graw Hill Book Company.
5. Kerlinger, F. N. (2004). *Foundations of Behavioural Research.* New york: Rinehart and Winston Inc.
6. Mangal, S. K. (2018). *Statistics in psychology and Education.* Delhi: PHI Learning Pvt. Ltd.
7. Mohanty, B. &. (2016). *Statistics for Behavioural and Social Sciences.* New Delhi, India: Sage Publications Pvt. Ltd. .

Mapping of COs

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDEE403T: MEASUREMENT AND EVALAUTION IN EDUCATION-II

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objectives

To make the students well aware of the total conceptual framework of educational measurement and evaluation

Course Outcomes

At the end of the course students will be able to:

CO 1: To inculcate the skill of construction and standardization of test and attitude scale among the students. (Remembering, Understanding, Application, Evaluation)

CO 2: To make the students well aware of the concept of norms and transformation of scores. (Remembering, Understanding, Application, Evaluation)
CO 3: To inculcate the skill of item writing for an achievement test. (Understanding, Analysis, Synthesis, Evaluation)
CO 4: To make the students well aware of describing and summarizing measurement results. (Application, Analysis, Synthesis, Evaluation)

Module I: Tools of Measurement (20 Hours)

- Need of tools in the process of measurement
- Characteristics of a good and scientific tool
- Construction and standardization of an achievement test, questionnaire, and attitude scale
- Manual of the test
- Concepts of reliability and validity

Module II: Transformation of Scores (20 Hours)

- Concept of standard score
- Need and importance of standard scores
- Conversion of raw scores in z-score, T-score, C-score, and Stanine scores
- Norms, age, grade, and percentiles

Module III: Items writing for the test (20 Hours)

- Need and types of items of the test
- Comparison of objective and essay type test items
- Number of items
- Level and distribution of difficulty
- Guidelines for writing effective multiple choice type, true-false type and other objective type items
- Guidelines for writing effective essay type items
- Measuring complex achievement: interpretive exercises, merits and demerits
- Guide line for constructing interpretive exercises

Module IV: Describing and Summarizing Measurement Results (15 Hours)

- Scores of individuals on test
- Organizing scores into a frequency table
- Graphical representation
- Describing scores distribution in terms of central tendency, variability, normality, percentiles, correlation (product-moment and rank difference)
- Grading systems, methods of assigning grades

Suggested Readings

1. Adams, G. S. (1964). Measurement and Evaluation in Education, Psychology, and Guidance. Holt, Rinehart Winston. New York.
2. Annastasi, A. (1976): Psychological Testing, McMillan Publication Co. New York
3. Ebel, R. L & Fresbie, D. A. (1991). Essentials of Educational Measurement. Prentice Hall of India Pvt. Ltd. New Delhi.
4. Edwards, A. L. (1966) : Techniques of Attitude Scale Construction, New York
5. Frank, S. Freeman (1990) : Theory and Practice of Psychological Testing, IH Publishing Co. Bombay
6. Granlund, N.E (1976): Measurement and Evaluation in Teaching, McMillan Publishing Co. New York
7. Linn, R. L. & Miller, M. D. (2008) : Measurement and Assessment in Teaching, Darling Kindersley, Pvt. Ltd
8. Sharma, R. A. (1998) : Essentials of Measurement in education and Psychology, R. Lall Book Depot, Meerut

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	EDGC102T	Guidance and Counselling in Education	4
2	Minor Course 2	EDTT103T	Teacher and Teaching Skills	4
3	Minor Course 3	EDTH205T	Educational Thinkers	4
4	Minor Course 4	EDHE206T	Human Rights Education	4
5	Minor Course 5	EDPE307T	Peace Education	4
6	Minor Course 6	EDWE308T	Women Empowerment	4
7	Minor Course 7	EDSD404T	Education for Sustainable Development	3
7	Minor Course 8	EDER405T	Elements of Research in Education-I	2
8	Minor Course 9	EDES406T	Educational Seminar	3

EDGC102T: GUIDANCE AND COUNSELLINGIN EDUCATION

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective

To familiarize the students with various concepts, tools and techniques of guidance and counselling and to acquire the necessary skills needed for guidance and counselling

Course Outcomes

CO 1: Define and Explain the concept of guidance, its nature, needs and principles and the role of a teacher as a guide. (Remembering, Understanding, Applying)

CO 2: State and explain the types of guidance and analyze the components of educational vocational and personal guidance, and perform the guidance activities. (Remembering, Understanding, Analysis, Applying)

CO 3: Define and explain the concept of counselling, differentiate the different types of counselling and find out the qualities of an effective counsellor. (Remembering, Understanding, Applying)

CO 4: Describe the tools and techniques of guidance and counselling and organize the guidance and counselling services. (Remembering, Understanding, Applying)

Module I: Introduction to Guidance (10 Hours)

Meaning and Definition; Nature of Guidance; Functions of Guidance; Historical background of the guidance in India; Need and Principles of Guidance;Teacher as a Guide.

Module II: Types of Guidance (17 Hours)

Educational Guidance, Vocational Guidance, Personal Guidance; Organisation of guidance and Counselling services

Module III: Concept of Counselling (14 Hours)

Meaning and Definition; Nature of Counselling; Need for Counselling in educational Institutions; Types of Counselling: Directive, Non-directive Counselling and Eclectic Counselling; Qualities of an effective counsellor

Module IV: Tools and Techniques of Guidance and Counselling (17 Hours)

Testing techniques- Intelligence, Creativity, Interest, Aptitude and Personality traits; Non-testing Techniques: Observation, Interview, Case study, Cumulative records.

Suggested Readings

1. Aggarwal, J. C. Educational, Vocational Guidance and Counseling. New Delhi: Doabai House (1991).
2. Bengalee, M. D. Guidance &Counseling. Bombay: Sheth publishers (1985).
3. Bhatagar, R.P. Guidance &Counseling in Education and Psychology Meerut: R-Lall Book Depot Educational Bookseller and Publishers (2018).
4. Bhatnagar, R. P., & Seema, R. Guidance and Counselling in Education and Psychology. Meerut: R.Lal Book Depot (2003).
5. Chauhan, S. Principles & Techniques of Guidance. N.Delhi: Vikas Publishing House Pvt Limited (2009).
6. Gibson Robert & Mitchell Marianne : Introduction to Guidance &Counseling, 6th edition, N. Delhi: Prentice Hall of India(2005)
7. Indu, D. The Basic Essentials of Counseling. New Delhi: Sterling Publishers Private Ltd (1983).
8. Kochhar SK Guidance &Counseling in Colleges & Universities. N. Delhi: Sterling publishers (1986).
9. Kochhar, S. K. Guidance in Indian education. N. Delhi: Sterling publishers (1981).
10. Kochhar, S. K. Guidance and Counseling in Colleges and Universities. New Delhi: Sterling Publishing Pvt. Ltd (1984).
11. Kochhar, S. K. Educational & Vocational Guidance in Secondary Schools. N. Delhi: Sterling Publishers (1987).
12. Madhukar, Indira,. Guidance &Counseling. N. Delhi: Authors Press (2005).
13. Madhusudan, M. Educational and Vocational Guidance. Sambalpur: Saha Publishers & Distributors (1983).

14. Narayan S. Rao .Counseling and Guidance. New Delhi: Tata McGraw Hill (1991).
15. Raj, Singh. . Educational & Vocational Guidance, N. Delhi: Commonwealth Publications (1994).
16. Sharma, N. R. Educational and Vocational Guidance. Agra: Vinod Pustak Mandir (1989).
17. Sharma, R.N. Vocational Guidance and Counseling. Delhi: Surjeet Publications (2008).
18. Singh, L.K. & Sudarshan, K. N.: Vocational Education. N. Delhi: Discovery Publishing house (1996).

Mapping of Cos to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2		H		
CO 3			H	
CO 4				M

EDTT103T: TEACHER AND TEACHING SKILLS

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective

To make the students well aware of skills of teaching

Course Outcomes

CO 1: To create awareness among the students about the conceptual framework of teaching-learning process. (Remembering, Understanding, Applying)
CO 2: To make the students well aware of the concept of teaching skills and approach of inculcating teaching skills. (Remembering, Understanding, Applying)
CO 3: To create understanding among the students about educational objectives required by any effective teacher. (Remembering, Understanding, Applying)
CO 4: To acquaint the students about the concept and goals of teaching practice and approaches to lesson planning. (Remembering, Understanding, Applying)

Module I: Introduction to Teaching and Structure of Teaching-Learning Process (12 Hours)

Concept, meaning and definition of teaching, Structure of teaching; Teaching as profession; Principles and maxims of teaching.

Module II: Teacher and Teaching Skills (16 Hours)

Qualities of an effective teacher; Concept of teaching skills and sources of teaching skills; Micro teaching as an approach to ensure mastery over teaching skills; Micro lesson planning and its implementation.

Module III: Educational Objectives (16 Hours)

Aims of education, general objectives and specific objectives; Utility of taxonomy of objectives; Taxonomy of cognitive, affective and psychomotor objectives

Module IV: Teaching Practice and Macro Lesson Plan (20 Hours)

Concept, need and objectives of teaching practice; Concept and need of macro teaching; Difference between macro teaching and micro teaching; Meaning and importance of macro lesson plan; Development of lesson plan for macro teaching.

Scheme of Evaluation

Internal Evaluation: 40 Marks

Class Test:	20 Marks
Assignment:	10 Marks
Attendance:	5 Marks
Non-formal Behaviour:	5 Marks

External Evaluation: 60 Marks

Teaching Practice: 5 days and Delivering 5 Lesson Plan:	30 Marks
One final lesson plan presentation:	20 marks
Viva Voce:	10 Marks

Suggested Readings

1. NCERT(2004): Curriculum framework for teacher Education, NCERT, New Delhi.
2. NCTE (2004): Some specific Issues and concerns of Teacher Education, NCTE, New Delhi.
3. Dunkin, M.J. (Ed)(1989): International Encyclopedia of Teaching and Teacher Education, Pergamon Press, Oxford.
4. Kapoor, KC, (Ed) (2008): Teacher Education in 21st Century, the Associate Publishers, Ambala Cantt.
5. CASE (2000-2003): Policies and Issues in Teacher Education, CASE, M.S. University of Baroda.
6. Reddy, R.S. (1998): Principles and Practices of Teacher Education, Rajat Publication.

Mapping of Cos to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDTH205T: EDUCATIONAL THINKERS

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective

To make the students well aware of Indian and Western educational thinkers.

Course Outcomes

CO 1: To create awareness among the students about the philosophical thoughts and education. (Remembering, Understanding, Applying)

CO 2: To make the students well aware of the contributions of Indian educational thinkers. (Remembering, Understanding, Applying, Analyzing, Evaluating)

CO 3: To make the students well aware of the contribution of Western educational thinkers. (Remembering, Understanding, Applying, Analyzing, Evaluating)

CO 4: To create understanding among the students about some similarities and differences among educational thinkers. (Understanding, Applying, Analyzing, Evaluating)

Module I: Introduction to Philosophical Thoughts of Education (10 Hours)

- Philosophies and their impact on education
- Indian philosophical traditions and their educational implications
- Indian society and education with special reference to British period

Module II: Indian Educational Thinkers (20 Hours)

- Swami Dayanand: Life sketch and his contribution in educational process
- Swami Vivekanand: Life sketch; Basics of his philosophy and its relevance to education.
- Rabindranath Tagore and Sri Aurobindo Ghosh: their contribution in the field of education
- M. K. Gandhi: Life sketch and his contributions in the field of education
- Indian educational thinkers with special reference to NPE 1986 and NEP 2020

Module III: Western Educational Thinkers (20 Hours)

- J. H. Pestalozzi: Life sketch, philosophy of life, educational philosophy in relation to curriculum, methods of teaching and role of teacher.
- J. J. Rousseau: life sketch, philosophy of education with special reference to negative education.
- John Dewey: life Sketch and philosophy of education.
- Froebel and Maria Montessori: Their life sketch and contribution in education
- Indian education policies and Western thinkers

Module IV: Analytical Views on Indian and Western Educational Thinkers (10 Hours)

- Similarities in educational thoughts of Indian and Western thinkers
- Differences in educational thought of Indian and Western thinkers
- Indian National Curriculum Framework- 2005 and Indian and Western educational thinkers

Suggested Readings

1. Aggarwal, J. C. (2002). Psychological, Philosophical and Sociological Foundations of Education, *Shipra Publications*, Delhi
2. Goswami, M. K. (2006). Educational Thoughts and Essays, *Asian Books Pvt Ltd*, New Delhi
3. Kumar, T. P. (2011). Great Philosophers of Education, *APH Publishing Corporation*, Darya Ganj, New Delhi
4. Nayak, B. K. (2001). Text book on Foundations of Education. Kitab mahal, College Square, Cuttak.
5. Rai, B. C. (2000). Principles of Education, *Prakashan Kendra*, Lucknow
6. Safaya, S. (2010). Modern Theory and Principles of Education, *Dahnpat Rai Publishing Company Pvt Ltd*, New Delhi
7. Singh, Y. K. (2013). Philosophical Foundations of Education, *APH Publishing Corporation*, New Delhi
8. Sur Roy, T. (2013) Educational Thinker: Oriental and Occidental, *Ashok Publications*, Guwahati
9. Taneja, V. R. (2009). Educational Thought and Practice, *Sterling Publishers Pvt Ltd*, New Delhi

Mapping of Cos to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

EDHE206T: HUMAN RIGHTS EDUCATION

(4 Credits- 60 hours) (L-T-P: 3-1-0)

Objective

To familiarize the students with Human Rights and Human Rights education, rights of children and to inculcate value education among them

Course Outcomes

CO 1: Recognize the origin, meaning, concept, objectives provisions of human rights and human rights education (Understanding)

CO 2: Identify various international covenants and conventions fostering human rights and gender equity (Understanding)

CO 3: Analyze the functions of various national and international human rights bodies and approaches to teach human rights at different ladders of school education (Analyzing)

CO 4: Apply the concept and objectives of value education in realizing Human Rights (Applying)

Module I: Introduction to Human Rights Education (20 Hours)

Origin and historical account of Human Rights; Description of UN Charter and UDHR; Meaning of Human Rights and Human Right Education; Constitutional Provisions for Human Rights

Module II: International Covenants, Convention and Gender Equity (15 Hours)

International Covenants on Economics, Social and Cultural Rights; Convention of Rights of Child and role of ILO; Right to Education Act -2009

Module III: Human Rights and Duties (15 Hours)

Human Right Protection Act and role of NHRC, SHRCs, UN, UNESCO; Curriculum framework of Human Rights Education; Approaches of Teaching for Human Rights Education

Module IV: Value Education (10 Hours)

Concept of Value; Sources of Value: Biological, Psychological, Sociological and Spiritual; Meaning, nature and objectives of Value Education; Value clarification approach

Suggested Readings

1. Bhardwaj, T.R. Education of Human Value. New Delhi: Mittal Pub.(2007).
2. Dhand, M. Teaching Human Rights- A Handbook for Teacher Educators. Bhopal: Asian Institute of Human Rights Education (2002).
3. Donnelly, J. Universal Human Rights in Theory and Practice. New Delhi: Sterling (2003).
4. NCERT. Human Rights: A Source Book. New Delhi: NCERT(1996).
5. Mohanty, J. Human Rights Education. New Delhi: Deep and Deep Publications (2009)
6. Rama, J. M. Human Rights an Indian Values. New Delhi: NCTE (1997)

Mapping of Cos to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4	M			H

EDPE307T: PEACE EDUCATION

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective

The objective of the course is to learn about the importance of peace and the role of social organizations , thinkers and various movements that promotes peace amongst mankind.

Course Outcomes

CO 1: Describe the importance of peace and the role of social organizations towards peace. (Remembering, Understanding)
CO 2: Explain the various roles of agencies in promoting peace (Remembering, Understanding)
CO 3: Analyze the concept of peace as held by different thinkers. (Analyzing)
CO 4: Discuss the various global issues and peace movements. (Evaluating)

Module I: Understanding peace as a dynamic social reality (10 Hours)

Basic concepts of Peace and Peace Education; nature, meaning, objectives; Theories of peace – democratic peace and active peace

Module II: Role of agencies in promoting peace(13 Hours)

Role of social organizations: Family, Religion, Mass Media, Community, School

Module III: Thinkers on Peace (17 Hours)

Some thinkers on harmony: Dalai Lama, Gandhi, Mother Teresa; Gautam Buddha; Montessori; Friere; Concept of peace education; peace teacher, peace method and other enabling practices in an educational setting

Module IV: Global issues and peace movements (12 Hours)

Underlying causes of violence and war; Global peace movement; Promoting positive peace; Human rights, population control, non-alignment movement, campaign for nuclear disarmament and role of world organizations in promoting peace

Activities to be conducted: (8 hours) (any 01)

1. Field visit to place/organization-government/non-government working towards building peace
2. Exhibition on Peace related themes
3. Strategies to create peace building: Meditation, Yoga, Dramatization, Debate

Suggested Readings

1. Dalai Lama. The joy of living and dying in peace. (ed.) Donald S. Lopez. Jr. Dharamsala: Tibetan and Archives (1998).
2. Diwahar, R. R. and Agarwal, M. (Ed). . Peace education. New Delhi: Gandhi Marg (1984).
3. Doyle, M. W. Liberal peace: Selected essays. London and New York: Routledge (2012).
4. Duckworth, C. Teaching peace: a dialogue on the Montessori Method. Journal of Peace Education (2006), 3(1), 39-53.
5. Fountain, S. Peace education in UNICEF. New York: UNICEF (1999).
6. Gat, A. The Democratic peace theory reframed: The impact of modernity. World Politics (2005), 58, pp. 73-100.
7. Girard, K. Preparing teachers for conflict resolution in the schools. Washington, DC: ERIC Clearinghouse on Teaching and Teacher Education (1995)
8. Hopper, B. Peace education and years 1to 10 studies of society and environment key learning Area. Queensland: Queensland School Curriculum Council.(2002)
9. Johan, G. Peace by peaceful means. New Delhi: Sage Publication.(1996)
10. Krishnamurti, J. (n.d). Education and Significance of life. Retrieved from http://www.jkrishnamurti.org /krishnamurti-teachings/view-text.php?tid=51&chid=66876.
11. Layne, C. Kant or Cant: The Myth of the Democratic Peace. International Security, Vol. 19. Issue 2, pp. 5-49.(1994)
12. Montessori, M. Peace and Education. India: The Theosophical Publishing House.(1943)
13. Morrison, M. L. Peace Education. Australia: McFarland(2003)
14. Nair, G. Peace education and conflict Resolution in school. Health Administrator Vol. XVII, Number 1:38-42 (1997)
15. Pant, D. and Gulati, S. Ways to peace: a resource book for teachers. New Delhi: National Council of Educational Research and Training (2014)
16. Salomon, G., &Nevo, B. Peace Education: The Concept, Principles, and Practices around the World. London: Lawrence Erlbaum Associates (2002).
17. Sheean, V. Mahatma Gandhi, a great life in brief. New Delhi: Random House.(1955).
18. UNESCO. Peace Education: Framework for Teacher Education. New Delhi: UNESCO (2005)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDWE308T: WOMEN EMPOWERMENT (3-0-1)

(4 Credits- 60 hours) (L-T-P: 3-0-1)

Objective(s)

The objective of the course is to learn about the importance of women empowerment, their raising self-esteem and self-confidence thereby eliminating the discrimination and all forms of violence against women and girl child through education and different government policies.

Course Outcomes

CO 1: To familiarize students with the concept of women empowerment. (Remembering)
CO 2: To make students aware about the importance and factors affecting Women empowerment. (Remembering, Analyzing)
CO 3: To be aware about the government plans and policies on Women Empowerment. (Remembering, Applying)
CO 4: To analyze the various schemes related to Women empowerment. (Analyzing)

Module I: Concept of Women's Empowerment (15 Hours)

Women Empowerment: Meaning, definition, characteristics; Importance of Women Empowerment; Dimensions of Women Empowerment; Principles of Women Empowerment; Models of Women Empowerment

Module II: Women Empowerment in India (15Hours)

Factors affecting Women Empowerment in India; Concept of Gender discrimination; Women's Rights; Health conditions and work related issues of women; Women empowerment through education

Module III: Constitutional Articles, Government Plans and Programmes for Women Empowerment (15 Hours)

Constitutional Articles: Economic Empowerment; Political Empowerment; Social Empowerment; Government Plans and Programmes; Economic Empowerment; Schemes for Women Empowerment: Beti Bachao Beti Padhao (BBBP) Scheme; One Stop Centres (OSCs); The Scheme of Universalization of Women Helpline; UJJAWALA; Swadhar.

Module IV: Practicum: (any one) (30 hours)

I. Visiting women self - help groups.
II. Organizing flash mob, skits in neighboring areas.
III. Reporting on one stop Centre scheme by Government of India.
IV. Releasing a magazine on status of women then and now.

Suggested Readings

1. Agrawal, S.P (1992): *Women Education in India*, Guwahati, Concept Publishing Company.
2. Das Phunu (2016):*Contemporary issues of Indian Education*, Shanti Prakashan, Guwahati
3. Government Report (2009). India 2009: A Reference Annual (53rd edition). Publications Division, Ministry of Information and Broadcasting, Government of India.
4. *Importance of education in empowerment of women in India*.Retrieved November 18, 2022, from https://www.motherhooduniversity.edu.in/pdf/Publications/2016/Khushboo%20Singh.pdf
5. IMF-World Bank Report (2008). Global Monitoring Report. Available for download at http://www.worldbank.org/ gmr2008
6. *Role of education in the empowerment of women in India - eric*. (n.d.). Retrieved November 18, 2022, from https://files.eric.ed.gov/fulltext/EJ1081705.pdf
7. Seth, Mira (2001) *Women and Development*. New Delhi: Sage Publication
8. UNESCO Report (2007). Global Education Digest. UNESCO Institute for Statistics, Montreal. http:// www.uis.unesco.org/template/pdf/ged/2007/EN_web2.pdf
9. UNESCO Report (2010). EFA Global Monitoring Report 2010, Reaching the Marginalized. Oxford University Press. Available at http://unesdoc.unesco.org/images/0018/001866/186606E.pdf

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDSD404T: EDUCATION FOR SUSTAINABLE DEVELOPMENT

(3 Credits- 45 hours) (L-T-P: 2-0-1)

Objective (s)

The course will familiarize the students with the concept of sustainable development and education for sustainable development along with its pedagogy.

Course Outcomes

CO 1: To create awareness about the concept of Sustainable Development. (Remembering, Understanding, Applying)
CO 2: To create awareness among students about the concept of Education for Sustainable Development and the role of Education in Sustainable Development. (Remembering, Understanding, Applying, Analyzing, Evaluating, Creating)
CO 3: To develop the skill of evaluating the utility and prevalence of sustainable development within self and in the community.(Applying)

Module I: Introduction to Sustainable Development (10 hours)

- Concept of Development
- Concept of Sustainability
- Sustainable Development: Its 5 Ps (People, planet, prosperity, peace, and partnership)
- Sustainable Development Goals- 17

Module II: Curricular Framework for Education for Sustainable Development (20 hours)

- Definition and meaning of Education for Sustainable Development
- Principles
- Key Sustainable Competencies to be developed through ESD: Systems thinking Competencies, Anticipatory Competency, normative competency, Strategic competency, Collaboration Competency, Critical thinking competency, Self-awareness Competency and integrated problem Solving Competency
- Pedagogical approaches in ESD: Whole- institution approach, Learner centered approach, Action oriented learning, Transformative approach
- Teaching techniques for ESD: Simulations, Class discussions, Issue Analysis Techniques, Storytelling.

Module III: Practical Implications of ESD (30 hours) (Any two)

- Sharing their own stories of struggle/ success with the class as well as submit report of self-reflection.
- Visiting neighboring areas to collect community related stories/ activities towards the realization of Sustainable Development Goals.
- Surveying industries and submitting report on its sustainability norms.
- Surveying schools and submitting report on its sustainability norms.

Suggested Readings

1. UNESCO. (2012). *Education for Sustainable Development: Source Book*. Retrieved from https://sustainabledevelopment.un.org/content/documents/926unesco9.pdf
2. Bubaker F. Shareia. (2015). Theories of Development. *International Journal of Language and Linguistics.*2(*1*), Pp. 78-90. Retrieved from http://ijllnet.com/journals/Vol_2_No_1_March_2015/9.pdf
3. UNESCO. (2016). *Incheon Declaration and Framework for Action*. Retrieved from http://uis.unesco.org/sites/default/files/documents/education-2030-incheon-framework-for-action-implementation-of-sdg4-2016-en_2.pdf
4. UNESCO. (2017). *Education for Sustainable Development Goals: Learning Objectives.*Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000247444?utm_sq=gj34xbfn94#:~:text=Target%204.7%20of%20the%20SDGs,peace%20and%20non%2D%20violence%2C%20global
5. UNESCO. (2018). *Issues and trends in Education for Sustainable Development*. Retrieved from https://www.ensi.org/global/downloads/Publications/433/Issues%20and%20trends%20in%20Education%20for%20Sustainable%20Development.pdf

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3			H

EDER405T: ELEMENTS OF RESEARCH IN EDUCATION

(2 Credits- 30 hours) (L-T-P: 2-0-0)

Objective (s)

To acquaint the students with the concept and design of educational research

Course Outcomes

CO 1: To make the students well aware of the nature and types of research. (Remembering, Understanding, Applying)
CO 2: To make the students to learn about the steps of research process. (Remembering, Applying, Evaluating)
CO 3: To make the students to learn about research designs and methods. (Remembering, Understanding, Applying)

CO 4: To learn about sampling and sampling and samples. (Remembering, Understanding, Applying)

Module I: Introduction to Research Methodology (20 Hours)

- Meaning and significance of research
- Methods of acquiring knowledge
- Scientific method of research
- Process of research
- Philosophical bases of research
- Types of research and areas of research in education
- Steps of research in education
- Review of related literature and making synopses
- Code of ethics in research

Module II: Designs and Methods in Educational Research (20 Hours)

- Meaning and significance of research design
- Steps for preparation of research design
- Types of research designs: quantitative, qualitative, and mixed research designs
- Research designs and corresponding methods of educational research: survey method, historical method, experimental method, case study method.
- Sample and sampling procedures

Suggested Reading

1. Best, John W & James V. Kahn. (2002): Research in Education. Prentice Hall, Pvt. Ltd. New Delhi.
2. Check, J. & Russell K. Schutt. (2012): Research Methods in Education.
3. Garret, H. E. (1971): Statistics in Psychology and Education. Vakils, Feffer & Simon, Bombay.
4. Guilford, J. P. (1973): Fundamental Statistics in psychology and Education. McGraw Hill, New York.
5. Koul, L. (2009): Methodology of Educational Research. Vikas Publishing House Pvt. Ltd. New Delhi.
6. Mangal, S. K. & Mangal, S. (2013): Research Methodology in Behavioural Sciences. PHI Learning Pvt. Ltd., Delhi.
7. Mangal, S. K. (2018): Statistics in Psychology and Education. PHI Learning Pvt. Ltd. New Delhi.

Mapping of Cos to Modules

	Module I	**Module II**
CO1	H	
CO2		H

EDES406T: EDUCATIONAL SEMINAR (1-0-2)

(3 Credits- 45 hours) (L-T-P: 1-0-2)

Objectives

To develop the skills and competencies required to prepare academic articles, present seminar and enhance critical thinking

Course Outcomes

CO 1: Recognize the meaning, concept and objectives of educational seminar (Remembering)
CO 2: Enhance higher cognitive abilities to respond to new knowledge, critical thinking, and keen observation of researches conducted (Understanding)
CO 3: Apply the abilities to seek clarification, defend the ideas of others, and present effectively (Applying)
CO 4: Perceive the feeling of tolerance, co-operation, and respect of the ideas and feelings of others (Understanding)

Module I: Introduction to Educational Seminar (10 Hours)

Meaning, Concept, scope and objectives of educational seminar; Types of seminar; Importance of educational seminar

Module II: Practicum (60 Hours)

- **Article Writing**: Selection of themes and making out sub-themes of the seminar; Concept paper writing, Writing of papers on sub-themes ensuring the coverage of local, national and international scenarios; Review of related literature pertaining to the selected theme and sub-themes
- **Preparation of the Proposal for Seminar and presentation**
- **Organization of the Seminar:** Description of the steps of organizing the seminar; Designing/developing the materials (brochures, leaflets, etc.); Writing report and publication of seminar proceeding; applying for ISBN; Collaboration with national/international agencies

Mapping of Cos to Modules

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3		M
CO 4		

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	EDLS103L	Life Skills Education	3
2	S E Course 2	EDJD104L	Reflective Journaling- A Technique for Personal and Academic Growth	3
3	S E Course 3	EDPT206L	Psychological Testing	3

EDLS103L: LIFE SKILLS EDUCATION

(3 credits-45 hours)(L-T-P:1-0-2)

Course objective:

The objective of the course is to essentially inculcate those abilities and skills that help promote mental well-being and competence in young people as they face the realities of life.

Course outcomes

CO 1: Explain the concept of life skills, Social Skills and their importance
CO 2: Creating awareness about cognitive skills and coping skills
CO 3: Employ various skills in life such as social skills, cognitive skills, communication skills, coping skills, creative thinking skills, decision making skills etc.
CO 4: Construct the meaning of self

Module I: Understanding of Life Skills and Social Skills (15 Hours)

Skills and life skills; Origin and development of Life skills; Significance of life skills; Introduction to 10 core skills (WHO, 1996)- Self Awareness, Empathy, Critical thinking, Creative thinking, Decision Making, Problem Solving, Effective Communication, Interpersonal relationship, Coping with stress, Coping with emotions

Module II: Practicum (60 hours)

Topics prescribed for activities

Understanding Self

- Discovering Self / My strength and weakness/ Self -esteem and its importance/ Overcoming low self- esteem/ Setting goals for self

Social Skills

- Empathy- Stepping into other's shoes/Treat others respectfully/Let us be caring and compassionate
- Effective Communication- Whispering games/ Brainstorming/ Discussion/ Enhancing verbal –non -verbal communication
- Interpersonal relationship- Ball game/ Discussion/ My relationship web/ I can appreciate

Thinking Skills

- Critical thinking- Let us be analytical/ journal writing/ Fact or fiction
- Creative thinking- Thinking out of the box/ Let us be imaginative
- Decision Making- Making informed choices/ team activity
- Problem Solving- Case analysis and presentation

Emotional Skills

- Coping with stress- Am I stressed?/ Stress Management
- Coping with emotions- Am I emotional?/ Emotional Collage

Suggested Readings

1. Alex, K. (2016). Soft skills: Know yourself and know the World. New Delhi. Vikas Publishing House Pvt. Ltd.
2. Thomas, G. (2010). Life skill education and curriculum. New Delhi. Shipra Publications.
3. Tripathy, A. (2016). A beautiful life: Life skills education. New Delhi. Global Publication.
4. Ouane, A. (2002). Key competencies in lifelong learning. Institutionalising lifelong learning: creating conducive environment for adult learning in the Asian context. UNESCO Institute for Education, Hamburg.
5. Delors, J. (1996). Learning: The treasure within: Report to UNESCO of the International Commission on Education for the Twenty First Century. Paris. UNESCO Publishing Press.
6. Dohmen, G. (1996). Lifelong learning: Guidelines for a modern education policy. Bundesministerium fur Bildung, Wissenschaft, Forschung und Technologie.

Mapping of COs

Course Outcomes	Module I	Module II	Module III
CO 1	H		

CO 2		H	
CO 3			H
CO 4	H	H	H

ERJD104L: REFLECTIVE JOURNALING - A TECHNIQUE FOR PERSONAL AND ACADEMIC GROWTH

(3 credits-45 hours) (L-T-P: 1-0-2)

Course objective

The objective of Reflective journaling is to inculcate the practice of reflective writing, documenting as well as interpreting of those experiences that were profound or had an impact on our lives

Course Outcomes:

CO 1: Recall one's life experiences *(Remembering)*
CO 2: Explain with clearly and specifically one's life experiences & Develop the skill of writing *(Application)*
CO 3: Analyze life experiences at a conscious level and enhance reflective thinking *(Analysis)*
CO 4: Synthesize one's thought in an organized manner and create a new piece of writing *(Creativity)*

Journaling is a strategy for making sense of experiences. The objective of journaling is to develop in students a reflection that can be described as an inner dialogue with oneself whereby a person calls forth his or her own experiences, beliefs, and perceptions about an idea; informing and transforming functions of knowledge; and a conscious and systematic mode of thought. This is to nurture in future educational leaders a sense of reflective practice.

Module I: Introduction to Journaling (10 Hours)

Introduction to beginners mind, Recalling and Remembering, Mindfulness and meditation, The art of Journal writing, Ways of writing a journal, Benefits of Journal writing, Steps of Journaling, Journaling as an approach to Reflective practice.

Module II: Journaling as a reflective practice (05 Hours)

Reflective Journals, Types of Reflections, Method of creating Reflective Journals, Reflect and Integrate Formatting a journal article, Personal action plan

Module III: PRACTICUM (60 Hours)

Each student is required to maintain a reflective journal, using the Visible Thinking Routine (Harvard), as a critical structure for guiding their journal writing. The students are to submit the journal every Friday. Journaling has to be done six days of the week. At the end of the semester, the student will be awarded a grade/marks after assessing the learning.

Suggested Readings

1. Davies, M. (2011). Concept mapping, mind mapping and argument mapping: what are the differences and do they matter?. Higher education, 62(3), 279-301. Retrieved from http://download.springer.com on 19th July 2016
2. Dhankar, Rohit (2013). Can reflective practice be taught? Teacher Plus 2013. (http://www. teacherplus.org /cover-story/can-reflective-practice-be-taught)
3. Hubbs, D. L., and Brand, C. F. . The paper mirror: Understanding reflective journaling (2005). Journal of Experiential Education, 28(1), 60-71.
4. Liuolienė, A., and Metiūnienė, R. Students' Learning Through Reflective Journaling Coactivity / Santalka, (2009). 17(4), 32-37. doi:10.3846/1822-430X.2009.17.4.32-37
5. Lowe, G. M., Prout, P., and Murcia, K. I See, I Think I Wonder: An Evaluation of Journaling as a Critical Reflective Practice Tool for Aiding Teachers in Challenging or Confronting Contexts. Australian Journal Of Teacher Edu (2013)

Mapping of COs

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3			H
CO 4	H	H	H

EDPT206L: PSYCHOLOGICAL TESTING

(3 credits-45 hours)(L-T-P: 0-0-3)

Course objective

To help students to gain better understanding of an individual and their behavior.

Course Outcomes

CO 1: Apply the steps and procedures for administering psychological tests correlate it to real life situations.(Application)

CO 2: Evaluate the psychological experiments with the help of apparatuses. (Evaluation)

a. **Psychological Experiment (with apparatus)**
   Any two from the following:
   1. Maze Learning
   2. Bilateral Transfer -Mirror learning
   3. Alexander Pass-Along Test
   4. Reaction Time

b. **Psychological Laboratory Practical (without apparatus)**
   Any two from the following
   1. Adjustment Inventory by Dr. D.N. Srivastava and Govind Tiwari
   2. Rorschach Ink blot test
   3. Thematic Apperception Test (TAT)
   4. Differential Aptitude Test (DBDA)

Scheme of Evaluation: (100 Marks)

Psychological Experiment with apparatus:	15 Marks
Psychological Experiment without apparatus:	15 Marks
Practical book:	10 Marks
Written Examination & Viva Voce:	60 Marks
Total	**100 Marks**

Mapping of COs

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	H

INTERNSHIP/APPRENTICESHIP

EDIN105I / EDIN207I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 Hours)

The 4-week internship, equivalent to a full month, can be completed either in-house within the department or, if possible, in other departments.

Objectives of internship:

1. To have a shift from theory to practical.
2. To acquaint pupil teachers/ students with the total environment of the school/ any other educational institution.
3. To observe the administrative and managerial activities.
4. To have a direct experience of the functioning of the school/ educational institution.
5. To have the direct experience of organizing morning assembly and its items/ events.
6. To observe some classes and have the idea of different teaching aids, and approaches of teaching adopted by regular teachers in classroom situations by different subject teachers.
7. To take some classes, and have experience of taking some classes regularly like a regular and permanent teacher of the institution.
8. To have experience in preparing a good timetable and developing its execution and having some discussions with teachers and principals about the existing timetable.
9. To participate in curricular, cocurricular and extracurricular activities to gain some experience.
10. To understand the human and non-human resources of the institution and their utilization.
11. To have interaction with the teachers, headmaster, principal etc. for understanding the functioning of the school.
12. To have some interaction with the local community members and understand the problems noted by community members.
13. To prepare a daily report by taking the direct experience of the situation.
14. To develop a positive attitude towards the functioning of the school/ institution.

FORMAT FOR DAILY REPORT WRITING DURING THE SCHOOL INTERNSHIP
Report No. ( ) Date:

Name of Student Teacher :
Name of the Programme :
Name of School for internship :
Time of Arrival :
Time of Departure :

1. **Morning Assembly** - Duration: ___ am to___ am
   Events:
   (a) Prayer/ National Anthem :
   (b) Any announcement :
   (c) Thought Delivered by :
   (d) Any other event :

2. Classes taken by Student Teacher During the Day of attending school (Planned Period):

No.	Class	Period	Subject	Topic
1				
2				

3. Unplanned Classes taken by the student teacher:

No.	Class	Period	Subject	Topic
1.				
2.				

4. Periods observed on the Day:

No.	Class	Period	Subject	Topic	Suggestions
1.					

5. Observations recorded:
- **i. Positive points:**
- **ii. Negative points:**
- **iii. Discussion with the concerned teacher:**

6. Participation in Co-curricular and Extra Co-curricular activities:
a)
b)

7. Organization of co-curricular/extra co-curricular activities:
a)
b)

8. Any other experience of the Day:
- **i.**
- **ii.**

(Signature of Student Teacher) **(Signature of Principal)**

EDIN309I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours)

The school internship is to acquaint the students with the total environment and functioning of the school. Students will get the opportunity to observe the administrative and managerial activities. They will develop the skills of organized participating in morning assembly, co-curricular activities, extracurricular activities and plan for teaching work in the classroom. It will help them understand the behaviour of teachers, students, principal, headmaster and other supporting staff. The school internship will prepare them for the real professional field as well as gain insight into their aptitude for teaching. Towards the end of the course, students will have to compile their entire activities in the form of a report and appear for viva voce. The rubric and distribution of marks for evaluation will be decided and prepared at the level of the department.

Activities to be performed:

1. Organization/ observation of morning assembly.
2. Classes to be taught during the day by preparing lesson plans.
3. Unplanned classes to be taken during the day if some teachers are on leave.
4. Observing the class of an effective/ good teacher.
5. Participating/ organizing co-curricular activities.
6. Participating/ organizing extracurricular activities.
7. Any other specific events of the day.

RESEARCH PROJECT /DISSERTATION

BA EDUCATION (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	EDDI407P	Research Project Phase I	6
8	Research Project/Dissertation	EDDI408P	Research Project Phase II	6
BA EDUCATION (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	EDDI409P	Dissertation I	18
8	Research Project/Dissertation	EDDI410P	Dissertation II	20

BA EDUCATION (Honours)

EDDI407P: RESEARCH PROJECT PHASE I
(6 credits – 180 hours) (L-T-P: 0-0-12)

EDDI408P: RESEARCH PROJECT PHASE II
(6 credits – 180 hours) (L-T-P: 0-0-12)

BA EDUCATION (Honours) with Research

EDDI409P: DISSERTATION I
(18 Credits -540 Hours) (L-T-P: 0-0-36)

EDDI410P: DISSERTATION II
(20 Credits -600 Hours) (L-T-P: 0-0-40)

The activities under the Research Project/Dissertation will enable the students to develop the skill to write a review of the literature and prepare the research proposal. It will also help the students in applying the skill in the collection of data in the field and develop the ability to analyze the data and ability to write the report in standard academic formats.

Every student shall undertake a research project under the supervision and guidance of a faculty member. The students are expected to complete the literature review and present a research proposal and theoretical framework of the research work selected during the first phase. The dates, mode and components of the evaluation and the weightages attached to them shall be published by the department at the beginning of the semester. The students of the final semester will have to compile their research study in the form of a dissertation. Each dissertation has to be systematically structured following the proper methodology of educational research. To set the dissertations in a standardized pattern the supervisor should ensure that it follows the proper sequence containing the following main aspects:

A. Preliminary section
B. Main body
C. Reference section

The supervisor will help students to understand the detailed steps of writing a dissertation. He/ she will ensure that the dissertation is prepared keeping in view of Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Phase I of the course is carried out in the 7thsemester where the students will work on research proposal, literature review, theoretical framework and the first part of the data collection. In the 8th semester they will complete data collection, analysis, and preparation of a research report (Phase II). Students are required to make a presentation of the dissertation submitted to the department on the date set in the academic calendar for the same.

DEPARTMENT OF ENGLISH

PROGRAMME: BACHELOR OF ARTS in ENGLISH (BA)

DEGREE: BA ENGLISH (HONOURS)/ BA ENGLISH (HONOURS) WITH RESEARCH

VISION

To be a centre of excellence in learning, teaching and research in the areas of language and literature by imparting personalized education, inculcating human values and thereby contributing to nation building.

MISSION

- To develop critical thinking, creative writing and interpretive ability
- To foster professionalism to face the competitive world by developing language and communicative skills and by
- maintaining creative literary activity
- To generate sensitivity to culture and ethical issues
- To develop human potential to its fullest by mentoring and upholding human and spiritual values
- To prepare individual to become responsible citizens of tomorrow

PROGRAMME OUTCOMES (POs)

PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organisational and personal) from different perspectives.

PO 2: **Effective communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in a group setting.

PO 4: **Effective Citizenship:** Demonstrate empathetic social concerns and equity centre, national development and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your actions and accept responsibility for them.

PO 6: **Environment and Sustainability:** Understand the issues of environmental context and sustainable development.

PO 7: **Self-directed and life-long learning:** Acquire the ability to engage in independent and life lessons to find proper channels for utilizing their potential in terms of their future academic work, and also to further their aspirations in their respective careers.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: To inform the students about different schools of thought, writers of English literature across different ages and continents, their theories, perspectives, models and methods.

PSO 2: To be able to demonstrate employable competence in creating and analyzing scholarly work in the areas of English language teaching, literary and cultural research, translation studies etc.

PSO 3: To create an understanding of literary texts applying interdisciplinary approaches such as psychoanalysis, popular culture, indigenous knowledge studies**,** digital humanities, environmentalism etc.

BA ENGLISH (HONOURS)/ BA ENGLISH (RESEARCH) list of courses

Semester	**Major Courses**		
1	Major 1	EGIG100T	Introduction to Literary Genres
2	Major 2	EGIL101T	Introduction to English Literature
3	Major 3	EGBR200T	British Literature : 14^{th}-17 C
3	Major 4	EGBL201T	British Literature : 17^{th}-18 C
4	Major 5	EGBT202T	British Literature : 18^{th}-19^{th}C
4	Major 6	EGBE203T	British Literature : 19^{th}-21^{st}C
4	Major 7	EGIW204T	Indian Writing in English
5	Major 8	EGEC300T	European Classical Literature
5	Major 9	EGAL301T	American Literature
5	Major 10	EGDL302T	Diaspora Literature
6	Major 11	EGPC303T	Postcolonial Literature

6	Major 12	EGLC304T	Literary Criticism
6	Major 13	EGWW305T	Women's Writing
6	Major 14	EGMP306P	Community Based Minor Project
7	Major 15	EGLT400T	Literary Theory
7	Major 16	EGLL401T	Language and Linguistics
8	Major 17	EGIC402T	Indian Classical Literature
8	Major 18	EGPL403T	Popular Literature
	Minor Courses		
1	Minor Course 1	EGBL102T	Basic Language Skills
2	Minor 2	EGBI103T	Basic Linguistics
3	Minor 3	EGAW205T	Academic Writing and Composition
4	Minor 4	EGEL206T	English Language Teaching
5	Minor 5	EGTS307T	Translation Studies
6	Minor 6	EGGS308T	Introduction to Gender Studies
7	Minor 7	EGCS404T	Introduction to Culture Studies
7	Minor 8	EGRM405T	Research Methodology : Research Paper and Dissertation
8	Minor 9	EGLA406T	Language, Literature and Culture
	Skill Enhancement Courses		
1	S E 1	EGCW104L	Creative Writing
2	S E 2	EGSS105L	Soft Skills
3	S E 3	EGEP207L	Editing and Proofreading

Mapping of POs and PSOs

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
Major Courses										
Major 1	H			M	M		L	H	M	M
Major 2	H			M	M		L	H	M	M
Major 3	M			M	M		L	H	M	M
Major 4	M						L	H	M	M
Major 5	M					L	L	H	M	M
Major 6	M					L	L	H	M	M
Major 7	H			M	M		M	H	M	H
Major 8	M		M	M	M		L	M	H	M
Major 9	H		M	M	M		L	H	H	M
Major 10	H		L	M	M	L	L	H	H	H
Major 11	H		L	M	M	M	M	H	H	H
Major 12	H		H	H	H	H	H	M	H	H
Major 13	H		M	H	H	H	H	H	H	H
Major 14	L	H	H	H	H	M	H	L	L	M
Major 15	H		H	H	H	H	H	M	H	H
Major 16	M	H	M				M	L	H	M
Major 17	H				M		M	H	M	M
Major 18	H	M	M	M	M	H	M	H	M	H
Minor Courses										
Minor 1	M	H	M	H			M	M	H	H
Minor 2	M	H	M	H			M	M	H	H
Minor 3		H	H				M	M	H	M
Minor 4	M	H	H				M	M	H	H
Minor 5	M	H	H				M	M	H	H
Minor 6	H		M	M	M	L	M	M	H	H
Minor 7	H		M	M	M	M	M	M	H	H
Minor 8	H		M	M	M	M	M	M	M	H
Minor 9	H		M			M	M	M		
Skill Enhancement Courses										
S E 1	L	M	M	M	H		H	L	M	H
S E 2		H	M	M	M		H		M	M
S E 3		H	M	M			H		H	M

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	EGIG100T	Introduction to Literary Genres 3-1-0	4
2	Major Course 2	EGIL101T	Introduction to English Literature 3-1-0	4
3	Major Course 3	EGBR200T	British Literature : 14^{th}-17 C	4
3	Major Course 4	EGBL201T	British Literature : 17^{th}-18 C	4
4	Major Course 5	EGBT202T	British Literature : 18^{th}-19^{th}C	5
4	Major Course 6	EGBE203T	British Literature : 19^{th}-21^{st}C	5
4	Major Course 7	EGIW204T	Indian Writing in English	4
5	Major Course 8	EGEC300T	European Classical Literature	5
5	Major Course 9	EGAL301T	American Literature	5
5	Major Course 10	EGDL302T	Diaspora Literature	4
6	Major Course 11	EGPC303T	Postcolonial Literature	4
6	Major Course 12	EGLC304T	Literary Criticism	4
6	Major Course 13	EGWW305T	Women's Writing	4
6	Major Course 14	EGMP306P	Community Based Minor Project	4
7	Major Course 15	EGLT400T	Literary Theory	5
7	Major Course 16	EGLL401T	Language and Linguistics	5
8	Major Course 17	EGIC402T	Indian Classical Literature	5
8	Major Course 18	EGPL403T	Popular Literature	5

EGIG100T: INTRODUCTION TO LITERARY GENRES

(4 Credit-60 hours (L-T-P: 3-1-0)

Objective(s)

The course intends to acquaint the students with an overview of different literary genres from the classical to the modern and postmodern era. This course will also help the students to identify and categorise different genres of English literature.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Define various genres of literature. (Remembering)

CO 2: Explain the significance and importance of different genres of literature. (Understanding)

CO 3: Apply the significance of the different genres in understanding literary texts. (Application)

Module I: Introduction to Literary Genres (20 Hours)

Definition and Meaning of Genre and Literary Genres. Origin & History of Literary Genres. Classification of Literary Genres: literary technique, tone, content, length. Stylistic Features and Criteria's of Different Literary Genres. Flexibility in Literary Genres

Module II: Genres and Subgenres in Literature (40 Hours)

Poetry: Narrative, Dramatic, Lyric, Verse & Epic.

Novel and Drama: Tragedy, Comedy, Romance, Satire, Tragi-comedy, Rom-comedy, Pastoral, Historical, Mystery & Crime, Horror, Science Fiction.

Non Fiction: Biography, Autobiography, Essay, Travel Writing, Memoir

Suggested Readings:

1. Abell, Catharine. "Genre, Interpretation and Evaluation." *Proceedings of the Aristotelian Society*, vol. 115, 2015, pp. 25–40. JSTOR, http://www.jstor.org/stable/44122584. Accessed 3 Feb. 2023.
2. Armitt, Lucie. *Fantasy Fiction: An Introduction*. United Kingdom, Continuum, 2005.
3. Fowler, Alastair. *Kinds of Literature: An Introduction to the Theory of Genres and Modes, Harvard University Press. 1982*
4. *Globalizing Literary Genres: Literature, History, Modernity*. Eds. Fabienne Imlinger, Jernej Habjan, United Kingdom, Taylor & Francis, 2015.
5. Harpham, Geoffrey Galt, and Abrams, Meyer Howard. *A Glossary of Literary Terms.* India, Cengage Learning, 2015.
6. Todorov, Tzvetan, and Richard M. Berrong. "The Origin of Genres." *New Literary History*, vol. 8, no. 1, 1976, pp. 159–70. *JSTOR*, https://doi.org/10.2307/468619. Accessed 3 Feb. 2023.
7. Frye, Northrop. *Anatomy of Criticism*. Princeton University Press, 2020.

Mapping of COs to Modules:

COs	Module I	Module II
CO 1	H	L
CO 2	M	H
CO 3	H	M

EGIL101T: INTRODUCTION TO ENGLISH LITERATURE

(4 Credits- 60 hours) (L-T-P: 3-1-0)

Objective(s)

The course intends to acquaint the students with the historical overview of English literature from the beginning to contemporary periods. The texts under study will lend a better understanding of the socio-cultural changes in respective periods through the lens of the writers.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the various genres and understand the historical development of English literature from the beginning to contemporary period. (Remembering)

CO 2: Estimate the characteristic features of English literature pertaining to its form and content across various periods (Evaluate)

CO 3: Discuss the representative style and themes of various writers as evident in their works to develop a better understanding of socio-political history of England (Creating)

Module I: Medieval, Renaissance and Elizabethan Period (20 Hours)

Poetry :Oral origins and conversion, Aldhelm, Bede, Cædmon, Heroic poetry, Christian literature, *Beowulf*, Medieval Romances, Fabliau, Lyric, Dream-Allegory, Ballad, Chaucer, Gower and Langland, *Tottel's Miscellany*, The poetry of Wyatt and Surrey, Metaphysical Poetry

Prose: The 'New Learning' of the Renaissance, Francis Bacon

Drama: Mystery, Morality and Miracle Plays, Marlowe, Shakespeare, and the Jacobean playwrights

Module II: The Restoration Age and Augustan Age (10 Hours)

Poetry: John Milton- *Paradise Lost,* James Thompson: *The Seasons*

Prose: the periodical essay: Addison and Steele, Defoe and the rise of the Novel – Richardson, Fielding, Smollet and Sterne

Drama: Restoration Drama: tragedy and comedy

Module III: The Romantic and Victorian Age (20 Hours)

Poetry: The shift from sensibility to romanticism in Gray (1716-71), Cowper (1731-1800), Blake (1757- 1827) and Burns (1759-96), William Wordsworth, Samuel Taylor Coleridge, Percy Bysshe Shelley, John Keats, Tennyson, the Brownings, Arnold, D.G. Rossetti and Christina Rossetti, G. M. Hopkins

Prose: The Novel of Manners; Gothic fiction; the Historical Novel, Victorian fiction with reference to the works of Charles Dickens, the Bronte Sisters, George Eliot and Thomas Hardy, Matthew Arnold and John Ruskin

Module IV: The Age of Modernism and Postmodernism (10 Hours)

Poetry: The Poetry of WB Yeats, T.S. Eliot and the Auden Circle, Poetry from the Sixties: Ted Hughes and Seamus Heaney

Prose: Fiction: Virginia Woolf, E. M. Forster, D.H. Lawrence and James Joyce, The 'Rise of English': Scrutiny and its influence

Drama: The New Theatre: John Osborne, Christopher Fry, Samuel Beckett, John Arden, Arnold Wesker

Suggested Readings:

1. Alexander, Michael. A History of English Literature, Basingstoke Hampshire: Palgrave Macmillan, 2000
2. Birch, Dinah ed. The Oxford Companion to English Literature, Oxford: OUP, 2009
3. Sanders, Andrew. The Short Oxford History of English Literature, Oxford: OUP, 2004
4. Widdowson, Peter. The Palgrave Guide to English Literature and its Contexts 1500-2000, Basingstoke Hampshire: Palgrave Macmillan, 2004

Mapping of COs to Modules:

COs	Module 1	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	M	H	H	H
CO 3	H	H	H	H

EGBR200T: BRITISH LITERATURE: 14th -17th C

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The course intends to acquaint the students with the beginning periods of English Literature and recognise the shifts in the later periods. While looking at various historical and socio-cultural events of the times through the lens of the representative writers, the students will be able to comprehend the shifts in the contexts and prospects of the narratives.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: *Define* and identify the role of various genres, themes and styles pertaining to the prescribed periods of English literature. (Remembering)

CO 2: *Apply* the understanding of historical events, socio-political and literary shifts of the age in the reading of the texts. (Applying)

CO 3: *Design* an innovative and critical understanding of the texts based on its social and cultural set up. (Creating)

Module 1: Selected Poetry (30 Hours)

a. Geoffrey Chaucer: "The Wife of Bath," "Prologue" from *Canterbury Tales*
b. Edmund Spenser: Selections from *Amoretti*: Sonnet 57 'Sweet warrior...' Sonnet 75 'One day I wrote her name...'
c. John Donne: "The Sunne Rising", "Batter My Heart", "A Valediction: Forbidding Mourning"

Module 2: Selected Drama (30 Hours)

a. Christopher Marlowe: *Doctor Faustus*
b. William Shakespeare: *Twelfth Night*

Suggested Readings

1. Calvin, John. "Predestination and Free Will" *The Portable Renaissance Reader*, edited by James Bruce Ross and Mary Martin McLaughlin, Viking Press, 1953, pp.704–11.
2. Castiglione, Baldassare. "Longing for Beauty" ,"Love and Beauty" and "Invocation of Love." *The Book of the Courtier*, translated by George Bull, Penguin Books, 1976, pp.324–8,330–5.
3. Mirandola, Pico Della. "The Oration on the Dignity of Man" *The Portable Renaissance Reader,* edited by James Bruce Ross and Mary Martin McLaughlin, Viking Press, 1953,pp.476–9.
4. Sidney, Philip. *An Apology for Poetry*, edited by Forrest G. Robinson, The Library of Liberal Arts- Bobbs- Merrill, 1970,pp.13–18.
5. Coffin, Charles M (Ed), *The Complete Poetry and Selected Prose of John Donne*, Modern Library Classics, 2001

Mapping of COs to Modules

COs	Module 1	Module 2
CO 1	H	H
CO 2	H	H
CO 3	H	M

EGBL201T: BRITISH LITERATURE: 17th – 18th C

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

This course will familiarize students with the historical and literary contexts of the age. With the help of the representative drama, poetry and fiction of the period, the students will be able to comprehend the thoughts, contexts and literary practices of 17th and 18th century England.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Apply the understanding of the historical and literary contexts of the period from 1700 to 1800 in the reading of the texts. (Applying)

CO 2: Illustrate the evolution of the existing and emergence of new literary genres. (Analysing)

CO 3: Develop a critical interpretation of the given literary texts. (Creating)

Module 1: Selected Drama (15 Hours)

William Congreve: The Way of the World

Module 2: Selected Poetry (10 Hours)

a. Thomas Gray: "Elegy Written in a Country Churchyard"

b. Samuel Johnson: "London"

Module 3: Selected Fiction (35 Hours)
a. Jonathan Swift: Gulliver's Travels (Books III and IV)
b. Laurence Sterne: The Life and Opinions of Tristram Shandy, Gentleman

Suggested Readings
1. Collier, Jeremy. A *Short View of the Immorality and Profaneness of the English Stage.* Rutledge, 1698.
2. Copley, Stephen (Ed.) "The Complete English Tradesman" (Letter XXII), "The Great Law of Subordination Considered."(LetterIV), and "The Complete English Gentleman." *Literature and Social Order in Eighteenth Century England*, Routledge, 1984.
3. Martin, Peter (Ed.) "Essay 156." *The Rambler Selected Writings: Samuel Johnson*, Harvard University Press, 2009.
4. Greenblatt, Stephen. *The Norton Anthology of English Literature*, vol.1, 8th edition, W. W. Norton & Company, 2006.

Mapping of COs to Modules

COs	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	M	M	H

EGBT202T: BRITISH LITERATURE: 18th - 19th C

(5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)
The paper will acquaint the students with the paradigms of Puritan, Restoration, Neoclassical and Romantic literature. The selected texts will enable the students to understand and trace the changing literary trends of different periods under consideration. It will also focus on the characteristic traits of the age through the prescribed texts.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Illustrate the historical and literary contexts of the eighteenth century and the Romantic age along with the writers. (Understanding)
CO 2: Examine the literary texts as representative of the historical events. (Analysing)
CO 3: Develop an insightful consideration regarding the literary texts and their writing style. (Creating)

Module I: Selected Poetry (25 Hours)
a. Alexander Pope- *"The Rape of the Lock"* (Canto 1)
b. William Blake 'The Lamb',
c. William Wordsworth "Tintern Abbey"
d. Percy Bysshe Shelley "Ode to the West Wind'
e. John Keats "To Autumn"

Module II: Selected Drama (15 Hours)

Oscar Wilde- *The Importance of Being Earnest*

Module III: Selected Fiction (35 Hours)
a. *Emily Bronte- Wuthering Heights*
b. Mary Shelley's *Frankenstein*

Suggested Readings:
1. Collier, Jeremy. A *Short View of the Immorality and Profaneness of the English Stage.* Routledge, 1698
2. William Wordsworth, 'Preface to Lyrical Ballads', in *Romantic Prose and* Poetry, ed. Harold Bloom and Lionel Trilling (New York: OUP, 1973) pp. 594–611.
3. John Keats, 'Letter to George and Thomas Keats, 21 December 1817', and 'Letter to Richard Woodhouse, 27 October, 1818', in *Romantic Prose and* Poetry, ed. Harold Bloom and Lionel Trilling (New York: OUP, 1973) pp. 766–68, 777–8.
4. Jean-Jacques Rousseau, 'Preface' to *Emile or Education,* tr. Allan Bloom (Harmondsworth: Penguin, 1991).

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO1	H	H	H
CO2	M	H	H

CO3	M	H	H

EGBE203T: BRITISH LITERATURE: 19th to 21st C

(5 Credits- 75 hours) (L-T-P: 4-1-0)

Objective(s):

This course intends to acquaint the students with the introductory concepts and seminal texts of the nineteenth century, twentieth century and twenty-first century. Along with the text the course also aims to introduce some of the innovative concepts like Colonialism, Modernism and Postmodernism and relate the notions with the prescribed texts.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Describe the historical and literary contexts of the nineteenth century, twentieth and twenty-first century (Remembering)

CO 2: Critically analyse the representation of the historical events in the given literary texts. (Analysing)

CO 3: Develop critical interpretation of the texts alongside the given historical periods. (Creating)

Module I: Introduction (10 Hours)

Historical overview of the Victorian Age (Class relations, Crises of faith, Empire, Gender roles), the Twentieth Century (World Wars, 'the New Woman' literature) and the Twenty-First Century (Culture and society, Gender and sexuality)

a. Module II: Selected Fiction (30 Hours)
b. Jane Austen - Pride and Prejudice
c. Charles Dickens – Hard Times
d. Joseph Conrad - Heart of Darkness
e. John Fowles The French Lieutenant's Woman
f. David Mitchell: Cloud Atlas

Module III: Selected Poetry (20 Hours)

a. Alfred Tennyson: "Ulysses"
b. Robert Browning:"My Last Duchess"
c. W.B. Yeats: 'The Second Coming'
d. T.S. Eliot: 'The Love Song of J. Alfred Prufrock'
e. Ted Hughes : 'Hawk Roosting'
f. Seamus Heaney: 'Digging'
g. Sean O' Brien : "Water Gardens"

Suggested Readings

1. Bowra, Maurice. The Romantic Imagination. Oxford University Press, 1999.
2. Darwin, Charles. "Natural Selection and Sexual Selection". The Descent of Man in The Norton Anthology of English Literature. vol.2.8th. Edited by Stephen Greenblatt. NewYork: Northon, 2006. pp.1545–9
3. Marx, Karl and Friedrich Engels. "Mode of Production: The Basis of Social Life", "The Social Nature of Consciousness", and "Classes and Ideology". A Reader in Marxist Philosophy. Edited by Howard Selsam and Harry Martel. New York: International Publishers, 1963. pp. 186–8,190–1,199–201
4. Mill, John Stuart. The Subjection of Women in Norton Anthology of English Literature. vol. 2. 8th. edited by Stephen Greenblatt. New York: Norton, 2006. chap. 1. pp.1061–9
5. The Drowned Book.2007

Mapping of COs to Modules:

COs	Module I	ModuleII	Module III
CO 1	M	H	H
CO 2	H	H	H
CO 3	M	H	H

EGIW204T: INDIAN WRITING IN ENGLISH

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to understand various features of Indian Writing in English, acquaint students with the works of significant Indian writers and to help them summarize and critically appreciate literary works.

Course/Learning Outcomes

At the end of this course students will be able to:
CO 1: *Define* the literature produced in India in English (Remembering)
CO 2: *Explain* and comment on the poems and fictional works produced in India in their various socio-cultural context (Understanding)
CO 3: *Apply* different critical theories involved in the production of the selected indigenous texts (Applying)

Module I: Selected Novels (25 Hours)
a. R. K. Narayan : *Swami and Friends*
b. Anita Desai : *In Custody*

Module II: Selected Poetry (15 Hours)
a. H.L.V. Derozio : "The Orphan Girl"
b. Kamala Das : "Introduction," "My Grandmother's House"
c. Nissim Ezekiel: "'Enterprise"
d. Robin S. Ngangom : "The Strange Affair of Robin S. Ngangom"

Module III: Selected Short Fiction and Non Fiction (20 Hours)
a. Salman Rushdie: 'The Free Radio'
b. Rohinton Mistry: 'Swimming Lesson'
c. Shashi Despande: 'The Intrusion'

Suggested Readings:
1. Bruce King, 'Introduction', in *Modern Indian Poetry in English* (New Delhi: OUP, 2nd edn,2005) pp. 1–10.
2. Meenakshi Mukherjee, 'Divided by a Common Language', in *The Perishable Empire* (New Delhi:OUP,2000) pp.187–203.
3. Raja Rao, Foreword to *Kanthapura* (New Delhi: OUP, 1989) pp. v–vi.
4. Salman Rushdie, 'Commonwealth Literature does not exist', in *Imaginary Homelands* (London: Granta Books,1991) pp. 61–70.

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO 1	H	H	H
CO 2	M	H	M
CO 3	H	H	H

EGEC300T: EUROPEAN CLASSICAL LITERATURE

(5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)
In this course, students shall understand the basics of prevailing trends and origins of Western Literature. They shall also learn in detail about the process of genre division and its origins. This will help them to not only enhance their existing knowledge about prototypes of Western literary traditions, but also clarify a wide range of references to these classical texts which are seen in the English texts of the later eras.

Course/Learning Outcomes
At the end of this course students will be able to:
CO1: Define the concepts of epic, tragedy, comedy, satire, catharsis etc. (Remembering)
CO2: Illustrate the significance and importance of Western Classical Literature (Understanding)
CO3: Utilize the contemporary theories in the critical analysis of various literary texts. (Applying)

Module I: Selected Greek texts (30 Hours)
a. Homer- *Iliad*
b. Sophocles- *Oedipus the King*

Module II: Selected Roman texts (45 Hours)
a. Plautus- *Pot of Gold*
b. Ovid- Selections from *Metamorphoses* -'Bacchus', (Book III), 'Pyramus and Thisbe' (Book IV)
c. Horace- *Satires* I: 4

Suggested Readings:
1. The prescribed texts
2. Plato, *The Republic*, Book X, tr. Desmond Lee (London: Penguin, 2007).
3. Homer- *Iliad*, tr. E.V. Rieu (Harmondsworth: Penguin, 1985).

4. Sophocles- *Oedipus the King*, tr. Robert Fagles in Sophocles: The Three Theban Plays (Harmondsworth: Penguin, 1984).
5. Plautus- *Pot of Gold*, tr. E.F. Watling (Harmondsworth: Penguin, 1965).
6. Ovid- Selections from *Metamorphoses* 'Bacchus', (Book III), 'Pyramus and Thisbe' (Book IV), tr. Mary M. Innes (Harmondsworth: Penguin, 1975).
7. Horace *Satires* I: 4, in *Horace: Satires and Epistles and Persius: Satires*, tr. Niall Rudd (Harmondsworth: Penguin, 2005).
8. Sharma,Ramesh and Ashima Sona ed. *Classics in Translation : Reflections on Indian and European Classical Literature*. Purbayon,2021

Mapping of COs to Modules

COs	Module I	Module II
CO1	H	M
CO2	M	H
CO3	M	M

EGAL301T: AMERICAN LITERATURE

(5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)

The objective of this course is to introduce students to a body of literature by the writers of literature of the USA. This course will introduce major American writers in the genres of poetry and fiction. This course expects the students to develop writing and analytical skills as these skills relate to developing a broad knowledge of American literature and its representative texts in relation to their historical and socio-cultural contexts.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate the pertinent themes pertaining to the American socio-political conditions. (Understanding)

CO 2: Examine concepts like American Dream, Social Realism and Transcendentalism in relation to the prescribed texts. (Analyse)

CO 3: Develop a critical understanding of intersectionality of race, class and gender from the readings of the texts prescribed (Creating)

Module I: Selected Texts (40 Hours)

a. Tennessee Williams: The Glass Menagerie
b. Toni Morrison: Beloved
c. Edgar Allan Poe: 'The Purloined Letter'
d. William Faulkner : 'Dry September'

Module II: Selected Poems (35 Hours)

a. Anne Bradstreet: 'The Prologue'
b. Walt Whitman: Selections from *Leaves of Grass*: 'O Captain, My Captain', 'Passage to India' (lines1–68)
c. Alexie Sherman Alexie: 'Crow Testament,' 'Evolution'

Suggested Readings

1. Hector St John Crevecouer, 'What is an American', (Letter III) in *Letters from an American Farm*er (Harmondsworth: Penguin, 1982) pp.66–105.
2. Frederick Douglass, A *Narrative of the life of Frederick Douglass* (Harmondsworth: Penguin, 1982) chaps. 1–7, pp.47–87.
3. Henry David Thoreau, 'Battle of the Ants' excerpt from 'Brute Neighbours', in *Walden* (Oxford: OUP, 1997) chap. 12.
4. Ralph Waldo Emerson, 'Self Reliance', in *The Selected Writings of Ralph Waldo Emerson*, ed. with a biographical introduction by Brooks Atkinson (New York: The Modern Library, 1964).
5. Toni Morrison, 'Romancing the Shadow', in *Playing in the Dark: Whiteness and Literary Imagination* (London: Picador, 1993) pp.29–39.

Mapping of COs to Modules

COs	Module I	Module II
CO1	H	H
CO2	H	H
CO3	H	M

EGDL302T: DIASPORA LITERATURE

(4 Credits- 60 hours) (L-T-P: 3-1-0)

Objective(s)

The scope of the course ranges from a thorough understanding of different connotations related to Diaspora and Diaspora literatures from across the world. The course is expected to create the understanding of phenomena such as home, exile, identity, displacement with the help of the prescribed texts.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Describe Diaspora, its concept, history and its literary association (Understanding)

CO 2: Apply the themes of these texts to further explore the conscientiousness of the relationship between the 'homeland' and the 'diaspora'. (Applying)

CO 3: Discover the 'home' country from a different prism through the eyes of writers who have lived in a composite culture.(Analysing)

Module I: Background: (15 Hours)

Diaspora: concept, history, definition, colonial connection, Diasporic identity, Home, Cosmopolitanism, Self; Anxieties of Diaspora-sense of trauma, inbetweenness, dislocation, displacement; Idea of Diaspora Literature

Module II: Selected Fiction (30 Hours)

a. V.S.Naipaul (Carribean-British) : *Half a Life* (2001)
b. Chimamanda Adichie (Nigerian-American) : *Americanah* (2013)
c. Yasmine Gooneratne (Srilankan-Australian) : "How Barry Changed His Image"
d. Jhumpa Lahiri (American- Indian) : "Unaccustomed Earth"

Module III: Selected Poetry (15 Hours)

a. Imtiaz Dharkar (Pak-British) : "At the Lahore Karhai"
b. Hana Safi (Mideast-American) : "Bad Brown Girl"
c. Meena Alexander (Indian American) : "Muse"

Suggested Reading

1. "Introduction: The Diasporic Imaginary" in Mishra,V. (2008).
2. *Literature of the Indian Diaspora.* London: Routledge
3. "Cultural Configurations of Diaspora," in Kalra, V. Kaur, R. and Hutynuk, J. (2005)
4. *Diaspora & Hybridity*. London: Sage Publications.
5. "The New Empire within Britain," in Rushdie, S. (1991). *Imaginary Homelands*. London: Granta Books
6. Meena Alexander. . *Illiterate Heart.* Northwestern University Press, 2003.
7. Prescribed texts

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO1	H	M	M
CO2		H	H
CO3	M	H	H

EGPC303T: POSTCOLONIAL LITERATURE

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

This course aims to acquaint the students with the concepts in the area of postcolonial studies in the field of literature. Apart from the historical understanding, they shall be able to connect the various literary references and critical ideas in several such texts. Furthermore, this course will also be relevant to real life situations involving activist concerns.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: Recall the various critical elements in adherence to the Post-colonial literature. (Remembering)

CO2: Illustrate the historical context of Post-colonial literature and the use of racist and colonial undertones in the texts under study. (Understanding)

CO3: Discuss, summarise and critically appreciate the literary and the thematic aspects of the texts under study. (Creating)

Module I: Introduction to Post-colonial Studies (15 Hours)
Historical background of Post-colonial Studies, concept, Decolonization, Globalization, Hybridization, identity, culture, 'othering'.

Module II: Selected Critical Writings (15 Hours)
a. *Orientalism*: Edward Said (Selections)
b. *Nation and Narration*: Homi K. Bhabha
c. 'Passive Resistance' and 'Education': Mahatma Gandhi

Module III: Selected Novels (15 Hours)
a. *The Shadow Lines*: Amitav Ghosh
b. *By the Sea:* Abdulrazak Gurnah

Module IV: Selected Drama and Poetry (15 Hours)
a. *A Dance of the Forests*: Wole Soyinka
b. "Vultures": Chinua Achebe
c. "Phenomenal Woman": Maya Angelou
d. "Names:" Derek Walcott

Suggested Readings:
1. The prescribed texts
2. "The Danger of a Single Story" (Transcript) by Chimamanda Adichie.
3. Benson, Eugene and L. Conolly (Eds). Encyclopaedia of Postcolonial Literatures in English. Routledge, 2005
4. Moore-Gilbert, Bartet al (Eds.) Postcolonial Theory: Contexts, Practices, Politics. Routledge, 1997
5. Mongia, Padmini. Postcolonial Theory. Oxford, 1996
6. Mukherjee, Meenakshi and Harish Trivedi (Eds.) Interrogating Postcolonialism. Indian Institute of Advanced Studies, 1996.
7. Ashcroft, Bill et al. The Empire Writes Back. Routledge, 2002.
8. Nayar, Pramod K. Postcolonial Literature: An Introduction. Pearson Education India, 2008.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO1	M	H	M	H
CO2	M	H	M	M
CO3	M	L	M	H

EGLC304T: LITERARY CRITICISM

(4 Credits-60 lectures) (L-T-P: 3-1-0)

Objective(s)
The objective of this course is to introduce and orient students in the major developments in literary criticisms beginning with Plato through to Philip Sidney, the Romantics like William Wordsworth, Victorians like Mathew Arnild , Modernists Virginia Woolf and Twentieth Century critics like T.S.Eliot, I.A. Richards and Magggie Humm so as to facilitate them in using their corresponding critical concepts in interpretation of literature.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define key critical terms and concepts. (Remembering)
CO 2: Distinguish between the various ideas of western literary criticism from the time of Aristotle to the Modern Period. (Understanding)
CO 3: Discuss and summarize the key concepts of the various critical texts. (Creating)

Module I: Plato to Sidney (20 Hours)
a. Aristotle: *Poetics*: "Tragic Hero," "Hamartia," "Peripeteia," "Anagnorisis"
b. Horace: *Ars Poetica*
c. Philip Sidney: "An Apology for Poetry" : Four abuses and their defense

Module II: Romantic to Modern Period (20 Hours)
a. William Wordsworth: "Preface to the *Lyrical Ballads* (1802)"
b. Mathew Arnold: "The Study of Poetry"
c. Virginia Woolf: "Modern Fiction"

Module III: Twentieth Century (20 Hours)

a. T.S. Eliot: Historical Sense, Definition of Poetry and Depersonalization in "Tradition and the Individual Talent"
b. I.A.Richards : "Four Kinds of Meaning" in *Practical Criticism*
c. Cleanth Brooks: "The Language of Paradox" in *The Well-Wrought Urn: Studies in the Structure of Poetry*
d. Maggie Humm: "Feminist Criticism" in *Feminist Criticism: Women as Contemporary Critics*

Suggested Readings

1. C. S. Lewis: Introduction in *An Experiment in Criticism,* Cambridge University Press. 1992
2. M. H. Abrams: *The Mirror and the Lamp*, Oxford University Press. 1971
3. Rene Wellek, Stephen G. Nicholas: *Concepts of Criticism*, Connecticut, Yale University. 1963
4. Taylor and Francis Eds. *An Introduction to Literature, Criticism and Theory*. Routledge. 1996
5. Prescribed texts

Mapping of COs to Modules

COs	Module I	Module II	Module III
Co1	H	H	H
CO2	H	H	H
CO3	H	H	H

EGWW305T: WOMEN'S WRITINGS

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The course aims at helping students to learn about the formal features of women's writing, including the ways women adopt, adapt, and challenge broader literary traditions. The course explores the conditions under which women wrote and published. It provides opportunities to explore key issues and debates in contemporary scholarship on women's writing.

Course/Learning Outcomes

At the end of this course students will be able to:
CO 1: Illustrate the various thoughts and theories pertaining to feminist writings and feminism. (Understanding)
CO 2: Analyse the various movements related to gender and the progress in gender and literature. (Analysing)
CO 3: Discuss and summarize the meanings, ideas and thoughts regarding gender and its connection with literature. (Creating)

Module I: Selected Poetry (15 Hours)

a. Emily Dickinson 'I cannot live with you', 'I'm wife; I've finished that'
b. Sylvia Plath 'Daddy', 'Lady Lazarus'
c. Eunice De Souza 'Advice to Women', 'Bequest'

Module II: Selected Fiction and Short Fiction (30 Hours)

a. Alice Walker: *The Color Purple*
b. Charlotte Perkins Gilman: "The Yellow Wallpaper"
c. Katherine Mansfield: "Bliss"
d. Chitra Banerjee Divakaruni: "Palace of Illusions"

Module III: Selected Non-fiction (15 Hours)

a. Mary Wollstonecraft- *A Vindication of the Rights of Woman* (New York: Norton, 1988) chap.1, pp. 11–19; chap.2, pp. 19–38.
b. Ramabai Ranade- 'A Testimony of our Inexhaustible Treasures', in *Pandita Ramabai Through Her Own Words: Selected Works*, tr.Meera Kosambi (New Delhi: OUP, 2000) pp. 295–324.
c. Helene Cixous "Laugh of Medusa"

Suggested Readings

1. Virginia Woolf, *A Room of One's Own* (NewYork: Harcourt, 1957) chaps.1 and 6.
2. Simone de Beauvoir, 'Introduction', in *The Second Sex*, tr. Constance Borde and Shiela Malovany- Chevallier(London: Vintage,2010) pp.3–18.
3. Kumkum Sangari and Sudesh Vaid, eds., 'Introduction', in *Recasting Women: Essays in Colonial History* (New Delhi: Kali for Women, 1989) pp. 1–25.
4. Chandra Talapade Mohanty, 'Under Western Eyes: Feminist Scholarship and Colonial Discourses', in *Contemporary Postcolonial Theory: AReader*, ed. Padmini Mongia (New York: Arnold, 1996) pp. 172–97.

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO1	H	H	H

CO2	H	H	H
CO3	M	H	H

EGMP306P: COMMUNITY BASED MINOR PROJECT
(4 Credits-60 hours) (L-T-P: 0-1-3)

Objective(s)
The objective of this course is to develop skills in students to probe into the complex relations between man, society, nature and world for their critical understanding and also to extend classroom learning to the society.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Infer the relation between man, society, nature and world in a particular community/ies (understanding)
CO 2: Analyze the relation between man, society , nature and world in a particular community(Analyzing)
CO 3: Apply the methodology of module 2 in the analysis and report writing. (Applying).

Module I: Theory: Background, Ethics, Thrust Area and Methodology (15 Hours)
Background: Meaning, definition and its academic significance
Ethics: Concept of Ethics, being formal, greetings, take consent of respondent, formal introduction, respect respondent's faith, community, belief, avoid abuses, be impartial, authentic and empirical, be objective
Thrust Areas: Indigenous Communities of Northeast India

Each student has to pick up any TWO of the following areas for project work in a community:
Creation myth: Origin of human being, Gods/Goddesses, Monsters, Demons etc. and how they manifest to each other
Family: concept, matrilineal or patrilineal, role of members of a family-father, mother, son, daughter, uncle, grandmother, grandfather and their maternal counterparts
Marriage: concept, arranged or elopement, marriage process, marriage rituals, roles of families (groom and bride sites, relatives, community)
Village: concept, structure of the village, caste, clans, occupations, inter village relationship, justice system
Festivals: concept, types, time, duration, purpose
Art: music literature, song, drama, musical instruments, paintings, performing art
Philosophy: idea of life, idea of sin, rebirth, salvation, relation between man and plants, man and animals, man and non-living things
Food: community food, kitchen, cooking method, food taking, food preservation
Language: name, vocabularies, idioms, phrases, adages
Folklore: myths, oral literature, folktales, folk theater etc.
Ecology: Relation between human being and nature; how nature manifests to the former

Methodology: The following can be adopted
- Interaction : note respondent's name and narration in short
- Questionnaire : printed document in which the respondents can answer/tick
- Literature review- folklore, poems, rituals, myth: reading and exploration
- Site visits: forts, religious places etc – their interpretation
- Photographs for documentation
- Report formatting: MLA VIII/IX

Module II: Practical (45 Hours)
Field Work: 20 hrs
Report: 25 hrs

Report Components: templates will be provided
1. Title page with its components: title, logo, name and ID of the students etc
2. Certificate from the teacher supervisor
3. Declaration of originality by the student
4. Field Visit Journal
5. Content page
6. Report:
   a. *Introduction*
   b. *Analysis*
   c. *Finding*

d. Conclusion
e. Reference

7. Length : 40 pages
8. Binding : Spiral

Font/Style:

1. Name : Times New Roman
2. Font Size: 12
3. Line spacing : double
4. Paper size: A4
5. Indenting: Left only
6. Reference method; MLA VIII/IX

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Assessment: It is MANDATORY that students get pass marks in all the following parameters.

1. Field Visit Journal Template : 10 marks

Name:
Semester:
ID:
Course Name and ID:

Sl	Date	Duration (to complete 20 hours)	Place/Community	Action	Sign of contact person

2. Report : Hard Copy 60 marks
   - Formal Pages : 10
   - Content Analysis : 10
   - Findings : 30
3. Presentation : PPT 30 marks
   - Content : 10
   - Presentation : 10
   - Interaction : 10

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Total : 100 marks

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Suggested Reading:

1. "A Code of Ethics for Community Learning and Development", Standard Council for Scotland, https://cldstandardscouncil.org.uk/wp-content/uploads/Code_of_Ethics.pdf
2. Philips, Patricia Pullam and Cathy A.Stawarski. *Data Collection: Planning for and collecting all Types of Data.* Pfeiffer, 2008.
2. **"**How To Write Project Reports in Microsoft Word and LaTeX." University of York, 2002-2022, Version 6, https://www-users.york.ac.uk/
3. "Australian Community Workers Ethics and Good Practice Guide," Australian Community Workers Association 2017, https://www.acwa.org.au/

Mapping of COs to Modules

COs	Module I	Module II
CO1	M	H
CO2	M	H
CO3	M	H

EGLT400T: LITERARY THEORY

(5 Credits- 75 hours) (L-T-P: 4-1-0)

Objective(s)

This course shall be instrumental in building the foundation of the students for the current line of critical thought in today's world. Students shall have a comprehensive idea of the connections of various philosophies in literary thought, through a postmodern lens. These theories shall also open up the world of interdisciplinary research for them.

Course/Learning Outcomes

At the end of this course students will be able to:
CO 1: Define these modern theories. (Remembering)
CO 2: Explain genesis and growth of the modern critical theories in the context of literary texts. (Understanding)
CO 3: Assess the texts in terms of their political, social, psychoanalytical, feminist and economic implications. (Evaluating)

Module I: Marxism (15 Hours)
a. Antonio Gramsci: ''Hegemony (Civil Society) and Separation of Powers"
b. Louis Althusser: "Ideology and Ideological State Apparatuses"

Module II: Feminism (20 Hours)
a. Elaine Showalter: "Twenty Years on: A Literature of Their Own Revisited"
b. Luce Irigaray: "When the Goods Get Together" (from This Sex Which is Not One)

Module III: Structuralism and Poststructuralism (20 Hours)
a. Roland Barthes: "Myth Today"
b. Michel Foucault: "'Truth and Power"

Module IV: Postcolonial Studies (20Hours)
a. Edward Said: "Introduction" (from *Orientalism*)
b. Aijaz Ahmad: "Indian Literature: Notes towards the Definition of a Category"

Suggested Reading
1. Terry Eagleton, *Literary Theory: An Introduction* (Oxford: Blackwell, 2008).
2. Peter Barry, *Beginning Theory* (Manchester: Manchester University Press, 2002).
3. Derrida, Jacques. 1970. "Structure, sign and play in the discourse of the human sciences". in *The Languages of Criticism and the Sciences of Man: The Structuralist Controversy*, pp. 247-272, edited by Richard Macksey and Eugenio Donato.
4. Gandhi, Leela. *Postcolonial Theory: A Critical Introduction*. United Kingdom, Taylor & Francis, 2020.
5. Geoffrey Novell Smith (London: Lawrence and Wishart,1971) pp. 5, 245–6.
6. Elaine Showalter, *A Literature of Their Own: British Women Novelists from Bronte to Lessing* (1977. Rpt. London: Virago, 2003) pp. xi–xxxiii.
7. Prescribed texts.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO1	H	H	M	M
CO2	M	H	M	M
CO3	L	M	H	H

EGLL401T: LANGUAGE AND LINGUISTICS

(5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)
The objective of this course is to introduce students to the background of language , exercise them on its theoretical foundation, phonology and morphology and syntax and semantics.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Define the historical development of languages, language varieties and language change. (Remembering)
CO 2: Explain the theoretical foundations of language. (Understanding)
CO 3: Determine the morpho-phonemic properties of human speech sounds. (Applying)
CO 4: Assess the word relations pertaining to different languages. (Evaluating)

Module I: Background of Language (18 Hours)
Language and communication; language varieties: standard and non- standard language; language change.

Module II: Theoretical Foundations (18 Hours)
Swiss Structuralism, American Structuralism- Its course and development.

Module III: Phonology and Morphology (19 Hours)
Basic concepts: phoneme, allophone, morpheme, allophone, inflectional and derivational morphology, compounding and word formation patterns.

Module IV: Syntax and semantics (20 Hours)

Categories and constituents of phrase structure, IC Analysis; Word relations: synonyms, antonyms, homonyms, metonymy; Interpretations of meanings: denotation, connotation, entailment and presupposition; Maxims of conversation and Speech acts.

Suggested Readings:

1. Mesthrie, Rajend and Rakesh M Bhatt. 2008. *World Englishes: The study of new linguistic varieties.* Cambridge: Cambridge University Press.
2. De Saussure, Ferdinand. 1966. *Course in general linguistics*. New York: McGraw Hill Introduction: Chapter 3. Akmajian, A.,
3. R. A. Demers and R, M. Harnish*, Linguistics: An Introduction to Language and Communication*, 2nd ed.
4. Fromkin, V., and R. Rodman*, An Introduction to Language*, 2nd ed. (New Yourk: Holt, Rinehart and Winston, 1974)
5. Akmajian, A., R. A. Demers and R, M Harnish, *Llinguistics: An Introduction to Language and Communication,* 2nd ed. (Cambridge, Mass,: MIT Press, 1984; Indian edition, Prentice Hall, 1991)

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	H	H	H	H
CO 3		M	H	M
CO 4	M		H	H

EGIC402T: INDIAN CLASSICAL LITERATURE

(5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)

The objective of this course is to orient students through some selected classical Indian literature, translated into English, to appreciate their aesthetic beauty, their social and cultural interpenetrations and their relevance today.

Course/Learning Outcomes

At the end of this course students will be able to

CO 1: Summarize the plot of the prescribed texts. (Understanding)
CO 2: Analyze the recurrent themes adopted by classical Indian writers. (Analyzing)
CO 3: Evaluate the role of characters, plots and themes as portrayed in the prescribed texts. (Evaluate)
CO 4: Formulate a critical understanding based on the reading of the prescribed texts. (Creating)

Module I: Selected text of Kalidasa and Vyasa (40 Hours)

a. Kalidasa: Abhijnana Shakuntalam, tr. Chandra Rajan, in Kalidasa: The Loom of Time (New Delhi: Penguin, 1989).
b. Vyasa.: 'The Dicing'
'The Sequel to Dicing'
'The Book of the Assembly Hall'
'The Temptation of Karna'
'The Book of Effort'
in The Mahabharata: tr. and ed. J.A.B. Van Buitenen (Chicago: Brill, 1975) pp. 106–69.

Module II: Selected text of Sudraka and Ilango Adigal (Hours)

a. Sudraka: *Mrcchakatika*, tr. M.M. Ramachandra Kale (New Delhi: Motilal Banarasidass, 1962).
b. Ilango Adigal: 'The Book of Banci', in *Cilappatikaram: The Tale of an Anklet*, tr. R. Parthasarathy (Delhi: Penguin, 2004) book 3.

Suggested Readings

1. Bharata, *Natyashastra,* tr. Manomohan Ghosh, vol. I, 2nd edn (Calcutta: Granthalaya, 1967) chap. 6: 'Sentiments', pp.100–18.
2. Iravati Karve, 'Draupadi', in *Yuganta*: *The End of an Epoch* (Hyderabad: Disha, 1991) pp.79–105.
3. J.A.B. Van Buitenen, 'Dharma and Moksa', in Roy W. Perrett, ed., *Indian Philosophy*, *vol. V*, *Theory of Value: A Collection of Readings* (New York: Garland, 2000) pp.33–40.
4. Vinay Dharwadkar, 'Orientalism and the Study of Indian Literature', in *Orientalism and the Postcolonial Predicament: Perspectives on South Asia*, ed. Carol A. Breckenridge and Peter van der Veer (New Delhi: OUP, 1994) pp.158–95.
5. Sharma,Ramesh and Ashima Sona ed. *Classics in Translation : Reflections on Indian and European Classical Literature*. Purbayon,2021

Mapping of COs to Module

COs	Module I	ModuleeII
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H

EGPL403T: POPULAR LITERATURE

(5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)

The course intends to acquaint the students with an overview of popular literature as well as popular culture. The texts under study will lend a better understanding of the themes and issues frequently arising in popular literature. The course will also help the students to examine theoretical frameworks for popular literature and its genres.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define poplar literature and its distinct characters (Remembering)
CO 2: Critically interpret and understand the elements of popular literature (Understanding)
CO 3: Apply various interpretative frameworks to their reading of selected works of popular literature (Application)
CO 4: Analyse the themes and motifs in the works under study (Analysis)

Module I: Selected Fiction (45 Hours)

a. Lewis Carroll : *Through the Looking Glass*
b. Agatha Christie: *The Murder of Roger Ackroyd*
c. Shyam Selvadurai: *Funny Boy*

Module II: Selected Biography (30 Hours)

a. Durgabai Vyamand Subhash Vyam-: *Bhimayana: Experiences of Untouchability*
b. Maya Angelou-: *I Know Why the Caged Bird Sings*

Suggested Readings

1. Chelva Kanaganayakam, 'Dancing in the Rarefied Air: Reading Contemporary Sri Lankan Literature' (*ARIEL*, Jan. 1998) rpt,
2. Malashri Lal, Alamgir Hashmi and Victor J.Ramraj, eds., *Post Independence Voices in South Asian Writings* (Delhi: Doaba Publications, 2001) pp. 51–65.
3. Sumathi Ramaswamy, 'Introduction', in *Beyond Appearances?: Visual Practices and Ideologies in Modern India* (Sage:Delhi, 2003) pp. xiii–xxix.
4. Leslie Fiedler, 'Towards a Definition of Popular Literature', in *Super Culture: American Popular Culture and Europe*, ed. C.W. E. Bigsby (Ohio: Bowling Green University Press, 1975) pp. 29–38.
5. Felicity Hughes, 'Children's Literature: Theory and Practice', *English Literary History*, vol.45, 1978, pp. 542–61.

Mapping of COs to Modules

COs	Module I	Module II
CO1	H	H
CO2	H	M
CO3	H	H
CO4	H	H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	EGBL102T	Basic Language Skills	4
2	Minor Course 2	EGBI103T	Basic Linguistics	4
3	Minor Course 3	EGAW205T	Academic Writing and Composition	4
4	Minor Course 4	EGEL206T	English Language Teaching	4
5	Minor Course 5	EGTS307T	Translation Studies	4
6	Minor Course 6	EGGS308T	Introduction to Gender Studies	4
7	Minor Course 7	EGCS404T	Introduction to Culture Studies	3
7	Minor Course 8	EGRM405T	Research Methodology : Research Paper and Dissertation	2
8	Minor Course 9	EGLA406T	Language, Literature and Culture	3

EGBL102T: BASIC LANGUAGE SKILLS

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to introduce students to language types and contexts, phonetic features and develop reading, comprehension and writing skills.

Course/Learning Outcome

CO1: Define the types of communication and recognize the fundamentals of speaking and writing skills. (Remembering)
CO2: Classify the segmental, supra-segmental and paralinguistic features of speech (Understanding)
CO3: Evaluate the reading and comprehension skills in the English language. (Evaluation)

Module I: Language: Types and Contexts (15 hours)

Verbal and Non-verbal (Spoken and Written); Personal, Social and Business - Barriers and Strategies; Intra Personal, Inter Personal and Group Communication; Monologue, Dialogue, Group Discussion, Effective Communication/ Miss- Communication, Interview, Public Speech.

Module II: Language: Phonetic Features (15 hours)

Segmental features: Organs of speech, vowels and consonants; Supra segmental features: Stress, Rhythm, Intonation; Paralinguistic features: Clarity, pace and pauses, voice modulation

Module III: Reading and Comprehension (15 hours)

Close reading, comprehension, summary paraphrasing, analysis and interpretation, translation (from Indian language to English and vice-versa), literary/knowledge texts.

Module IV: Writing skills (15 hours)

Grammar for writing, vocabulary building, techniques to improve writing skills, letter writing and its types, academic writing vs. journalism, blog writing, editing and revising.

Suggested Readings

1. Varma, Pramodini. Fluency in English - Part II, Oxford University Press, 2015.
2. Bhalla, Prem P. Business English, Pearson, 2016.
3. Kumar, S.P. Language, Literature and Creativity, Orient Blackswan, 2012.
4. K., Alex. Soft Skills.S. Chand & Co. Ltd. 2008.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO1	H	H		H
CO2		H		
CO3			H	M

EGBI103T: BASIC LINGUISTICS

(4 Credits- 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to introduce students to Linguistics, exercise them on phonology and morphology, syntax and semantics and eventually equipped them with the idea of sociolinguistics.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define basic concepts in linguistics and find the interconnection between language and society. (Remembering)
CO 2: Outline the phonological and the morphological structure of languages. (Understanding)
CO 3: Identify and explain the different levels of language organisation. (Applying)

Module I: Introduction to Linguistics (15 Hours)

Definition of language; Characteristics of language; Definition and scope of linguistics; Different branches of linguistics; Linguistics and traditional grammar; langue and parole; competence and performance; synchrony and diachrony; syntagmatic and paradigmatic; sign, signifier and signified

Module II: Phonology, Morphology (15 Hours)

Organs of speech; speech mechanism; vowel sounds and consonant sounds; phonemic transcription; phonemes, morphemes, allomorphs and morphs; syllable and word formation processes; word stress and sentence intonation;

Module III: Syntax & Semantics (15 Hours)

Syntactic structure of English language- IC analysis, transformational grammar; layers of meaning at the semantic level of language- deep structure and surface structure; Different aspects of meanings, lexical relations, synonymy, hyponymy, antonymy, homonymy, polysemy, denotation, connotation, collocation, association, prototypes; entailment, presupposition

Module IV: Sociolinguistics (15 Hours)

Language and Society, Dialect and Idiolect, Standard Language, Register and Style, Bilingualism and Multi-lingualism, Code-Switching and Code-Mixing, Language varieties, dialect, idiolect, register, isoglosses, dialect boundaries, diaglossia, pidgin and creole, speech community, speech event, speech situation, speech acts, Language Shift and Language Death

Suggested Readings

1. Abrams, M.H. *A Handbook of Literary Terms*,2009,Cengage Learning India, New Delhi
2. Balasubramoniam, T. *A Textbook for English Phonetics for Indian Students*, Macmillan, New Delhi
3. Yule, George, *The Study of Language ,*fourth edition, Cambridge university Press, 2010 New Delhi
4. Wood, F.T. *An outline history of the English language*, Macmillan,1941, New Delhi

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO1	H			H
CO2		H		
CO3	M	H	H	

EGAW205T: ACADEMIC WRITING AND COMPOSITION

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The course intends to acquaint the students with an overview of the process of doing research. This will introduce the students to the basics of academic writing as well the steps of doing research. The course will also help the students to develop critical thinking as well as the basic research skills.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define and identify the role of academic writing and its components. (Remembering)
CO 2: Explain the significance of critical thinking. (Understanding)
CO 3: Critically examine the applicability of the techniques of the writing process. (Analysing)

Module I: Introduction to writing (15 Hours)

The Writing Process: Introduction to Academic writing, Dos and don'ts of academic writing, Conventions of Academic Writing

Module II: General Principles of Summarizing (15 Hours)

Writing in one's own words: Summarizing and Paraphrasing

Module III: Development of Critical thinking (15 Hours)

Critical Thinking: Synthesis, Analyses, and Evaluation

Module IV: Development of Argument, Citation and reviewing (15 Hours)

Structuring an Argument: Introduction, Interjection, and Conclusion Citing Resources; Editing, Book and Media Review

Suggested Readings

1. Gerald Graff and Cathy Birkenstein, *They Say/I Say: The Moves That Matter in Academic Writing.* W.W.Norton &Company, 2009.
2. Gupta, Renu. *A Course in Academic Writing*. Orient Black Swan, 2017.
3. Hamp-Lyons, Liz. And Heasley, Ben. *Study writing: A Course in Writing Skills for Academic Purposes.* CUP, 2006.
4. Leki, Ilona. *Academic Writing: Exploring Processes and Strategies*.CUP, 1998.

Mapping of Cos to the Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H	L	H	M
CO 2	L		H	M
CO 3	M	L	H	H

EGEL206T: ENGLISH LANGUAGE TEACHING

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to introduce students to teaching of English language, acquaint them with methods and approaches of the teaching, orient them in grammatical and practical language skills and develop skill in learning language through literature.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the vast body of Language teaching methodologies (Remembering)

CO 2: Demonstrate the different approaches to teaching of English as a second language (Understanding)

CO 3: Design as well as adapt on the syllabuses of second language teaching and constructing lesson plans for dealing with language learners of different linguistic backgrounds (Creating)

Module I: Introduction to English Language Teaching (10 Hours)

Introduction, Fundamental concepts of Language Teaching, Historical Perspective of ELT, Language Pedagogy. Elements of the Structure of English Language.

Module II: Methods and Approaches of Teaching English (20 Hours)

Theoretical aspects of Language Acquisition and Learning; Language Skills assessment; Psychological approach to language teaching in a bilingual/ multilingual context; Use of Technology in Language Teaching; Educational Technology; Testing and Evaluation.

Module III: Grammar and Practical Language Skills (20 Hours)

Parts of Speech; Articles and Prepositions; Degrees of Comparison; Direct and Indirect Speech; Sentence patterns; Letter Writing; Report Writing; Reading Comprehension; Listening and Speaking; English Speech Sounds – Vowels and Consonants, Stress and Intonation patterns; Language Games; Vocabulary Expansion; Telephonic Conversation; Teaching English for Academic and Business Purpose.

Module IV: Language through Literature (10 Hours)

Role of Literature in Language Learning; Teaching of Literature; Use of Language Model.

Suggested Readings

1. Ray Mackay, *A Basic Introduction to English Language Teaching*; Oxford, 2018.
2. Penny Ur, *A Course in English language Teaching*, CUP.2010.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2	M	H	M	
CO 3	H	H	M	M

EGTS307T: TRANSLATION STUDIES

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to introduce students to translation studies, general concepts and terms used in translation studies, types/modes of translation and process of translation. At the same time, the course also attempts to give some

practical exercises in translation.

Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: Understand the significance and importance of translation in a multilingual and multicultural society like India (Understanding)
CO 2: Examine critically the basic concepts and terms used in translation studies vis-à-vis their use in the practice of translation (Analyzing)
CO 3: Create and offer a critique of works in translation (Creating)

Module I: Introduction to Translation (10 Hours)
Introducing Translation: a brief history and significance of translation in a multi linguistic and multicultural society like India.

Module II: Basic Concepts and Terms used in Translation Studies (10 Hours)
Introducing basic concepts and terms used in Translation Studies through relevant tasks, for example: Equivalence, Language Variety, Dialect, Idiolect, Register, Style, Mode, Codemixing/ Switching, SL, TL, ST. TT

Module III: Types/ modes in Translation (10 Hours)
Semantic/Literal translation Free/sense/literary translation Functional/communicative translation Technical / Official Trans-creation Audio-visual translation

Module IV: The Process of Translation (30 Hours)
Defining the process of translation (analysis, transference, restructuring) through critical examination of standard translated Literary/non l literary texts and critiquing subtitles of English and Hindi films.

Practice: Translation in Mass Communication/Advertising, subtitling, dubbing, Exercises to comprehend 'Equivalence in translation': Structures (equivalence between the source language and target language at the lexical (word) and syntactical (sentence) levels. This will be done through tasks of retranslation and recreation, and making comparative study of cultures and languages.

Practice: Tasks of Translation in Business: Advertising Discussions on issues of 'Translation and Gender' by attempting translation for media, films and advertisements from different languages.

Developing skills for Interpreting: understanding its dynamics and challenges. Interpreting: Simultaneous and Consecutive (practical application)

Suggested Readings

1. Baker, Mona, *In Other Words: A Coursebook on Translation*, Routledge, 2001. (Useful exercises for practical translation and training)(Ed.) *Routledge Encyclopedia of Translation Studies*. London and New York: Routledge, 2001. (Readable entries on concepts and terms)
2. Sherry Simon, Gender in translation: Cultural Identity and the Politics of Transmission. New York: Routledge, 1996. Catford, I.C. *A Linguistic Theory of Translation*. London: OUP, 1965. Frishberg, Nancy J. *Interpreting: An Introduction*. Registry of Interpreters, 1990.
3. Gargesh, Ravinder and Krishna Kumar Goswami. (Eds.). *Translation and Interpreting: Reader and Workbook*. New Delhi , Orient Longman, 2007.
4. House, Juliana. *A Model for Translation Quality Assessment*. Tubingen: Gunter Narr, 1977. Lakshmi, H. *Problems of Translation*. Hyderabad: Booklings Corporation, 1993.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H	H	H	
CO 2		H	H	H
CO 4	H	H	H	H

EGGS308T: INTRODUCTION TO GENDER STUDIES

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s):
The course intends to acquaint the students with an overview of gender equality concerns. This course will also help the students to develop an understanding of gender as it intersects with sexuality, race, ethnicity, religion, class and other critical variables.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: Explain basic concepts relating to gender and provide logical understanding of gender roles. (Understanding)

CO2: Analyse various perspectives of the body and discourse on power relationships. (Analysing)

CO3: Assess the cultural construction of masculinity and femininity and its various consequences. (Evaluating)

Module I: Introduction. (15 Hours)

Sex and Gender, Types of Gender, Gender Roles and Gender Division of Labor, Gender Socialization and Gender Stereotyping, Gender Stratification and Gender Discrimination.

Module II: Gender Perspective of Body. (15 Hours)

Biological, Phenomenological and Socio-Cultural Perspectives of Body, Body as a Site and Articulation of Power Relations, Cultural Meaning of Female Body and Women's Lived Experiences, Gender and Sexual Culture

Module III: Social Construction of Femininity. (15 Hours)

Bio-Social Perspective of Gender, Gender as Attributional Fact, Essentialism in the Construction of Femininity, Challenging Cultural Notions of Femininity, Images of Women in Sports, Arts, Entertainment and Fashion Industry

Module IV: Social Construction of Masculinity. (15 Hours)

Definition and Understanding of Masculinities, Sociology of Masculinity, Social Organization of Masculinity, Politics of Masculinity, Power and Hegemony

Suggested Reading:

1. Butler, Judith. *Gender Trouble: Tenth Anniversary* Edition. N.P., Taylor & Francis, 2002.
2. Connell, R.W. *Gender*. Cambridge: Polity Press, 2002.
3. Holmes M. *What is Gender*. New Delhi, Sage Publications, 2007
4. Kimmel S Michael. *The Gendered Society: Reader*. Oxford: Oxford University Press, 2004
5. Oakley A*. Sex, Gender and Society. London*, Temple Smith, 1985
6. Millet K. *Sexual Politics*. London, Abacus, 1972.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H	M	L	L
CO 2	L	H	M	M
CO 3	L	M	H	H

EGCS404T: INTRODUCTION TO CULTURAL STUDIES

(3 Credits- 45 hours) (L-T-P: 2-1-0)

Objective(s)

To introduce students with the basic concepts of cultural studies, make them aware of some of the most important thinkers and methodologies in the field and help them analyse texts from many different critical perspectives.

Course/Learning Outcomes

CO 1: Outline culture, cultural identities and politics of production across various human historical conditions. (Understand)

CO 2: Identify the constructed categories of identity, authority and knowledge. (Apply)

CO 3: Examine culture as an asymmetrical entanglement of material and abstract attributes to draw on political theory, psychology and critical theory. (Analyse)

Module I: Introduction and background (20 Hours)

Birth of Cultural Studies-Raymond Williams and Richard Hoggert (Origin, Evolution and Early trends); Birmingham Centre for Contemporary Studies and Stuart Hall

Construction of culture (Socio-political, Religious, Technological)

Representation of culture (Language, Gender, Race, Class, Ethnicity and Kinship);

High and Low culture; Folk Culture; Popular Culture; Mall culture; Media Culture; Consumer Culture; Global Culture

Media and Culture

Culture and Cultural Identities

Module II: LiteraryTheories and Cultural Studies (15 Hours)

Structuralism; Post Structuralism and Deconstruction; Marxism; Postmodernism; Feminisms and Post-feminisms; Queer Theory; Techno culture; Post humanism

Module III: Understanding culture through literature (10 Hours)
Bell Hooks 'Understanding Patriarchy'
George Orwell 'Shooting an Elephant'

Suggested Readings

1. Durham, Meenakshi Gigi, and Douglas M. Kellner, eds. *Media and Cultural Studies: Keyworks*. John Wiley & Sons, 2012.
2. Grossberg, Lawrence, and Della Pollock, eds. *Cultural Studies-Vol 12.2*. Vol. 12. No. 2. Psychology Press, 1998.
3. Hall, Stuart. *Cultural studies 1983: A Theoretical History*. Duke University Press, 2016.
4. Longhurst, Brian, et al. *Introducing cultural studies*. Routledge, 2016.
5. Turner, Graeme. *British cultural studies: An introduction*. Psychology Press, 2003.
6. Williams, Raymond. *Culture and society, 1780-1950*. Columbia University Press, 1983.

Mapping of Cos to Modules

COs	Module I	Module II	Module III
CO1	H	H	H
CO2	M	H	H
CO3	M	H	H

EGRM405T: RESEARCH METHODOLOGY: RESEARCH PAPER AND DISSERTATION

(2 Credits- 30 hours) (L-T-P: 1-1-0)

Objective(s)
This course aims to equip the student with theoretical and practical knowledge, so that they are introduced into the field of research in English Literature. Not only does this course give the students practical experience of working in a dissertation, it also shows alternative ways of approaching and phrasing their arguments. Finally, it seeks to keep them up to date with the contemporary trends and styles in the same.

Course/Learning Outcomes
CO1: Describe academic writing, research paper/dissertation and its methodology (Understanding)
CO2: Formulate a research argument and develop a research paper/dissertation. (Creating)

Module I: Methodology (15 Hours)
- Introduction to academic/ research writing
- Avoiding Plagiarism in research, Plagiarism checking tools (Ouriginal, Turnitin)
- Selection of a research topic
- Developing an outline of the research
- Choosing an appropriate title for the research
- Writing an abstract
- Review of Literature
- Developing an argument
- Bringing a critical interpretation into writing
- Drawing inferences/ framing a conclusion
- MLA Handbook 8th/9th Edition
- Referencing and Citation, citation tools (Mendeley, Zotero)
- Bibliography
- Research Ethics

Module II: Practical- Writing and editing a Research Work (15 Hours)
- Draft of the abstract
- Draft of all components of Introduction
- First draft of the research work
- Tentative bibliography, annotated bibliography

Suggested Reading

1. Correa, Delia Da Souza & Owens, W.R. The Handbook to Literary Research. Routledge. 2009
2. Kothari, C. R. & Gaurav Garg. Research Methodology: Methods and Techniques. New Age. 2019
3. MLA Handbook for Writers of Research Papers, Eighth Edition. MLA. 2016.

Mapping of COs to Modules:

COs	Module I	Module II
CO1	H	M

CO2	M	H

EGLA406T: LANGUAGE, LITERATURE AND CULTURE

(3 Credits-45 hours) (L-T-P: 2-1-0)

Objective(s)

The course shall develop the language skills of students by introducing them to the structures of language through a wide variety of literary works. This course will also introduce the students to the general characteristics of the literature of different ages in India. Finally this course will help the students to develop an understanding of culture and its relation with literature.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: Understand the intrinsic relationship between languages, literature and culture (Understanding)
CO2: Illustrate the structure and function of language and its literary and cultural significance (Application)
CO3: Analyze the recurrent themes and forms of Indian literature through the ages (Analyzing)

Module 1: Language (15 Hours)

Language and Communication: The Definition of Language, the Characteristics of Human language
Why Does Language Matter?
Language and Society: Language and Class, Language and Gender; Language and Ethnicity; Language and Identity
Language Variation: Dialect; Idiolect; Slang ;Pidgin; Creole; Jargon; Standard and Non-Standard Language; Bilingualism, Multilingualism; Code-mixing; Code-switching

Module 2: Indian Literature Through the Ages (20 Hours)

This section of the course will involve a study of significant themes and forms of Indian literature through the ages, with the help of prescribed texts.
Prescribed text: *Indian Literature: An Introduction* (Delhi: University of Delhi, 2005).
Different Phases of Indian literatures: Ancient, Medieval, and Modern
Chapter 1: Veda Vyasa, *The Mahabharata:* "The Ekalavya Episode"
Chapter 2: Asadullah Khan Ghalib: "Desires Come by the Thousands"
Chapter 3: Rabindranath Tagore: 'The Cabuliwallah"
Chapter 4: Ismat Chugtai: "Touch-Me-Not"
Chapter 5: Indira Goswami: "The Journey"
Chapter 6: Shrikant Mahapatra: "Folk Songs"

Module 3: Culture and Society in Contemporary India (10 Hours)

The Idea of culture, Definition of culture, High culture, Popular culture, Culture and media, Indian Society and culture

Suggested Readings

1. Roger Fowler, ed., *Essay on Style and Language* (London: Routledge and Kegan Paul Ltd, 1966). Roger Fowler, *The Linguistics of Literature* (London: Routledge and Kegan Paul Ltd, 1971)
2. H. G. Widdowson, *Stylistics and the Teaching of Literature* (London: Longman, 1979).
3. J. A. Fishman, *Sociolinguistics: A Brief Introduction* (Mass: Newbury House Rowley, 1971).
4. R. S. Gupta and K. S. Agarwal. *Studies in Indian Sociolinguistics* (New Delhi: Creative Books, 1996).
5. R. A. Hudson, *Sociolinguistics* (Cambridge: Cambridge University Press, 1980). Geoffrey Leech and Michael Short,*Style in Fiction* (London: Longman, 1981).
6. Sisir Kumar Das, ed., *A History of Indian Literature* (New Delhi: SahityaAkademi,1995)
7. 'Notes on the History of the Study of the Indian Society and Culture', in Structure and Change in Indian Society, ed. Milton Singer and Bernard S Cohn (Chicago: AldinePress1968)
8. 'Towards a Definition of Culture', in India and World Culture (New Delhi: Sahitya Academy, 1986). Journalism: Changing Society Emerging Trends (Delhi: Authorspeak, 2003).

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	L	H	M

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	EGCW104L	Creative Writing	3
2	S E Course 2	EGSS105L	Soft Skills	3
3	S E Course 3	EGEP207L	Editing and Proofreading	3

EGCW104L: CREATIVE WRITING

(3 Credits-45 hours) (L-T-P: 2-1-0)

Objective(s)

To help students understand different types of creative writings, instill creative writing skills and produce clear and coherent writing skills.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: Define the different creative techniques adopted by different writers in their work. (Remembering)
CO2: Apply different tropes and figures of speech to enhance creativity in literary and non- literary texts. (Applying)
CO3: Elaborate and develop literary and non-literary texts as well as performances by adopting different skills and techniques of creative writing. (Creating)

Module I: Introduction to Creative Writing (7 Hours)

Introduction; Objectives of Creative writing; History of Creative Writing as an academic pursuit; Scope and Area of Creative Writing

Module II: The Art and Craft of Writing (7 Hours)

Origin of Thought and Birth of an Idea: Inspiration, Imagination and Creativity, Incubation, Implementation and Interpretation; Strategies of a Writer

Module III: Modes of Creative Writing (11 Hours)

Mechanics of Writing: Cohesion, Coherence, Style, Context, Register, Content; Aesthetic function of Writing; Rules for good writing; Things that must be avoided by a Writer; Literal and Figurative Use of Language; Active and Passive style of writing; Direct and Indirect Speech Styles; Personal and impersonal styles of writing; Formal and informal use of language

Module IV: Types of Creative Writing (13 Hours)

Writing a film / book review; Narrative or discursive essay / article; Poetry writing; Short story writing; Dramatic dialogue writing; Writing for the New Media; Poster writing; Advertisement; Newspaper article and editorial; Blogs; Writing for Radio and Television, Memoirs, Pamphlets, Life Writing.

Module V: Preparing for Publication (7 Hours)

Cover Letter Writing, Understanding Editorial Preferences and Submission Guidelines

Suggested Reading

1. Dev, Anjana Neira et al. Creative writing: A Beginner's Manual. Pearson, 2009
2. Everett, Nick. "Creative Writing and English." The Cambridge Quarterly. Vol. 34 ed.3 2.
3. Jones, Leo. Cambridge Advanced English: Student's Book. Cambridge University Press, 1991 3.
4. Palmer, A.J. Writing and Imagery- How to Deepen Your Creativity and Improve Your Writing. Aber Books, 2010
5. Seely, John. The Oxford Guide to Writing and Speaking. Oxford University Press. 1998.

Mapping of Cos to Modules

COs	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	M	M	M
CO 2	M	M	H	H	H
CO 3			H	H	H

EGSS105L: SOFT SKILLS

(3 Credits-45 hours) (L-T-P: 2-1-0)

Objective(s)

To help students develop effective communication and presentation skills and to enable them mastering interpersonal, team building and leadership skills.

Course/Learning Outcomes

At the end of the course students will be able to:
CO1: Outline the importance of soft-skills in personal and professional life. (Understanding)
CO2: Distinguish the different aspects of soft-skills and the do's and don'ts of grooming and etiquette. (Analysing)
CO3: Integrate the ideas pertaining to teamwork, leadership and adaptability to help in personality building at the workplace. (Applying)

Module I- Personality and Self: (15 Hours)
Introduction to soft skills; Dimensions and Determinants of personality; Positive self image and negative self image; Building self-esteem and confidence; Defining strengths; Personal values; creative thinking, communication skills-writing skills, speaking skills

Module II -Building a Social Image: (13 Hours)
Self-grooming; Body Language; Eye contact; Emotional Intelligence; Adaptability; Leadership; Teamwork; Problem solving, Time and stress management, Motivation and Persuasion

Module III -Communication and Team Building: (17 Hours)
Presentation Skills; Group Discussion; Small talk; Public speaking; Interview Skills; Preparation of CV; Business etiquettes; Corporate etiquette; Telephone etiquette; Social etiquette; Technical correspondence, Negotiation Skills

Suggested Readings
1. Chauhan, Gajendra S. Soft Skills: An Integrated Approach to Maximise Personality. Willey. 2015.
2. K., Alex. Soft Skills.S. Chand & Co. Ltd. 2008.
3. Mitra, Barun. Personality Development and Soft Skills. OUP. 2016.
4. Sharma, Prashant. Soft Skills: Personality Development for Life Success. BPB Publications. 2018. Butterfield, Jeff. Soft Skills for Everyone. Cengage Learning. 2011.

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO1	H	H	H
CO2	M	H	H
CO3	M	H	H

EGEP207L: EDITING AND PROOFREADING

(3 Credits-45 hours) (L-T-P: 2-1-0)

Objective(s)
This course will introduce the students with the basic skills related to the Editing and Proofreading industries and will train them with practical knowledge of the different components of these skills.

Course/Learning Outcomes
CO1: Understand different facets of the book-publishing industry and its related skills. (Understanding)
CO2: Analyse the essentials of copy editing and proofreading as skills with scopes of employability. (Analysing)
CO3: Develop practical knowledge of different components of copy editing and proofreading skills. (Creating)

Module I: Editing (15 Hours)
Basic idea of Editing and Copy editing; Copy-editing in the process of publishing; Role, responsibility and position of a copy editor; Fundamentals of copy editing; Ethics of copy editing; Liaison with other professionals; Essentials of a good copy-editor; Prospects of copy editing

Module II: Proof-reading (10 Hours)
Basic idea of proofreading; Proofreading in the process of publishing; Role and responsibility of a proofreader; Fundamentals of proofreading; Ethics of proofreading; Essentials of a good proofreader; Prospects of proofreading

Module III: Practical guidance and Style manuals (20 Hours)
Components of a book in print; Idea of style-manuals followed by publishers; Common copy-editing and proofreading symbols; Dos and Don'ts of grammar and punctuation; Idea of page-layout and software usage; Idea of cover designing , illustration and software usages; Idea of appendix making; Blurb-writing

Suggested Reading
1. Einsohn, Amy and Marilyn Schwartz. The Copy Editor's Handbook, University of California Press, 4th Edition, 2019
2. Butcher Judith, Caroline Drake, Maureen Leach. Butcher's Copy Editing South Asia Edition, Cambridge University Press, 4th Edition, 2007

3. Graves, Robert and Alan Hodge, The Reader Over Your Shoulder: A Handbook for Writers of English Prose, Rosetta Books, 2018
4. Clayton, Terry Erle, Beyond Spell Check, Red Plough International, 2019
5. Garner, Bryan A. The Chicago Guide to Grammar, Usage, and Punctuation, University of Chicago Press, 2016

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	M	M	H

INTERNSHIP

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	EGN106I	Internship	4	
4	Internship	EGIN208I	Internship	4	
5	Internship	EGIN309I	Internship	2	

EGN106I: EDITORIAL, JOURNALISM, COPYWRITING, REPORT WRITING, COMMUNICATION, PUBLISHING, TEACHING ETC.

(4 Credit- 120 hours)

Objective(s)

The objective of this internship is to make students acquainted with broader possible areas for employment after graduation, experience them and acquire skills necessary for them

Course/Learning Outcomes

CO 1: Understand possibility and availability of a broader area for professional development in corporate sectors like publication houses, coaching institutes, training centres, NGOs, INGOS, private and public offices etc. after graduation and create link with them (understanding)

CO 2: Develop bases for corporate professional skills through the course of the internship in the broader areas as stipulated above (creating)

Module 1: Theory (5 Hours)

- Background: meaning, definition of intern and internship
- Significance of internship for a graduate
- Ethics of internship: learning platform, commitment, honesty, objectivity, accountability, discipline, solidarity, competence, respect, responsibility, communication etc.
- Internship Journal Register and assessment parameters

Module 2: Practical (55 Hours)

- The students will be given freedom to choose internship places for the areas specified above. In case they cannot, the Department will forge them the places. There will be a faculty **Internship In-charge** to facilitate the process.
- After allocation, at their place of internship the students will maintain the **Internship Journal Register** (as a part of assessment) as per the template.

INTERNSHIP JOURNAL REGISTER

Name of the Student:
ID:
Department:
Semester:
Place of Internship:

Date	Day	Time in	Work Description	Time out	Sign of employer

- At the end of the internship, the place of internship will issue a certificate, as per the template; **confidential in a sealed envelope**. The Internship In-charge will communicate the internship places for it.

Name of the Institution

Ref: Date:

Performance Certificate

Certified that _____, from the **Department of English, Assam Don Bosco University**, has taken internship at this institution in _____ from _____ to _____.

His/Her performance during the course of the internship is **satisfying/moderately satisfying/highly satisfying**.

Seal and Signature

Assessment: It is mandatory for the students to get pass marks in all the following:

1.	Internship Journal Register		:	**30**
2.	Performance Certificate		:	**30**
	Satisfying	: *5*		
	Moderately satisfying	: *10*		
	Highly satisfying	: *15*		
3.	Presentation (**to a panel**)		:	**40**
	Report (hard copy)	: *20*		
	Presentation (PPT)	: *10*		
	Interaction	: *10*		
	Total:			**100**

Mapping of COs to Modules

COs	Module I	Module II
CO 1	H	
CO 2		H

EGIN208I: EDITORIAL, JOURNALISM, COPYWRITING, REPORT WRITING, COMMUNICATION, PUBLISHING, TEACHING ETC.

(4 Credit- 120 hours)

Objective(s)

The objective of this internship is to make students acquainted with broader possible areas for employment after graduation, experience them and acquire skills necessary for them

Course/Learning Outcomes

CO1: Understand possibility and availability of a broader area for professional development in corporate sectors like publication houses, coaching institutes, training centres, NGOs, INGOS, private and public offices etc. after graduation and create link with them (understanding)

CO2: Develop bases for corporate professional skills through the course of the internship in the broader areas as stipulated above (creating)

Module 1: Theory (5 Hours)

- Background: meaning, definition of intern and internship
- Significance of internship for a graduate
- Ethics of internship: learning platform, commitment, honesty, objectivity, accountability, discipline, solidarity, competence, respect, responsibility, communication etc.

- Internship Journal Register and assessment parameters

Module 2: Practical (55 Hours)

- The students will be given freedom to choose internship places for the areas specified above. In case they cannot, the Department will forge them the places. There will be a faculty **Internship In-charge** to facilitate the process.
- After allocation, at their place of internship the students will maintain the **Internship Journal Register** (as a part of assessment) as per the template.

INTERNSHIP JOURNAL REGISTER
Name of the Student:
ID:
Department:
Semester:
Place of Internship:

Date	Day	Time in	Work Description	Time out	Sign of employer

- At the end of the internship, the place of internship will issue a certificate, as per the template; confidential in a sealed envelope. The Internship In-charge will communicate the internship places for it.

Name of the Institution

Ref: Date:

Performance Certificate

Certified that _____, from the **Department of English, Assam Don Bosco University**, has taken internship at this institution in _____from_____to _____.
His/Her performance during the course of the internship is **satisfying/moderately satisfying/highly satisfying**.

Seal and Signature

Assessment: It is mandatory for the students to get pass marks in all the following:

4.	Internship Journal Register			:	**30**
5.	Performance Certificate			:	**30**
	Satisfying	:	*5*		
	Moderately satisfying	:	*10*		
	Highly satisfying	:	*15*		
6.	Presentation (**to a panel**)			:	**40**
	Report (hard copy)	:	*20*		
	Presentation (PPT)	:	*10*		
	Interaction	:	*10*		
	Total:				**100**

Mapping of COs to Modules

COs	Module I	Module II
CO 1	H	
CO 2		H

EGIN309I: EDITORIAL, JOURNALISM, COPYWRITING, REPORT WRITING, COMMUNICATION, PUBLISHING, TEACHING ETC.
(2 Credit- 60 hours)

Objective(s)

The objective of this internship is to make students acquainted with broader possible areas for employment after graduation, experience them and acquire skills necessary for them

Course/Learning Outcomes

CO1: Understand possibility and availability of a broader area for professional development in corporate sectors like publication houses, coaching institutes, training centres, NGOs, INGOS, private and public offices etc. after graduation and create link with them (understanding)

CO2: Develop bases for corporate professional skills through the course of the internship in the broader areas as stipulated above (creating)

Module 1: Theory (5 Hours)

- Background: meaning, definition of intern and internship
- Significance of internship for a graduate
- Ethics of internship: learning platform, commitment, honesty, objectivity, accountability, discipline, solidarity, competence, respect, responsibility, communication etc.
- Internship Journal Register and assessment parameters

Module 2: Practical (25 Hours)

- The students will be given freedom to choose internship places for the areas specified above. In case they cannot, the Department will forge them the places. There will be a faculty Internship In-charge to facilitate the process.
- After allocation, at their place of internship the students will maintain the Internship Journal Register (as a part of assessment) as per the template.

INTERNSHIP JOURNAL REGISTER

Name of the Student:

ID:

Department:

Semester:

Place of Internship:

Date	Day	Time in	Work Description	Time out	Sign of employer

- At the end of the internship, the place of internship will issue a certificate, as per the template; **confidential in a sealed envelope**. The Internship In-charge will communicate the internship places for it.

Name of the Institution

Ref: Date:

Performance Certificate

Certified that _____, from the **Department of English, Assam Don Bosco University**, has taken internship at this institution in _____from_____to _____.

His/Her performance during the course of the internship is **satisfying/moderately satisfying/highly satisfying**.

Seal and Signature

Assessment: It is mandatory for the students to get pass marks in all the following:

7. Internship Journal Register : **30**
8. Performance Certificate : **30**
   - *Satisfying* : *5*
   - *Moderately satisfying* : *10*
   - *Highly satisfying* : *15*
9. Presentation (**to a panel**) : **40**
   - *Report (hard copy)* : *20*
   - *Presentation (PPT)* : *10*

Interaction : 10

Total: 100

Mapping of COs to Modules

COs	Module I	Module II
CO1	H	
CO2		H

RESEARCH PROJECT /DISSERTATION

BA ENGLISH (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	EGDI407P	Research Project Phase I	6
8	Research Project/Dissertation	EGDI408P	Research Project Phase II	6
BA ENGLISH (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	EGDI409P	Dissertation I	18
8	Research Project/Dissertation	EGDI410P	Dissertation II	20

BA ENGLISH (Honours)

ENDI407P: RESEARCH PROJECT PHASE I

(6 credits – 180 hours) (L-T-P: 0-0-12)

In this project (Phase I and II), students will write a **research paper**. This project aims at orienting and training students under a teacher supervisor in the literary research for exploring knowledge yet not discovered or critique the existing knowledge for innovation. This is also an exercise on developing critical faculty of the young minds in organizing, anlaysing, applying, objectifying, elucidating and creating novel ideas through enquiry that adds to the body of knowledge around literary studies. Here students are expected to set and qualify for the following components: **1) clear and researchable topic, 2) undergo a literature review with critical rigor, 3) set aims and objectives, 4) problematize the topic, 5) frame research questions, 6) adopt a functional methodology, 7) analyze texts/area under enquiry and 8) and draw a innovative objective conclusion** so as to make the paper publishable in referred/indexed journals. However, in this phase as Phase I, the students will complete only the **first four** components. The student will submit a hardcopy to the supervisors and the same will be assessed for qualification on the strength of the four components.

ENDI408P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-12)

The project phase II begins with the assumption that the students have qualified themselves in the initial phase of the research, the first four components. Under the supervisorship of a teacher, the students in this phase are expected to complete the other components of the research paper. This phase thus will combine both the phases and the students will complete the research paper with around 15 pages (approx 7000 words) and submit a hard copy to the supervisors in a prescribed template along with a plagiarism report with not more than 10% similarity index. As a part of its assessment, the paper will be judged on the strength of the components and the students have to pass the same for qualification of the degree BA English (Honours).

BA ENGLISH (Honours) with Research

ENDI409P: DISSERTATION I

(18 Credits -540 Hours) (L-T-P: 0-0-36)

This course aims at orienting and training students under a teacher supervisor in writing a dissertation for exploring knowledge yet not discovered or critique the existing knowledge for innovation. This is also an exercise on developing critical faculty of the young minds in organizing, anlaysing, applying, objectifying, elucidating and creating novel ideas through enquiry that adds to the body of knowledge around literary studies. In this phase of the dissertation, students are expected to set clear and **researchable topics, aims and objectives, undergo a literature review with critical rigor, problematize the topic, frame research questions, adopt a functional methodology , work on probable chapterization and assume probable outcomes**, or in

short attempt a dissertation proposal to be expanded in the Dissertation Phase II. The student will submit a hardcopy in a prescribed template to the supervisors and the same will be assessed for qualification on the above criteria for developing the critical faculty. There will be no viva-voce/interview in this phase as a part of the assessment.

ENDI410P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

The Dissertation II begins with the assumption that the students have qualified themselves in the initial phase, in terms of the proposal. Under the supervisorship of a teacher, the students in this phase are expected to develop the chapters with clearly set aims and objectives, analysis and come out with clear findings in tune with the aims and objectives set in the proposal in the Phase I. This phase thus will combine both the phases and the students will complete the dissertation with around 30 pages and submit the same in hardcopy in a prescribed template along with a plagiarism report not more than 10% similarity index. As a part of its assessment, the students will have to phase a viva-voce from an expert panel and pass the same for qualification of the degree BA English (Honours) with Research.

DEPARTMENT OF MASS COMMUNICATION

PROGRAMME: BACHELOR OF ARTS in MASS COMMUNICATION (BA)
DEGREE: BA MASS COMMUNICATION (HONOURS)/ BA ENGLISH (HONOURS) WITH RESEARCH

VISION:
To be a centre of excellence in teaching, learning and research committed to mould ethical and socially responsible media professionals and entrepreneurs who can deliver professional content for diverse media platforms.

MISSION:
The Department of Mass Communication seeks to:
1. Achieve excellence in teaching, learning and research.
2. Promote critical thinking and problem-solving skills.
3. Equip learners by combining the theoretical aspects with creative innovation and entrepreneurship practices.
4. Mould ethical and socially responsible media professionals and entrepreneurs.
5. Provide knowledge base and consultancy services to the community in the field of media and communication.

PROGRAM OUTCOMES
PO 1: **Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO 2: **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
PO 3: **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO 4: **Effective Citizenship**: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO 5: **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO 6: **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.
PO 7: **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PROGRAMME SPECIFIC OUTCOMES
PSO 1: **Knowledge of Communication**: An ability to define and identify the various fields of mass communication.
PSO 2: **Developing Critical Understanding**: An ability to understand the theories and practices of communication that prepares learners for future careers in mass media or for further studies.
PSO 3: **Developing Technical Skills:** An ability to apply media technology skills as well hone written and spoken communication skills essential for various media platforms.
PSO 4: **Enhancing Professional Skills:** An ability to analyze and assess responsibilities as professionals in the field of media.
PSO 5: **Creating Multimedia Content:** An ability to create media programmes for varied media audience needs.

MAPPING OF COURSES TO PO/PSOs

SL.	Name of Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
1	Introduction to Media and Communication	H	L	L	M	L		M	H	H	M	M	M
2	Introduction to Journalism	H	H	H	M	H	L	M	M	M	H	H	H
3	Professional Communication	L	H	H	H	M	L	H	L	L	H	M	M
4	History of Media	H	H		M	L		L	H	M	M	M	M
5	Visual Communication	H	H	M	M	M		H	H	M	H	M	H
6	Graphic Design	M	H	H	M	M		H	H	H	H	M	H
7	Community Media and Society	H	H	H	H	M	M	H	M	H	H	H	H
8	Introduction to Video Production	M	H	H	M	H	L	H	H	H	H	H	H
9	Public Relations and Corporate Communications	H	H	H	M	H	L	H	H	H	M	H	M
10	Introduction to New Media	M	H	H	L	H		M	H	M	H	M	H

11	Media, Culture and Society	H	M	M	M	M	L	M	H	M	H	M	M
12	Radio Production	M	H	H	H	M	L	L	H	H	H	H	H
13	Data Journalism	H	H	M	H	H	M	H	H	H	H	H	M
14	Advertising	H	H	H	M	M	L	L	H	H	H	M	M
15	Development Communication	H	H	H	H	M	M	M	M	M	H	M	H
16	Media Laws and Ethics	M	M	M	H	H	H	H	H	L	H	H	L
17	News Reading and Anchoring	H	H	H	H	H	H	H	H	H	H	M	H
18	Folk Media	M	H	H	H	H	M	L	H	M	L	M	L
19	Writing for Media	H	H	M	M	H	L	M	H	H	H	M	L
20	Introduction to Research	H	H	H	M	H	M	H	M	H	H	H	M
21	Communication for Social Behavioural Change	H	H	H	H	H	M	M	H	H	M	H	M
22	Media Management and Entrepreneurship	H	H	M	H	M	M	H	H	H	H	H	L
23	Digital Photography	M	H	M		L		H	H	H	H	H	H
24	Communication and Disaster Management	M	H	H	H	H	H	M	H	H	H	H	M
25	Animation and VFX	H	H	H	M	L		H	H	H	H	H	H
26	Global Media and Politics	H	L	M	H	H	L	L	H	H	L	M	M
27	Film Studies	H	M	L		M		H	H	H	H	H	M
28	Documentary Production	H	H	H	M	M		H	H	H	H	H	H
29	Media in North East India	H	H	H	H	H	H	H	M	H	H	H	H
30	Media Project	H	H	H	H	H	H	H	L	L	H	H	H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	MCIM100T	Introduction to Media and Communication	4
2	Major Course 2	MCIJ101T	Introduction to Journalism	4
3	Major Course 3	MCVC200T	Visual Communication	4
3	Major Course 4	MCAD201T	Advertising	4
4	Major Course 5	MCIV202T	Introduction to Video Production	5
4	Major Course 6	MCPR203T	Public Relations and Corporate Communications	5
4	Major Course 7	MCML204T	Media Laws and Ethics	4
5	Major Course 8	MCDC300T	Development Communication	5
5	Major Course 9	MCDP301T	Digital Photography	5
5	Major Course 10	MCAV302T	Animation and VFX	4
6	Major Course 11	MCFS303T	Film Studies	4
6	Major Course 12	MCMS304T	Community Media and Society	4
6	Major Course 13	MCMS305T	Media, Culture and Society	4
6	Major Course 14	MCMP306P	Media Project	4
7	Major Course 15	MCGM400T	Global Media and Politics	5
7	Major Course 16	MCMM401T	Media Management and Entrepreneurship	5
8	Major Course 17	MCMN402T	Media in North East India	5
8	Major Course 18	MCDJ403T	Data Journalism	5

MCIM100T: INTRODUCTION TO MEDIA AND COMMUNICATION
(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective:
The objective of the course is to learn the key concepts in communication and mass communication in order to evaluate communication in its many forms and investigate its relationship to society and culture.

Course Outcomes:
At the end of this course students will be able to:
CO 1: Define the basic terms related to Communication (Remembering)
CO 2: Classify different types and models of communication (Understanding)
CO 3: Analysis effects of media on society (Evaluating)

Module I: Media and Everyday Life (12 hours)
Television, Print, Radio, Advertisement, Digital media, The internet – discussion around media and everyday life, Discussions around mediated and non-mediated communication.

Module II: Communication and Mass Communication (13 hours)
Forms of communication, Levels of communication, Mass communication and its process, Normative theories of the Press, Gatekeeping theory, Media and the public sphere.

Module III: Four Models of Communication (15 hours)
Aristotle's Model, SMCR Model, Harold Lasswell's Model, Shannon and Weaver's Model, David Berlo's Model

Module IV: Mass Communication and Effects Paradigm (20 hours)
Direct effects – propaganda and mass society theory, Limited effects – individual difference theory and personal influence theory, Cultural effects – agenda setting; spiral of silence; cultivation analysis, Uses and gratification theory, Critique of the effect's paradigm and emergence of alternative paradigm, Reception theory.

Suggested Readings
1. Cell Phone Nation: How Mobile Phones Have Revolutionized Business, Politics and Ordinary Life in India, Robin Jeffrey, 2013, Hachette
2. Handbook of Journalism and Mass Communication, Virbabla Aggarwal, 2012, Concept Publishing Company
3. Introduction to Communication Studies, John Fiske, 2010, Routledge
4. Mass Communication in India, Keval J. Kumar, 2020, Jaico Publishing House
5. Mass Communication Theory, Indian Edition, Baran and Davis, 2006, SouthWest Coengate Learning
6. Mass Communication Theory, McQuail Dennis, Sage Publications

7. The Indian Media Business, Fourth Edition, Vanita Kohli-Khandekar, 2017, Sage Publications India
8. Understanding Media Theory, Kevin Williams, 2017, Bloomsbury Academic India

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	L	H	L	M
CO2		L	H	
CO3	L	M		H

MCIJ101T: INTRODUCTION TO JOURNALISM

(4 Credits – 60 hours) (L-T-P: 2-0-2)

Objective:

The primary objective of this course is to offer a comprehensive exploration into the concepts, principles, and practices of journalism, enabling students to gain a profound understanding of the field.

Course Outcomes:

At the end of this course students will be able to:

CO 1: Define the concepts, meanings and functions of journalism (Remembering)
CO 2: Discuss the meaning and functions of news (Understanding)
CO 3: Use the tools and techniques of journalism for writing and producing news stories (Apply).

Module 1: Understanding Journalism (20 hours)

Meaning and Definition of Journalism, Growth of Journalism, Type of Journalism, Functions of journalism, Difference between print, electronic and online journalism, citizen journalism, media role in democracy, public sphere, journalism ethics.

Module 2: Understanding News (20 hours)

Meaning and definition of news, nature, elements of news, sources of news, process: from the event to the reader, Hard news vs. Soft news, basic components of a news story, Attribution, embargo, verification, balance and fairness, brevity, dateline, credit line, by-line.

Module 3: News Structure and Writing Techniques (20 hours)

Types of reporting: Objective, Interpretative and Investigative, Organising a news story, Robert Gunning: Principles of clear writing, Principles of Writing: 5W's and 1H, Inverted pyramid, criteria for newsworthiness, principles of news selection, use of archives, Types of Writing: News, Feature, Interview, Column, Editorial, Review, Letter to Editor.

Suggested Readings

1. An Introduction to Journalism, Carole Flemming and Emma Hemingway, 2006, Vistaar Publications
2. Modern Journalism and news writing, Sativa Chadda, 1998, Popular Prakashan
3. Mass Media in a Changing World, George Rodmann, 2007, McGraw Hill Publication
4. News writing and reporting for today's media, Itule D. Bruce and Douglas A. Anderson, 2002, McGraw Hill Publication
5. News writer's Handbook: An Introduction to Journalism, M.L. Stein, Susan Paterno and R. Christopher Burnett, 2006, Blackwell Publishing
6. The Newspaper's Handbook, Richard Keeble, 2006, Routledge Publication.
7. The Journalistic Hand Book, M.V Srivastava, Sterling Publishers

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H	M	
CO2		H	H
CO3		H	H

MCVC200T: VISUAL COMMUNICATION

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective

The main objective of the paper is to make students understand the various means of communication, both oral and visual. It will also make students knowledge about the filed of editing and designing using various fonts, typography and printing. It will also make student knowledge about the importance of sign and symbols, its uses and importance.

Course/Learning Outcomes:

CO 1: Define and analyse the concepts and theories of visual communication (Remembering)

CO 2: Illustrate the fundamentals of design (Understanding)
CO 3: Apply the knowledge of the elements and principles of design to solve real world design problems (Applying)
CO 4: Analyse the various design requirements for various purposes (Analyse)
CO 5: Evaluate how specific visual arts and design convey meaning (Evaluating)
CO 6: Create and compose artistic ideas and works of art with internal and external meaning (Creating)

Module 1: Introduction to Visual Communication (10 Lectures)
Visual communication - Definition; nature and functions, Characteristics and types of visual communication, Advantages and disadvantages, Techniques of visual communication.

Module 2: Design (10 Lectures)
Graphic design, Digital design, Graphic design Vs. Digital design, Typography - Fonts and typefaces, Computer configuration, Scanner, Printer, Paper size - type and quality, Formats and Resolution, Raster vs. Vector images

Module 3: Fundamentals of Design (15 Lectures)
Gestalt theory, Definition, approaches and centrality of design, Elements of Design – symmetry; rhythm; contrast; balance; mass and scale, Perception, Illusions.

Module 4: Principles of Visual Communication (15 Lectures)
Principles of Visual Communication; Colour psychology and theory, Semiotics, Sign and code, Index and symbol, Dyadic and triadic model of sign, Types of code, Branches of semiotics, Denotation, Connotation and Myth.

Suggested Readings

1. Digital Graphic Design, K.R. Pender, 1997, Butterworth-Heinemann
2. Designing for Print, C. Conover, 2011, John Wiley and Sons
3. Good: An Introduction to Ethics in Graphic Design, L. Roberts, 2006, Ava Publishing
4. Graphic design basics, A. E. Arntson, 2011, Cengage Learning
5. Lateral Thinking: Creativity Step by Step, Edward De Bono, Harper and Row Publishers
6. Manual of Graphic Technique 2: For Architects, Graphic Designers, and Artists, Tom Porter and Sue Goodman, Astragal Books
7. Reading images: The grammar of visual design, G. R. Kress and T. Van Leeuwen, 1996, Psychology Press
8. Palmer, Frederic. Visual Elements of Art and Design, 1989, Longman
9. Seeing Is Believing: An Introduction to Visual Communication, A.A. Berger, 1989, Mayfield Publishing Company
10. The Complete Guide to Digital Graphic design, B. Gordon and M. Gordon, 2002, Watson-Guptill Publications
11. Visual Communications: Images with Messages, E. Lester, 1998, Thomson Learning

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	H
CO 4			H	H
CO 5				H
CO 6			H	H

MCAD201T: ADVERTISING

(4 Credit-60 Hours) (L-T-P: 4-0-0)

Objective(s):
The objective of the course is to learn the concepts of advertising and its classification and functions and trace the evolution of branding and understand the concept and characteristics of brands.

Course Outcomes
CO 1: Define the basic terms related to advertising. (Remembering)
CO 2: Demonstrate the scope, functioning of advertising (Understanding)
CO 3: Apply the knowledge of Branding & Planning. (Applying)

Module I: Introduction to Advertising (15 Hours)

Advertising – concept; classification and functions, Media of advertising, Advertising as a key element in the promotional mix of marketing, Evolution of advertising – World and India, Difference between advertising and publicity, Marketing communication and propaganda

Module II: Theoretical Aspects of Advertising (15 Hours)
Geographical Spread, Target Group, Public awareness advertising, Product advertising, Service advertising, Corporate advertising, Public relations advertising, Financial advertising, Global advertising, Political advertising, Stimulus response theory, Starch model, FLIRT model, AIDA, AIDCA, DAGMAR approach, Aspects of Consumer Behaviour - Analysing Human Behaviour; Market Segmentation

Module III: Brand Management & Strategic Planning (15 Hours)
Evolution of branding, Concept of a brand, Characteristics of brands, The Importance of brand planning Understanding brand management, Theories and models in brand management, Brand Prism Model, Perceptual Mapping, Brand Name Spectrum, Brand Positioning, Brand Benefits, Consumer Benefits, Brand Matrix and Media Matrix, Introduction to Strategic Planning and Client Servicing

Module IV: Practicum (15 Hours)
Advertising Campaign Development, Market Research, Target Audience Analysis, Campaign Strategy Development, Message Creation, Media Selection, Budgeting, Designing Advertisements: Print Advertising, Storyboarding for TV Commercials, Digital Advertising, Visual and Textual Content Creation, Brand Audit and Analysis, Case Study Analysis, Strategic Planning and Client Servicing Simulation: Strategic Planning in Advertising, Client Servicing in Advertising Agencies, Developing Strategic Advertising Plans, Client Communication and Feedback

Suggested Readings:
1. Jethwaney, Jaishri and Jain, Shruti (2012). *Advertising Management*.
2. Ogilvy, David. *Ogilvy on Advertising*, Prion.
3. Dennison, Dell. *The Advertising Handbook*, Jaico Books
4. Vilanilam J. V & Verghese A.K. *Advertising Basics*, Sage Publications, India
5. Clifton Rita & John Simmons. *Brands and Branding*, Profile Books Ltd. UK.

Mapping of Cos to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2	H	H	H	H
CO3		H		H

MCIV202T: INTRODUCTION TO VIDEO PRODUCTION
5 Credits: (75 HOURS) (L-T-P: 3-2-0)

Objective
The objective of this paper is to make the students clear and handy in camera shooting and editing, using various softwares and camera equipments. Students will have more knowledge in writing and sound editing. The students will also be aware of various news broadcasting and genres, news elements and various camera shots too.
Besides learning the techniques of television production, students will also learn to be proficient in the use of video editing software. At the end of the course, students will prepare a short television production/news reading/PSA etc, which will be submitted as a requirement for the completion of the course.

Course/Learning Outcomes:
CO 1: Define the meaning and concept of broadcast media (Remembering)
CO 2: Understand the principles and techniques of broadcast media (Understanding)
CO 3: Demonstrate competency in shooting and editing video (Applying)
CO 4: Critique the issues and debates in news broadcasting and production (Analysing)
CO 5: Produce content for broadcast media (Creating)

Module 1: Basics of Visual Images (10 Lectures)
What is an image, electronic image, television image - Digital image, Editing images, What is a visual? (Still to moving) - Visual Culture - Changing images if visual - Characteristics of Television as a medium.

Module 2: Basics of Sound (15 Lectures)
Concepts of sound-scape, sound culture - Types of sound-Sync, Non-Sync, Natural sound, Ambience Sound - Sound recording

techniques - Introduction to microphones - Characteristics of Radio as a medium – Introduction to Audio Production.

Module 3: Writing and Editing Radio News (10 Lectures)
Elements of a Radio News Story: Gathering, Writing/Reporting - Elements of a Radio News Bulletin - Working in a Radio Newsroom - Introduction to Recording and Editing sound.

Module 4: Writing and Editing Television News (15 Lectures)
Basics of a Camera- (Lens & accessories) – Types of Shots - Electronic News Gathering (ENG) & Electronic Field Production (EFP) - Visual Grammar – Camera Movement, Types of Shots, Focusing, Visual Perspective. Elements of a Television News Story: Gathering, Writing/Reporting. Elements of a Television News Bulletins - Basics of Editing for TV.

Module 5: Broadcast News (10 Lectures)
Critical Issues and Debates - Public Service Broadcasters - AIR and DD News - Voice of India? (Analysis of News on National Broadcasters) Changing Character of Television News (24 -hrs news format, News Production cycle, News 'Lingo', News 'Formulae'? News as Event, Performance and Construction.

Suggested Readings:

1. Broadcast News Writing, Reporting and Producing, 7th Edition, Frank Barnas, 2017, Routledge
2. Broadcasting in India, P.C Chatterjee, 1987, Sage Publications
3. Broadcast Journalism, 1st Edition, S C Bhatt, 2007, Har-Anand Publications
4. Broadcast Journalism: Techniques of Radio and Television News, 7th Edition, Ray Alexander and Peter Stewart, 2016
5. The Radio Handbook, Routledge, by Carrol Fleming, 2002
6. The Indian Media Business, Vanita Kohli-Khandekar, 2017, Sage Publications
7. Television Production and Broadcast Journalism, Philip L. Harris, 2011
8. Television Production Handbook, 12th Edition, Zettl Herbert, 2014, Wadsworth Publishing Co Inc
9. The Television Reader, and Routledge, Robert C Allen and Annette Hill, 2004, 10-40
10. Documentary- 'The future of Television News.'

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H			H
CO2	H	H		H	
CO3	H				
CO4			H		
CO5	M	M	M	M	M

TELEVISION PRODUCTION

Credits: 2 (0-0-2)

Description
Students will acquire introductory skills and knowledge about the art of television production. They will learn to comfortably handle digital video cameras as well as apply the techniques of camera movements and camera angles. They will also learn pre-production, production and post-production techniques. Besides learning the techniques of television production, students will also learn to be proficient in the use of a video editing software. At the end of the course, students will prepare a short television production which will be submitted as a requirement for the completion of the course.

Suggested Assignments:
Public Service Advertisement (PSA), Commercial Advertisement, Talk shows, News Bytes, Music Video, Television Interviews, Shortfilms and documentaries.

MCPR203T: PUBLIC RELATIONS & CORPORATE COMMUNICATION

(5 credit: 75 Hours) (L-T-P: 5-0-0)

Objective(s):
The objective of the course is to understand the concept and genesis of public relation, corporate communication and learn the techniques for effective public relations & corporate communication.

Course Outcomes:
CO 1: Trace the evolution of Public relations & Corporate Communication (Remembering)
CO 2: Discuss the concept and tools of Public relations & Corporate Communication (Understanding)
CO 3: Apply the concepts, principles and tools of Public relations & Corporate Communication (Applying)

Module 1: Public Relations-Concepts and practices (15 lectures)
Introduction to Public Relations, Growth and development of PR, Importance, Role and Functions of PR, Principles and Tools of Public relations, Organisation of Public relations: In-house department vs consultancy, PR in govt. and Private Sectors, Govt's Print, Electronic, Publicity, Film and Related Media Organizations.

Module 2: PR-Publics and campaigns (10 lectures)
Research for PR, Managing promotions and functions, PR Campaign-planning, execution, evaluation, Role of PR in Crisis management, Ethical issues in PR-Apex bodies in PR- IPRA code - PRSI, PSPF and their codes.

Module 3: Corporate Communication (20 lectures)
Definitions, concept and genesis, CC and public affairs, Publics in CC-Financial publics, media, opinion makers, government, elected representatives, Present state of CC, Organising corporate communication activities, Areas of strategic thinking in corporate communication Ethics and laws in corporate communication Lobbying, Sponsorship, Financial communication, Corporate reputation. Corporate Social Responsibility- its importance, CSR focus areas and practices: environmental conservation, energy conservation, disaster management, workplace health and safety, consumer rights advocacy, community development.

Module 4: Practicum (15 lectures)
Public Relations Practice: Develop a PR strategy., Create a press release., PR crisis situation and devise a response plan, PR Campaign Planning and Execution: PR Campaign Planning, Execution Strategies, Evaluation Techniques, Corporate Communication (CC) Strategies, Public Affairs, Financial Communication Develop CSR project proposal, Communication plan to promote the CSR initiative.

Suggested Readings

1. Effective Public Relations and Media Strategy, 3rd Edition, Reddi C.V. N, 2013, PHI Learning Pvt Ltd
2. Handbook of Public Relations, Heath Robert L, 2000, Sage Publications.
3. Public Relation Techniques, Jefkins Frank, 1994, Heinmann Ltd
4. Public Relations Strategies & Tactics, Wilcox, 2009, Pearson Education
5. Communication in Organisations, Fisher, D., 1999, Jaico Publishing House
6. Corporate Communication: Principles and Practice, Jaishri Jethwaney, 2018, Sage Publications
7. Crisis Communication Strategies: How to Prepare in Advance, Respond Effectively and Recover in Full, 1st Edition, Amanda Coleman, 2020, Kogan Page

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2	H	H	H	H
CO3				H

MCML204T: MEDIA LAWS AND ETHICS
Credits: 4 (2-0-2)

Objectives:
By the end of this course on Media Laws and Ethics, students will be able to understand and apply legal and ethical frameworks that govern media practices, ensuring responsible and ethical decision-making in media-related professions.

Course Outcomes:
CO 1: Discuss media laws and ethics in India and global context (Remembering)
CO 2: List the salient features of the Indian Constitution in relation to the media (Understanding)
CO 3: Demonstrate an understanding of the nature of ethics and morality in journalism (Applying)
CO 4: Critique the ethical issues of the media (Analyzing)

Module 1: Introduction to Indian Constitution (10 Lectures)
Preamble-Salient Features, Fundamental Rights and Duties, Features of Article 19 (1A) and 19 (2), Directive Principles of State Policy, Indian Judiciary and Parliamentary System, Press as fourth estate of democracy.

Module 2: Media Laws (15 Lectures)
Freedom of Press and Reasonable Restriction, Defamation, Contempt of Court, Sedition and Obscenity, Emergence of

Censorship, Vernacular Press Act, Right to Information Act, IT Act and Cyber Law 2000, Restrictions on Media, Official Secrets Act, Judiciary and Contempt of Court, Legislature and its Privileges, IPC and Cr. PC, Censorship and its different forms- Right to Privacy, Laws related to Press & Broadcast Media, Copyright Act: Main features, issues, Books and Newspapers Registration Act, Working Journalists Act, Press Council Act and Role of PCI.

Module 3: Digital Laws (10 Lectures)
Cable TV Network Regulation Act, Cinematography Act, Prasar Bharti Act, Digitization and Conditional Access System (CAS), Cyber laws: The need for cyber laws**,** Cyber preparedness across the globe**,** Regulatory authorities and framework**,** New IT Rules 2021.

Module 4: Media and Ethical Principles (15 Lectures)
Importance of Media Ethics, Fairness and Objectivity, Code of Ethics in Advertising and Films**,** Rationale and Evolution of Journalistic Ethics**,** Journalistic Values: Concept, Importance and Debates, Journalists' Code of Conduct**,** Resolving Ethical Dilemmas, Media Regulation**,** Regulatory practices in developed democracies, Debates and Controversies related to Media Regulation, Regulation of Broadcast, Press and Web, Different forms of Regulation: State Regulation, Self-Regulation, Co-Regulation, Press Ombudsman: Readers' Editor.

Module 5: Media Organisations (10 Lectures)
International Bodies: International Press Institute, Role of UNESCO, SAFMA, Press Council, TRAI, BRAI, IBF, CBFC, INS, Editors Guild, IFWJ, IJA, NUJ, IUJ, NBA, BEA, Trade Union Rights in Media.

Suggested Readings:

1. Constitution of India, I.S. Vidyasagar, 2006, ABD Publishers
2. Freedom of Press: Under the Indian Constitution, BR Sharma, 1993, Deep and Deep publications
3. Introduction to the Constitution of India, D.D. Basu, 2004, Prentice-Hall of India.
4. Good News, Bad News: Journalism Ethics and the Public Interest, Jeremy Iggers, 1998, Oxford University Press
5. Indian Journalism: Keeping It Clean, Alok Mehta, 2007, Rupa
6. Media Ethics: Truth, Fairness and Objectivity, Paranjoy Guha Thakurta, 2011, OUP
7. Manna, B. (2006). Mass Media and Related Laws in India. Academic Publishers.
8. A Compendium of Codes of Conduct for Media Professionals, Prabhakar, M. et. al., 1999, University Book House.
9. Introduction to the Constitution of India, Durga Das Basu, 1966, SC Sarkar & Sons Pvt Ltd, Calcutta
10. Press Laws and Media Ethics, Anil K. Dixit, 2006, Reference Press
11. Principles and Ethics of Journalism and Mass Communication, YK D'souza, 1998, Publishers, New Delhi
12. The Muzzled Press, KS Padhy, 1994, Kanishka Publishers
13. The International Libel Handbook: A Practical Guide for Journalists, Ed. Nick Braith Waite, 1995, Butterworth-Heinemann Ltd

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	
CO2	H				
CO3				H	
CO4				H	
CO5					

MCDC300T: DEVELOPMENT COMMUNICATION

(5 Credits – 75 hours) (L-T-P: 5-0-0)

Objective:
The objective of the course is to learn the theoretical overview of the concept of the development and how it relates to the empirical experience in developing countries. It would further explore development communication theories and approaches with relation to media forms ranging from traditional to new media.

Course Outcomes:
At the end of this course students will be able to:
CO 1: Explain the concepts and theories of development and social change (Understanding)
CO 2: Identify the linkages between development, media, and communication (Applying)
CO 3: Examine the role of the media in fostering social change (Analyse)
CO 4: Plan media programmes for development interventions (Creating)

Module 1: Development: Concept, Concerns, Paradigms (15 hours)

Concept of development, Measurement of development, Development versus growth, Human development, Models of development - Basic Needs Model; Gandhian Model, Panchayati Raj, Developing countries versus developed countries, UN Millennium Development Goals.

Module 2: Development Communication (20 hours)
Concept and approaches, Paradigms of development - dominant paradigm; dependency paradigm; alternative paradigm, Development communication approaches, Alternative development communication approaches, Development support communication, Area woods triangle, Social and Behaviour Change Communication.

Module 3: Role of Media in Development (20 hours)
Mass Media as a tool for development, Performance record of each medium- print; radio; television; traditional media, Role of development agencies and NGOs, Critical appraisal of development communication programmes and government schemes- SITE; Krishi Darshan; Kheda; Jhabua; MNREGA, ICT and development- e-governance; e-chaupal; national knowledge network; Development support communication in India in the areas of agriculture; health & family welfare, population; women empowerment; poverty; unemployment; literacy; consumer awareness, Right to Information.

Module 4: Practicing Development Communication (20 hours)
Strategies for designing messages for print; community radio; television programmes for rural India, New media technologies for development, Development Journalism, Use of traditional media for development, Critical appraisal of mainstream media's reportage on rural problems and issues.

Suggested Readings:

1. Rogers, E.M. (1976). *Communication and development : critical perspectives*. Sage Publications.
2. Melkote, S. R., & Steeves, H. L. (2015). *Communication for development : theory and practice for empowerment and social justice* (3rd edition.). SAGE.
3. Murthy, D. V. R. (2009). *Development Journalism: What Next?* Kanishka Publishing House.
4. Narula, U. (2019). *Development Communication-Theory and Practice*. HAR-ANAND PUBLICATION PVT LTD (REVISED EDITION).
5. Scott, M. (2014). *Media and development*. Zed Books.
6. Schramm, W. (1964). *Mass Media and National Development: The Role of Information in the Developing Countries*. Stanford University Press.
7. Ghosh, R., & Pramanik, A. K. (Eds.). (1999). *Panchayat system in India : historical, constitutional, and financial analysis.* New Delhi : Kanishka Publishers.
8. Mathur, K. (2013). *Oxford India Short Introductions Panchayati Raj*. Oxford University Press India.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H	H		
CO2		M	H	
CO3			H	M
CO4				H

MCDP301T: DIGITAL PHOTOGRAPHY

(5 Credits – 75 hours) (L-T-P: 2-1-2)

Objective:
The objective of the course is to learn the techniques and concepts of photography and enable the students to use the still image as an important tool of communication.

Course Outcomes:
At the end of this course students will be able to:

CO 1: Summarize the origin and development of photography. (Understanding)
CO 2: Identify the vital functions of a digital camera. (Applying)
CO 3: Experiment with lighting and composition techniques. (Applying)
CO 4: Develop a photography portfolio and project. (Creating)

Module I: History of photography (15 hours)
Origins and development of photography, early technological advancements, Pioneers of photography, Early and modern cameras, Types of photographic modern photographic cameras

Module II: Digital cameras and photographic lens (15 hours)
Elements of photography, Essential components of digital camera, Digital camera sensors, Digital image capture and file formats, Components of camera lens, Types of lenses, Focal length, Angle of view, Depth of field, Lens filters, Lens defects.

Module III: Photographic Lighting (15 hours)
Exposure triangle, Exposure meter, Writing with light, Types of lights, Lighting situations, Light accessories, White Balance, Histogram.

Module IV: Photographic Composition (15 hours)
Elements of photographic design – lines; shape and form; texture; pattern, arranging visual elements in a frame – foreground; background and middle ground; rule of thirds; space, understanding perspective, Framing and formatting, Balance and sense of scale, Rhythm and repetition.

Module V: Post-production and Presentation (15 Lectures)
Overview, Organising photographs, saving digital files, basic image editing, getting one's work noticed, Pictures on the World Wide Web, personal website, getting connected, stock photography.

Suggested Readings:

1. Comon, P.R. (2011). *Fundamentals of photo composition*. Sterling.
2. Langford, M., Fox, A., & Smith, R. S. (2015). *Langford's Basic Photography: The Guide for Serious Photographers* (10th ed.). Routledge.
3. Judge, A. (2013). *Mastering Aperture, Shutter Speed, Iso and Exposure: How They Interact and Affect Each Other*. Createspace Independent Pub.
4. Edwards, S. (2006). *Photography: A Very Short Introduction*. Oxford University Press; Illustrated edition.
5. Peterson, B. (2016). *Understanding Exposure* (4th ed.). Amphoto Books; Revised edition.
6. Taschen (Ed.). (2021). *A History of Photography. From 1839 to the Present (Bibliotheca Universalis)*. Taschen GmbH.
7. Gaskell, N., & Gujral, D. (2019). *Photography in India: A Visual History from the 1850s to the Present*. Prestel.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H	M		
CO3		L	H	H	
CO4		L	M	M	H

MCAV302T: INTRODUCTION TO ANIMATION AND VFX

(4 CREDIT- 60 HOURS) (L-T-P-: 1-1-2)

Objectives:
The objectives of the course is to learn how to make animation, design give vfx and prepared a practical project with the help of any editing softwares.

COURSE / Learning OUTCOMES
CO 1: Identify the tools and techniques for animation and VFX (Remembering)
CO 2: Understand and apply various techniques of animation and VFX (Understanding)
CO 3: Demonstrate progress in basic animation and VFX skills (Evaluating)
CO 4: Design and develop animation and VFX art-work (Creating)

Module 1: Introduction to a 2D Animation Software (20 hours)
Getting started, Exploring the software, Exploring the Drawing and Painting Tools, Manipulating Objects, Creating an Animation, Basics of Action Script, creating a New Document, Understanding Objects, creating a Table, Understanding Links, Understanding Text Formatting Options.

Module 2: Introduction to a VFX Software (25 hours)
Getting Started, Adobe After Effects Workflow, creating a basic animation using effects and presets, animating text, working with shape layers, animating layers, working with masks, Puppet tools, Roto brush tool, performing colour correction, Rendering and outputting.
As a part of the final project, students will submit any of the following projects. Students are expected to apply the concept, knowledge and skills gained during the course of the study while undertaking this paper. Each student will have to submit at least one of the following projects to complete the course.

Project Evaluation Criteria

Last date of project submission

- To be notified by the department
- Portfolio Submission and Presentation: To be notified by the department

Suggested Readings:

1. Adobe Flash Professional CC: Classroom in a Book, Adobe Creative Team, Adobe Press
2. Adobe After Effects CC: Classroom in A Book, Lisa Fridsma and Brie Gyncild, Adobe Press
3. Basics Animation 03: Drawing for Animation, Paul Wells, Bloomsbury Publishing India Pvt. Ltd.
4. How to Make Animated Films, Tony White, Focal Press
5. Kogent Learning Solutions Inc, After Effects CS6 in Simple Steps. Dreamtech Press

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H

MCFS303T: FILM STUDIES

(L-T-P: 4-0-0)

Objective:

Upon completion of the Introduction to Film Studies course, students will possess the skills to analyze and assess the artistic components, methodologies, and societal implications of films, fostering a well-rounded comprehension of the medium and its cultural significance.

Course Outcomes:

CO 1: Identify the historical background of moving images (Remembering)
CO 2: Discuss the major film movements (Understanding)
CO 3: Interpret the role of cinema in popular culture (Applying)
CO 4: Critique cinema from around the world (Analyzing)

Module 1: Indian Cinema (15 lectures)

Early Cinema and the studio era, 1950s – Cinema and the nation (Guru Dutt, Raj Kapoor and Mehboob), 1970s – The rise of the angry young man, Indian New Wave, Globalisation and India cinema, regional cinema, Cinema in North East India.

Module 2: Film Language (15 lectures)

Visual language – shot; scene; mise-en-scene; deep focus; continuity editing; montage, Sound and colour – diegetic and non-diegetic sound; off-screen sound; sync sound; use of colour as a stylistic element, Early cinema, Genre and the development of classical Hollywood cinema.

Module 3: Film Form and Style (15 lectures)

German Expressionism and Film Noir, Italian Neorealism, French New Wave, Third Cinema and Non-Fiction Cinema, Film Authorship with a special focus on Satyajit Ray/Akira Kurosawa, Introduction to feminist film theory.

Module 4: Film and Censorship (15 lectures)

Melodrama, Stardom, Film Censorship – Impact and Relevance in today's era, The Central Board of Film Certification (CBFC), Directorate of Film Festivals, National Film Archives of India, National Film Development Corporation of India (NFDC).

Suggested Readings:

1. A Dialectic Approach to Film Form in Film Form: Essays in Film Theory (Edited and Translated by Jay Leyda), Sergei Eisenstein, 1977, Harvest/Harcourt Brace Jovanovich, Publishers
2. Classical Hollywood Cinema: Narrational Principles and Procedures" in Philip Rosen, ed. Narrative, Apparatus, Ideology. 1986, Columbia University Press,New York Non-continuity, Continuity, Discontinuity: A Theory of Genres in Early Films in Elsaesser Thomas, ed. Early Cinema: Space, Frame, Narrative,1990, British Film Institute
3. Discourses of Nationalism in Guru Dutt's Pyaasa, Alison Griffiths, 1996, Deep Focus
4. Heavenly Bodies: Film Stars and Society in Film and Theory: An Anthology, Richard Dyer, 2000, Blackwell Publishers
5. Indian Cinema: Origins to Independence in Geoffrey Nowell Smith, ed. The Oxford History of World Cinema. Oxford University Press,New York
6. PatherPanchali in Jeffrey Geiger and R.L Rutsky, ed. Film Analysis: A Norton Reader, Neepa Majumdar, 2005, WW Norton & Company

7. Notes on Film Noir in John Belton ed. Movies and Mass Culture. New Brunswick, 1996, Rutgers University Press,New Jersey.
8. The Cult of the Auteur, The Americanization of Auteur Theory, Interrogating Authorship and Genre, in Film Theory: An Introduction.,2000, Blackwell Publishers
9. Towards a Third Cinema, in Robert Stam and Toby Miller, eds. Film and Theory: An Anthology.2000, Blackwell Publishers:Massachusetts and Oxford.
10. The Moment of Disaggregation," and "The Developmental Aesthetic" in his Ideology of the Hindi Film: A Historical Construction, Madhava Prasad, 1998, Oxford University Press
11. The Ontology of the Photographic Image, what is Cinema Vol. I, Andre Bazin, 1967, University of California Press
12. The Actor as Parallel Text in Bombay Cinema in Quarterly Review of Film & Video Vijay Mishra,Peter Jeffery and Brian Shoesmith
13. The Panoramic Interior," in Bombay Cinema: An Archive of the City,Ranjani Mazumdar, 2007
14. Visual Pleasure and Narrative Cinema in Philip Rosen ed. Narrative, Apparatus, and Ideology: A Film Theory Reader, 1986, Columbia University Press

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1		H		M
CO2		H		
CO3			H	
CO4	H			

MCMS304T: COMMUNITY MEDIA AND SOCIETY

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective

The main objective of this paper is to make students aware about the rural scenario life, problems, challenges and lack of communication. It will make students aware about the various communication theory and apply them for the development. It will also help the students to know the various way of showcasing their talent line blogging, documentary etc.

Course/Learning Outcomes:

CO 1: Define the meaning and concept of community and rurality. (Remembering)
CO 2: Trace the history of community media. (Understanding)
CO 3: Apply communication channels for community society. (Applying)

Module 1: Village and Community in India: An interface (9 Lectures)

Introduction, Characteristics of Villages, Conventional Portrayal of Village society, Agricultural Communities, Non-agricultural communities, Changes and continuity in media aspects.

Module 2: Community Media- A Historical Trajectory (9 Lectures)

Role of media in any society, Evaluation of the chronology, Community Media: A Background, Uses and Gratification Theory Approach, Agenda Theory Approach.

Module 3: Orality, Community and Society (9 Lectures)

Significance of Oral communication, Formal official communication vs. informal oral communication, Regular interaction between written and oral, Role of Bollywood, Limitations of written.

Module 4: Community Blogging (9 Lectures)

Blogging and Medium of Communication, Blogging and Digital Activism, Blogging for the Need of Community, Blogging and Rural Community, Blogging for development community.

Suggested Readings

1. Thapar, Romila, "The Penguin History of Early India: From the Origins to AD1300" (New Delhi: Penguin Books 2002)
2. Biswal, S. (2016, October-December, a).The sun shines bright on digital platforms, Vidura, 8(4),10-11.
3. Dalal, R. (2010).Hinduism: An Alphabetical Guide. London: Penguin Books. p. 136.
4. Freire, P. (1970). Pedagogy of the Oppressed. NY: Continuum Publishing.
5. Singh Upinder, A History of Ancient and Early Medieval India: From the Stone Age to the 12th Century, Pearson Longman, Delhi, 2008
6. Zimmerman F., 'Monsoon in Traditional Culture', in Monsoon, eds. Jay S.Fein and Pamela L. Stephens, John Willey & Sons, New York, Chichester, Brisbane, Toronto, Singapore, 1987, pp. 51-76.
7. Joyce, M. (2008). Introduction: How to Think About Digital Activism. In Digital Activism Decoded: The New Mechanics of Change (1-14). NY, Amsterdam: International debate education association.

8. Kirkpatrick, G. (2008). Technology and Social Power. Basingstoke: Palgrave Macmillan.

MCMS305T: MEDIA, CULTURE AND SOCIETY

(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Objective(s):

The objective of the course is to learn the concepts of culture and explore the relationship between media, culture & technologies.

Course Outcomes

At the end of this course students will be able to:

CO 1: Define the key terms related to media, culture and society (Remembering)
CO 2: Understand the linkage between media, culture and society (Understanding)
CO 3: Analyse the ways in which media, culture and society influence each other (Analysing)

Module 1: Understanding Culture (15 lectures)

Concept of Culture, Mass Culture, Popular Culture, Folk Culture, Media and Culture, Culture and Mediation, Culture & Power, Hybridization.

Module 2: Critical Theories (15 lectures)

Frankfurt School, Media as Cultural Industries, Imperialism, Political Economy, Ideology and Hegemony, Culture & Consumption. Culture & Identity. Cultural Materialism.

Module 3: Representation (5 lectures)

Media as Texts, Signs and Codes in Media, Discourse Analysis, Representation of nation, class, caste and gender issues in Media, Media Representation, Media & Identity, Media & Environment.

Module 4: Audiences (15 lectures)

Audiences, Audience as market, Media Audience, Uses and Gratification Approach, Reception Studies, Active Audiences, Women as Audiences Sub Cultures; Music and the popular, Fandom.

Module 5: Media and Technologies (10 lectures)

Folk Media as a form of Mass Culture, live performance; Audience in live Performance, Media technologies; Medium is the Message; Technological Determinism; New Media and Cultural forms.

Suggested Readings:

1. Media Studies: An Essential Introduction Edited by Philip Rayner, Peter Wall and Stephen Kruger, Routledge (Covers Module II, III, IV and V)
2. Convergence Culture: Where Old and New Media Collide, Henry Jenkins, 2008, New York University Press
3. Mass Media and Society: Issues and Challenges K. B. Dutta, 2021, University Book House
4. Media, Culture, and Society: An Introduction, Paul Hodkinson, 2016, Sage Publications
5. The New Media Handbook, 1st Edition, Andrew Dewdney and Peter Ride, Routledge 2006
6. Mass Communication Theory, Fourth Edition, Dennis McQuail, 2000, Sage
7. Cultural Theory and Popular Culture: An Introduction, John Storey, 2009, Pearson Longman
8. Traditional Folk Media in India, Parmar S, 1975, Geka Books
9. The History of the Future: Oculus, Facebook, and the Revolution That Swept Virtual Reality, Blake J. Harris, 2019, Dey Street Books

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	M	M	H
CO2	H	H	H	H	H
CO3		H		H	H

MCGM400T: GLOBAL MEDIA AND POLITICS

(L-T-P: 5-1-0)

COURSE OBJECTIVES:

By the end of this course on Global Media and Politics, students will be able to critically analyze and understand the intricate relationship between media and politics on a global scale, exploring the role of media in shaping public opinion, political processes, and international relations.

COURSE OUTCOMES (CO's)

CO 1: Identify the inter-relation between local, global, international and intercultural issues and trends (Remembering)
CO 2: Understand the relationship between media and political actors (Understanding)
CO 3: Demonstrate understanding of the role and the position of media institutions in the wider context of socio-political relations and conflict (Applying)
CO 4: Critically evaluate media-related issues to contemporary debates in global politics (Analysing)
CO 5: Produce critical media content on contemporary socio-political issues (Creating)

Module 1: Media and International Communication (15 Lectures)
The advent of popular media, Radio and International Communication, Media propaganda in the inter-war years - World War I and World War II.

Module 2: Media and Super Power Rivalry (15 Lectures)
Media during the Cold War; Vietnam War; Disintegration of USSR, Radio free Europe; Radio Liberty; Voice of America, Communication debates: NWICO; McBride Commission and UNESCO, Unequal development and Third World concerns: North-South; Rich-Poor.

Module 3: Global Conflict and Global Media (15 Lectures)
World Wars and Media Coverage post 1990: Rise of Al Jazeera, The Gulf Wars: CNN's satellite transmission, embedded Journalism, 9/11 and implications for the media, Case studies.

Module 4: Media and Cultural Globalization (15 Lectures)
Cultural Imperialism, Cultural politics, Media hegemony and Global cultures, Homogenization, the English language Local/Global, Local/Hybrid.

Module 5: Media and the Global Market (15 Lectures)
Discourses of Globalisation: barrier–free economy; multinationals; technological developments; digital divide, Media conglomerates and monopolies: Ted Turner/Rupert Murdoch, Global and regional integrations: Zee TV as a pan-Indian channel, Bollywood Entertainment: Local adaptations of global programmes KBC; Big Boss; Indian Idol etc.

Suggested Readings:
1. Communication and Society, Today and Tomorrow "Many Voices One World," 2004, Unesco Publication, Rowman and Littlefield publishers
2. Globalisation: language, Culture and Media, Indian Institute of Advanced Studies, Patnaik, B.N & Imtiaz Hasnain (ed), 2006, Shimla
3. International Communication: Continuity and Change, Daya Kishan Thussu, 2003, Oxford University Press
4. Journalism after 9/11, Barbie Zelizer and Stuart Allan, 2012, Taylor and Francis Publication
5. Media and Society into the 21st Century: A Historical Introduction, Lyn Gorman and (2nd Edition), David McLean, 2009, Wiley-Blackwell, pp.82-135, 208-283.
6. Media and communications in third world countries, Zahida Hussain and Vanita Ray, 2007, Gyan Publications
7. Reporting war: Journalism in wartime, Stuart Allan and Barbie Zelizer, 2004, Routledge Publication
8. The Globalization of Corporate Media Hegemony, Lee Artz and Yahya R. Kamalipour, 2003, New York Press
9. War, Media and Propaganda - A Global Perspective, Yahya R. Kamalipour and Nancy Snow, 2004, Rowman and Littlefield Publishing Group

MCMM401T: MEDIA MANAGEMENT AND ENTREPRENEURSHIP

(5 Credits: 75 Hours) (L-T-P: 5-0-0)

Objective(s):
The objective of the course is to learn the fundamentals of Media management and different schools of thought. Explore the concept, origin, and growth of media management as a field and understand the concept of media entrepreneurship.

Course Objectives:
CO 1: Identify the various principles of media management (Remembering)
CO 2: Understand the concept of media management and entrepreneurship (Understanding)
CO 3: Apply the knowledge and principles of media management and entrepreneurship (Applying)

Module 1: Media Management: Concept and Perspective (20 Lectures)
Fundamentals of management, Management School of Thought, Concept, origin and growth of Media Management, Media as an industry and a profession, Media Ownership, Ownership patterns of mass media in India: sole proprietorship, partnership, private limited companies, public limited companies, trusts, co-operatives, religious institutions (societies) and franchisees (chains), Media policies.

Module 2: Media Industry: Issues & Challenges (15 Lectures)

Media industry as manufacturers- Manufacturing Consent, news and content management. Market Forces, performance evaluation (TAM, TRP, BARC and HITS) and Market shifts.

Module 3: Entrepreneurship Development (20 Lectures)
Entrepreneurship – concept; definition, need and significance, Entrepreneurship growth process, Barriers, Entrepreneurship education model, Entrepreneur – characteristics; types and role demand, Entrepreneurial Motivation and challenges, Types of enterprises - based on capital; product; location; ownership pattern and process.

Module 4: Media Entrepreneurship (20 Lectures)
Concept of Media Entrepreneurship, Characteristics of Media Entrepreneurs, Case Studies, Government Initiatives, Schemes for Entrepreneurship, Media Entrepreneurial Scenario in Northeast India, Scope; opportunities; problems and issues.

Suggested Readings:
1. Indian Media Business, Vinita Kohli Khandekar, 2008, Sage
2. Managing Media Organisation, John M. Lavine and Daniel B. Wackman, 1988, Longman Publishing Group
3. Media Industries-History, Theory and Method, Jennifer Holt and Alisa Perren, (Edited), 2011, Wiley Blackwel
4. Media Management in the age of Giants, Dennis F. Herrick,2012, Surjeet Publications
5. Media Management: Strategy, Business Models and Case Studies, Bernd W Wirtz, 2020, Springer
6. Media Management, B. K. Chaturvedi, B. N. Mandal, 2009, Global Vision Publishing House
7. Political Economy of Communications in India, Pradip Ninan Thomas, 2010, Sage
8. Strategic management in media, Lucy Kung, 2008, Sage Publications
9. Social Media Management: Technologies and Strategies for Creating Business Value, Amy Van Looy, 2016, Springers.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2	H		H	H
CO3	H	M	H	H

MCMN402T: MEDIA IN NORTHEAST INDIA

(Credit: 5 – 75 hours) (L-T-P: 5-0-0)

Objective:
The main aim of this course will foster a comprehensive understanding of the media landscape in North East India. Students will explore the intricacies and dynamics of the region's media industry, gaining an in-depth knowledge of its unique characteristics, challenges, and opportunities.

Course Objectives
At the end of the course students will be able to:
CO 1: Describe the important socio-political and development realities of Northeast India (Remembering)
CO 2: Trace the growth of media organisations in Northeast India (Understanding)
CO 3: Analyse the emerging trends of the news media industry in the Northeast (Analysing)

Module 1: Introduction to Northeast India (25 Lectures)
Brief History of Northeast India, Geography; People, Language, Culture and Customs, Northeast Politics, Development Policies, Issues and Challenges, Social and Political Movements in Northeast India, Conflict and Peace Process.

Module 2: History of Media in Northeast (25 Lectures)
Growth and Development of Press in the Northeast, Role of Christian Missionaries in the Development of the Press, Basic Features of the Press in Northeast, renowned media persons and writers of the Region, Role of media in development of Northeast.

Module 3: Current Status of Media in Northeast (25 Lectures)
Current media landscape in North-eastern Region, Ownership Pattern and Status of Journalists, Problems and Challenges of the Press in Northeast, New Media in Northeast, Scopes and Prospects of Media Industry in the Region, Film Industry in NE, Production House.

Suggested Readings
1. Beyond Counter-insurgency: Breaking the Impasse in Northeast India, Sanjib Baruah, 2011, Oxford University Press
2. History of the Sibsagar Field, A.K. Gureney, Assam Mission, Nowgaon Jubilee Publication.
3. Governing India's Northeast: Essays on Insurgency, Development and the Culture of Peace, Samir Kumar Das, 2013, Springer
4. Media, Conflict and Peace in Northeast India, H.K Kabi and N. S Patnaik, 2015, Vij Books Pvt. Ltd, New Delhi

5. Press in Assam—Origin and Development, S.P Baruach, Lawyer's Book Stall, Guwahati
6. State vs. Society in Northeast India: History, Politics and the Everyday (SAGE Studies on India's North East), First Edition, G. Amarjit Sharma, 2021, Sage Publications
7. The American Missionaries and North-East India (1836-1900 AD), H.K. Barpujari,1986, Spectrum Publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H		
CO2		H	H
CO3			H

MCDJ403T: DATA JOURNALISM

(Credit: 4 – 60 hours) (L-T-P: 2-0-2)

Objectives:

The core objective of this course is to provide a thorough knowledge and understanding of the fundamental concepts and principles of data journalism. Students will delve deeply into the intricacies of data-driven reporting and analysis within the context of journalism.

Course Outcomes:

At the end of the course students will be able to:

CO 1: Define the meaning and concept of data journalism (Remembering)
CO 2: Discuss the process and techniques of data journalism (Understanding)
CO 3: Develop infographics for visualisation of stories (Create).

Module 1: Introduction to Data Journalism (20 hours)

Understanding data journalism, visual storytelling, data literacy, types of data, sector-specific data stories, sources of data, alternative data sources, data privacy, challenges of data journalism.

Module 2: Data Gathering (20 hours)

How to find a story in data, planning a data-driven story: hypothesis and questions, web research and data collection**,** online fact-checking and verification**,** common data format.

Module 3: Data Interpretation and Visualisation (20 hours)

Purpose of data visualisation, verifying data, Inverted Pyramid of Data Journalism, organising data, scrapping and cleaning, analysing facts sheets, data interpretation, statistical tools and methods, open-source data visualisation tools, data design, ethics of data visualisation.

Suggested Readings:

1. Cairo, Alberto, 2012, The Functional Art: An Introduction to Information Graphics and Visualization, New Riders
2. Foreman, John 2013, Data Smart: Using Data Science to Transform Information into Insight, Wiley
3. Herzog, David, 2015, Data Literacy: A User's Guide, , Sage Publication
4. John Mair, Richard Keeble and Megan Lucero, 2017, Data Journalism: Past, Present and Future, , Theschoolbook.com
5. Jonathan Gray Liliana Bounegru, and Lucy Chambers, 2012, The Data Journalism Handbook, Shroff/O'Reilly
6. Nathalie H. Riche, et.al, 2018, Data-Driven Storytelling, AK Peters/CRC Press
7. Reilley, Mike and Sunne, Samantha, 2022, Data + Journalism: A Story-driven Approach to Learning Data Reporting, Taylor & Francis Ltd; 1st edition
8. Richarch, Alex, 2023, Foundations of Data and Digital Journalism, Routledge; 1st edition

Mapping of COs to Syllabus

	Module 1	**Module 2**	**Module 3**
CO1	H	H	
CO2		H	H
CO3			H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	MCPC103T	Professional Communication	4
2	Minor Course 2	MCWM104T	Writing for Media	4
3	Minor Course 3	MCHM205T	History of Media	4
4	Minor Course 4	MCNM206T	Introduction to New Media	4
5	Minor Course 5	MCDP307T	Documentary Production	4
6	Minor Course 6	MCCD308T	Communication and Disaster Management	4
7	Minor Course 7	MCFM404T	Folk Media	3
7	Minor Course 8	MCIR405T	Introduction to Research	2
8	Minor Course 9	MCSB406T	Communication for Social Behavioural Change	3

MCPC103T: PROFESSIONAL COMMUNICATION

(4 Credit: 60Hours) (L-T-P: 4-0-0)

Objective(s):

The objective of the course is to develop proficiency in different types of professional writing, and presentation skills.

Course Outcomes:

CO 1: Define the meaning and concept of communication (Remembering)

CO 2: Demonstrate Writing/Presentation skills using a range of materials including text, visual, sounds and technology (Understanding)

CO 3: Develop professional writing skills in business letters, email, press release, articles (Applying)

Module 1: Theories & Language of Communication (5Lectures)

Theory of Communication, Types and modes of Communication, Effective Communication, Mis-Communication, Barriers and Strategies, Verbal and Non-verbal (Spoken and Written), Personal, Social and Business, Intra-personal, Interpersonal and Group communication.

Module 2: Professional writing (15 Lectures)

Principles and elements of professional writing, Types of writing - business letters/correspondences; professional emails; press releases; reports; features/articles, Copy-editing and proof-reading; Digital content curation

Module 3: Professional Presentation Skills (10 Lectures)

Presentation skills, 7P's of presentation, Use of visual aids in a presentation, Non-verbal communication in a presentation situation

Module 4: Speaking & Listening Skills (20 Lectures)

Strategies for effective oral communication, developing the right speaking skills - one-to-one conversations; interview; group and public speaking; handling criticism, Effective listening skills and interpretation

Module 5: Suggestive projects & Presentation (10 Hours)

Assignment, Presentation, Seminar, Group Presentation on communication model, writing business letter, email, press release, report writing, news feature, article, copy editing, monologue, group discussion, interviewing, public speaking and other allotted topics.

Suggested Readings

1. Active Listening 101: How to Turn Down Your Volume to Turn Up Your Communication Skills, Emilia Hardman, 2012, Kindle Edition
2. Business Communication, Krishnamacharyulu and Lalitha, 2011, Himalayan Publishing House
3. Introduction to Communication Studies, John Fiske, 2010, Routledge.
4. Nonverbal Communication: Science and Applications, David Matsumoto, Mark G. Frank and Sung Hyi Hwang, 2012, Sage Publications.
5. Skilled Interpersonal Communication: Research Theory and Practice, Owen Hargie, 2010, Routledge

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H			H	
CO 2		H	H	H	
CO 3		H			H

MCWM104T: WRITING FOR MEDIA

(4 Credit: 60 hours) (L-T-P: 2-0-2)

Objectives:

This course is carefully crafted to deliver practical training in various writing techniques specifically tailored for different media platforms.

Course Outcome

At the end of this course students will be able to:

CO 1: Define the meaning and concept of journalistic writings (Remembering)
CO 2: Identify and analyse characteristics and styles of various forms of media writing (Understanding)
CO 3: Develop story ideas, write and edit news stories for multimedia platforms (Create).

Module – 1: Introduction to (20 hours)

Concept and principles of Writing, Fundamentals of Writing, Language of writing, Journalistic Writing, Writing Formats, Creative Writing, Interactive Writing, Cinematic Writing, PR Writing, Mass Media Audience, Objectivity and Creativity, Content curation, Digital tools of writing, Ethics in writing.

Module - 2: Techniques of Copy Editing (20 hours)

Concept and meaning of copy editing, tool and techniques of news editing, Headline writing, Types of Headline, News lead, Types of Lead, lead writing, Caption writing, proof reading

Module 3: Practicum (20 Hours)

Planning and developing story ideas, News writing, Feature Writing, Editorial Writing, Column Writing, News Interview, blog writing, letter to editor, Infographic Design.

Suggested Readings

1. Golsteing, N. (ed), 2004: The Associated Press Style Book, Cambridge, MA: Press
2. Modern Journalism and news writing, Sativa Chadda, Sativa, 1998, Popular Prakashan, Bombay
3. News writing and reporting for today's media, Itule D. Bruce and Anderson A. Douglas, 2000, McGraw Hill Publication
4. Stovall, J. G. (2015). *Writing for the Mass Media*. Ninth Edition. New York: Pearson
5. Srivastava, M.V. The Journalistic Hand Book. Sterling Publishers
6. Stovall, J. G. (2015). *Writing for the Mass Media*. Ninth Edition. New York: Pearson. ISBN-13 978-0-13-386327-7
7. Writing Tools: 50 Essential Strategies for every writer, Peter Roy Clark, 2006, Little Brown

Mapping of COs to Syllabus

CO	Module 1	Module 2	Module 3
CO1	H		H
CO2		H	H
CO3		H	H

MCHM205T: HISTORY OF THE MEDIA

Credits: 4 (2-0-2)

Objectives:

By the end of this course on the History of the Media, students will be able to analyze and critically evaluate the development, impact, and societal implications of various forms of media throughout history.

Course Outcomes:

CO 1: Discuss the history of print media and its role in Indian freedom movement (Remembering)
CO 2: Understand history and development of television industry (Understanding)
CO 3: Analyse the emerging trends in the media and information industry (Analyzing)
CO 4: Evaluate the development of the media and information industry (Evaluating)

Module 1: History of Print Media (15 lectures)

Media and Modernity: Print Revolution, Telegraph, Morse code, Yellow Journalism, Evolution of Press in United States, Great Britain and France, History of the Press in India, Colonial Period, National Freedom Movement, Gandhi and Ambedkar as Journalists and Communicators.

Module 2: Media in the Post-Independence Era (15 lectures)

Emergency and Post Emergency Era, Changing Readership, Print Cultures, Language Press.

Module 3: Sound Media (15 lectures)
Emergence of radio Technology, the coming of Gramophone, Early history of Radio in India, History of AIR: Evolution of AIR Programming, Penetration of radio in rural India-Case studies, Patterns of State Control; the Demand for Autonomy, FM: Radio Privatization, Music: Cassettes to the Internet.

Module 4: Visual Media (15 lectures)
The early years of Photography, Lithography and Cinema, From Silent Era to the talkies, Cinema in later decades, the coming of Television and the State's Development Agenda, Commercialization of Programming (1980s) Invasion from the Skies: The Coming of Transnational Television (1990s), Formation of Prasar Bharati.

Suggested Readings

1. Broadcasting in India page, P.C Chatterjee, 1991, Sage Publication
2. Cassette Culture. Chicago, Peter Manuel, 1993, University of Chicago Press
3. India's Newspaper Revolution: Capitalism, Politics and the Indian Language Press, Robin Jeffrey, 2003, Oxford University Press
4. Journalism in India from the Earliest to the Present Day, Parthasarathy Rangaswamy, 1989, Sterling Publishers
5. Radio Farm Forum as a Tool of Change in Indian Villages, In, Neurath P. Economic Development of Cultural Change, Vol 10, No. 3 (pp 275-283)
6. Satellites Over South Asia, David Page and William Crawley, 2001, Sage Publication
7. Social History of Media: From Gutenberg to the Internet, A. Briggs and P. Burke, 2010, Polity Press

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M	M	
CO 3			H	H
CO 4			M	M

MCNM206T: INTRODUCTION TO NEW MEDIA

Credits: 4 (3-1-0)

Course Objectives:
The objective of this course is to introduce students to the dynamic and evolving field of new media. Through theoretical exploration, practical exercises students will gain a comprehensive understanding of the concepts, theories, and practices that define new media. The course aims to familiarize students with the various forms, platforms, and technologies used in new media, such as social media, content strategy, blogging, online communities, and emerging technologies.

Course Outcomes:
CO 1: Define new media (Remembering)
CO 2: Understanding the concept and meaning of new media (Understanding)
CO 3: Analyse the emerging trends in the new media (Analysing)
CO 4: Apply the principles and techniques of new media for content creation (Applying)

Module 1: Key Concepts and Theory (20 lectures)
Defining new media, terminologies and their meanings – Digital media, new media, online Media; Information society and new media, Technological Determinism, Computer mediated, Communication (CMC), Networked Society, Internet- its Beginnings and Protocols, 1G, 2G, 3G and 4G and 5G, World Wide Web, Information Superhighway, URL, Search Engine working, Hyperlinking, RSS, Social networking, Podcast, OTT, Artificial Intelligence, Pop-ups.

Module 2: Understanding Virtual Cultures and Digital Journalism (20 lectures)
Internet and its Beginnings, Remediation and New Media technologies, Online Communities, User Generated Content and Web 2.0, Networked Journalism, Alternative Journalism; social media in Context, Activism and New Media, new media and virtual identity.

Module 3: Digitization of Journalism (15 lectures)
Introduction to web journalism - features of web journalism - Approaches to web journalism: Web Journalist Vs. Conventional journalist, Linear and Non-linear writing techniques, Linking, Multimedia, Storytelling structures. Authorship and what it means in a digital age, Piracy, Copyright, Copyleft and Open Source, Digital archives.

Module 4: Overview of Web Writing and Content Design (20 lectures)
Contextualized Journalism, Writing Techniques, Linking,

Open-Source Overview of Web Writing, Website planning and visual design, Content strategy and Audience Analysis, Brief history of Blogging, Creating and Promoting a Blog Online Communities, New Media and Ethics: Piracy, Copyright.

Suggested Readings:

1. A Journalist Guide to the Internet: The Net as a Reporting Tool, Christopher Callhan, 2007, Pearson/Allyn and Bacon
2. An Introduction to Digital Multimedia, Savage, Terry Michael, and Karla E. Vogel, 2013, Jones & Bartlett Publishers
3. Cyber Media Journalism: Emerging Technologies, Jagdish Chakraborty, 2005, Authors Press, New Delhi
4. Online Journalism: A Critical Primer, Jim Hall, 2001, Pluto press, London
5. Understanding New Media, Siapera, Eugenia, 2011, Sage Publications
6. Understanding Digital Culture, Vincent Miller, 2011, Sage Publications
7. Writing for Multimedia and the Web: A Practical Guide to Content Development for Interactive Media, Garrand, Timothy, 2006, CRC Press
8. Who Controls the Internet? Illusions of Borderless World, Jack Goldsmith, Jack, and Tim Wu, 2006, Oxford University Press
9. What is New Media? In The Language of New Media, Lev Manovich, 2001, MIT Press

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2	H	H		
CO3	M	H	H	H
CO4				H

MCDP307T: DOCUMENTARY PRODUCTION

Credits: 4 (4-0-0)

Objective:

At the conclusion of the Documentary Production course, students will have the capability to effectively strategize, create, and analyze documentary films, showcasing their expertise in storytelling methods, technical proficiencies, and ethical considerations that are unique to the documentary genre.

Course Outcomes:

CO 1: Discuss the types of documentaries and production techniques (Remembering)
CO 2: Understand ethical issues related to documentary production (Understanding)
CO 3: Reflect upon and analyse the documentary form (Analyzing)
CO 4: Critically evaluate documentary forms and production techniques (Evaluating)
CO 5: Produce, direct, film and edit documentary productions (Creating)

Module 1: Documentary Theory (20 lectures)

Understanding the Documentary, Observational and Verite documentary, Introduction to Realism Debate, the performative/fictive in Documentary: Using re-enactment/reconstruction, Ethics and Representation.

Module 2: Pre-Production (20 lectures)

Researching the Documentary, Modes of Research: Library, Archives, location, life stories - Ethnography, writing a concept: telling a story, Script Writing, Treatment, writing a proposal and budgeting, Structure and scripting the documentary.

Module 3: People and Techniques (10 lectures)

The Documentary Crew, Equipment, Scripting, Sound for Documentary.

Module 4: Video Documentary Production (10 Hours)

The Documentary Camera, shooting styles, Production details and logistics, Introduction to Editing styles.

Practicum:

Shooting a short film (5-6 minutes) and editing the same.

Suggested Screenings

- Michael Moore: Roger and Me, Nanook of the North by Robert J Flaherty, Nightmail by Basil Wright, Bombay Our City by Anand Patwardhan, Black Audio Collective, City of Photos by Nishtha Jain, Films by PSBT

Suggested Readings:

1. A New History of Documentary Film, Jack EC Ellis, 2005, Continuum Intl Pub Group,

2. "Documentary" in Geoffrey Nowell Smith ed The Oxford History of World Cinema, Charles Musser, 1996, Oxford University Press
3. Directing the Documentary, Michal Rabigerl, 2004, Focal Press
4. How to Write a Documentary Double Take by PSBT, Trisha Das
5. Indian Film, Erik Barnow and Krishnaswamy, 1980, Oxford University Press
6. The Open Frame Reader: Unreeling the documentary Film Ed. by PSBT, Rajiv Mehrotra, 2006, Rupa Publications
7. The Truth about Non-Fiction" and "Towards a Poetics of Documentary in Michael Renov ed. Theorizing Documentary AFI Film Readers, Michael Renov, 1993, Routledge Publications
8. The Techniques of Documentary Film Production, W.Hugh Badley, 1969, Focal Press,
9. The Truth about Non-Fiction and Towards a Poetics of Documentary in Michael Renov ed, Theorizing Documentary AFI Film Readers, Renov Michael, 1994, Routledge Publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H		H	
CO2	H			
CO3	M	M		
CO4			M	H
CO5				H

MCCD308T: COMMUNICATION AND DISASTER MANAGEMENT

4 Credits – 60 hours) (L-T-P: 2-0-2)

Objectives:

This is designed to provide hands-on training in the field of communication for disaster management. Students will gain valuable experience and skills in effectively communicating during times of crisis and learn essential strategies and techniques for efficient disaster communication.

Course Objectives

At the end of the course students will be able to:

CO 1: Understand approaches of disaster management (Understanding)
CO 2: Analyse media's role in disaster management (Analysing)
CO 3: Design and produce disaster communication materials (Applying)

Module 1: Introduction to Disaster Management (25 hours)

Meaning, concepts and types of disaster, Economy of Disaster, Politics of Disaster, Disaster Preparedness Plan, Risk Analysis, Crisis and Disaster Management, Response: Rescue, Relief and Rehabilitation, Post Disaster effects and Remedial Measures, National Disaster Management Authority (NDMA).

Module 2: ICT for Disaster Communication (25 hours)

Use of ICTs in disaster management/communication, Emergency Response, HAM radio and community radio, Internet, email, mobile, social media, blogging; computer, television, radio, applications like distress communication and deploying bio surveillance, Geo-Informatics Technology, GIS, GPS, Weather forecasting.

Module 3: Natural Disaster and Role of Media (25 hours)

Case study on man-made and major natural disasters and role of media, crisis communication, preparing for a crisis, Communication, Participation, and Activation of Emergency Preparedness Plan, Designing crisis communication plans, Audience-specific strategic message development.

Suggested Readings:

1. An Introduction to Disaster Management, Natural Disaster and Man-made hazard, S Vaidyanathan, 2020, CBS Publishers and Distributors Pvt. Ltd.
2. Bhopal - The Inside Story, Chouhan, Alvares L.B, Claude, 2004, Apex Press.
3. Crisis and Disaster Management Turbulence and Aftermath, Asim Kumar Mukhopahyaya, Kumar, 2015, Generic
4. Disaster Management, Harsh K Gupta, (Editor), 2003, Universities Press.
5. Disaster Policy and Politics: Emergency Management and Homeland Security, R. Sylves, 2008, CQ Press
6. ICTs in Disaster, Aruna Sarangi, 2010, Neha Publishers and Distributors
7. Understanding Disaster Management in Practice with reference to Nepal, Practical Action, Achyut Luite, 2010
8. Understanding the Economic and Financial Impacts of Natural Disasters, Charlotte Benson and Edward Clay, 2004, World Bank Publications
9. Voices from Chernobyl: The Oral History of a Nuclear Disaster, Svetlana Alexievich and Gessen Keith, 1997, Picador

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H		
CO2		H	H
CO3		H	H

MCFM404T: FOLK MEDIA

(3 Credits – 45 hours) (L-T-P: 2-0-1)

Objective:

The objective of the course is to learn the scope and nature of folk media in India along with its role and potential in the contemporary times.

Course Outcomes:

At the end of this course students will be able to:

CO 1: Identify the major forms of folk media in India (Remembering)
CO 2: Explain the nature and scope of folk media (Understanding)
CO 3: Examine the role of folk media in fostering social change (Analyse)
CO 4: Plan and organise folk media performance for varied audiences (Creating)

Module I: Meaning and Nature of Folk Media (7 hours)

Definition, nature and types of folk media, Strengths and Advantages, Current status of folk media in India, Challenges faced by folk media, Few major forms of folk media in India.

Module II: Nature and Scope of Folk Media (8 hours)

Participatory Communication and Folk Media, Folk Media and Its Role in Social Change, UNESCO's Recogni-tion of Folk Media, Case Studies, Traditional Folk Media as Development Media, Differences Between Folk Media and Electronic Media. Impact on rural development, uses in different fields – DFP, Song and Drama Division, NGOs, Social Action Groups

Module III: Folk Media of Northeast India (7 hours)

Various types of folk Media in Northeast India, Various folk forms of Assam and its significance – Bihu songs, Lokageet, Bhaona, Lullabies, Ojapali, Ainaam, Sattriya, Borgeet

Module IV: Street theater and Puppetry (8 hours)

Influence of folk theater on street theater, Role of street theater in the Indian Freedom struggle, street theater as agitational propaganda and social education, origin of puppets, traditional forms of puppets, contemporary forms of puppet, window on the world puppets, use of puppets – entertainment; education; social education

Module V: Practicum(15 hours)

Traditional media in practice: Students will be trained in various techniques of folk media. At the end of the course, students are expected to perform a street play and/or a puppet performance on specific social issues.

Suggested Readings:

1. Parmar, S. (1975). *Traditional Folk Media in India*. Gekha Books.
2. Deshpande, S. (Ed.). (2013). *Theatre of the Streets: The Jana Natya Manch Experience* (2nd ed.). Jana Natya Manch.
3. Bhushan, C. (2004). *Assam: Its Heritage and Culture*. Kalpaz Publications.
4. Deshpande, S. (2020). *Halla Bol: The Death and Life of Safdar Hashmi* (1st ed.). LeftWord Books.
5. Banerjee, U. K., Ghosh, S. (2014). *Puppets in India and Abroad*. India: National Book Trust, India.
6. Kumar, S. (2013). *Role of Traditional Folk Arts as Media of Mass Communication: A Study with Special Reference to Coastal Karnataka*. Germany: Lap Lambert Academic Publishing GmbH KG.
7. Naskar, R. (2011). The Role of Folk Media and Participatory Communication in Rural Development: An Exploratory Case Study of Combating Child Marriage in Malda. *Global Media Journal*, *2*(2), 1–9.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H		H	L	
CO 2	L	H	L		L
CO 3		H		H	L
CO 4				M	H

MCIR405T: INTRODUCTION TO RESEARCH

(2-0-0)

Objectives:

Upon completion of the Introduction to Research course, students will acquire basic understanding of the research, types, functions and different methods of communication research. They will also develop an understanding of various techniques of research which will further create interest for studying research.

Course outcomes

CO 1: Define the meaning of communication research (Remembering)
CO 2: Explain the methods of communication research (Understanding)

Module 1: Introduction to Research (15 Lectures)

Meaning, Definition, Function, Types of Research, Research Approaches, Role of theory in research, Research design, Research question, Hypothesis, Review of Literature.

Module 2: Media and Communication Research (15 Lectures)

Understanding media and communication research, Qualitative-Quantitative Technique, Content Analysis, Survey Method, Observation Methods, Experimental Studies, Case Studies, Historical Research, Ethnography, Netnography.

Suggested Readings:

1. Mass Media Research, Thomson Wadsworth, Roger D. Wimmer and Joseph R. Dominick, 2006
2. Media Research Methods; Audiences, institutions, Texts, Bertrand, Ina and Hughes, Peter, 2005, Palgrave
3. Media Audience Research: A Guide for Professionals, Graham Mython, 2015, Sage Publications
4. Media Analysis Techniques, Berger, A. Arthur, 2005, Sage Publications
5. Research Methodology: Methods and Techniques, C.R. Kothari, 2004, New Age International Ltd. Publishers

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	
CO2	M	H

MCSB406T: COMMUNICATION FOR SOCIAL AND BEHAVIOUR CHANGE

(3 Credit – 45 hours) (L-T-P: 3-0-0)

Objective:

The purpose of this course is to offer a comprehensive understanding of the concept of communication for social and behaviour change, delving deeply into its principles and methodologies.

Course/learning Outcomes

At the end of the course students will be able to:

CO 1: Define the concept of Social and Behaviour Change (Remembering)
CO 2: Analyse the discuss various strategic approaches to SBC programing and community intervention (Analyse)
CO 3: Plan and execute SBC programmes and campaigns (Creating)

Module – 1: Introduction to Social and Behaviour (10 hours)

Understanding Social and Behaviour Change, Social norms, Social and community barriers and enablers, community knowledge, attitude and practice, social influencers, stakeholders in social and behaviour change, SBC priorities, SBC Goals: Advocacy, Social Mobilisation, Social Marketing, Behaviour Change, Capacity Building.

Module – 2: Strategic Approach to Social and Behaviour Change (10 hours)

SBC principles and practices, Goals: Advocacy, Social Mobilisation, Social Marketing, Behaviour Change, Capacity Building, Situation Analysis, People Analysis, Context Analysis, Formative Research, Dipstick Research, SBC Planning, Process and models, Socio-ecological Model, SBC Monitoring, Evaluation and Impact Assessment

Module – 3: Communication Strategy for SBC Programming (15 hours)

Communication design, audience segments, priorities and profiles, communication channels, effective messaging, Budgeting and fundraising for SBC programmes, Pre-test, Communication Toolkits, Designing Knowledge Products and IEC materials.

Suggested Readings

1. Esta de Fossard, 2015, Communication for Behaviour Change: Writing and Producing Radio Dramas - Vol.1
2. Kristina Niedderer, Stephen Clune, et al, 2017, Design for Behaviour Change: Theories and practices of designing for change (Design for Social Responsibility)
3. Kathleen Starr and Leigh Householder, 2019, Why We Resist: The Surprising Truths about Behavior Change: A Guidebook for Healthcare Communicators, Advocates and Change Agents
4. Martin, S. Hagger, et.al, 2020, The Handbook of Behaviour Change, Cambridge University Press.
5. Richard E. Petty and John T. Caioppo, 2011, Communication and Persuasion: Central and Peripheral Routes to Attitude Change
6. Stephen Wendel, 2013, Designing for behaviour change: Applying Psychology and Behaviour Economics, O'Reilly, 1st Edition

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H	H	
CO2		H	H
CO3		H	H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	MCNA105L	News Reading and Anchoring	3
2	S E Course 2	MCRP106L	Radio Production	3
3	S E Course 3	MCGD207L	Graphic Designing	3

MCNA105L: NEWS READING AND ANCHORING

(3 Credits - 90 Hours) (L-T-P: 0-0-3)

Objective

The paper will make the students experience in the field of news reading and anchoring. Module 1 will deal about the news reader, duties, responsibilities and functions. Module 2 will emphasise students about voice over, performance, language skills, presentation skills etc. in the end of the semester students will produce news bulletin where they will edit, give voice over and present news from the studio and from the field.

Course/Learning Outcomes:

CO 1: Identify the various skills necessary to be a professional news anchor (Remembering)
CO 2: Understand the roles and responsibilities of a news presenter (Understanding)
CO 3: Apply news reading and anchoring skills to develop programmes for cross-media platforms (Applying)
CO 4: Articulate the art of anchoring, news reading and reporting (Analysing)
CO 5: Produce news content for multimedia platforms (Creating)

Module 1: News Reading, Anchoring & Presentation (15 hours)

Duties and responsibilities a news reader, 7Ps in News Presentation: Posture, Projection, Pace, Pitch, Pause, Pronunciation and Personality, Learning Interviewing skills, Anchor's role in debates and panel discussions inside Studio and outside, On location anchoring/ Reporting facilitator, Relevance of research and keeping updated with current affairs, Knowing personalities and their background, Understanding ground realities and issues, Art of listening, Analysis of news capsule from camera perspective particularly when it is outdoor reporting, Reporting for various beats: Politics, sports, business, crime, legal/court etc.

Module 2: Voice Over, Narration and Commentary (15 hours)

Basics of Voice: pitch/tone/intonation/inflection, Voice Over: Rhythm of speech, Breathing, Resonance, Studio autocue reading, Voice recording. Understanding of Voice Modulation, command over language, Skills of on-air presence: Connect with audience; Express appropriate emotion; Confidence; Conversational skills; Fluency; Ability to improvise; Solid knowledge base, Detailed analysis of styles used by prominent TV anchors and radio presenters.

Suggested Exercise

- TV/Radio News presentation, News documentaries, Programme Anchoring, Talks shows, News Interview, Online Live Streaming, Field reporting.

Suggested Readings

1. Cracking The Secrets of TV Presentation, Samia Rahman, 2016, Kindle Edition
2. Mastering Public Speaking, Dorothy Lynn, 2006, Jaico Publishing House
3. Mastering the News Media Interview: How to Do Successful Television, Radio and Print Interviews, Stephen C. Rafe, 1991, Grafton
4. Public Speaking, Pebley O'neal Katherine and Stephanie O'shaughnessy, 2005, Prufrock
5. Radio Jockeying and News Anchoring, First Edition, Aruna Zachariah, 2009, Kanishka Publishing House
6. The ABC of News Anchoring, Richa Karla Karla, 2012, Pearson Education India
7. Working For Media: Handbook for Building a Career in Journalism: Learn the Art of Anchoring, Reporting and News-Making, Bharti Nagpal, Kindle Edition

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	
CO2	H	
CO3	H	H
CO4	H	H

MCRP106L: RADIO PRODUCTION

(3 Credits: 90 HOURS)(L-T-P: 0-0-3)

Objectives

The objective of this paper is to make student more aware the role and uses of radio. Its importance in our day to day live. Students will be made to learn practical work on radio, like documentary, PSA etc. at the end of semester students will prepare a shot production for their final work.

Course Outcomes:

CO 1: Understand the skills and techniques of radio production (Understanding)
CO 2: Identify the radio technologies for audio recording and broadcasting (Applying)
CO 3: Discover the skills required for developing content for radio (Analysing)
CO 4: Produce radio programmes for varied audiences (Creating)

Module 1: Stages of Radio Production (10 hours)

Pre-production - idea; research; radio script, Production- creative use of sound; understanding sound recording; sound recording equipment; single and multitrack recording, post-production - understanding audio editing; introduction to basic audio editing skills using a software program.

Module 2: Radio Broadcast Formats (10 hours)

Radio broadcast formats – Public service advertisements (PSAs); jingles; radio magazine; interview, talk show; discussion; feature; documentary.

Module 3: Radio Production Technology (10 hours)

Basics of sound, Microphone - types and selection of microphones, Audio cables and connectors, Hardware for audio recording, Audio recorders, Headphones, Recording audio in the field, Portable audio mixers, Sound cards, Digital Audio Workstations (DAW).

Suggested Exercise

Produce radio programme format mentioned in module II.

Suggested Readings:

1. Radio Production, Aspinall R, 1971, Paris: UNESCO.
2. Indian Broadcasting, Luthra H.R, 1986, Publication Division.
3. Nine Components of Sound [Video file]. (n.d.). Retrieved from http://www.filmsound.org/articles/ninecomponents/9components.htm#Pitch
4. Radio Programme Production, M. Neelamalar, 2017, PHI Learning Pvt. Ltd
5. The Radio Handbook, Flemming C, 2002, Routledge, London
6. Techniques of Radio Production, Mcleish Robert, 2016, Focal Press
7. The Adventures of Indian Broadcasting, Chatterjee P.C, 1998, Konark
8. Writing for Radio and Television in India, Kedia Krishan K, 2008, Cyber Tech Publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H		
CO2	H		
CO3		H	
CO4	H		H

MCRP106L: RADIO PRODUCTION

(3 Credits: 45 HOURS)(L-T-P: 0-0-3)

Objectives

The objective of this paper is to make student more aware the role and uses of radio. Its importance in our day to day live. Students will be made to learn practical work on radio, like documentary, PSA etc. at the end of semester students will prepare a shot production for their final work.

Course Outcomes:

CO 1: Understand the skills and techniques of radio production (Understanding)
CO 2: Identify the radio technologies for audio recording and broadcasting (Applying)
CO 3: Discover the skills required for developing content for radio (Analysing)
CO 4: Produce radio programmes for varied audiences (Creating)

Module 1: Stages of Radio Production (10 hours)
Pre-production - idea; research; radio script, Production- creative use of sound; understanding sound recording; sound recording equipment; single and multitrack recording, post-production - understanding audio editing; introduction to basic audio editing skills using a software program.

Module 2: Radio Broadcast Formats (10 hours)
Radio broadcast formats – Public service advertisements (PSAs); jingles; radio magazine; interview, talk show; discussion; feature; documentary.

Module 3: Radio Production Technology (10 hours)
Basics of sound, Microphone - types and selection of microphones, Audio cables and connectors, Hardware for audio recording, Audio recorders, Headphones, Recording audio in the field, Portable audio mixers, Sound cards, Digital Audio Workstations (DAW).

Suggested Exercise
Produce radio programme format mentioned in module II.

Suggested Readings:
1. Radio Production, Aspinall R, 1971, Paris: UNESCO.
2. Indian Broadcasting, Luthra H.R, 1986, Publication Division.
3. Nine Components of Sound [Video file]. (n.d.). Retrieved from http://www.filmsound.org/articles/ninecomponents/9components.htm#Pitch
4. Radio Programme Production, M. Neelamalar, 2017, PHI Learning Pvt. Ltd
5. The Radio Handbook, Flemming C, 2002, Routledge, London
6. Techniques of Radio Production, Mcleish Robert, 2016, Focal Press
7. The Adventures of Indian Broadcasting, Chatterjee P.C, 1998, Konark
8. Writing for Radio and Television in India, Kedia Krishan K, 2008, Cyber Tech Publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H		
CO2	H		
CO3		H	
CO4	H		H

MCGD207L: GRAPHIC DESIGNING

(3 credits: 45 hours) (L-T-P: 2-1-1)

Objective:
The core objective of this course is to provide a thorough knowledge and understanding of Image editing software, understanding of tools for image editing. Students will learn the art of designing photoshop etc.

Course/ Learning Outcome:
CO 1: Gain skills in the development of print and on-line publications (Remembering)
CO 2: Demonstrate competency in image editing (Understanding)
CO 3: Engage with the conceptual and technical aspects of design such as logo, banner, brochure, poster-making (Creating)

Module 1: Image Editing Tool (15 Lectures)
Introduction to image editing tool, Getting started with image editing software, Menu Bar, Using the Help, using icons below menu bar, saving documents, Page Setup, Printing of documents, Toolbox, Layers and importance of layers, Filters, Layer Styles, Adjustment Layers, Retouch and Healing Tools, Type Tool, Free Transform Tool, Master Selection Tools, Installing and Managing Brushes and Other Presets, Image editing actions and common effects, Colour correction tools, Print setting

Module 2: Page Layout Tool (15 Lectures)
Introduction to page layout tool, Getting started with Page Layout software, Menu Bar, Using the Help, Using icons below menu bar, Saving documents, Page Setup, Printing of documents, Create; Edit; and Format text and paragraphs, Working with multiple images in a document, Drawing tools, Work with multiple pages; margins and columns, Working with master page, Customizing page layout software, Selecting page size, Working with text, Working with objects and layers, Applying and managing colour, Applying Fills; Strokes; and Effects, Publish work as PDF, Proof-reading, Print setting

Suggested Readings:
1. Digital Graphic Design, K. R. Pender, 1997, Butterworth-Heinemann.

2. Designing for Print, C. Conover, 2011, John Wiley and Sons.
3. Graphic design basics, A. E. Arntson, 2011, Cengage Learning
4. Good: An Introduction to Ethics in Graphic Design, L. Roberts, 2006, Ava Publishing
5. Reading images: The grammar of visual design, G. R. Kress and Leeuwen T. Van, 1996, Psychology Press
6. Seeing Is Believing: An Introduction to Visual Communication, A.A. Berger, 1989, Mayfield Publishing Company
7. The Complete Guide to Digital Graphic design, B. Gordon and M. Gordon, 2002, Watson-Guptill Publications
8. DT Editorial Services. Illustrator CC in Simple Steps. Dreamtech Press.
9. Kogent Learning Solutions Inc. CorelDraw X7 in Simple Steps, Dreamtech Press.

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	MCN107I	Internship	4
4	Internship	MCIN208I	Internship	4
5	Internship	MCIN309I	Internship	2

MCN107I / MCIN208I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 Hours)

All students shall undergo an internship involving media related activities after the exit of 1st year and 2nd year. **However this internship is compulsory only for those students who is willing to exit the course at the end of 1st or 2nd year and desires to earn extra credit.** The purpose of the internship is to give the students an opportunity to have a hands-on field experience to effectively put into practice the theoretical and practical learning from the programme in an area of interest. Students may undergo their internship in a media house of their choice. The student shall be required to discuss the choice of media house with the department and obtain its consent. Before going for the internship, a Letter of Consent from the concerned media house, in the prescribed format, shall be submitted by the student to the Department. After returning from the internship each student shall have to submit a detailed report in a prescribed format. Each student shall also make a presentation of the internship experience and learning in the Department and submit a certificate of successful completion of the internship from the designated authority of the concerned media house. The schedule of the conduct, report submission and evaluation of the internship shall be as notified by the Department. The components of evaluation of the Internship and their weightages shall be as notified by the department at the beginning of the semester.

MCIN309I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours)

Students will undertake 4-weeks internships in media and communication organizations during the vacation between fourth and fifth semester. They will discuss the choice of media and communication organization with their respective mentors and obtain the consent of the head of the department. Before going for the internship, an Internship Agreement Contact form from the concerned organization will be submitted by the student to their respective mentors. At the end of the internship students will submit a copy of the Internship Completion Certificate to their mentors from the designated authority of the concerned media and communication organization. Students will submit a report of their internship which will include the following documents:

- **Employer Evaluation:** At the end of the internship the supervising employer will be asked to submit a written evaluation of the student's performance.
- **Journal:** Each student will keep a daily journal with an entry for each day spent doing work for the internship. This journal should be e-mailed to the mentor at the beginning of each work week. In this journal the students should summarize the activities and assignments on which the student worked. The student should also keep track of the number of hours for each week.
- **Internship Completion Certificate**
- **Work Samples:** Examples of work during the Internship.

The department will issue the following documents to the students for the internship:

- **Internship Application Form:** to be submitted to the mentor prior to internship.
- **Internship Agreement Contract:** to be submitted to the mentor prior to internship.
- **Employer Evaluation of Intern:** to be included in the portfolio

Last date of Internship

- To be notified by the department
- Internship Report Submission and Presentation: To be notified by the department

RESEARCH PROJECTS /DISSERTATIONS

BA MASS COMMUNICATION (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	MCDI407P	Research Project Phase I	6
8	Research Project/Dissertation	MCDI408P	Research Project Phase II	6
BA MASS COMMUNICATION (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	MCDI409P	Dissertation I	18
8	Research Project/Dissertation	MCDI410P	Dissertation II	20

BA MASS COMMUNICATION (Honours)

MCDI407P: RESEARCH PROJECT PHASE I

(6 credits – 180 hours) (L-T-P: 0-0-12)

In this course, students will gain familiarity with the domains of research and explore various areas related to research writing. The objective is to equip them with the necessary skills to formulate and develop critical ideas into well-structured research papers. Throughout the course, students will be introduced to the essential components of research, including topic selection, literature review, data collection, and referencing. By mastering these elements, they will be empowered to write research papers suitable for publication in prestigious indexed journals. The specific evaluation criteria for the course will be communicated by the department at the beginning of the semester, providing clear guidance on how students' progress will be assessed.

MCDI408P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-12)

In this course, after students will gain familiarity with the domains of research and explore various areas related to research writing in phase 1. The objective is to equip them with the necessary skills to formulate and develop critical ideas into well-structured research papers. Throughout the course, students will be expected to apply some specific methods of communication research such as: Case studies, Ethnographic Study, Content Analysis.in their research work. By mastering these elements, they will be empowered & expected to write research papers suitable for publication in prestigious journals indexed by Scopus, Web of Science, and UGC Care. The focus of the research papers will revolve around media, film studies, development communication, and related subjects. Students will analyze and address relevant issues within these areas, fostering a deeper understanding of their chosen topics. The specific evaluation criteria for the course will be communicated by the department at the beginning of the semester, providing clear guidance on how students' progress will be assessed.

BA MASS COMMUNICATION (Honours) with Research

MCDI409P: DISSERTATION I

(18 Credits -540 Hours) (L-T-P: 0-0-36)

As part of the course students will undertake a research study in the field of media and communication. Students will complete data collection, analysis, and preparation of research reports and submit the final dissertation. The dissertation has to be systematically structured following proper methodology of communication research. Students will have to ensure that the dissertation is prepared keeping in view Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Students are required to make a presentation of the dissertation submitted to the department on the date set by the department.

The Exercise:

During this course, students will have to choose a research topic of their choice, conduct a literature review with bibliography, and develop a research proposal which will be submitted in partial fulfilment for the requirement of Bachelor's degree in Mass Communication. Students will also write and present a research paper.

MCDI410P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

During this phase 2 students will complete data collection, analysis, preparation of research report and submit the final dissertation. The dissertation has to be systematically structured following proper methodology of communication research. Phase - I of the course is carried out in the 2nd Semester where students work upon research proposals, literature review and research methodology. Students will have to ensure that the dissertation is prepared keeping in view Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Students are required to make a presentation of the dissertation submitted to the department on the date set by the department.

DEPARTMENT OF PSYCHOLOGY

PROGRAMME: BACHELOR OF ARTS in PSYCHOLOGY (BA)

DEGREE: BA PSYCHOLOGY (HONOURS)/ BA PSYCHOLOGY (HONOURS) WITH RESEARCH

VISION

To be a centre of excellence in teaching, learning, research and in the practice of psychological counselling, thereby promoting community mental health and psychosocial competence in order to foster cohesion in the society.

MISSION

Department of psychology of Assam Don Bosco University seeks to-

1) Achieve excellence in teaching, learning, research, practice and extension activities.
2) To nurture and develop the counselling skills of the students.
3) To prepare competent counsellors who are socially committed and culturally sensitive and are bound by the ethics of the profession.
4) To create an environment committed to promoting the application of science of psychological counselling to real world situation.

Program Outcomes:

PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO 7: **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes:

PSO 1: **Knowledge of Basic Concepts of Psychology:** To impart knowledge and understanding of the basic concepts, systems, theories of psychology and psychopathology.

PSO 2: **Practical Application Skills:** An ability to apply the theoretical principles of Psychology demonstrating an understanding of behavior, thoughts, and feelings of the individual and the individual in group settings

PSO 3: **Assessment Skills:** Basic professional skills pertaining to psychological testing, assessment and counselling.

PSO 4: **Multicultural Competence:** To recognize, understand, and respect the complexity of multiculturalism in the practice and application of counseling and psychotherapy.

Mapping of Courses with POs/PSOs

Code	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
PCIP101T	Introduction to Psychology	M	L					H	M	M		M
PCSP102T	Social Psychology	H				M			H	M		L
PCPR201T	Psychological Research and Testing	M		M		L	L	L	H	M		
PCDP202T	Developmental Psychology	H		M	L	L		M	H	H	M	M
PCPR203T	Statistics in Psychological Research	H	L	L	L	M	L	M	H	H	H	M
PCBP204T	Bio Psychology			M	M	M	L	H	H	M	M	M
PCOP205T	Organizational Psychology	H				M		M	M		M	
PCGP301T	Geriatric Psychology	H		H		M	L	M	H	L	L	H
PCCP302T	Cognitive Psychology	M	M	L		M		L	L			
PCHP303T	Health Psychology			M	L		L	H	H	M	M	M
PCFP304T	Forensic Psychology	M	H	H	M	M	L	L	M	M	L	H
PCCO305T	Counselling Psychology	H		H		H			M		M	M

PCAP306T	Abnormal Psychology-I	M		M			M	M	H	M		
PCMP307P	Minor Project/Field Study	H	M	H	H	M	H	H	H	H	H	H
PCAB401T	Abnormal Psychology-II											
PCFP402T	Foundations of Psychotherapy	M	L	H	L		M		H	L		L
PCPA403T	Psychotherapeutic Approaches	M	L	L	L	H	L	M	H	M	L	M
PCCP404T	Criminal Psychology	L				M		M		L		M
PCHS103T	History and Systems of Psychology	L					M		M		M	
PCPP104T	Human Resource Management: A Psychological Perspective	H	L		M		H	H	H	M	M	L
PCEM206T	Emotional Intelligence	H	L	M		H	M	L	H	M	M	M
PCEA207T	Eastern Approaches to Psychology	H	M	H	M	H	L	M	H	H	H	M
PCYG308T	Youth, Gender and Identity	L	H	H	H	M	M	M	H	M	L	H
PCPO309T	Positive Psychology	H	M	H	H	M	M	H	H	L	M	H
PCCM405T	Community Psychology	H	L		M		H	H	H	M	M	L
PCPW406T	Psychology for Health and Wellbeing	H	L	M		H	M	L	H	M	M	M
PCAR407T	Advanced Research Methodology and Statistics	H	M	H	M	H	L	M	H	H	H	M
PCCI408T	Culture and Indigenous Psychology	L	H	H	H	M	M	M	H	M	L	H
PCBM105L	Techniques of Behaviour Modification	H	M	H	H	M	M	H	H	L	M	H
PCDP106L	Sports Psychology	H	L		M		H	H	H	M	M	L
PCPR208L	Peer Counselling	H	L	M		H	M	L	H	M	M	M

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	PCIP101T	Introduction to Psychology	4
2	Major Course 2	PCSP102T	Social Psychology	4
3	Major Course 3	PCPR201T	Psychological Research and Testing	4
3	Major Course 4	PCDP202T	Developmental Psychology	4
4	Major Course 5	PCPR203T	Statistics in Psychological Research	5
4	Major Course 6	PCBP204T	Bio Psychology	5
4	Major Course 7	PCOP205T	Organizational Psychology	4
5	Major Course 8	PCGP301T	Geriatric Psychology	5
5	Major Course 9	PCCP302T	Cognitive Psychology	5
5	Major Course 10	PCHP303T	Health Psychology	4
6	Major Course 11	PCFP304T	Forensic Psychology	4
6	Major Course 12	PCCO305T	Counselling Psychology	4
6	Major Course 13	PCAP306T	Abnormal Psychology-I	4
6	Major Course 14	PCMP307P	Minor Project/Field Study	4
7	Major Course 15	PCAB401T	Abnormal Psychology-II	5
7	Major Course 16	PCFP402T	Foundations of Psychotherapy	5
8	Major Course 17	PCPA403T	Psychotherapeutic Approaches	5
8	Major Course 18	PCCP404T	Criminal Psychology	5

PCIP101T: INTRODUCTION TO PSYCHOLOGY
(4 Credits: 60 hours) (L-T-P: 4-0-0)

Course Objective
To learn the basic/core concepts and subject matters of psychology.

Course Outcomes
1. Explain the nature and characteristics of psychological research and perspectives. (Understanding)
2. Apply research designs and approaches appropriately. (Applying)
3. Analyse the basic principles and theories of intelligence, learning and memory and motivation. (Analysing)
4. Evaluate modern and Indian perspectives of psychology (Evaluating)

Module 1: Introduction (16 hours)
Nature of Psychology: Definition, Fields of psychology, Schools of modern psychology, History and Modern perspective
Scientific Methodology (with special emphasis. on Experimentation),
Biological basis of human behaviour: Structure of neurons, Neurotransmitters, Overview of nervous system (special emphasis on brain)

Module 2: Learning, Memory and perception (16 hours)
Learning: Classical conditioning, instrumental learning, observational learning (socio-cognitive learning)
Memory: Processes of memory, Models of memory: Parallel Distributed Processing, Information processing model (Sensory register, STM, LTM and concept of working memory), Levels of processing model, Forgetting
Perception: Top down and Bottom-Up processes, Size Constancy, Depth Perception

Module 3: Motivation & Emotion (12 hours)
Approaches to understanding motivation and Types of Motives
Elements of Emotions (components), Emotional Intelligence and Gender, Culture & emotions

Module 4: Individual differences: Personality and Intelligence (16 hours)
Personality: Nature and Theories
Intelligence: Nature and Theories

Suggested Readings
1. Banyard, P., Davies ,M.N.O., Norman, C. & Winder, B. . Essential psychology. New Delhi: SAGE Publications (Eds.) (2010).
2. Baron, R. & Misra.G. . Psychology. New Delhi: Pearson (2014).
3. Ciccarelli, S.K. & White, J.N. & Misra, G. Psychology. New Delhi : Pearson Education (2018)..
4. Morgan, C T., King, R., Weisz, J. & Schopler, J. .Introduction to Psychology (7th Ed). McGraw Hills (2017).

5. Holt, N., Bremner, A., Sutherland, E., Vliek, M. and Passer, M., & Smith, R. Psychology: The Science of Mind and Behaviour. London: Tata McGraw-Hills. (2015).

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H	H	M	
CO2	M			
CO3		M	H	H
CO4	M	H		H

PCSP102T: SOCIAL PSYCHOLOGY

(4 credits- 60 hours) (L-T-P: 3-1-0)

Course Objective

To familiarize with the psychological perspective of the human interaction and behaviour in social setting.

COURSE OUTCOMES

1. Illustrate the interpersonal processes (Understanding)
2. Apply the keys aspects of individual processes in the social world (Applying)
3. Examine the individual processes in the social world (Analysing)
4. Explain the concept group, cooperation and conflict. (Evaluating)

Module 1: Understanding Social Psychology (15 hours)

History of social psychology, Scope of social psychology, and to understand the individual in the social world

Module 2: Individual Processes (15 hours)

Person perception, Attention-theories, biases and errors; Attitude: Formation, change and resistance to change

Module 3: Interpersonal processes (10 hours)

Interpersonal attraction, prosocial behavior, aggression

Module 4: Group dynamics (20 hours)

Key aspects of groups, cooperation and conflict, group decision making

Suggested Readings

1. Baron,R.A.,Byne,D.& Bhardwaj.G (2010).Social Psychology (12th ed). New Delhi: Pearson
2. Chadha.N.K.(2012).Social Psychology.MacMillan: New Delhi
3. Myers,D.G.(2008).Social Psychology.New Delhi : Tata McGraw-Hill

Mapping of CO's to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	M		
CO-2		H	M	M
CO-3	M		H	H
CO-4	M	H		H

PCPR201T: PSYCHOLOGICAL RESEARCH AND TESTING

(4 credits – 60 hours) (L-T-P: 4-0-0)

Course Objective

To learn the different approaches of research and steps of test construction.

Course Outcomes:

1. Understand the various approaches and research traditions in psychological research. (Understanding)
2. Application of different techniques and tools in psychological research. (Applying)
3. Analyse the effectiveness of various tools used in different types of research designs in psychological research. (Analysing)
4. Evaluate the significance of research in psychology and the advantages and disadvantages of the different orientations and research traditions. (Evaluating)

Module I: Introduction to Psychological Research (10 hours)

Basics of Research in Psychology: What is Psychological Research? The Goals of Psychological Research; Principles of Good Research; Ethics in Psychological Research.

Research Traditions: Quantitative and Qualitative; Comparing qualitative and quantitative research traditions.

Module 2: Test Construction (20 hours)
Psychological Testing: Steps of Test Construction, Item Writing, Types of Items, Standardization; Reliability, Validity and Norms of a Psychological Test; applications.

Module 3: Experimental Method (15 hours)
Types of Experimental Methods: Introduction to Experimental and Quasi-experimental Methods. Methods of Data Collection: Sampling (Probability and Non-Probability Sampling Methods).

Module 4: Non-Experimental Methods – I (15 hours)
Case Study, Sociometry, Observation, Surveys, Focus Group Discussion, Interviews.

Suggested Readings:

1. Chadha, N. K. (2009) Applied Psychometry. Sage Pub: New Delhi.
2. Dyer, C. (2001) Research in Psychology: A Practical Guide to Research Methodology and Statistics (2nd Ed.) Oxford: Blackwell Publishers
3. Gregory, R.J. (2006). Psychological Testing: History, Principles, and Applications (4th Ed.). New Delhi: Pearson Education.
4. Murphy, K.R. &Davidshofer, C. O. (2004). Psychological Testing: Principles & Applications (6th ed.) New Jersey: Prentice Hall.
5. Neuman, W.L. (2006). Social Research Methods: Qualitative and Quantitative Approaches (6th ed.) Boston: Pearson Education.
6. Willig, C. (2001). Introducing qualitative research in psychology: Adventures in theory and method. Philadelphia: Open University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		M
CO 2	H		M	
CO 3		M		H
CO 4		H	M	H

PCDP202T: DEVELOPMENTAL PSYCHOLOGY

(4 Credits-60 Hours) (L-T-P: 3-1-0)

Course Objective
To acquire the knowledge of the stages of life span development, theories and sociocultural factors influencing human development.

Course outcomes:
1. State the concept of and process of human development across the life span. (Remembering)
2. Explain the various domains of human development (Understanding)
3. Utilize the knowledge of different theoretical perspectives, developmental tasks, adjustment process and hazards across the lifespan (Applying)
4. Analyse the sensitivity to socio-cultural context of human development. (Analysing)

Module 1: Understanding Human Development (10 hours)
Define the concept of Human Development. Theories, themes and research designs related to the study of human development

Module 2: Periods of Life Span Development (20 hours)
Prenatal development, Birth and Infancy, Childhood, Adolescence, Adulthood

Module 3: Domains of Human Development (20 hours)
Cognitive development: perspectives of Piaget and Vygotsky; Language development; Physical development; Emotional development; Moral development; Personality development

Module 4: Socio-Cultural Contexts for Human Development (10 hours)
Family, Peers, Media & Schooling, Human Development in the Indian context

Suggested Readings:

1. Berk, L. E. (2010). Child Development (9th Ed.). New Delhi: Prentice Hall.
2. Mitchell, P. and Ziegler, F. (2007). Fundamentals of development: The Psychology of Childhood. New York: PsychologyPress.
3. Papalia, D. E., Olds, S.W. & Feldman, R.D. (2006). Human development (9th Ed.). New Delhi: McGraw Hill.
4. Santrock, J. W. (2011). Child Development (13th Ed.). New Delhi: McGraw Hill.
5. Santrock, J.W. (2012). Life Span Development (13th ed) New Delhi: McGraw Hill.

6. Saraswathi, T.S. (2003). Cross-cultural perspectives in Human Development: Theory, Research and Applications. New Delhi: Sage Publications.
7. Srivastava, A.K. (1997). Child Development: An Indian Perspective. New Delhi.

Mapping of COs to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	M	M	
CO-2	M	H		M
CO-3		H	H	
CO-4			H	H

PCPR203T: STATISTICS IN PSYCHOLOGICAL RESEARCH

(5 Credits-75 Hours) (L-T-P: 5-0-0)

Course Objective

To learn about the basics of descriptive statistics and its usages, difference between parametric and non-parametric statistics.

Course Outcomes

1. State the basic concepts of research, identify major research designs and recognize the philosophical foundations of research. (Remembering)
2. To understand the importance of inferential statistics and scales of measurements. (Understanding)
3. To analyse the scope and uses of graphical representation of the quantitative data. (Analysing)
4. To use measures of Central Tendency and Measures of Variability in research. (Applying)

Module 1: Introduction to Statistics (15 Hours)

Statistics: Definition, usages and limitations; Test of Hypothesis, Variables and Constants; Measurement Scales.

Module 2: Organization and Graphic Representation of Data (20 hours)

Organizing of Data: Frequency Distribution, Computation of Percentiles and Percentile Ranks.
The Histogram; Frequency Polygon; Bar Diagram; Pie Chart, Cumulative Frequency Graph

Module 3: Measures of Central Tendency (20 hours)

a) Measures of Central Tendency

The Mode, Median and Mean; Properties and Relative Advantages and Disadvantages of the Mode, Median and Mean; Computation of Mean, Median Mode.

b) The Normal Distribution

The Nature and Properties of the Normal Probability Distribution; Standard Scores and the Normal Curve; The Normal Curve as a Model for Sampling Distributions; Divergence from Normality (Skewness and Kurtosis)

Module 4: Correlation (20 hours)

a) Correlation

Meaning of Correlation, Computation of coefficient of correlation as Pearson's Correlation Coefficient; Spearman's Rank-Order Correlation Coefficient.

b) Parametric and Non-Parametric Statistics: t-Test, Chi-Square and ANOVA

Suggested Readings

1. Ahuja, R. (2001). Research Methods, Jaipur: Rawat.
2. Alston, M. Bocoles, W., (2003). Research in Social Workers: An Introduction to the Methods (Indian ed.), Jaipur: Rawat.
3. Baker, T. L. (1994). Doing Social Research, Singapore: McGraw Hill.
4. Goode, W. J. and Hatt, P. K. (1981). Methods in Social Research, Singapore: McGraw Hill.
5. Gupta, S. C. (1997). Fundamentals of Statistics, Delhi: Himalaya Publishing House.
6. Gupta, S.P. (1997). Statistical Methods, New Delhi: Sultan Chand and Sons.
7. Jacob, K.K., Methods and Fields of Social Work in India, Asia Publishing, Bombay, 1996
8. Kothari, C. R. (2004). Research Methodology: Methods and Techniques, (2nd ed. reprint), New Delhi: New Age International.
9. Laldas, D.K. (2000). Practice of Social Research, Jaipur: Rawat.
10. Mikkelsen, B. (2005). Methods for Development Work and Research-A New Guide for practitioners, New Delhi: Sage.
11. Sarantakos, S. (2005). Social Research, New York: Palgrave Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	M

CO 2		M		H
CO 3	M	H	H	
CO 4		M	H	H

PCBP204T: BIO-PSYCHOLOGY

(5 Credits- 75 hours) (L-T-P: 5-0-0)

Course Objective

To acquire in-depth knowledge of the biological basis of human behavior.

COURSE OUTCOMES

1. Identifying and define the biological bases of behavior. (Remembering)
2. Associating the role of the nervous system with behavior, hunger and thirst. (Understanding)
3. Examining the impact of bio chemicals in behavior and mental health at a conceptual level. (Applying)
4. Analyze the biological markers of individual difference in sleep and wake cycles. (Analyzing)

Module 1: Introduction to Bio-psychology (15 hours)

History and scope; Major theoretical perspectives: Rene Descarte, Phinaes Gage, Charles Darwin. Nature versus Nurture controversy; Sub disciplines and allied fields; Methods in Bio Psychology.

Module 2: Neurons and Genetic bases of behavior (15 hours)

Structure of neuron; Nerve impulse and Synaptic transmission; Neurotransmitters; Types of neurons. Genetic bases of behavior: Structure of a gene, DNA and Chromosomes, Types and Functions of Genes, Genotype and Phenotype.

Module 3: Nervous System (20 hours)

a) Nervous System: Central Nervous System: Brain and Spinal Cord; Peripheral Nervous system: Division; Role of nervous system in controlling behavior.
b) Biological Basis of Thirst and Hunger: Thirst: Mechanisms of water regulation- Osmotic thirst- Hypovolemic thirst and sodium specific hunger, Hunger: Digestion and food selection-short- and long-term regulation of feeding-Brain mechanisms - Eating Disorders.

Module 4: The Endocrine System and behavior (10 hours)

Endocrine glands; Hormones; Role of endocrine system on emotions and behavior.

Module 5: Circadian Rhythms, Sleep and Dreaming (15 hours)

Rhythms of waking and sleeping: Endogenous cycles- Setting and resetting the biological clock- Mechanisms of the biological clock, Sleep and brain mechanisms: Sleep and other interruptions of consciousness, the onset of sleep and hypnagogic hallucinations, stages of sleep. Paradoxical or REM sleep, Brain mechanisms of wakefulness and arousal: Brain functions in REM sleep- Functions of sleep, dreaming: REM sleep and dreaming. Biological perspectives on dreaming.

Suggested Readings

1. Carlson, N. R. (2012). Foundations of physiological psychology. (Sixth Edition). Delhi:
2. Pearson Education.S
3. Passer,M.W.andSmith,R.E.(2010).Psychology:TheScienceofMindandBehaviour.NewDelhi: Tata McGraw-Hill
4. Breedlove, S. M., Rosenzweig, M. R., & Watson, N. V. (2007) Biological Psychology: An
5. introduction to behavioral, cognitive, and clinical neuroscience, 5th Edition. Sinauer
6. Associates, Inc., Sunderland, Massachusetts.
7. Green, S. (1995). Principles of biopsychology. UK: Lawrence Erlbaum Associates Ltd.
8. Pinel, J. P. J. (2011). Biopsychology, 8th Edition. Pearson Education, New Delhi.
9. Kalat, J. W. (2015). *Biological psychology*. Cengage Learning.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H		M
CO2		H	M	
CO3	M		H	M
CO4		M	H	H

PCOP205T: ORGANIZATIONAL BEHAVIOUR

(4 Credits: 60 hours) (L-T-P: 4-0-0)

Course Objective

To learn about the core concepts of organizational behaviour, dynamics of individual and group behaviors in an organizational set up.

Course Outcomes:

1. Identify and state the key concepts of Organizational Behavior. (Remembering)
2. Explain various organizational contexts in the globalized world. (Understanding)
3. Apply knowledge of psychological constructs in modifying the organizational environment. (Applying)
4. List current areas in need of upgrading in the Indian context. (Analyzing)

Module 1: Introduction (10 hours)

Historical antecedents of Organizational Behaviour, Contemporary Trends and Challenges, Organizational Behavior: Challenges in the Indian Setting

Model 2: Individual level processes (20 hours)

Employee attitudes: Job satisfaction, Organizational Commitment, Organizational Citizenship Behaviour Work Motivation: Early theories- Maslow, McClelland, Two-Factor; Contemporary Theories-Goal setting, Equity, Expectancy; Applications: Job Characteristics Model, Job redesign

Module 3: Dynamics of Organizational Behavior (16 hours)

Organizational Culture, Power and Politics: sexual harassment, organizational politics; Positive Organizational Behavior

Module 4: Leadership (14 hours)

Basic approaches: Trait theories, Behavioral theories, Contingency theories; Contemporary Issues: Approaches to leadership, Contemporary leadership roles, Challenges to the leadership construct; Creating Effective Leaders.

Suggested Readings

1. Chadha, N.K. (2007). Organizational Behavior. Galgotia Publishers: New Delhi.
2. Furnham Adrian.The Psychology of Behaviour at Work: The Individual in the Organization. Psychology Press. (1997).
3. Greenberg, J. & Baron, R.A. (2007). Behaviour in Organizations (9th Ed.). India: Dorling Kindersley. Griffin, R.W. & Moorhead, G. (2009). Organizational Behavior: Managing People & Organizations. New Delhi : Biztantra publishers.
4. Levy Paul. Industrial/Organizational Psychology: Understanding the Workplace. Worth Publishers. (2009).
5. Luthans, F. (2009). Organizational behavior. New Delhi: McGraw Hill.
6. Pareek, U. (2010). Understanding organizational behaviour. Oxford: Oxford University Press.
7. Robbins, S. P. & Judge, T.A. (2007) Organizational Behavior(12th Ed). New Delhi: Prentice Hall of India.
8. Robbins, S. P., & Judge, T. A. (2013). Organisational Behavior (15th editi). England: Pearson Education Limited.
9. Rothman Ian, Cooper L. C. (2015). Work and Organizational Psychology. Routledge.
10. Singh, K. (2010). Organizational Behavior: Texts & Cases. India: Dorling Kindersley
11. Sinha, J.B.P. (2008). Culture and Organizational Behavior. New Delhi: Sage.
12. Wayne F.C., Herman A. (2013). Applied Psychology in Human Resource Management: Pearson New International Edition. Pearson Education Limited.

Mapping of COs to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	H	M	
CO-2		H		M
CO-3	M	M	H	
CO-4			M	H

PCGP301T: GERIATRIC PSYCHOLOGY

(5 Credits: 75 hours) (L-T-P: 4-0-1)

Course Objective

To learn about the concepts related to geriatric psychology such as ageing cognitive decline, depression and socio-cultural factors influencing aging.

Course Outcomes:

1. Demonstrate an understanding of the psychological, social and cultural factors that influence ageing and the experience of older adults. (Understanding)

2. Apply the knowledge of geriatric psychology to real-world situations such as planning out an intervention programme for older adults to improve the quality of life. (Applying)
3. Critically analyse and examine research on ageing and geriatric psychology including identifying limitations and gaps in existing literature. (Analysing)
4. Assess and evaluate the ethical and social implications of issues related to ageing such as elder abuse and end-of-life decision making. (Evaluating)

Module 1: Introduction (15 hours)

a) Geriatric Psychology - Definition and multidisciplinary nature
b) Old Age - Definitions, Myths and Assumptions about Ageism
c) Theories of Ageing - Modernisation Theory, Disengagement Theory and Activity Theory
d) Relevance of these theories to working with older adults and cultural considerations

Module 2: Health and Well-Being of Older Adults (25 hours)

a) Concept of Healthy Ageing - Distinction between typical and pathological patterns of ageing, Factors affecting Healthy Ageing
b) Psychosocial Aspects of Ageing - Loneliness, Quality of Life, Activities of Daily Living (Recreation and Use of Leisure Time), Self-Concept and Self-Esteem, Coping with grief and bereavement
c) Elder Abuse: Typology and Consequences of Elder Abuse - Physical, Economic, Psychological; Characteristics of victims based on gender, marital status, health, living arrangements, problem behaviours
d) Nature of Degeneration and its psychosocial implications: Diabetes, Cardiovascular Disease, Disability related issues - hearing and ophthalmologic impairment, Neuropsychological diseases - Depression, Dementias, Parkinson's Disease

Module 3: Therapeutic and Preventive Interventions (20 hours)

a) Physical Interventions: Physiotherapy, Laughter Club, Respite care, Nutrition Care, Education on adoption of healthy Life Style
b) Psychosocial Interventions: Coping with loss, Building and Maintaining Self-Concept, Active Ageing.
c) Neuropsychological Intervention: Cognitive Stimulation Therapy for Dementia
d) Preventive Intervention against Elder Abuse.

Module 4: Application/Practicum (15 hours)

Design and carry out a preventive intervention against elder abuse
OR
Create a Systematic Review/Meta-analysis of the literature on (1) any of the therapeutic/preventive interventions discussed OR (2) any concepts under module 2
OR
Execute any one of the therapeutic interventions at an elder care facility (**The application/practicum needs to be done under strict supervision)**

Suggested Readings

1. Butler, R.N., Lewis, M.I., Sunderland, T. (1998). Ageing and Mental Health: Positive Psychosocial and Biomedical Approaches.
2. Bensadon, B. A. (Ed.). (2015). Psychology and geriatrics: Integrated care for an ageing population. Elsevier Academic Press.
3. Steffens, D.C., Blazer, D.G., Thakur, M.E. (Eds.). (2015). The American Psychiatric Publishing Textbook Of Geriatric Psychiatry, Fifth Edition.
4. Kennedy. G.J. (2012). Geriatric Mental Health Care: A Treatment Guide for Health Professionals. Guilford Press
5. Yates, L. A., Yates, J., Orrell, M., Spector, A., & Woods, B. (Eds.). (2017). Cognitive stimulation therapy for dementia: History, evolution and internationalism. Routledge.
6. Kalache, A., & Gatti, A. (2003). Active ageing: a policy framework. Advances in gerontology, 11, 7-18.
7. World Health Organization. (2002). Active ageing: A policy framework (No. WHO/NMH/NPH/02.8). World Health Organization.

Mapping of CO's to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	H		
CO-2	M		H	H
CO-3		M	H	H
CO-4		H	M	

PCCP302T: COGNITIVE PSYCHOLOGY

(5 Credits-75 Hours) (L-T-P: 5-0-0)

Course Objective

To acquire the knowledge about the cognitive functioning and the relationship between mind, brain and behaviour.

Course Outcomes

1. Define the basic concepts of cognitive psychology, identify major theoretical foundations and recognize the historical background of cognitive psychology. (Remembering)
2. To analyze the scope and application of cognitive psychology. (Analysing)
3. To use measures of cognitive psychology in research and practice. (Applying)
4. To evaluate different cognitive methods, tools and their appropriate applicability. (Evaluation)

Module 1: Introduction to Cognitive Psychology (15 Hours)

Definition, History of cognitive psychology.
Cognitive Neuroscience: Basic neuroanatomical principles, modern techniques for exploring cognition (EEG, fMRI, PET)
Emotional Intelligence, Artificial Intelligence.

Module 2: Memory Processes (25 Hours)

Processes of Memory, Sensory Memory, Short Term and Long-Term Memory, Working Memory
Semantic and Episodic Memory, Level of Processing, Constructive nature of Memory
Forgetting: Incidental and Motivated Forgetting. Process of forgetting (Interference versus Decay Theory), Memory Distortions

Module 3: Attention & Perception (20 Hours)

Basic Concepts of Attention: Divided Attention, Selective Attention, Visual Attention and Auditory Attention.
Perception: Subliminal Perception; Gestalt Approach of Perceptual Organisation, Time perception
Pattern Recognition: Bottom Up and Top-Down Approach, Perceptual Learning, Depth Perception.

Module 4: Thinking, Problem Solving and Decision Making (15 Hours)

Types of thinking, Components of thinking: images, concepts, creativity.
Decision Making: Complex, Uncertain Decision Making
Human Problem Solving: Strategies and Heuristics.

Suggested Readings

1. Galotti, K.M. (2013). Cognitive Psychology In and Out of the Laboratory (5th ed.). Sage Publications Inc.
2. Robert J. Sternberg (2009). Cognitive Psychology (5th ed.).
3. Kellogg, R.T. (2007). Fundamentals of Cognitive Psychology. Sage Publication.
4. Matlin, M. W. (2006). Cognition. John Wiley & Sons, Inc.
5. Riegler, G.L.R. (2008). Cognitive Psychology: Applying the Science of the Mind. Pearson Education.
6. Reed, K.S. (2000). Cognition: Theory and Applications. Wadsworth.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H	H		M
CO2	M		H	
CO3		M	H	H
CO4	M		M	H

PCHP303T: HEALTH PSYCHOLOGY

(4 credits: 60 hours) (L-T-P: 4-0-0)

Course Objective

To understand the basics of Health Psychology, Disease Models, Health Behaviours and Health Management system.

Course outcomes

1. Learn the need to study health psychology and the approaches to change in health behavior (Understanding)
2. To understand the relationship between psychological factors and physical health and learn how to enhance well-being. (Applying)
3. Examine the stressors and its impact on the etiology and course of many health-related problems (Analyzing)
4. Estimate the management of various health related disorders (Evaluating)

Module 1: Introduction to Health Psychology (20 hours)

Introduction to Health Psychology; components of health: social, emotional, cognitive and physical aspects; mind-body relationship; goals of health psychology, Bio-psychosocial model of health.

Module 2: Behavior and health (10 hours)
Characteristics of health behaviour; Barriers to health behaviour; Theories of health behaviour and their implications.

Module 3: Stress (10 hours)
Nature, Sources, Effects of stress on physical and mental health; Coping and stress management.

Module 4: Health Management (20 hours)
Health-enhancing behaviors: Exercise, Nutrition, safety, managing and controlling pain. Health Protective behaviours, Illness Management.

Suggested Readings:
1. Allen, F. (2011). Health psychology and behaviour. Tata McGraw Hill Edition.
2. Dimatteo, M. R., & Martin L. R. (2011). Health psychology. India: Dorling Kindersley.
3. Misra,G. (1999).Stress and Health. New Delhi: Concept.
4. Sarafino, E.P. (2002). Health psychology: Bio psychosocial interactions (4th Ed.). NY: Wiley.
5. Taylor, S.E. (2006). Health psychology, 6th Edition. New Delhi: Tata McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	
CO 2	M	H		
CO 3		M	H	
CO 4	M		M	H

PCFP304T: FORENSIC PSYCHOLOGY

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Objective
To accuire comprehensive knowledge about the core concepts of Forensic Psychology, theories of crime and forensic psychological investigation methods.

Course Outcomes
1. Understand the importance of nature of crime. (Understanding)
2. Apply the methods of forensic psychological investigation related with Forensic Psychology. (Applying)
3. Examine the social, psychological theories of crime. (Analyzing)
4. Explain the concept of Juvenile delinquency, sexual offenders and serial offenders. (Evaluating)

Module 1: Introduction to Forensic Psychology (12 hours)
Meaning, nature and definition of Forensic Psychology, Historical background, training of a Forensic psychologist, Work ethic of a forensic Psychologist, Psychology & law, Psychologist as an expert witness, Forensic Psychology in Criminal Proceedings, Competency to stand trial, Criminal responsibility, diminished capacity, risk assessment, Eye-witness testimony

Module 2: Theories of crime (18 hours)
Need for scientific understanding of crime, psychoanalytical conceptualization of crime, eysenck's biosocial theory of crime social learning theory of crime,frustrated induced criminality, Neuropsychological theories of crime, Offender profiling; examination of high-risk offenders,

Module 3: Juvenile offenders and Sexual offenders (18 hours)
Nature and definition of Juvenile offenders, sexual offenders and serial offenders, Social risk factors, Psychological risk factors, family background, Intelligence and delinquency,

Module 4: Forensic Psychological Investigation methods (12 hours)
Methods in Forensic Investigation-Polygraph, Brain electrical Oscillations Signature, narcoanalysis, , forensic hypnosis, voice-stress analysis, Theories, techniques, instrumentation, methodology, procedure & critical evaluation, Forensic interviewing,

Suggested readings
1. Nagel.Y.K.,Srivastava K.,Gupta A (2014) Handbook of Forensic Psychology. Author house UK ltd 1663 Liberty Drive. Bloomington, IN 47403. USA
2. Horton N.A., Heritage.C.L.(2010). Handbook of forensic Neuropsychology. Springer Publishing company. New York

3. Curt R.Bartol.,Anne M.Bartol (2008) Current perspectives in Forensic Psychology and criminal behaviour. Sage Publications India Pvt.Ltd. B I/I I Mohan cooperative Industrial area. Mathura road,New Delhi 110 044,India

Mapping of CO's to Syllabus

Course Outcomes	Module-1	Module-2	Module-3	Module-4
CO1	H	M		
CO2	H	H	M	
CO3	M		H	H
CO4		M		H

PCCO305T: COUNSELLING PSYCHOLOGY

(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Course Objective

To learn about the foundations of counselling psychology, theoretical perspective and techniques of counselling.

Course outcomes

1. State counselling and state the goals of counselling. (Remembering)
2. Explain the process of establishing client-counselor relationship. (Understanding)
3. Identify counselling techniques as per the current trends. (Applying)
4. Analyze the basic principles and techniques of counseling approaches. (Analysing)

Module 1: Introduction to Counselling Psychology (12 hours)

Definition and goals of Counselling, Counselling as a profession: training, skills and ethics, The effective counsellor: personality and background of the counselor, Counselling relationship

Module 2: Techniques of Counselling (20 hours)

Psychoanalytic approach, Humanistic approaches, Behavioral approach, Cognitive approach

Module 3: Counselling Applications (20 hours)

Child Counselling, Family Counselling, Career Counselling, Crisis intervention: suicide and grief

Module 4: Contemporary Trends (8 hours)

Indian approaches: yoga and meditation, Counselling and technology, Expressive techniques: art, music, dance.

Suggested Readings

1. Aguilera, D.C. (1998). Crisis Intervention: Theory and Methodology (8thEd.) Philadelphia: Mosby
2. Belkin, G. S. (1998). Introduction to Counselling (3rd Ed.) Iowa: W. C. Brown
3. Burnard, P. (2009). Counseling Skills Training: Book of activities. Viva Books, New Delhi.
4. Capuzzi, D. & Gross, D. R. (2007). Counselling and Psychotherapy: Theories and Interventions (4th Ed.) New Delhi. Pearson.
5. Corey, G. (2009) Counselling and Psychotherapy; Theory and Practice. (7th Ed.) New Delhi: Cengage Learning.
6. Geldard, K. & Geldard, D. (2011). Counselling Children: A Practical Introduction (3rd Ed.) New Delhi: Sage Gladding, S. T. (2012).
7. Counselling: A Comprehensive Profession. (7th Ed) New Delhi. Pearson.
8. In G. Misra (Ed): Psychology in India. Volume 3: Clinical and Health Psychology. New Delhi. ICSSR/Pearson.
9. Nelson-Jones, Richard. (2008). Basic Counseling Skills: A helper's manual, Second Edition, Sage, South Asia Edition
10. Rao, S.N. & Sahajpal, P. (2013) Counselling and Guidance. New Delhi: Tata McGraw Hill.
11. Sharf, R. S. (2012). Theories of Psychotherapy & Counselling: Concepts and Cases (5th Ed). Brooks/ Cole Cengage Learning.

Mapping of CO's to Syllabus

Course Outcomes	M1	M2	M3	M4
CO1	H		M	
CO2	H	M		M
CO3		M	H	
CO4		H	M	H

PCAP306T: ABNORMAL PSYCHOLOGY-I

(4 Credits: 60 hours) (L-T-P: 4-0-0)

Course Objective

To learn the causes, etiology, classification and identify the clinical picture and dynamics of different mental disorders.

Course Outcomes

1. Classify and categorize psychological disorders. (Understanding)
2. Apply the diagnostic criteria to categorize Anxiety disorders, Conversion disorders, Dissociative disorders, Developmental disorders, Substance related disorders and eating disorders. (Applying)
3. Analyze the distinction between normality and abnormality. (Analyzing)
4. Explain the causal factors of mental health and illnesses. (Evaluating)

Module 1 – Understanding abnormality (12 Hours)

Definition and criteria of abnormality, Causes of Abnormal Behavior: Necessary, Predisposing, Precipitating and Reinforcing causes, classification (latest edition of DSM & ICD), Clinical Assessment, Diathesis Stress Models

Module 2- Clinical States (20 Hours)

a) Anxiety Disorders – Phobias, Obsessive Compulsive Disorder, Generalized Anxiety Disorder (Clinical Picture and Dynamics of anxiety disorders)
b) Conversion Disorder (Clinical Picture and Dynamics)
c) Dissociative Identity Disorder (Clinical Picture and Dynamics)

Module 3: Developmental Disorders (Clinical Picture and Dynamics) (16 Hours)

Mental Retardation, Autism, ADHD, and Learning Disabilities

Module 4: Substance related Disorders and Eating Disorders (12 Hours)

a) Substance-Related Disorder: Alcohol abuse and Drug abuse (clinical picture and causes)
b) Eating disorder: Anorexia Nervosa and Bulimia Nervosa

Suggested Readings:

1. Barlow D.H. and Durand V.M. (2005). Abnormal Psychology: An Integrated Approach (4th Ed.).Wadsworth: New York.
2. Bennett,P. (2006). Abnormal and Clinical Psychology: An introductory textbook. New York: Open University Press.
3. Brewer,K. (2001). Clinical Psychology. Oxford : Heinemann Educational Publishers
4. Carson, R.C., Butcher,J.N.,Mineka,S.& Hooley,J.M. (2008). Abnormal Psychology. New Delhi: Pearson.
5. Kearney, C. A. & Trull, T. J. (2012). Abnormal Psychology and Life: A dimensional approach. New Delhi : Cengage learning.
6. Kring, A. M., Johnson, S. L., Davison G.C. & Neale J.M. (2010). Abnormal Psychology (11th Ed.).NY: John Wiley.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H	M		
CO2		H	M	
CO3	M		H	M
CO4		H	M	H

PCAB401T: ABNORMAL PSYCHOLOGY-II

(5 Credits: 75 Hours) (L-T-P: 5-0-0)

Course Objective

To learn about the mental health and illnesses and categories of mental illness as specified in DSM-V and ICD-10.

Course outcomes:

1. Classify and categorize Schizophrenia, mood disorders, personality and Paraphilia and related disorders, (Understanding)
2. Apply diagnostic criteria of Schizophrenia, mood disorders, personality disorders and paraphilia and its different types to diagnose and select the appropriate psychological intervention for different adult mental health related issues (Apply)
3. Analyze the distinction between normality and abnormality. Distinguish clinical features of different mental illnesses various types. (Analyzing)
4. Evaluate Bio Psycho Social modes and other modes of treatments for Psychological Disorders. (Evaluating)

Module 1: Schizophrenia and related Disorder (20 Hours)

Scizophrenia: Clinical Picture, Types and causal factors
Schizoaffective disorder (Clinical Picture)
Schizotypal disorder (Clinical Picture)
Acute and transient psychotic disorder (Clinical Picture)
Delusional disorder (Clinical Picture)

Module 2: Mood Disorders (15 Hours)

Clinical Picture, subtypes, causal factors and suicide

Module 3: Personality and Sexual Disorders (20 Hours)
Personality Disorders (Clusters of Disorders, Clinical Picture and Dynamics)
Sexual Disorders (Clinical Picture): Gender Identity Disorder, Paraphilia - Paedophilia, Voyeurism, Exhibitionism, Sexual Masochism, Sexual Sadism

Module 4: Prevention and Treatment of Disorders (20 Hours)
a) Perspectives on Prevention - Primary, Secondary and Tertiary Prevention,
b) Biological treatment: Pharmacotherapy and Electroconvulsive therapy
c) Psychological treatment: Psychoanalytic therapy, Behaviour therapy and Cognitive & Behaviour therapy

Suggested Readings
1. Barlow D.H. and Durand V.M. (2005). Abnormal Psychology: An Integrated Approach (4th Ed.).Wadsworth: New York.
2. Bennett,P. (2006). Abnormal and Clinical Psychology: An introductory textbook. New York: Open University Press
3. Brewer,K. (2001). Clinical Psychology. Oxford : Heinemann Educational Publishers
4. Carson, R.C., Butcher,J.N.,Mineka,S.& Hooley,J.M. (2008). Abnormal Psychology. New Delhi: Pearson.
5. Kearney, C. A. & Trull, T. J. (2012). Abnormal Psychology and Life: A dimensional approach. New Delhi : Cengage learning.
6. Kring,A.M.,Johnson,S.L.,Davison G.C. & Neale J.M. (2010). Abnormal Psychology (11th Ed.).NY: John Wiley.
7. Plante, T.G. (2010). Contemporary Clinical Psychology John Wiley & Sons.
8. Riskind, J.H., Manos,M.J. and Alloy,L.B. (2004) Abnormal Psychology : Current Perspectives. McGraw Hill
9. Sadock, B. J. (2015). Kaplan & Sadock's synopsis of psychiatry: behavioral sciences/clinical psychiatry (Vol. 2015, pp. 648-655). Philadelphia, PA: Wolters Kluwer.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	H
CO2	H	M	M	H
CO3	H	H	M	M
CO4	H	M	H	M

PCFP402T: FOUNDATIONS OF PSYCHOTHERAPY

(5 credits - 75 Hours) (L-T-P: 5-0-0)

Course Objective
To acquire comprehensive knowledge about assessment and psychotherapeutic intervention techniques.

Course Outcomes
1. Gather the significance and scope of psychological assessment in diagnosis and intervention (Understanding)
2. Apply psychotherapeutic concepts and constructs to diagnose and intervene individuals with mental illnesses. (Applying)
3. Estimate the appropriate assessments for different population as per the diagnoses. (Analyzing)
4. Evaluate the applicability of different types to psychotherapy to mental health and illnesses. (Evaluating)

Module I: Introduction to Psychotherapy (12 Hours)
Historical background of psychotherapy; Definition, Principles and goals of psychotherapy; Professional training and ethics in clinical practice, Current issues in Psychotherapy

Module 2: Clinical Interviewing (12 Hours)
Nature and purpose of clinical interview, mental status examination; Observing behaviour, clinical judgement; communication strategies, diagnosis and assessment, other approaches to Psychotherapy

Module 3: Major therapeutic models in Psychotherapy (20 Hours)
Therapeutic Models (Behavioural approaches, cognitive therapy and cognitive-behaviour therapy, Psychodynamic therapy, Systemic and group approaches, Eclectic and integrative approaches)

Module 4: Intellectual and Neuropsychological Assessment (15 Hours)
Intelligence, Tests batteries: WAIS, WISC, MISIC, BKT
Approaches to neuropsychological assessment: Halstead-Reitan, Luria-Nebraska, PGI-BBD,
Behavioural assessment, Psychological Assessment: Cognitive and Personality Assessment and Case studies in Psychotherapy.

Module 5: Personality Assessment (16 Hours)
Personality: Nature, Objective and assessments: MMPI-2, MCMI-III, EPQ-R.
Projective methods of personality assessments: Rorschach, TAT

Suggested Readings

1. Hecker, J. E., & Thorpe, G. L. (2011). Introduction to Clinical psychology: Science, practice, and ethics, 4th ed. India: Dorling Kindsley.
2. Korchin, J. S.( ). Modern clinical psychology: Principles of intervention in the clinic and community. CBS Publishing
3. Gregory, R. J. (2000). Psychological testing: History, principles, and applications (3rd Ed.). Boston: Allyn & Bacon.
4. Wolman, B.B. (1965). Handbook of clinical psychology. N.Y: McGraw Hill INC
5. Arun Kumar, (ed.), Clinical Psychology, Anmol Publication Pvt. Ltd., 2000.
6. Freedman, A.M., Kaplan, H.I. and Sadock, B.J., Comprehensive Text Book of Psychiatry (IIIrd Edition) Vol. 1.2. William and wilkins, Batrmore, London, 1989.
7. Anastasi, A., & Urbina, S. (2005). Psychological Testing. 7th ed. Pearson Education: New Delhi, India.
8. Barlow, D.H. & Durand, V.M. (2005). Abnormal psychology: An Integrative Approach (4th ed.). Wadsworth/Thompsons. Belmont CA.
9. Butcher J.N; Mineka Susan; and Hooley Jill M. (2014) Abnormal Psychology (15th Ed.) Dorling Kindersley Pvt. Ltd. of Pearson Education. New Delhi, India.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	M		M	
CO2	H	H	M		
CO3			M	H	H
CO4		M	H		H

PCPA403T: PSYCHOTHERAPEUTIC APPROACHES

(5 Credit- 75 Hours) (L-T-P: 5-0-0)

Course Objective

To learn about different psychotherapeutic approaches and its clinical application.

Course Outcomes

1. Classify and categorise major therapeutic approaches. (Understanding)
2. Apply various approaches of assessment in practice (Applying)
3. Analyse the distinction among different types of psychotherapy. (Analysing)
4. Evaluate the applicability of different types to psychotherapy and related professsionals to mental health and illnesses. (Evaluating)

Module 1: Overview of Psychotherapy (12 hours)

Definition of Psychotherapy, Qualities of an effective psychotherapist,
Systematic framework of Psychotherapy, Related professions, other approaches to Psychotherapy-Supportive psychotherapy, Zen Psychology, NLP.

Module 2: Psychodynamic Psychotherapy (12 hours)

Psychoanalysis: Background and basic principles Psychoanalytic theory since Freud
Psychodynamic psychotherapy in contemporary clinical psychology

Module 3: Humanistic, Experiential and Family Therapies (16 hours)

Humanistic psychotherapy
Eclectic treatment combinations Family therapy
Group therapy

Module 4: Cognitive Behavioural Interventions (20 hours)

Behaviour therapy techniques
Cognitive modification procedures
Cognitive behaviour therapy: specific applications in various psychological disordersDialectic Behaviour therapy

Module 5: Relaxation Therapies (15 hours)

Progressive muscular relaxation
Autogenic training
Biofeedback
Eye Movement desensitization and reprocessing

Suggested Readings:

1. Encyclopaedia of Psychotherepy (2002). Academic Press

2. Beck, J.S (1995). Cognitive therapy: Basic and beyond. New York: Guilford Press.
3. Ellis, A. (1970). The essence of rational psychotherapy: A comprehensive approach to treatment. New York: Institutefor
4. Rational Living.
5. Walen, S.R., Digiuseppe, R., & Dryden, W. (1992). A practitioner's guide to rational emotive therapy. Oxford UniversityPress. Inc.
6. Brems, C. (2001). Basic skills in psychotherapy and counselling. Singapore: Brooks/Cole.
7. Corey, G. (1996). Theory and practice of counselling and psychotherapy (5th ed.). Pacific Grove, CA: Thomson Brooks/ Cole.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	M		
CO2	H	H		M	
CO3		M		M	H
CO4			M	H	H

PCCP404T: CRIMINAL PSYCHOLOGY

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Course Objective

To acquire knowledge about the nature and theories of crime, serial offenders and the importance of criminological psychological assessment into practice.

Course Outcomes

1. Understand the importance of nature of crime. (Understanding)
2. Apply the methods of criminal psychological investigation related with criminal psychology. (Applying)
3. Examine the social, psychological theories of crime. (Analyzing)
4. Explain the concept of Juvenile delinquency, sexual offenders and serial offenders. (Evaluating)

Module 1: Crime, Criminal and Criminology (15 hours)

What is Crime? Who is the criminal? Define Crime. Schools of Criminology – The Pre –Classical School, The Classical School, Neo- Classical school, Positive approach – Radical Positivism and Liberal Positivism, Ceasare Lombroso, Enrico Ferri, Raffaele Garofalo, Gabrial Tarde

Module 2: Theories of Crime (20 hours)

Need for scientific understanding of crime, psychoanalytical conceptualization of crime, Eysenck's biosocial theory of crime social learning theory of crime,frustrated induced criminality, Neuropsychological theories of crime, Offender profiling; examination of high-risk offenders,

Module 3: Psychology and Crime (20 hours)

Meaning, Purpose and scope of criminal Psychology, Criminal profiling, Nature and definition of Juvenile offenders, sexual offenders and serial offenders, Social risk factors, Psychological risk factors, family background, Intelligence and delinquency,

Module 4: Psychological Investigation Methods – Its use in Criminal Behaviour (20 Hours)

Criminal profiling: definition and process of profiling personality, Factors underlining criminal profiling, Merit and demerit of criminal profiling.

Suggested Readings

1. Nagel.Y.K.,Srivastava K.,Gupta A (2014) Handbook of Forensic Psychology. Author house UK ltd 1663 Liberty Drive. Bloomington, IN 47403. USA
2. Horton N.A., Heritage.C.L.(2010). Handbook of forensic Neuropsychology. Springer Publishing company. New York
3. Curt R.Bartol.,Anne M.Bartol (2008) Current perspectives in Forensic Psychology and criminal behaviour. Sage Publications India Pvt.Ltd. B I/I I Mohan cooperative Industrial area. Mathura road, New Delhi 110 044,India

Mapping of CO's to Syllabus

Course Outcomes	Module-1	Module-2	Module-3	Module-4
CO1	H	H		M
CO2	H		H	M
CO3		M	H	
CO4	M		M	H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	PCHS103T	History and Systems of Psychology	4
2	Minor Course 2	PCPP104T	Human Resource Management: A Psychological Perspective	4
3	Minor Course 3	PCEM206T	Emotional Intelligence	4
4	Minor Course 4	PCEA207T	Eastern Approaches to Psychology	4
5	Minor Course 5	PCYG308T	Youth, Gender and Identity	4
6	Minor Course 6	PCPO309T	Positive Psychology	4
7	Minor Course 7	PCCM405T	Community Psychology	3
		PCPW406T	Psychology for health and Wellbeing	
7	Minor Course 8	PCAR407T	Advanced Research Methodology and Statistics	2
8	Minor Course 9	PCCI408T	Culture and Indigenous Psychology	3

PCHS103T: HISTORY AND SYSTEM OF PSYCHOLOGY
(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Course Objective
To acquire comprehensive knowledge about the major concepts, theoretical perspectives, historical trends and empirical findings.

Course outcome:
CO 1: Comparison and Contrast between systems of Psychology and demonstrate fundamental knowledge and comprehension of the major concepts, theoretical perspectives, historical trends and empirical findings (Understanding)
CO 2: Apply Psychology- specific content and effective self-reflection (Applying)
CO 3: Contrast key concepts, principles and overarching themes (Analyzing)
CO 4: Critically evaluate sources of information in the field of Psychology and major psychological systems (Evaluating)

Module-1: Understanding Psyche: Debates and Issues (10 hours)
Free will and Determinism.
Empiricism and Rationality.
Yoga and Vedantic view

Module-2: Schools of Psychology (20 hours)
Early schools of Psychology: Structuralism and Functionalism (Brief Introduction).
Positivist Orientation: Key contribution of Watson, Tolman, Pavlov and Skinner
Cognitive Revolution: Information Processing Model

Module-3: Psychoanalytic and Humanistic Orientation (20 hours)
Freudian Psychoanalysis, Cultural Psychoanalysis (Sudhir Kakar)
The turn towards "social"- Adler, Jung, Fromm
Ego Psychology- Erik Erikson
Humanistic orientation- Carl Rogers, Maslow

Module-4: Contemporary Developments (10 hours)
Feminism and Social Constructionism

Suggested Readings:

1. Benjamin Jr. (2009). A History of Psychology: Original Sources & ContemporaryResearch 3rd Edn. Blackwell Publishing.
2. Feist&Feist. Theories of Personality McGraw Hill Higher Education.
3. King, D.B., Viney, W. & Woody, W.D. (2008). A history of psychology: Ideas and context. (4th Ed.). Pearson education.
4. Kurt Pawlik,GeryD'ydewalle (2006). Psychological Concepts: An InternationalHistorical Perspective. Taylor Francis Group.
5. Leahey, T.H. (2005). A History of Psychology: Main currents in psychological thought(6th Ed.). Singapore: Pearson Education.
6. Mc Adams (2000). The Person: An Integrated Introduction to Personality Psychology
7. Paranjpe, A. C. (1984). Theoretical psychology: The meeting of East and West. NewYork: Plenum Press.
8. St. Clair, Michael. (1999). Object Relations and Self-Psychology: An Introduction. Wadsworth Publishing Company.
9. Schultz & Schultz (1999). A History of Modern Psychology. Harcourt College Publishers/Latest edition available.
10. Wolman, B.B. (1979). Contemporary theories & systems in psychology. London:Freeman Book Co.

Mapping of CO's to syllabus

Course Outcome	Module I	Module II	Module III	Module IV
CO1	H	H	M	
CO2	M	H		
CO3	M		H	H
CO4		M	H	H

PCPP104T: HUMAN RESOURCE MANAGEMENT: A PSYCHOLOGICAL PERSPECTIVE

(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Course Objective

To lean about the core concepts of Human Resource Management, various practices and professional competencies from psychological perspective.

Course Outcomes:

CO 1: To understand human resource management as a profession, its concepts and meaning (Remembering)
CO 2: Understand the role of human resource management, various practices and evaluation process (Understanding)
CO 3: Equip learners with knowledge, skills, attitude, professional competencies and social sensitivities essential for a successful career in Human resource management (Applying)
CO 4: Analyse skills learned and modifications of failures during training or practical applications (Analysing)

Module 1: Introduction to Human Resource Management (HRM) (10 hours)

Personnel management, HRM and HRD, Context and issues in HRM

Module 2: Human Resource Practices (10 hours)

Job analysis; Recruitment and selection; Training; Performance evaluation

Module 3: International human resource management (IHRM) (20 hours)

The context of Globalization, Dimensions of Cultural difference (Hofstede), Policies and practices in the multinational enterprise, Selection of international assignees; Expatriate failure, Cross-cultural training.

Module 4: Organizational change and development (20 hours)

Organizational change: concepts, models (one model), techniques (one for individual and one for group), organizational development:
concepts, models (one model), techniques (one for individual and one for group).

Suggested Readings:

1. Aamodt, M.G. (2001) Industrial/ Organizational Psychology. Thompson Wadsworth, a division of Thompson learning Inc.
2. Bhatnagar, J. & Budhwar, J. (2009). The changing face of people management in India. London: Routledge.
3. Briscoe, D. R., Schuler, R. S. & Claus, L. (2009). International human resource management:
4. Policies and practices for multinational enterprises (3rd Ed). New York: Routledge.
5. Chadha, N.K. (2005). Human Resource Management- Issues, case studies and experiential exercises. 3rd edition. New Delhi: Sai Printographers.
6. DeCenzo, D.A.& Robbins, S.P.(2006). Fundamentals of human resource management. (8th Ed). NY: Wiley.
7. Harzing,A-W.K. and Pennington, A. (2011). International human resource management. New Delhi: Sage publications.
8. Jex, S.M. & Britt, T.W. (2008) Organizational Psychology: A Scientist- Practitioner Approach. 2nd ed. John Wiley and sons Inc. New York.
9. Luthans,F. (2010) Organizational Behaviour. 12th Edition. McGraw Hill.
10. Muchinsky, P.M. (2006) Psychology applied to work: An Introduction to Industrial and Organizational Psychology. NC : Hypergraphic press
11. Pareek,U. (2010) Understanding Organizational Behaviour. Oxford: Oxford University Press.
12. Robbins, S.P., Judge T.A. and Sanghi, S. (2009) Organizational Behaviour. 13th ed. Pearson Education , Inc.
13. Schlutz,D. and Schultz, S.E. (2006) Psychology and Work Today. 9th ed. New Jersey, Pearson Education Inc.

Mapping of COs to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	M		
CO-2	M	H	M	
CO-3			M	H
CO-4		M	H	H

PCEM206T: EMOTIONAL INTELLIGENCE

(4 Credits – 60 Hours) (L-T-P: 3-0-1)

Course Objective

To gain comprehensive knowledge about the basic concepts of emotional intelligence in different contexts.

Course Outcomes

1. Explain different concepts of emotional intelligence. (Understanding)
2. Apply the theoretical concepts of emotional intelligence into real life settings. (Applying)
3. Analyse the managing emotions. (Analyzing)
4. Evaluate Relationships, Conflict Management, And Effective Leadership. (Evaluating)

Module 1: Introduction (15 hours)

Emotional Intelligence, Models of Emotional Intelligence. EQ competencies: self-awareness, self-regulation, motivation, empathy and interpersonal skills. Importance of Emotional Intelligence

Module 2: Knowing One's and Others' Emotions (15 hours)

Levels of emotional awareness. Recognizing emotions in oneself. The universality of emotional expression. Perceiving emotions accurately in others.

Module 3: Managing Emotions (10 hours)

The relationship between emotions, thought and behaviour. Techniques to manage emotions

Module 4: Applications (20 hours)

Workplace. Relationships. Conflict Management. Effective Leadership

Suggested Readings:

1. Bar-On, R., & Parker, J.D.A.(Eds.) (2000). The handbook of emotional intelligence. SanFrancisco, California: Jossey Bros.
2. Goleman, D. (1995). Emotional Intelligence. New York: Bantam Book.
3. Goleman, D. (1998). Working with Emotional Intelligence. New York: Bantam Books.
4. Singh, D. (2003). Emotional intelligence at work (2 nd ed.) New Delhi: Response Books.

Mapping of CO's to syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	M	M	
CO-2	H	H		M
CO-3	M		H	H
CO-4		M	H	H

PCEA207T: EASTERN APPROACHES TO PSYCHOLOGY

(4 Credits- 60 Hours) (L-T-P: 4-0-0)

Course Objective

To acquire a comprehensive knowledge about different approaches of Eastern Psychology and their practice.

Course outcomes:

CO 1: Classify among Indian/Chinese/Japanese approaches to psychology. (Understanding)
CO 2: Make use of the appropriate Indian/Chinese/Japanese approaches to psychology in applied settings. (Applying)
CO 3: Examine ancient and contemporary eastern approaches of psychology. (Analyzing)
CO 4: Recommend the suitable approach in applied/research settings. (Evaluating)

Module 1: Introduction (12 hours)

Definitions, nature, differentiation of concepts-eastern, indigenous and Indian psychology; relationship between culture and psychology, emergence of non-western and indigenous perspectives to psychology.
Nature of Indian Psychology, Fundamental assumptions of Indian Psychology, Mind-body complex, Psychology: Eastern and Western Approach, , Current areas of research in Indian psychology.

Module 2: Major Schools of Indian Psychology (20 hours)

Indian approaches to Psychology-Upanishads, Sankhya, Dvaita and Advaita schools; Viewpoints of Upanishads, Bhagavad Gita, Buddhism and Jainism.

Module 3: Major Schools of Eastern Psychology (15 hours)

Chinese approaches to psychology - Taoism and Confucianism, Japanese approaches to Psychology -Morita and Naikan therapies.

Module 4: Indian Approaches to Health and Wellbeing (13 hours)
Concept of Self and Consciousness, Yoga, Ayurveda, goals of life-concept of Purusharthas, personality development-concept of Ashramas.

Suggested Readings

1. Bankart, C. P. (1996). Talking cures: A History of Western and Eastern Psychotherapies. Pacific Grove, CA: Brooks/Cole.
2. Ajaya, S. (1983). Psychotherapy East and West. Honesdale (PA): Himalayan International Institute.
3. Berry, J. W., Poortinga, YpeH. And Pandey, J. (1997). Handbook of cross-cultural psychology, T" Edition, Vol.1 Theory and method. Boston: Allyn and Bacon. (Chapters3,4 and 8 by J.G.Miller, D. Sinha, P.M. Greenfield)
4. Jones-Smith, E. (2012). Theories of counselling and psychotherapy: An integrative approach.Thousand Oaks, CA: Sage.
5. Garg, Pulin K. K. and Parikh, I. J. (1995). Crossroads of culture: a study in the culture of transience, New Delhi: Sage.
6. Kakar.S.(1982). Shamans, mystics and doctors: A psychological enquiry into India and its healing traditions. Bombay: Oxford University Press.
7. Paranjpe, A. C. (1998). Self and identity in modern psychology and Indian thought. New York: Plenum.
8. Dunn, B. R., Hartigan, J. A., and Mikulas, W. L. (1999). Concentration and mindfulness meditations: Unique forms of consciousness? Applied Psychophysiology and Biofeedback, 24 (3), 147-165.
9. Kuyken, W., Byford, S., Taylor, R. S., Watkins, E., Holden, E., White, K., Barrett, B., Byng, R., Evans, A., Mullan, E., and Teasdale, J. D. (2008). Mindfulness-based cognitive therapy to prevent relapse in recurrent depression. Journal of Consulting and Clinical Psychology, 76(6), 966-978.
10. Segal, Z. (2008). Finding daylight: Mindful recovery from depression. Psychotherapy Networker.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	M	
CO 2	M	H	H	
CO 3		M		H
CO 4	M		M	H

PCYG308T: YOUTH, GENDER AND IDENTITY

(4 Credits: 60 hours) (L-T-P: 3-0-1)

Course Objective
To learn about the core concepts of psychological, social and cultural factors of gender, identity, sex and sexuality.

Course Outcomes
CO 1: Demonstrate an understanding of the psychological, social and cultural factors that influence construction and perception of gender, identity, sex and sexuality. (Understanding)
CO 2: Apply gender and identity theories to real-world situation such as in clinical work and case studies. (Applying)
CO 3: Critically analyse and examine the impact of gender and identity on interpersonal relationships and communications. (Analysing)
CO 4: Assess and evaluate the societal and cultural norms that perpetuate gender and identity inequalities. (Evaluating)

Module 1: Introduction (15 Hours)
Concepts of Gender: Theoretical Perspectives - Essentialist, Social Constructionist, & Queer Theory, Gender Identity, Gender Performativity, Beyond the Binary.
Concepts of Identity: Intersectionality and Multiple identities, Marcia's Theory on Identity Formation.

Module 2: Gender, Sex and Sexuality (20 Hours)
Concept of Sex and Sexuality - Definition, Developmental trajectory, Being Intersex, Nature of sexuality and sexual orientation, Queer Disclosure - Coming out of the closet - Psychological Perspective.
Gender Roles and Stereotypes: The rules of gender - how we learn them and how they limit us all.
Psychology, Gender and Sexuality - A Contentious Relationship - Historical perspective

Module 3: Issues in our cultural context (15 hours)
Legal issues - Section 377, Transgender Persons (Protection of Rights) Act 2019, Gender-Based Violence, POSH Act 2013, Surrogacy and Reproductive Health.
Inclusion, Exclusion, Discrimination: Caste, Class, Ethnicity,
Gender, Sex, and Sexuality in North-East India

Module 4: Application / Practical (10 Hours)
Design and carry out an intervention to promote gender equity and inclusion in diverse social contexts.
OR

Create a Systematic Review/Meta-analysis of the literature on any one of the topics that have been covered in the course.

Suggested Readings

1. De Beauvoir, S. (2010). The Second Sex. Knopf. (Only Chapter 1)
2. Fausto-Sterling, A. (1993). The five sexes. The sciences, 33(2), 20-24.
3. Butler, J. (2002). Gender trouble. Routledge. (Only "Subject of Sex/Gender/ Desire")
4. Chopra, R. (2006). Invisible men: Masculinity, sexuality, and male domestic Labor. Men and Masculinities, 9(2), 152-167.
5. Crenshaw, K. W. (2017). On intersectionality: Essential writings. The New Press.
6. Bakshi, K., & Dasgupta, R. (2019). Queer studies: Texts, contexts, praxis. Orient BlackSwan.
7. YW Boston Blog (2017). What is intersectionality, and what does it have to do with me?
8. War, R.J., Kharkongor, G.C. (Eds). (2022). Gender, Sexuality and Society in Northeast India. MLCU Press.
9. Sedgwick, E. K. (2008). Epistemology of the Closet. University of California Press.

Mapping of CO's to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	H		
CO-2	M		H	M
CO-3		M	H	H
CO-4		H	M	H

PCCM405T: COMMUNITY PSYCHOLOGY

(3 Credits- 45 Hours) (L-T-P: 2-0-1)

Course Objective

To understand the psychological perspective of the concepts, approaches, models and strategies of community development.

Course Outcome

1. Comprehend and discuss the concepts, approaches, models and strategies of community development (Understanding)
2. Ability to apply knowledge and skills acquired in community psychology to address issues of human diversity, social justice, inclusion and community mental health (Applying)
3. Ability to assess various concerns in a community and apply models and approaches for community development (Evaluating)
4. Designing an intervention plan for community development and empowerment. (Creating)

Module 1: Introduction to Community Psychology (10 hours)

Definition of community psychology; types of communities; models.

Module 2: Core values (12 hours)

Individual and family wellness; sense of community; respect for human diversity; social justice; empowerment and citizen participation; collaboration and community strengths.

Module 3: Health promotion (11 hours)

Process of community organization for health promotion, importance. Community program for: child and maternal health, physical challenged and old age in the Indian context.

Module 4: Interventions (12 hours)

Community development and empowerment; case studies in Indian context.

Suggested Readings:

1. Banerjee, A., Banerji, R., Duflo, E., Glenneske, R., & Khenani, S. (2006). Can Information Campaign start local participation and improve outcomes- A study of primary education in Uttar Pradesh, India, World Bank Policy Research, Working Paper No.3967
2. Kloos B. Hill, J Thomas, Wandersman A, Elias M.J. & Dalton J.H. (2012). Community Psychology: Linking Individuals and Communities, Wadsworth Cengage Learning.
3. McKenzie, J. F. Pinger, R. R. & Kotecki, J. E. (2005). An introduction to community health. United States: Jones and Bartlett Publishers.
4. Misra, G. (Ed). (2010) Psychology in India. Indian Council of Social Science Research. Dorling Kindersley (India) Pvt Ltd. Pearson Education.
5. Poland, B. D., Green, L.W. & Rootman, I. (2000) Setting for Health Promotion: Linking Theory and Practice, Sage Publication, New Delhi

Mapping of CO's to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	H	M	
CO-2	H	M	H	
CO-3		M	H	
CO-4			M	H

PCPW406T: PSYCHOLOGY FOR HEALTH AND WELLBEING

(3 Credits: 45 Hours) (L-T-P: 2-1-0)

Course Objective

To gain knowledge about the variety of health enhancing, health protective, and health compromising behavior and their application in illness management and wellbeing.

Course Outcomes:

1. Identifying stressors in one's life and how to manage them. (Remembering)
2. Learn the importance of inner strength and human values which could help in maintenance of holistic health and gain insights into positive aspects of work. (Understanding)
3. Make use of psychological principles to enhance health management not only in their own lives but in community as well. (Applying)
4. Examine the stress response and its impact on the etiology and course of many health-related problems. (Analyzing)

Module 1: Illness, Health and Wellbeing (8 hours)

Continuum and Models of health and illness- Bio-Medical, Biopsychosocial, holistic health; health and wellbeing

Module 2: Stress and Coping (7 hours)

Nature and sources of stress; Effects of stress on physical and mental health; Coping and stress management

Module 3: Health Management (8 hours)

Health-enhancing behaviours; Health compromising behaviours; Health Protective behaviours; Illness Management

Module 4: Promoting Human strengths and life enhancement (15 hours)

Classification of human strengths and virtues; cultivating inner strengths: Hope and optimism; Gainful Employment and Me/We Balance

Module 5: Tutorials (7 Hours)

Objective: The aim is to understand the applicability of principles learnt and solidify the understanding so as to develop the ability to design ways of better health management for the community.

Module 1 Illness, Health and Wellbeing (1 hours)

Doubt clearing sessions/Assignments/tests with application-based questions

Module 2 Stress and Coping (2 hours)

Doubt clearing sessions/group activities/workshops/Assignments

Module 3 Health Management (2 hours)

Doubt clearing session/ Case study/Group discussion/Assignments

Module 4 Promoting Human strengths and life enhancement (2 hours)

Doubt clearing sessions/ reflections/Journal writing/Assignments

Suggested Readings

1. Taylor, S. E. (2012). Health Psychology (8th Edition). New York: McGraw Hill.
2. Ghosh, M. (2015). Health Psychology-Concepts in Health and Well-being. New Delhi: Dorling Kindersley (India) Pvt. Ltd.
3. DiMatteo, M.R. & Martin, L.R.(2002). Health psychology.New Delhi: Pearson.
4. Forshaw, M. (2003).Advanced Psychology: Health Psychology. London: Hodder and Stoughton.
5. Forshaw, M. (2003). Advanced Psychology: Health Psychology. London: Hodder and Stoughton.
6. Hick, J.W. (2005).Fifty signs of Mental Health. A Guide To Understanding Mental Health. Yale University Press.

7. Snyder, C.R., & Lopez, S.J. (2007). Positive Psychology: The scientific and practical explorations of human strengths.Thousand Oaks, CA: Sage.
8. Carr, A. (2004). Positive Psychology: The science of happiness and human strength.UK: Routledge.
9. Dalal, A.K & Misra, G. (2006). Psychology of Health and Well-Being: Some Emerging Perspectives, Psychological Studies, 2(2-3)
10. Dharmshaktu, N.S (2018). Holistic Health and Wellbeing: How to Achieve it, Journal of Preventive, Curative and Community Medicine, 4(2-3).

Mapping of CO's to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	M		
CO-2	H	H		
CO-3	M		H	H
CO-4		M	H	H

PCAR407T: ADVANCED RESEARCH METHODOLOGY AND STATISTICS

(2 Credits-30 Hours) (L-T-P: 1-0-1)

Course Objective

To learn about the basic concepts of research design, sampling techniques and their appropriate applicability.

Course Outcome

1. To understand the importance of research design, sampling techniques. (Understanding)
2. To use the measures of variability and regression prediction in research. (Applying)
3. To analyse the scope and uses of research design, sampling techniques. (Analysing)
4. To evaluate different types of research design, sampling techniques and their appropriate applicability. (Evaluating)

Module 1: Research Design (7 Hours)

Meaning, purpose, types of research design-experimental, non-experimental and quasi-experimental design, steps in experimentation.

Module 2: Types of Sampling Techniques (8 Hours)

Meaning, types, advantages and disadvantages, probability and non-probability sampling method, requisites of a good sampling method, sampling error, calculation of sample size.

Module 3: Data Analysis (15 hours)

Measures of Variability and Standard (z) Scores: The Range; The Interquartile and the Semi-Interquartile Range; The Variance; The Standard Deviation; Calculation of Standard Deviation; Properties and Comparison of Measures of Variability; Standard Scores (z-score); Properties of z-scores.

Regression Prediction: Meaning, types, Computation of Regression (SPSS) ; Mediation and Moderation Analysis; Introduction to SPSS: Getting Started with SPSS; Uses of SPSS in Statistics and Research.

Suggested Reading:

1. Aron, A., Aron, E.N., & Coups, E.J. (2007). Statistics for Psychology (4th Ed). India: Prentice Hall .
2. N.K. Chadha (1991) Statistics for Behavioral and Social Sciences. Reliance Pub. House: New Delhi
3. Coakes, S. J.,Steed, L., & Ong,C. (2009). SPSS: Analysis Without Anguish Using Version 16.0 for Windows. Milton,QLD: Wiley Students Edition.
4. Field, A. (2009). Discovering Statistics using SPSS (3rd Ed). New Delhi :Sage.
5. King, B.M. & Minium, E.W. (2007). Statistical Reasoning in the Behavioral Sciences (5th Ed).USA: John Willey.
6. Siegal, S. (1956). Nonparametric Statistics. NY: McGraw Hill.
7. Singh, A. K. (1996). Tests, Measurements and Research in Behavioural Sciences. Bharati Bhavan.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	M	
CO 2		H	H	M
CO 3	M	M	H	
CO 4		M	H	H

PCCI408T: CULTURAL AND INDIGENOUS PSYCHOLOGY
(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Course Objective
To acquire a comprehensive knowledge about the Culture and Psychology, Cultural Processes, Self-Concept, Intercultural perspective and Indian Psychological perspective and related practices.

Course Outcomes
1. To understand the role of culture in understanding behavior. (Understanding)
2. Analyse the psychological insights in the Indian thought traditions. (Analysing)
3. To evaluate the psychological benefits and costs of cultural competence, migration, globalization and cultural diversity. (Evaluating)
4. Discuss models of the family, self-construal and developmental pathways. (Creating)

Module 1: Introduction to Cultural Processes (7 hours)
Culture: Meaning, types, psychic unity and Cultural Relativity
Cultural Differences, methods and Importance of studying cultural psychology.

Module 2: Culture and Self (15 hours)
Self: Meaning and Definition and its relation with culture, self and identity
Culture and architecture: The Making and Remaking of Cultures: A Developmental Perspective
Concept of family and children, models of the family, self-construal and developmental pathways.

Module 3: Intercultural Contacts (13 hours)
Nature, psychological benefits and costs of cultural competence; Migration, globalization and cultural diversity; Management of multicultural identities.

Module 4: Indigenous Psychology (10 hours)
Indian Psychology – Implications and applications; Indian perspective on emotions; indigenization of psychology in India.

Suggested Readings

1. Auluck, S. (2002). Self and identity. In G. Misra, and A. K. Mohanty (eds.), Perspectives on indigenous psychology, p. 374-398. New Delhi: Concept Publishing Company.
2. Chiu, C., & Hong, Y. (2006). Social Psychology of Culture. New York: Psychology Press.
3. Jain, U. (2002). An Indian perspective on emotions. In G. Misra, and A. K. Mohanty (eds.), Perspectives on indigenous psychology, p. 281-291. New Delhi: Concept Publishing Company.
4. Misra, G., & Gergen, K. J. (2002). On the place of culture in psychological science. In G.
5. Misra, and A. K. Mohanty (eds.), Perspectives on indigenous psychology, p. 421-439. New Delhi: Concept Publishing Company.
6. Roa, K. R. (2011). Indian psychology: Implications and applications. In Cornelissen, R.M. M., Misra, G., Varma, S. (Eds.), Foundation of Indian Psychology: Theories and concepts, Vol, 1. New Delhi: Pearson.
7. Sinha, J. B. P. (2002). Towards indigenization of Psychology in India. In G. Misra, and A. K. Mohanty (eds.), Perspectives on indigenous psychology, p. 440-457. New Delhi: Concept Publishing Company.
8. Smith, P.B., Bond, M. H., & Kagitcibasi, C. (2006). Understanding Social Psychology across cultures: Living and working in a changing world. London: Sage.

Mapping of CO's to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H		M	
CO2		H	M	
CO3	M			H
CO4		M		H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	PCPP108L	Introduction to Psychological Practicum I	3	
2	S E Course 2	PCPP109L	Introduction to Psychological Practicum II	3	
3	S E Course 3	PCPP210L	Introduction to Psychological Practicum III	3	

PCPP108L: INTRODUCTION TO PSYCHOLOGICAL PRACTICUM I

(3 credits – 90 hours) (L-T-P: 0-0-3)

Course Objective: *To learn the basic/core concepts of psychological practicum.*

Course Outcomes

CO1: To understand different types of psychological enquiry. (Understanding)
CO2: To apply the basic concepts of assessment techniques in measuring important psychological constructs. (Applying)
CO3: To evaluate the importance of different types of assessment techniques and measurement tools. (Evaluating)

Module I: Introduction to Practicum (10 hours)

a) **Primary modes of psychological enquiry**: Experimental method, Observation, Survey, and Interview
b) **Psychometric Properties**: Reliability, Validity, Standardization, Sources of error

Module II: Seguine Form Board Test (30 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module III: Müller-Lyer Illusion Experiment (30 hours)

Basic concepts, purpose, development, administration, scoring, interpretation

Module IV: Eysenck's Personality Questionnaire (20 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Suggested Readings

1. Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.
2. Kaplan, R. M. & Saccuzzo, D. P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.
3. Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.) New Delhi: New Age International.
4. Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (2017). *Introduction to Psychology (7th ed.,)*. New Delhi: Tata McGraw-Hill.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H	H	H
CO 3		H	H	H

PCPP109L: INTRODUCTION TO PSYCHOLOGICAL PRACTICUM II

(3 credits – 90 hours) (L-T-P: 0-0-3)

Course Objective: *To learn the basic/core concepts of psychological practicum.*

Course Outcomes

CO1: To understand different types of psychological assessment tools. (Understanding)
CO2: To apply the case specific psychological assessment tools. (Applying)
CO3: To evaluate the differences of different types of assessment techniques and measurement tools. (Evaluating)

Module I: Developmental Screening Test (25 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

Module II: Binet Kamat Test of Intelligence (BKT) (40 hours)
Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

Module III: Vineland Social Maturity Scales (VSMS) (25 hours)
Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Suggested Readings

1. Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.
2. Kaplan, R. M. & Saccuzzo, D. P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.
3. Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.) New Delhi: New Age International.
4. Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (2017). *Introduction to Psychology (7th ed.,)*. New Delhi: Tata McGraw-Hill.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H

PCPP210L: INTRODUCTION TO PSYCHOLOGICAL PRACTICUM-III
(3 credits – 90 hours) (L-T-P: 0-0-3)
Course Objective: *To learn the basic/core concepts of psychological practicum.*
Course Outcomes
CO1: To understand different methods of psychological assessment. (Understanding)
CO2: To apply different kinds of psychological assessment tools. (Applying)
CO3: To compare different types of psychological assessment tools. (Analyzing)
CO4: To evaluate the appropriate assessment techniques for basic psychological screening. (Evaluating)

Module I: Gesell's Drawing Test (30 hours)
Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

Module II: Alexander's Passalong Test (35 hours)
Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

Module III: The World Health Organization quality of life (WHOQOL) (25 hours)
Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Suggested Readings

1. Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.
2. Kaplan, R. M. & Saccuzzo, D. P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.
3. Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.) New Delhi: New Age International.
4. Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (2017). *Introduction to Psychology (7th ed.,)*. New Delhi: Tata McGraw-Hill.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H

PROJECT

PCMP307P: MINOR PROJECT/FIELD STUDY

(4 Credits: 120 Hours) (L-T-P: 0-0-4)

Course Objective

To learn about the practical application clinical skills and therapies in the real-world setting.
Or
To learn about the practical implications of research methodologies and statistics.

Course Outcome:

1. Understand the practical application of the theoretical constructs. (Understanding)
2. Apply the theoretical concepts into practice. (Applying)
3. Choose the use of an approach(es) to suit the needs of a client/research study. (Evaluating)
4. Build an understanding regarding the meaning and goals of Counselling/research. (Creating)

Minor Project:

A minor project is an opportunity to the student for practical application of the research traditions, research designs, different research methods, data analysis and discussing the result from a scientific perspective.

Field Study:

The summer internship is a compulsory program which the students undertake after the final examinations of B.A. 6th Semester under the supervision and guidance of the site supervisors and the faculty members of the department. The programme is intended to be for a duration 15 days for which the students would be evaluated at the end of the third semester. The students are expected to gain learning experience in the following areas:

1. Observation of individual/group counselling sessions
2. Conducting mental status examinations
3. Exposure to various psychological assessment tools
4. Formulation of case reports

Module I: Introduction

Three detailed case studies to be conducted and documented. Documentation will consist of the following: beginning, first evaluation, definition of counselling goal, reason for counselling, protocols of counselling sessions, conclusion and further suggestions.

Module II: Documentation & Evaluation

Findings from the case studies are to be presented to the faculty members and students of the department. The presentation will be followed by a viva voce examination. Details of the components of evaluation and weightage attached to them are to be determined by the department and inform the students at the beginning of the semester.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	M
CO 2	M	M
CO 3	H	H
CO 4	M	H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	PCN107I	Internship	4
4	Internship	PCIN209I	Internship	4
5	Internship	PCIN310I	Internship	2

PCIN107I / EDIN209I: INTERNSHIP (Exit of 1st Year or 2nd Year)
(4 Credits: 120 Hours)

Course Objective
To learn the application of the theoretical understanding into the clinical/counselling/industrial setting.

Course outcomes
1. Classify and identify the psychological disturbance (Understanding)
2. Apply the symptom checklist to identify the symptoms of mental illnesses. (Applying)
3. Select appropriate psychological referral for different childhood, adolescent and adult mental health related issues. (Analysing)
4. Evaluate the different models of mental health and illness. (Evaluating)

Internship for Exit after completion of first year or second year
An internship in psychology gives an opportunity to apply theories and principles one has learnt in psychology courses to the "real world" of social service agencies, medical institution, the criminal justice system, business, and industries. During an internship, one can explore career, interest, develop professional skills, observe functioning of community organizations, expand one's clinical and interpersonal skills, and, in many cases, help others. An internship is a great opportunity to enrich one's academic experience while making a valuable contribution to the community by making an optimal utilization of their skills.
The students have to complete an internship program under supervised guidance of the field supervisor and the faculty members for a period of 30 days for exit at the end of first or second year of graduation program. The students are required to submit an internship report including the attendance log sheet duly signed by the field supervisor, completion certificate, daily case reports (30 days) along with two case histories. During the internship program, the students are expected to gain learning experience in the following areas:

1. Observation of individual/group counselling sessions
2. Exposure to various psychological assessment tools
3. Formulation of case reports
4. Recording daily activities

Module I: Introduction
The students will be placed in the field for a minimum of thirty days. The fieldwork setting shall be NGO's, hospitals, clinics, schools, industrial organizations. The students are expected to apply all the psychological skills whenever applicable depending upon the organization and their service. The students should be involved in the activities of the institution and fulfill the responsibilities as requested by the agency supervisor.

Module II: Record and Documentation
Students shall prepare a daily report (along with 2 case/detailed psychological activity reports) of the fieldwork activities and submit it to the concerned faculty supervisor. The faculty supervisor shall provide the necessary feedback and guidance to the students.
At the end of the internship the students shall submit a summary report of the cases taken and activities done during their placement.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	H
CO 3	H	M
CO 4		H

PCIN310I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)
(2 Credits: 60 Hours) (L-T-P: 0-0-3)

Course Objective
To learn the application of the theoretical understanding into the clinical/counselling/industrial setting.

Course outcomes
1. Classify and categories the psychological disorders as coded in DSM and ICD (Understanding)
2. Apply diagnostic criteria to diagnose individuals with mental illnesses. (Applying)
3. Select appropriate psychological intervention for different childhood, adolescent and adult mental health related issues. (Analysing)
4. Evaluate the different models of mental health and illness. (Evaluating)

An internship in psychology gives an opportunity to apply theories and principles one has learnt in psychology courses to the "real world" of social service agencies, medical institution, the criminal justice system, business, and industries. During an internship, one can explore career, interest, develop professional skills, observe functioning of community organizations, expand one's clinical and interpersonal skills, and, in many cases, help others. An internship is a great opportunity to enrich one's academic experience while making a valuable contribution to the community by making an optimal utilization of their skills.
The students have to complete an internship program under supervised guidance of the field supervisor and the faculty members for a period of 15 days for exit at the end of first or second year of graduation program. The students are required to submit an internship report including the attendance log sheet duly signed by the field supervisor, completion certificate, daily case reports (15 days) along with two case histories. During the internship program, the students are expected to gain learning experience in the following areas:
1. Observation of individual/group counselling sessions
2. Exposure to various psychological assessment tools
3. Formulation of case reports
4. Recording daily activities

Module I: Introduction
The students will be placed in the field for a minimum of thirty days. The fieldwork setting shall be NGO's, hospitals, clinics, schools, industrial organizations. The students are expected to apply all the psychological skills whenever applicable depending upon the organization and their service. The students should be involved in the activities of the institution and fulfil the responsibilities as requested by the agency supervisor.

Module II: Record and Documentation
Students shall prepare a daily report (along with 2 case/detailed psychological activity reports) of the fieldwork activities and submit it to the concerned faculty supervisor. The faculty supervisor shall provide the necessary feedback and guidance to the students.
At the end of the internship the students shall submit a summary report of the cases taken and activities done during their placement.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	H
CO 3	H	M
CO 4		H

RESEARCH PROJECT /DISSERTATION

BA PSYCHOLOGY (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	PCDI409P	Research Project Phase I	6
8	Research Project/Dissertation	PCDI410P	Research Project Phase II	6
BA PSYCHOLOGY (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	PCDI411P	Dissertation I	18
8	Research Project/Dissertation	PCDI412P	Dissertation II	20

BA PSYCHOLOGY (Honours)

PCDI409P: RESEARCH PROJECT PHASE I
(6 credits – 180 hours) (L-T-P: 0-0-12)

The Research Project is an extended essay that represents a question or statement for analysis and interpretation of the results based on existing literature. A research project enables the students to represent their own innovative ideas and critical analysis to represent the existing gaps of literature. Research Project Phase I includes presentation of Title of the Project, Literature Review, Objective, Research Questions, and Methodology of the Study. The evaluation includes presentation of the research work followed by Viva Voce examination (100 Marks).

PCDI410P: RESEARCH PROJECT PHASE II
(6 credits – 180 hours) (L-T-P: 0-0-12)

The Research Project is an extended essay that represents a question or statement for analysis and interpretation of the results based on existing literature. A research project enables the students to represent their own innovative ideas and critical analysis to represent the existing gaps of literature. Research Project Phase II includes complete presentation of the research work including data analysis, interpretation, conclusion, limitation and future directions. The evaluation includes presentation of the research work followed by Viva Voce examination (100 Marks).

BA PSYCHOLOGY (Honours) with Research

PCDI411P: DISSERTATION I
(18 Credits -540 Hours) (L-T-P: 0-0-36)

Every student shall undertake a research project work under the supervision and guidance of a faculty member. The student may choose the topic of research and start the preliminary work by the end of the second semester. The students are expected to complete the Literature Review followed by a Literature Review presentation and the Proposal presentation during the Phase I. Students are expected to complete the data collection. The report of the Phase-I is to be submitted to the department before the date notified. The mode and components of evaluation of Phase I and Phase II of the research project and the weightages (Full Marks: 100) attached to them shall be published by the Department at the beginning of the semester. There shall be a power point presentation along followed by viva voce examination on the research work.

PCDI412P: DISSERTATION II
(20 Credits -600 Hours) (L-T-P: 0-0-40)

Every student shall undertake a research project work under the supervision and guidance of a faculty member. The student may choose the topic of research and start the preliminary work by the end of the 7^{th} semester. The students are expected to complete the Literature Review followed by a Literature Review presentation and the Proposal presentation during the Phase I. Students are expected to complete the data collection by the end of 7^{th} semester. Phase II of the Dissertation should ideally be undertaken during 8^{th} semester. The thesis is to be submitted to the department before the date notified. The mode and components of evaluation of Phase I (Full Marks: 100) and Phase II (Full Marks: 100) of the research project and the weightages attached to them shall be published by the Department at the beginning of the semester. There shall be a power point presentation followed by the viva voce examination on the research project.

DEPARTMENT OF PUBLIC ADMINISTRATION

PROGRAMME: BA PUBLIC ADMINISTRATION (HONOURS)/BA PUBLIC ADMINISTRATION (RESEARCH)

VISION:

Our unwavering commitment is to emerge as a distinguished centre of excellence in the domain of Public Administration, embodying unparalleled standards in learning, teaching, and research. Through the provision of bespoke experiences, we strive to instill profound human values, ultimately fostering nation-building.

MISSION:

- Strive for academic excellence by delivering high-quality education, research, and practical training in Public Administration, fostering a deep understanding of theoretical frameworks and practical applications.
- Cultivate and nurture visionary leaders with the skills to navigate complex public sector challenges, promoting effective governance and upholding the highest standards of ethical conduct in public service roles.
- Encourage cutting-edge research initiatives that address contemporary societal issues, while fostering strong ties with the community and relevant stakeholders to drive positive societal development.
- Provide a personalized learning environment, catering to individual needs and aspirations, maximizing student potential for growth, success, and lifelong learning in the field.
- Enhance global awareness and prepare students to contribute effectively in an interconnected world, while dedicating efforts to contribute significantly to nation-building through competent and socially responsible public administrators driving positive change and sustainable development.

PROGRAM OUTCOMES (POs)

PO 1: Knowledge Acquisition: Ability to demonstrate a deep understanding of the principles, theories, and practices in Public Administration, acquired through rigorous academic training, research, and practical experiences.

PO 2: Ethical Decision-making: Ability to exhibit ethical leadership qualities and the ability to make principled decisions while navigating complex public sector challenges, demonstrating a commitment to upholding ethical standards and social responsibility.

PO 3: Practical Application: Equipped with the skills and competencies to apply the theoretical knowledge effectively in real-world scenarios, through internships, projects, and experiential learning opportunities.

PO 4: Interdisciplinary Perspective: Development of a holistic perspective of Public Administration by integrating knowledge from various disciplines, enabling them to analyze public governance issues from a broader societal context.

PO 5: Effective Communication: Ability to demonstrate proficiency in oral and written communication, enabling them to convey complex ideas, policies, and recommendations clearly to diverse stakeholders within the public sector.

PO 6: Problem-solving and Analytical Skills: The ability to be adept at critical thinking, problem-solving, and data analysis enables them to identify and address public administration challenges with innovative and evidence-based solutions.

PO 7: Community Engagement and Impact: The ability to actively engage with local and global communities, demonstrating a commitment to community welfare through participation in service projects, research initiatives, and collaborations with public organizations to effect positive change and contribute to nation-building efforts.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: To exhibit an in-depth understanding of advanced principles, theories, and contemporary practices in Public Administration, acquired through specialized academic training and extensive research exposure.

PSO2: To demonstrate a high level of ethical leadership and decision-making skills, exemplifying their ability to navigate intricate challenges within the public sector while upholding moral standards and social responsibility.

PSO3: To demonstrate exceptional proficiency in applying theoretical knowledge to real-world scenarios, effectively utilizing their skills and competencies gained through internships, projects, and experiential learning opportunities.

PSO 4: To develop a comprehensive and integrated analytical perspective in Public Administration, synthesizing knowledge from diverse disciplines to address public governance issues from a multidimensional societal context effectively.

LIST OF COURSES

Category	Course Code	Course Name
Major Course 1	PAIP100T	Introduction to Public Administration
Major Course 2	PAAT101T	Administrative Theory
Major Course 3	PAIA200T	Indian Administration
Major Course 4	PAPP201T	Public Policy and Governance

Major Course 5	PADA202T	Development Administration
Major Course 6	PACP203T	Comparative Public Administration
Major Course 7	PAAE204T	Administrative Ethics in Governance
Major Course 8	PAAL300T	Administrative Law
Major Course 9	PAEG301T	Environmental Governance
Major Course 10	PAGO302T	E-Governance
Major Course 11	PARL303T	Rural Local Governance
Major Course 12	PAUL304T	Urban Local Governance
Major Course 13	PASW305T	Social and Welfare administration
Major Course 14	PARW306P	Excursion / survey, and report writing
Major Course 15	PAFA400T	Public Financial Administration
Major Course 16	PAPA401T	Public Personnel Administration
Major Course 17	PAEP402T	Engaged policy and Governance
Major Course 18	PAGA403T	Governance & Administration in South East Asia
Minor Course 1	PAHR102T	Introduction to Human Rights (HR)
	PAII103T	Introduction to International Relations (IR)
Minor Course 2	PAPA104T	Environmental Policy and Administration (HR)
	PASP105T	Policy Making – Structures and Processes (PP)
Minor Course 3	PARI205T	Human Rights in India (HR)
	PAET206T	Emerging Trends in International Relations (IR)
Minor Course 4	PARC207T	Refugees and International Conflicts (HR/IR)
	PAIC208T	Public Policy Implementation (PP)
Minor Course 5	PAFP307T	Foreign Policy of India (IR)
	PAIE308T	Policy Education, Impact and Evaluation (PP)
Minor Course 6	PASP309T	Statistics for Public Administration Research (HR,IR & PP)
	PAPP310T	Public Policy in India (PP)
Minor Course 7	PAHT404T	Human Trafficking in India
Minor Course 8	PARM405T	Research Methodology
Minor Course 9	PACG406T	China and Global System (IR)
	PAIC407T	Institutions & complexities in Public Policy Process (PP)
S E Course 1	PAOH106L	Office, Home Management and Secretarial practice
S E Course 2	PACO107L	Corporate Communication
S E Course 3	PAES209L	Ethics & Self Awareness

Mapping of Courses with POs/PSOs:

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO 4
Major Courses											
Major 1	M		H	M		H	M	M		M	
Major 2		M		M	H			H	H		H
Major 3	H		H	H		H			H		
Major 4	H				H			H		H	H
Major 5		H		H		H	H		H		M
Major 6	M		H		M		H		H	H	
Major 7	M		H	M		H	M	M		M	
Major 8		M		M	H			H	H		H
Major 9	H		H	H		H			H		
Major 10	H				H			H		H	H
Major 11		H		H		H	H		H		M
Major 12	M		H		M		H		H	H	
Major 13		H		H	H		H		H	H	
Major 14		H		H		M		H			
Major 15	M			H				M		H	
Major 16		M	H	H					M	H	
Major 17				H			H	M	H		
Major 18	M				H				H		
Minor Courses											
Minor 1 HR	H		M		H		H	M	H		H

Minor 1 IR		H		H		M		H		H	
Minor 2 HR	M		H		H	H	H		H	H	
Minor 2 PP											
Minor 3 HR	H		H	H	M	H		H	H		H
Minor 3 IR		H		M		H		H		H	
Minor 4 HR/ IR	M				H		H		M		H
Minor 4 PP	H		H		H		M		H	H	
Minor 5 IR	M	H		H		H		H		M	
Minor 5 PP				H			H		H		
Minor 6 HR/ IR / PP	H		M		M			H			H
Minor 6 PP			H				H			H	
Minor 7				M	H				M	H	
Minor 8				M			H			H	H
Minor 9 – IR		H							H		
Minor 9–-PP	H			H				M		H	
Skill Enhancement Courses											
S E 1	M		H					H			H
S E 2		H			M		M		H		
S E 3	H			H		H				H	

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	PAIP100T	Introduction to Public Administration	4
2	Major Course 2	PAAT101T	Administrative Theory	4
3	Major Course 3	PAIA200T	Indian Administration	4
3	Major Course 4	PAPP201T	Public Policy and Governance	4
4	Major Course 5	PADA202T	Development Administration	5
4	Major Course 6	PACP203T	Comparative Public Administration	5
4	Major Course 7	PAAE204T	Administrative Ethics in Governance	4
5	Major Course 8	PAAL300T	Administrative Law	5
5	Major Course 9	PAEG301T	Environmental Governance	5
5	Major Course 10	PAGO302T	E-Governance	4
6	Major Course 11	PARL303T	Rural Local Governance	4
6	Major Course 12	PAUL304T	Urban Local Governance	4
6	Major Course 13	PASW305T	Social and Welfare administration	4
6	Major Course 14	PARW306P	Excursion / survey, and report writing	4
7	Major Course 15	PAFA400T	Public Financial Administration	5
7	Major Course 16	PAPA401T	Public Personnel Administration	5
8	Major Course 17	PAEP402T	Engage policy and Governance	5
8	Major Course 18	PAGA403T	Governance & Administration in South East Asia	5

PAIP100T: INTRODUCTION TO PUBLIC ADMINISTRATION
(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course students will be able to:
CO1: Recall the various aspects and significance of Public Administration as a theoretical discipline (Remembering).
CO2: Explain various growth and trends in Public Administration (Understanding).
CO3: Identify the various forms and principles of Organizations (Applying).
CO4: Examine the Role and functions of the chief Executive, Line, staff, auxiliary agencies and the relationship that exist among them (Evaluating).

Module I: Public Administration as a Discipline (15 hours)
Meaning, Nature, Scope, Dimensions and Significance of the discipline and its relations with social sciences, Public and Private Administration, Evolution of Public Administration

Module II: Growth and Trends in Public Administration (15 hours)
New Public Administration (NPA), New Public Management (NPM), Globalization and Public Administration, Paradigm Shift from Government to Governance, New Public Service (NPS)

Module III: Organization and its Principles (15 hours)
Organization: Meaning, Basis and Forms of Organizations. Principles of Organization: Hierarchy, Unity of Command, Span of Control, Coordination, Supervision, Authority and Responsibility, Centralization and Decentralization, and Delegation.

Module IV: Chief Executive, Leadership and Accountability (15 hours)
Chief Executive: Meaning, Types, Functions and Role; Line, Staff and Auxiliary Agencies; Headquarter and Field relationships; Decision Making; Communication; Leadership; Accountability

Suggested Readings

1. Avasthi, A and Maheshwari, S R (2013) Public Administration. Lakshmi NarainAgarwal: Agra
2. Basu, Rumki (2008) Public Administration: Concepts and Theories. Sterling Publishers: New Delhi
3. Bhagwan, Vishnoo; Bhushan, Vidhya and Mohla, Vandana (2010) Public Administration. S. Chand: Jalandhar
4. Bhambri, C. P. (2010) Public Administration Theory and Practice (21st Edition). Educational Publishers: Meerut
5. Bhattacharaya, Mohit (2008) New Horizons of Public Administration. Jawahar Publishers and Distributors: New Delhi
6. Bhattacharya, Mohit (2000) Public Administration. World Press: Calcutta
7. Bhattacharya, Mohit (2012) Public Administration: Issues and Perspective. Jawahar Publishers and Distributors: New Delhi
8. Chakrabarty, Bidyut and Chand, Prakash (2012) Public Administration in a Globalizing World: Theories and Practices. Sage: New Delhi

9. Fadia, B L, Fadia, Kuldeep (2017) Public Administration in India: Sahitya Bhawan: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PAAT101T: ADMINISTRATIVE THEORY

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course students will be able to:

CO1: Recall various administrative theories (Remembering).

CO2: Illustrate the different phases in the development of the theoretical constructs of Public Administration (Understanding).

CO3: Identify the philosophy and principles of Public Administration as expounded by various thinkers (Applying).

CO4: Compare and contrast the classical theories with the modern/contemporary theories of Public Administration (Analysing).

Module I (20 hours)

Indian and Classical Theories: Kautilya; Scientific management (Taylor and his associates); Bureaucratic theory of organization (Weber); Administrative management theory (Henry Fayol, Luther Gulick and others).

Module II (20 Hours)

Human Relations and Behavioural Theories: Human Relations theory (Elton Mayo and his Colleagues); Behavioral theory (Chester Barnard and Herbert Simon).

Module III (20 Hours)

Administrative Behaviour Theories: Leadership; Communication; and Motivation (Maslow and Herzberg), Modern Administrative Theories: Minnow brook Prespectives; New Public Service

Suggested Readings

1. Laxmikanth, M (2017) Administrative Theory. McGraw Hill Education: New Delhi
2. Prasad, D R; Prasad, V S; Satyanarayana, P; and Pardhasaradhi, Y (2017) Administrative Thinkers. Sterling: New Delhi
3. Nicholas Henry (2018) Public Administration and Public Affairs. Routledge.
4. M. Blau, Bureaucracy in Modern Society, (New York: Random House, 1962).
5. R.W. Cox, Public Administration in Theory and Practice, (New Delhi: Prentice Hall, latest edition).
6. D. Ravindra Prasad et.al. Administrative Thinkers, New Delhi, Sterling Publishers Pvt. Ltd (Latest English edition).
7. S.R. Maheshwari Administrative Thinkers, (New Delhi: Macmillan, Latest English edition).
8. Bhattacharaya, Mohit (2008) New Horizons of Public Administration. Jawahar Publishers and Distributors: New Delhi
9. Sapru, R.K. (2013), Administrative Theories and Management Thought. Prentice Hall of India: New Delhi.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2		H	M
CO 3	M	M	H
CO 4		M	H

PAIA200T: INDIAN ADMINISTRATION

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course students are able to:

CO1: Recall the significant stages in the evolution of the Indian Administration (Remembering).

CO2: Explain the Roles and Functions of Constitutional Institutions (Understanding).

CO3: Identify the relationship existing between the various organs of Administration (Applying).

CO4: Examine the constitutional provisions and dynamics of the union-state relationship (Analysing)

Module I (20 hours)
Evolution & Constitutional Framework: Evolution of Indian Administration during Ancient, Medieval and British period; Constitutional Framework of Indian Administration; and Salient Features of Indian Administration

Module II (15 hours)
Union Government: President; Prime Minister & Council of Ministers; Central Secretariat, Cabinet Secretariat, Cabinet Committees, Prime Minister Office; Ministry of Home Affairs and Finance Ministry.

Module III (20 hours)
Constitutional Institutions, Union State Relations & Control over Administration: Election Commission of India; Union Public Service Commission; Union State Relations (Legislative, Executive and Financial); Parliamentary, Executive and Judicial Control over Administration

Module IV (20 hours)
Citizen and State Interface: Citizens' Grievances Redressal Institutions and Mechanisms; Institutional Mechanism for Prevention of Corruption: Central Vigilance Commission; Lok Pal and Lok Ayukta; Politician and Civil Servant relationship.

Suggested Readings

1. Arora, Ramesh K. and Goyal, Rajni (1997) Indian Public Administration: Institutions and Issues. New Age International Publishers: New Delhi
2. Avasthi, A and Avasthi, A P (2004) Indian Administration. Laksmi Narain Aggarwal: Agra
3. Balfour, Lady Betty (2015) Lord Lytton's Indian Administration 1876-1880 The Untold History. Gyan Books: New Delhi
4. Basu, D D (2013) Introduction to the Constitution of India (21st Edition). Lexus Nexus: New Delhi
5. Chakraborty, Bidyut (2016) Indian Administration. Sage: New Delhi
6. Fadia, B L and Fadia, Kuldeep (2017) Indian Administration, (New Edition). Sahitya Bhawan: Agra
7. Ghuman, B S; Monga, Anil and Johal, Ramanjit Kaur (Eds.) (2012) Corruption and Quality of Governance: Experiences of Select Commonwealth Countries. Aalekh Publishers: Jaipur
8. Kangle R P (1972) The Kautilya Arthshastra. Motilal Banarsidass: New Delhi
9. Kapur, Devesh; Mehta, Pratap Bhanu and Vaishnav, Milan (Eds.) (2017) Rethinking Public Institutions in India. Oxford University Press: New Delhi
10. Maheshwari, S R (2000) Indian Administration. Orient Longman: New Delhi
11. Sharma, M (2007) Indian Administration. Anmol: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	M	
CO 3		M	H	
CO 4			M	H

PAPP201T: PUBLIC POLICY AND GOVERNANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, students are able to:
CO1: Recall significance and scope, Public Policy Approaches and Models (Remembering).
CO2: Explain various concepts and theories of Governance (Understanding) .
CO3: Identify the Role of various stakeholders in Public Policy Formulation (Applying).
CO4: Examine the various aspects of Policy Implementation, Policy Education and Policy Evaluation. (Analysing)

Module I: Introduction (15 hours)
Public Policy: Concept, Significance and Scope; Public Policy Approaches and Models with special reference to the Incrementalist and Rationalist Paradigms. Policy Cycle, Constraints in the policy process

Module II: Concepts and Theories of Governance (15 hours)
Governance as per the World Bank, UNDP and others; Public Choice Theory, Public Value Theory; Governance as Theory, Governance and Public Governance; Role of State, Market and Civil Society in Governance.

Module III: Role of Various stakeholders in Public Policy formulation (15 hours)
Role of Legislature, Executive, Judiciary, Planning Machinery at the Central, State and local levels

Module IV: Public Policy Implementation, Education and Evaluation (15 hours)

Approaches to Policy Implementation, Role of Executive (with special reference to Bureaucracy), Legislature, Judiciary, Non-Governmental Organisations, Pressure Groups, Issues in Public Policy Implementation, Policy Education, Policy Evaluation: Approaches to Policy Evaluation: Criteria for Evaluation, Issues in Policy Evaluation

Suggested Readings

1. Chakraborti, Rajesh (2017) Public Policy in India. Oxford University Press: New Delhi
2. Chakraborty, Bidyut and Chand, Parkash (2016) Public Policy: Concept, Theory and Practice. Sage: New Delhi
3. Knill, Christoph, and Jale Tosun. Public policy: A new introduction. Bloomsbury Publishing, 2020.
4. Birkland, Thomas A. An introduction to the policy process: Theories, concepts, and models of public policy making. Routledge, 2019
5. Dror, Yehezkel. Public policy making reexamined. Routledge, 2017

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3		M	M	M
CO 4	H			H

PADA202T: DEVELOPMENT ADMINISTRATION

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course students are able to:

CO1: Show a basic intellectual understanding of development, its approaches and sustainable development (Understanding)

CO2: Recall the concepts of Development Administration including the ecological and post-globalization contexts (Remembering)

CO3: Identify the various issues in Development Administration (Applying)

CO4: Classify the various perspectives on Public Private Partnership, Corporate Social Responsibility, Inclusive Development, and Sustainable Development Goals (Analysing)

Module I: Introduction (15 hours)

Development and its dimensions; Development and Modernization; Approaches to Development; Ecology of Development Administration; Sustainable Development and Anti-Development

Module II: Conceptual Constructs (15 hours)

Development Administration – concept, nature, scope and objectives; Features and Significance of Development Administration; Contribution of Ralph Braibanti, Edward Weidner, Fred W. Riggs and Dwight Waldo.

Module III: Issues in Development Administration (15 hours)

Globalization and Development Administration; Emergence of Non-State Actors in Development Administration; Gender Parity in Development; Role of Bureaucracy in Development

Module IV: New Perspectives of Development (15 hours)

Public Private Partnership; Corporate Social Responsibility; Inclusive Development; Sustainable Development Goals (SDGs); Human Development Indicators and Social Audit

Suggested Readings

1. Palekar, S L (2012) Development Administration, PHI Learning: New Delhi
2. Palekar, S L (2012) Development Administration, PHI Learning: New Delhi
3. Farazmand, Ali, ed. Handbook of comparative and development public administration. CRC press, 2019.
4. Heady, Ferrel. Public Administration, A Comparative Perspective. CRC Press, 2001.
5. Ramulu, Ch. Bala (1999) International Organizations and Rural Employment Programs in India: Emerging Trends. Om Publishers: Faridabad, New Delhi
6. Sapru, R K (2008) Development Administration. Sterling : New Delhi
7. Mahajan, Puri, Anupama (2019) Development Administration in India: SAGE Publications India Pvt Ltd
8. Kaushik, Archana (2019) Welfare and Development Administration in India: Global Vision Publishing House: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			

CO 2		M		
CO 3			H	M
CO 4				H

PACP203T: COMPARATIVE PUBLIC ADMINISTRATION

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course students are able to:

CO1: Recall meaning, scope, and salient features of comparative Public Administration. (Remembering)

CO2: Explain the relevance of Comparative Public Administration in the context of Liberalization, Privatization and Globalization. (Understanding)

CO3: Identify the various approaches in the Study of Comparative Public Administration (Applying)

CO 4: Compare and contrast the grievance redressal mechanisms in UK, USA and Japan

Module I (25 Hours)

Introduction: Comparative Public Administration: Meaning, Nature, Scope and Significance. Relevance of Comparative Public Administration in the era of Liberalization, Privatization and Globalization, Salient Features of Administration in Developed & Developing Countries: UK, USA, Japan and India.

Module II (10 Hours)

Approaches: Structural-Functional M Approach; and Ecological Approach

Module III (25 hours)

Administrative Systems & Accountability: Grievance Redressal Mechanism of UK, USA, Japan, Local government of UK, USA, Japan.

Suggested Readings

1. Arora, R K and Sharma, S (Eds.) (1992) Comparative and Development Administration: Ideas and Actions. Arihant Centre for Administrative Change: Jaipur
2. Bhatt, A and Ranjan, R (2010) Comparative Government and Politics (1st Edition). Anmol Publications: New Delhi
3. Chaturvedi, T N (1994) Tulnatmak Lok Prashashan. College Book Depot: Jaipur
4. Dahiya, Sewa Singh and Singh, Ravindra (2012) Comparative Public Administration. Sterling Publishers: New Delhi
5. Farazmand, A (Ed.) (2001) Handbook of Comparative and Development Public Administration (2nd Edition). Marcell Dekker: New York
6. Heady, Ferrel (2001) Public Administration: A Comparative Perspective (6th Edition). Marcel Dekker: New York
7. Nadkarni, Vidya and Noonan, Norman C (Eds.) (2013) Emerging Powers in a Comparative Perspective: The Political and Economic Rise of the BRIC Countries. Bloomsbury Academic: London.
8. Mahajan, Anupama. P., (2022), Sage Publishing: New Delhi.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	M		
CO 2	M		
CO 3		H	
CO 4			H

PAAE204T: ADMINISTRATIVE ETHICS IN GOVERNANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course students are able to:

CO1: Recall the concepts of Dharma, Freedom, Equality and Fraternity (Remembering)

CO2: Explain the practices of Satyagraha and truth in the present context (Understanding)

CO3: Identify the ethical principles used in addressing issues of inequalities (Applying)

CO4: Examine the functioning of the institutions like Lokpal and Lokayuktah through case studies (Analyzing)

Module I (20 Hours)

Introduction: Ethics – concept and significance; Key concepts – Right, Duty, Freedom, Equality, Fraternity, Karma, Purusharthas, and Dharma. Contribution of Kautilya: Character Building, Contribution of Mahatma Gandhi – Satyagraha and Truth.

Module II (20 Hours)
Applied Ethics: Issues of Inequality, Abortion, Foeticide, Suicide, Environment Degradation, Capital Punishment; Significance of Ethical and Moral Values in Governance**,** Nature of Moral Dilemmas

Module III (20 hours)
Ethics in Public Life: Civil Service Neutrality and Anonymity**;** Code of Ethics and Code of Conduct for Civil Services in India. Corruption – Causes, Remedies; Institutional Arrangements for fighting Corruption in India: CVC, CBI, Lokpal and Lokayuktah. Measures to Tackle Corruption

Suggested Readings
1. Arora, R K (2008) Ethics in Governance: Innovations Issues and Instrumentalities. Rawat: Jaipur
2. Arora, Ramesh K (Ed.) (2014) Ethics, Integrity and Values in Public Service. New Age International: New Delhi Bhargava, R (2006) Politics and Ethics of the Indian Constitution. Oxford University Press: New Delhi
3. Chakraborty, Bidyut (2016) Ethics in Governance in India. Routledge: New Delhi
4. Chaturvedi, T N (Ed.) (1996) Ethics in Public Life. IIPA: New Delhi
5. Gandhi, Mahatma (2009) Hind Swaraj. Rajpal & Sons: Delhi Godbole, M (2003) Public Accountability and Transparency: The Imperatives of Good Governance. Orient Longman: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	M		
CO 2		H	
CO 3		M	H
CO 4			

PAAL300T: ADMINISTRATIVE LAW

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes
At the end of this course students are able to:
CO1: Recall the principles of natural justice, rule of law, administrative legislation, and adjudication (Remembering)
CO2: Explain the constitutional law, administrative law and droit administratif (Understanding)
CO3: Identify the merits and demerits of administrative tribunals and especially Central Administrative Tribunals (Applying)
CO4: Examine the evolution, growth and concept of ombudsman, lokpal and lokayukta and central vigilance commission (Analyzing)

Module I (20 Hours)
Introduction: Administrative Law: Meaning and reasons for its growth, Distinction between Constitutional Law and Administrative Law and Droit Administratif.

Module II (25 Hours)
Basics Tools: Rule of Law; Principles of Natural Justice; Judicial Review of Administrative Action - concept and writs, Delegated Legislation- concept, rationale, merits and demerits.

Module III (30 hours)
Administrative Tribunal and Ombudsman: Administrative Tribunals-concept, Structure and functions Ombudsman: Institution of Ombudsman: concept and genesis, (Lok Pal and Lokayukta in India-composition, powers, functions and significance.

Suggested Readings
1. Chhabra, S (1990) Administrative Tribunals. Deep and Deep: New Delhi
2. Diwan, P (2007). Indian Constitution (2nd Edition). Law Agency: Allahabad
3. Kagzi, M C J (2008) Indian Administrative Law (2nd Edition). Metropolitan: Delhi
4. Massey, I P (2008) Administrative Law. Eastern Book Company: New Delhi
5. Mehta, S M (1990) Indian Constitutional Law. Deep and Deep: New Delhi
6. Sathe, S P (1998) Administrative Law (6th Edition). Tripathi: Bombay
7. Sharma, S K (2007) Directive Principles and Fundamental Rights. Deep and Deep: New Delhi
8. Werhan, Keith (2020), Principles of Administrative Law, West Academic Books: USA

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	H		

CO 2	H		
CO 3		H	M
CO 4			H

PAEG301T: ENVIRONMENTAL GOVERNANCE
(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes
At the end of this course, students are able to:
CO1: Recall the key concepts of environment, natural resources, biodiversity and Conservation and Management of waste. (Remembering)
CO2: Explain the environmental policies, Environmental Impact Assessment, Impact Prediction, Evaluation and Mitigation. (Understanding)
CO3: Identify the Structure, Functions and Role of Central Pollution Control Board, State Pollution Control Board and National Green Tribunal. (Applying)
CO4: Examine the Global Environment Issues, Role of UNEP and Sustainable Development Goals and Environment. (Analyzing)

Module I: Conceptual constructs (20 hours)
Environment, Healthy Environment, Climate, Biodiversity, Waste Management, Ecosystem Balance; Natural Resource Conservation & Management; Environmental Hazards and Risk Management, Population and Environment: Basic Issues, Environmental Impact of Population Growth and Agenda for Action

Module II: Environment Policies and Evaluation (10 hours)
National Environment Policy, 2006; Environmental Impact Assessment; and Impact Prediction, Evaluation and Mitigation

Module III: Environmental Administration (15 hours)
Ministry of Environment; Central Pollution Control Board – Structure, Functions and Role; State Pollution Control Board – Structure, Functions and Role; National Green Tribunal

Module IV: International Perspective (30 hours)
Global Environment Issues – Water Contamination, Atmospheric Pollution, Acid Rain, Noise Pollution and control strategies thereof. Important International conferences on Environment and recent developments; Interstate and International Cooperation for Environment Protection – Role of UNEP; Sustainable Development Goals and Environment

Suggested Readings

1. Bhatt, M S; Ashraf, S; and Illiyan, A (Eds.) (2008) Problems and Prospects of Environment Policy: Indian Perspective. Aakar Books: Delhi
2. Divan, S and Rosencranz, A (2001) Environmental Law and Policy in India (18thEdition). Oxford University Press: New Delhi
3. Dwivedi, O P (1997) India's Environmental Policies, Programmes and Stewardship. Palgrave Macmillan: London, UK
4. Krishnamoorthy, B (2017) Environmental Management: Text and Cases (3rdEdition). PHI Learning: New Delhi
5. Kulkarni, V and Ramachandra, T V (2006) Environmental Management. TERI Press: New Delhi
6. Roberts, J (2011) Environmental Policy (2ndEdition). Routledge: Abingdon, Oxon
7. Uberoi, N K (2007) Environmental Management (2ndEdition). Excel Books: New Delhi
8. UNEP (2015) Embedding the Environment in Sustainable Development Goals. Post 2015 Discussion Paper 1 Version

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4				H

PAGO302T: E-GOVERNANCE
(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course students are able to:
CO1: Recall the concepts, Scope and Significance of governance. (Remembering)
CO2: Explain the various perspectives and theories of Governance. (Understanding)
CO3: Identify the various e-governance initiatives undertaken to deliver Public services to the stakeholders. (Applying)

CO4: Developing necessary skills to use and operate e-governance or digital service delivery. (Applying)
CO5: Examine the legal frame works, Issues & Challenges for e-Governance in India. (Analyzing)

Module I: E-Governance (15 hours)
Concepts and Initiatives: Meaning, Definitions, Scope (Including stages and types of interactions in e-Governance) and Significance of e-Governance

Module II: Perspectives and Theories (15 hours)
Theories of e-Governance (Six perspectives and six theories), Models of e-Governance (The General Information Dissemination Model, the Critical Information Dissemination Model, the Advocacy Model, the Interactive Model)

Module III: Growth of E-Governance (15 hours)
Growth of e-Governance initiatives in India, Pre-National e-Governance Plan and Post NeGP (NeGP 2006), e-Governance Initiatives in the area of Government to Citizens (G2C), Government to Business (G2B) and Government to Government G2G).

Module IV: Legal Framework, Issues & Challenges for e-Governance (15 hours)
I T Act – 2000 (ICT Act and important features of the Act); Information and Cyber Security. e-Readiness; Digital Divide (Gender, Geographic, Economic, Social and Political); Challenges; Resistance to Change, Capacity Building, Adaptation of Technology and Administrative Reforms.

Suggested Readings

1. Bellamy, Christine and John, Taylor (1998) Governing in the Information Age. Open University Press: Buckingham
2. Bhatnagar, S C (2004) E-Government: From Vision to Implementation. Sage: New Delhi
3. Sinha, R P (2006) E- Governance in India. Concept publishing Company: New Delhi
4. Bouwman, Harry; Hooff, Bart van den; Vingaert, Lidwien van de; and Dijk, Jan van (2005)
5. Information and Communication Technology in Organizations: Adoption, Implementation, Uses and Effects, Sage Publications: New Delhi
6. Gosling, P. (1997) Government in the Digital Age. Government Information Quarterly, Vol. 18, No. ER2. Bowerdean: London
7. Heeks, Richard (2006) Implementing and Managing e-Government: An International text. Sage: London
8. Jones, S. G. (Ed.)(1995) Cyber Society, Computer mediated communication and Community. Sage: Thousand Oaks CA

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4				H

PARL303T: RURAL LOCAL GOVERNANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course students are able to:
CO1: Recall the meaning and significance of Rural Local Governance and the Community Development Programs. (Remembering)
CO2: Explain the evolution and growth of rural local governance with special reference to Panchayati raj institutions in India. (Understanding)
CO3: Identify the composition, functions and role of Gram Panchayat, Panchayat Simiti and Zila Parishad. (Applying)
CO4: Appraise the role and relationships of rural local democratic decentralized institutions (PRIs) with other institutions. (Evaluating)

Module I (20 Hours)
Introduction: Rural local governance- meaning and significance; Community development programs and committees and commissions on Panchayati Raj constituted by the Government of India.

Module II (20 Hours)
Panchayati Raj Institutions: 73rd Constitutional Amendment Act, 1992; Gram Sabha – composition, functions and role; Gram Panchayat – composition, functions and role; Panchayat Samiti – composition, functions and role; and Zila Parishad – composition, functions and role.

Module III (20 Hours)
Institutional Framework for PRIs: District Rural Development Agency; District Planning Committee; State Election Commission; State Finance Commission. Panchayati Raj Finance; Devolution of powers, functions (shifted from Module IV)

Suggested Readings

1. Baluchamy, S (2004) Panchayati Raj Institutions. Mittal Publications: New Delhi.
2. Biju, M R (2008) Panchayati Raj System in India: A Symbol of Participatory Democracy and Decentralized Development. Kaniska Publication: New Delhi.
3. Dharmaraj, Sengmalam (2008) Panchayati Raj System in India. Abhijeet Publications: New Delhi
4. Mahi Pal. (2020). Rural Local Governance And Development, SAGE Publications India Private Limited
5. Dr. S.R Myneni. (2016). Local Self Government, Allahabad Law Agency
6. Dr. Maheshwari. (2020). Local Self Government in India, Laxmi Narayan Agarwal
7. Bidyut Chakrabarty, Rajendra Kumar Pandey. (2018). Local Governance in India, Sage Publications India Private Limited

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	M		
CO 2		M	
CO 3			H
CO 4			M

PAUL304T: URBAN LOCAL GOVERNANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course students are able to:
CO1: Show the evolution and growth of urban local bodies in India. (Remembering)
CO2: Explain the composition, role, functions and resources of urban local governance. (Understanding)
CO3: Examine the relevance of relevance of the various Urban Development Programs and Governance. (Analyse)
CO4: Identify the various issue areas in Urban Governance. (Applying)

Module I: Introduction (15 hours)
Evolution of Local Governance in India, Urbanization: Concept; Trends; Challenges; Rural-Urban relationship.

Module II: Organizational Framework for Urban Governance (15 hours)
74th Constitutional Amendment Act; Structure, Composition and Functions of Metropolitan Committees, Municipal Corporations, Municipal Councils and Nagar Panchayats; State Finance Commission; State Election Commission

Module III: Urban Development Programmes and Urban Governance (15 hours)
Urban Development Programmes like AMRUT, NUHM etc.; SMART cities and other recent trends;

Module IV: Issue Areas in Urban Governance (15 hours)
Sources of Finance of Urban Local Government; Personnel Administration; Bureaucracy and Local Governance, State-Local relations; Globalization and Urban governance; Administrative Reforms in Local Governance

Suggested Readings

1. Ahluwalia, Isher Judge (2014) Transforming our cities: Facing up to India's Growing Challenge: Postcards of Change. HarperCollins: New Delhi
2. Ahluwalia, Isher Judge (2017) Urbanisation in India. Sage: New Delhi.
3. Ahluwalia, Isher Judge; Kanbur, Ravi and Mohanty, P K (2014) Urbanization in India: Challenges, Opportunities and the Way Forward. Sage: New Delhi
4. Aziz, A (1996) Decentralised Governance in Asian Countries. Sage: New Delhi Baud, I S A and Wit, J Dee (Eds.)(2008) New Forms of Urban Governance in India: Shifts, Models, Networks and Contestations. Sage: New Delhi
5. Bhattacharya, Mohit (1976) Management of Urban Government in India. Uppal: New Delhi
6. Sachdeva, Pradeep (2011) Local Government in India. Pearson: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	
CO 4				H

PASW305T: SOCIAL AND WELFARE ADMINISTRATION
(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course students are able to:
CO1: Recall Key concepts of Social Administration and its significance in India (Remembering)
CO2: Explain the various scopes, principles and Organisations under Social Welfare Administration. (Understanding)
CO3: Identify the Role, Importance of social welfare, Personnel Administration in the states in India. (Applying)
CO4: Examine the various Issues and Problems in Social Administration in India (Analysing)

Module I: Social Administration: An Introduction (10 Hours)
Concepts, Meaning, Nature, Scope and Principles, Significance of Social Administration, Social Administration in India, Social change and Social justice, Limitations and Prospects in future

Module II: Social Welfare Administration (20 Hours)
Meaning, Definition, Principles, and Scope of SWA, Policies and Organizations at the Central level - Ministry of Social Welfare; Ministry of Social Justice and Empowerment; Ministry of Minority Affairs; Ministry of Tribal Welfare, Organisational structure, functions, programmes of Central Social Welfare Board and State Social Welfare Board; National Commissions for SC/ST, OBC, minorities, women

Module III: Directorate of Social Welfare in states (20 Hours)
Role, Importance of social welfare, Personnel Administration: Manpower planning, Induction, Training, Supervision, Staff Welfare, Service Condition and Staff Morale, Problems faced by social work organisation, Laws related to Personnel Management

Module IV: Issues and Problems in Social Administration (10 Hours)
Social Administration and the Role of Civil Society, Globalization and Role of International Agencies, Role of administrators in Social Administration, Emerging Challenges to Social Administration in India: Administrative inefficiency and demotivation.

Suggested Readings
1. D. R. Sachedva, Social Welfare Administration in India (New Delhi: Kitab Mahal, 2009)
2. P. D. Sharma and B. M. Sharma, Indian Administration: Retrospect and Prospect (New Delhi: Rawat Publications, 2009.
3. Mohinder Singh, Social Policy and Administration in India (New Delhi: M.D. Publications, 1996)
4. Roger A. Lohmann and Nancy Lohmann, Social Administration (New York: Colombia University Press, 2002)
5. Barbara N. Rogers and others, Comparative Social Administration (New York: Transaction Publications, 2007)
6. D.R. Sachdev, Social Welfare Administration in India (New Delhi: Kitab Mahal, 1992)
7. Ella Weinfurther Reed (ed), Social Welfare Administration, originally published in 1961 (New York: Colombia University, Press, digitalized in 2005)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	
CO 4				H

PARW306P: FIELD BASED LEARNING / MINOR PROJECT: Excursion/ A survey in Urban/Rural areas and report writing (4 Credits - 120 Hours) (L-T-P: 0-0-4)

PAFA400T: PUBLIC FINANCIAL ADMINISTRATION
(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes
At the end of this course students are able to:
CO1: Understand the various aspects of Public Financial Administration in general and in the Indian context in particular (Understanding)
CO2: Explain the public budgeting and financial resource mobilization strategies in the Indian context (Understanding)
CO3: Identify the functions and relations of financial institutions. (Applying)
CO4: Examine the role of the Comptroller and Auditor General and Legislative Control over finances in Public Financial Administration. (Analyzing)

Module I: Introduction (15 hours)
Meaning and Significance of Public Finance and Public Financial Administration, Budget: Concept, Principles and Budget as an Instrument of Financial Administration,

Module II: Budgetary systems, Concept and Types of Budgets (20 hours)
Traditional Budgeting; Performance Budgeting; and Zero-Base Budgeting, Budget Preparation, Authorization and Execution with special reference to India

Module III: Financial Institutions and Union–State Financial relations (20 hours)
Union Ministry of Finance: organization, functions and role. Finance Commission: composition, functions and role, Monetary and Fiscal Policies and their significance. Union-State Financial Relations

Module IV: Resource Mobilization, Tax Administration and Financial Control (20 hours)
Resource Mobilization: Tax and Non-Tax Sources, Public Borrowings and Deficit Financing, Tax Administration: Principles; Issues and Reforms, Concept of Audit: Role of Comptroller and Auditor General. Legislative control over finances with special reference to Parliamentary Committees

Suggested Readings

1. Burkhead, J (1956) Government Budgeting. Wiley Sons: New York.
2. Chand, P (2010) Control of Public Expenditure in India (2ndEdition). Allied Publishers: New Delhi. Chand, P (2010). Performance Budgeting (2ndEdition). Allied Publishers: New Delhi.
3. Frank, Howard A (2006) Public Financial Management (1st Edition). CRC Press, Taylor & Francis Group: New York
4. Gupta, B N (2006) Indian Federal Finance and Budgetary Policy. Chaitanya Publishing House: Allahabad
5. Indian Administrative Reforms Commission (1969) Report on Centre-State Relations. Manager of Publications, Government of India, New Delhi.
6. Laxmikanth, M. (2022), Public Administration, Tata McGraw Hill Publication: New Delhi.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		M
CO 3			H	
CO 4				H

PAPA401T: PUBLIC PERSONNEL ADMINISTRATION

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes
At the end of this course students are able to:
CO1: Understand Key concepts and knowledge relating to Public Personnel Administration. (Understanding)
CO2: Explain the concepts and types of Career Systems, Classifications, Recruitment and Training. (Understanding)
CO3: Identify the Constitutional Provisions and the working of the recruitment agencies at Union and state levels. (Applying)
CO4: Examine various mechanisms and their role in Public Personnel Administration and the role of Employee associations and other adjudications institutions (Analysing)

Module I: Introduction: Public Personnel Administration (10 hours)
Meaning, Nature and Scope; Issues in Public Personnel Administration: Neutrality, Ethics and Accountability.

Module II: Civil Service System: Career Systems (10 hours)
Concepts and types; Classification – Concepts and types; Recruitment; Training; Salary; Code of Conduct

Module III: Public Personnel system in India-I (20 hours)
Constitutional Provisions; Recruitment agencies at the Union and State levels; Recruitment, training, career advancement; position classification, discipline, performance appraisal, promotion, pay and service conditions.

Module IV: Human Resources and Personnel Management (20 hours)
Importance of Human resource development, Significance of Personnel Management, Advantages and Disadvantages of Bureaucratic System, Merit system and Spoils System, Hindrances to career development.

Module V: Personnel Mechanism (15 hours)
Employer-Employees Relations, Grievance, Redressal mechanism, Right to Form Associations, Joint-Consultative Council; Central Administrative Tribunal; Recent Civil Service Reforms.

Suggested Readings

1. Bhayana, S S and Singh S (2016) Public Personnel and Financial Administration (4th Edition). New Academics: Jalandhar
2. Sharma M. K., Personnel Administration, Anmol Publications Pvt Ltd
3. Bidyut Chakrabarty, Prakash Chand (2017)Public Administration: : From Government To Governance by BidyutChakrabarty Prakash Chand, Orient Blackswan Pvt Ltd
4. Davar, Rustom S (2008) Personnel Management and Industrial Relations in India (2nd Edition). Vikas Publishing House: New Delhi
5. Flippo, Edwin B (2008) Principles of Personnel Management (4th Edition). McGraw Hill: Kogakusha
6. Saxena, A P (2010) Training and Development in Government. Indian Institute of Public Administration: New Delhi
7. Maheshari, S R (2006) Public Administration In India: The Higher Civil Service, OUP India: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M				
CO 2		M			
CO 3			H		
CO 4				H	H

PAEP402T: ENGAGED POLICY AND GOVERNANCE

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes
At the end of this course students are able to:
CO1: Understand key concepts of Participatory Governance; and Relations between Participatory Governance and Deepening of Democracy (Understanding)
CO2: Explain the Pitfalls in Participatory Governance and the debate on democracy versus development (Understanding)
CO3: Identify issues related to Community engagement at the Grassroots Level (Applying)
CO4: Examine Issues of local Engagement and Participation (Analysing)

Module I: Participatory Governance: An Overview (15 hours)
The Rationale of Participation: Concepts and Challenges; New Governance Paradigm: The Emerging Partnerships/Engagement Initiatives; Relations between Participatory Governance and Deepening of Democracy

Module II: Democracy, Social Inclusion and Development (20 hours)
Democracy and Development; Cross-country analysis of democracy and development between India and China; Political Regimes, Political Participation and Social Inclusion; Innovations and Pitfalls in Participatory Governance

Module III: Engaged Governance (15 hours)
Government Transparency in Policy Decisions; Engaging the Community at Grassroots Level; Electronic Platforms for Receiving and Implementing Public Input

Module IV: Participatory Local Governance (25 hours)
Participatory Governance Toolkits; Measuring Engagement or Participation; Issues in Engagement and Participation; Case Studies a) Kudumbashree in Kerala, India b) Grameen Bank in Bangladesh c) Participatory Budgeting, Brazil d) Watershed Development Programme in Raleganssiddhi, India

Suggested Readings

1. Alexander, Jeffrey C. 2006. The Civil Sphere. New York: Oxford University Press.
2. Baiocchi, G., P. Heller, et al. 2011. Bootstrapping Democracy: Transforming Local Governance and Civil Society in Brazil. Stanford; Stanford University Press.
3. Barber, Benjamin. 1984. Strong Democracy: Participatory Politics for a New Age. Berkeley: University of California Press.
4. Boulding, C. and B. Wampler 2010. “Voice, Votes, and Resources: Evaluating the Effect of Participatory Democracy on Well-being.” World Development 38(1): 125-135.
5. Bowler, S. and T. Donovan 2002. “Democracy, Institutions and Attitudes About Citizen Influence on Government.” British Journal of Political Science 32(02): 371-390.
6. Diamond, L. J. 1999. Developing Democracy: Toward Consolidation. Baltimore, MD: Johns Hopkins University Press.

7. Fung A., E. Wright, et al. 2003. Deepening Democracy: Institutional Innovations in Empowered Participatory Governance. London: Verso Books.
8. Grindle, Merilee, 2007, Going Local: Decentralization, Participation, and the Promise of Good Governance. Princeton University Press.
9. Heller, P. 2000. "Degrees of Democracy: Some Comparative Lessons from India." World Politics 52(4): 484-519.
10. Isaac, T.M. Thomas and Patrick Heller. 2003. "Democracy and Development: Decentralized Planning in Kerala." In Deepening Democracy: Institutional Innovations in Empowered Participatory Governance. The Real Utopias Project IV. London: Verso.
11. Sen, Amartya. 1999. Development as Freedom. Oxford: Oxford University Press.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	
CO 4				H

PAGA403T: GOVERNANCE & ADMINISTRATION IN SOUTH EAST ASIA

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course students are able to:
CO1: Show the historical background of South East Asia, Its geo-political status, Nature of Governance and Administration (Understanding)
CO2: Explain the Political structures and forms of Southeast Asian countries (Understanding)
CO3: Identify Contemporary issues in Southeast Asia (Applying)
CO4: Appraise the importance of South-East Asia in International Politics and relations (Evaluating)

Module I: Introduction to Southeast Asia (15 hours)

Southeast Asia and its formation; Historical background; Southeast Asia's geo-political status; nature of governance and administration of Southeast Asia; Case studies

Module II: Governance and administration of Southeast Asian Countries (20 hours)

Political structures and forms of Southeast Asian countries; Government Systems; Administrative Governance; Political governance; Economic governance; Debate on Southeast Asia as a model of governance and administration for the rest of the World; Case studies

Module III: Contemporary issues in Southeast Asia (20 hours)

Democracy vs Dictatorship; Religion and politics of divide; Terrorism; Population Explosion; Environmental Problem; Aggression and Territorial Disputes; Poverty and underdevelopment; Case studies

Module IV: Importance of Southeast Asia in international politics and relations (20 hours)

Economic Influence; Political Changes and impacts; Master Plan on ASEAN connectivity and achievements; International responses and reactions to Southeast Asia; Case studies

Suggested Readings

1. Kesavan, K. V., Singh, D. (2010). South and Southeast Asia: Responding to Changing Geo-political and Security Challenges. India: Institute of Southeast Asian Studies.
2. Mendoza, M. L., Gonzalez, E. T. (2003). Governance in Southeast Asia: Issues and Options. Philippines: Philippine Institute for Development Studies.
3. Ba, D. Alice and Beeson, Mark (2017). Contemporary Southeast Asia: The Politics of Change, Contestation, and Adaptation. United Kingdom: Bloomsbury Publishing.
4. Mccloud, D. G. (2018). Southeast Asia: Tradition and Modernity in The Contemporary World, Second Edition. United Kingdom: Taylor & Francis.
5. Kingsbury, D. (2016). Politics in Contemporary Southeast Asia: Authority, Democracy and Political Change. United Kingdom: Taylor & Francis.
6. Liow, J. C. (2016). Religion and Nationalism in Southeast Asia. United Kingdom: Cambridge University Press.
7. Acharya, A. (2013). The Making of Southeast Asia: International Relations of a Region. Singapore: Cornell University Press.
8. Kingsbury, D. (2016). Politics in Contemporary Southeast Asia: Authority, Democracy and Political Change. UK: Taylor & Francis.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	
CO 4				H

MINOR COURSES

MINOR COURSES
(HUMAN RIGHTS –HR/INTERNATIONAL RELATIONS -IR/PUBLIC POLICY-PP/ HISTORY-HI)

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	PAHR102T	Introduction to Human Rights (HR) / Introduction to International Relations (IR)	4
		PAII103T		
2	Minor Course 2	PAPA104T	Environmental Policy and Administration (HR) / Policy Making – Structures and Processes (PP) / Historiography, Early Civilizations, Ancient to Medieval Indian History (HI)	4
		PASP105T		
		PAHI108T		
3	Minor Course 3	PARI205T	Human Rights in India (HR)/ Emerging Trends in International Relations (IR)/ Modern Indian History	4
		PAET206T		
		PAMH210T		
4	Minor Course 4	PARC207T	Refugees and International Conflicts (HR/IR) / Public Policy Implementation (PP) / World History	4
		PAIC208T		
		PAWH211T		
5	Minor Course 5	PAFP307T	Foreign Policy of India (IR)/ Policy Education, Impact and Evaluation (PP)	4
		PAIE308T		
6	Minor Course 6	PASP309T	Statistics for Public Administration Research (HR,IR & PP) / Public Policy in India (PP)	4
		PAPP310T		
7	Minor Course 7	PAHT404T	Human Trafficking in India	3
7	Minor Course 8	PARM405T	Research Methodology	2
8	Minor Course 9	PACG406T	China and Global System (IR)	3
		PAIC407T	Institutions & complexities in Public Policy Process (PP)	3

MINOR COURSES IN HUMAN RIGHTS

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	PAHR102T	Introduction to Human Rights (HR)	4
2	Minor Course 2	PAPA104T	Environmental Policy and Administration (HR)	4
3	Minor Course 3	PARI205T	Human Rights in India (HR)	4
4	Minor Course 4	PARC207T	Refugees and International Conflicts (HR/IR)	4
6	Minor Course 6	PASP309T	Statistics for Public Administration Research (HR,IR & PP)	4

MINOR COURSES IN INTERNATIONAL RELATIONS

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	PAII103T	Introduction to International Relations (IR)	4
3	Minor Course 3	PAET206T	Emerging Trends in International Relations (IR)	4
4	Minor Course 4	PARC207T	Refugees and International Conflicts (HR/IR)	4
5	Minor Course 5	PAFP307T	Foreign Policy of India (IR)	4
6	Minor Course 6	PASP309T	Statistics for Public Administration Research (HR,IR & PP)	4
8	Minor Course 9	PACG406T	China and Global System (IR)	3

MINOR COURSES IN PUBLIC POLICY

Semester	Category	Course Code	Course Name	Credits
2	Minor Course 2	PASP105T	Policy Making – Structures and Processes (PP)	4
4	Minor Course 4	PAIC208T	Public Policy Implementation (PP)	4
5	Minor Course 5	PAFP307T	Policy Education, Impact and Evaluation (PP)	4
6	Minor Course 6	PASP309T	Statistics for Public Administration Research (HR,IR & PP) / Public Policy in India (PP)	4
		PAPP310T		
8	Minor Course 9	PAIC407T	Institutions & complexities in Public Policy Process (PP)	3

MINOR COURSES IN HISTORY

Semester	Category	Course Code	Course Name	Credits
2	Minor Course 2	PAHI108T	Historiography, Early Civilizations, Ancient to Medieval Indian History (HI)	4
3	Minor Course 3	PAMH210T	Modern Indian History	4
4	Minor Course 4	PAWH211T	World History	4

MINOR COURSES IN HUMAN RIGHTS

PAHR102T: INTRODUCTION TO HUMAN RIGHTS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

CO1: Recall the concepts of human rights and International efforts to develop Human Rights norms. (Remembering)
CO2: Explain the nature and significance of UDHR, and the role of non-governmental organisations on human rights (Understanding)
CO3: Identify the nature and types of rights provided by the International Covenant on Civil and Political Rights, and the procedure to file complaints (Applying)
CO4: Compare and Contrast the state's obligations for implementing ICESCR and the Economic, Social and Cultural Rights provided under the Indian Constitution. (Analysing)

Module I: Understanding Human Rights (15 hours)

Meaning of Human Rights; Kinds and Nature of Human Rights; International efforts to develop Human Rights norms

Module II: UDHR (15 hours)

Objectives, Nature, and importance of UDHR; Worldwide Influence of UDHR; NGOs on Human Rights

Module III: ICCPR (15 hours)

Nature of International Covenant on Civil and Political Rights (ICCPR); types of Rights provided by the ICCPR; The procedure to file complaints

Module IV: ICESCR (15 hours)

International Covenant on Economic, Social and Cultural Rights (ICESCR); The Nature of obligations under ICESCR; Economic, Social and Cultural Rights under the Indian Constitution

Suggested Readings

1. O'Byrne, Darren. *Human rights: An introduction*. Routledge, 2014.
2. Assembly, UN General. "Universal declaration of human rights." *UN General Assembly* 302.2 (1948): 14-25.
3. Schabas, William A. *UN International Covenant on Civil and Political Rights: Nowak's CCPR Commentary*. NP Engel Verlag, 2019.
4. Saul, Ben, David Kinley, and Jaqueline Mowbray. *The international covenant on economic, social and cultural rights: commentary, cases, and materials*. OUP Oxford, 2014.
5. Sepúlveda, M. Magdalena, and María Magdalena Sepúlveda Carmona. *The nature of the obligations under the International Covenant on Economic, Social and Cultural Rights*. Vol. 18. Intersentianv, 2003.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PAPA104T: ENVIRONMENTAL POLICY AND ADMINISTRATION

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students would be able to:
CO1: Recall major Environmental Policy and legislations in India (Remembering)
CO2: Show the environmental issues in India (Understanding)
CO3: Identify the Impact of urbanization on the Environment (Applying)

CO4: Appraise the level of Environmental Protection in India (Evaluating)

Module I: Environmental issues in India (15 hours)
Nature of Environmental Problems in India; Environmental policy and Legislation in India; Implementation of Laws relating to Environmental Protection
Module II: Development and Environment (15 hours)
Development – Environment Discourse; Global Environmental Governance

Module III: Urbanization (15 hours)
Urban Environmental administration and politics in India; Impact of urbanization on Environment and Public Health

Module IV: Urban Environmental administration (15 hours)
Environmental Protection and People's rights and duties; Steps taken by the government for environmental protection in recent years; case studies on environmental degradation

Suggested Readings
1. Bruckmeier, Karl. "Global Environmental Governance: Social-Ecological Perspectives." (2018). ArildVatn- Environmental Governance: Institutions, Policies and Actions
2. Divan, Shyam, and Armin Rosencranz. Environmental Law and Policy in India: Cases and Materials. Oxford University Press, 2022.
3. Evans, James P. Environmental governance. Routledge, 2012.
4. Portney, Kent E. Taking sustainable cities seriously: Economic development, the environment, and quality of life in American cities. MIT Press, 2013.
5. Spence, Michael, Patricia Clarke Annez, and Robert M. Buckley, eds. Urbanization and growth. World Bank Publications, 2008.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PARI205T: HUMAN RIGHTS IN INDIA

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, students are able to:
CO1: Understand the historical context of human rights in India (remembering/ understanding)
CO2: Analyse how Indian tradition and the Constitution promote human rights (analysis/ evaluation)
CO3: Analyse the mechanism for human rights mechanism in India (analysis/ evaluation)
CO4: Analyse the threats to Human Rights from state and Social Institutions (analysis/ evaluation)

Module I: Human Rights in Historical Context (15 hours)
Right to Set Determination; Colonialism and Human Rights; National Movement and Human Rights

Module II: Human Rights - India's Heritage (15 hours)
Human rights in Indian tradition; Human rights in the Constitution of India

Module III: Mechanisms for Human Rights Protection (15 hours)
Human Rights and the Law; Special Institutions to Protect Human Rights

Module IV: Threats to Human Rights (15 hours)
Human Rights and The State; Threats to Human Rights from Social Institutions; Case studies on the violation of human rights

Suggested Readings
1. Silverman, Helaine, and D. Fairchild Ruggles. *Cultural heritage and human rights*. Springer New York, 2007.
2. Sastry, T. Suryanarayana N., ed. *India and human rights: reflections*. Concept Publishing Company, 2005.
3. Das, Asish Kumar, and Prasanta Kumar Mohanty. *Human rights in India*. Sarup & Sons, 2007.
4. Kumar, C. Raj. *Corruption and human rights in India: comparative perspectives on transparency and good governance*. Oxford University Press, 2011.

5. Nair, P. M., and Sankar Sen. *Trafficking in women and children in India*. Orient Blackswan, 2005.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M	M		
CO 2		H		
CO 3			H	
CO 4				H

MINOR COURSES IN INTERNATIONAL RELATIONS

PAII103T: INTRODUCTION TO INTERNATIONAL RELATIONS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

CO1: Recall the various concepts related to International Relations. (Remembering)
CO2: Explain the various Issues related to International Relations (Understanding)
CO3: Identify the roles, functions and areas of influence of various regional and International Organisations (Applying)
CO4: Examine the various Power Shifts in International Relations and Emergence of India in the Post Covid 19 Scenario. (Analysis)

Module I: Introduction and Basic concepts of IR (20 hours)

a) Introduction: Definition of IR; Characteristics/nature of IR; Why study IR – Development of IR as discipline, Impact of Globalisation on IR- Global South and IR
b) Actors and processes in IR: States and Non-State Actors (IGO's, NGO's, MNC's and terrorist groups).
c) Power: Definition and Exercising Power – Elements of National Power, Soft Power and Its relevance in the contemporary IR study.
d) National Interest and Foreign Policy – Determinants of FP – Foreign Policy Making – India, USA and China
e) Balance of Power – Bi-Polar/Unipolar/Multi-Polar and Non-Polarity- Soft balancing.

Module II: Issues in Contemporary IR (15 hours)

International Terrorism, Nuclear Proliferation, Human Security, Climate Change and Environmental Security, Energy Security, Natural resource scarcity, Pandemic and Disaster Management; IR In Covid and Post Covid

Module III: Regional and International Organizations (10 hours)

UN Reform – EU -SAARC – BIMSTEC-SCO- BRICS-RCEP

Module IV: Global Power Shift and IR (15 hours)

Power Transition Theory and the Rise of China, Trump Doctrine and the Decline of US led Liberal Order, India as an Emerging Power, Global Uncertainty and the Debate on Post COVID 19 World Order

Suggested Readings

1. Michel, Torsten (2023): The Rhetoric of Inquiry in International Relations: A Hermeneutic Investigation into the Forms of Argumentation in International Relations Meta-Theory: Routledge
2. Baylis, John and Steve Smith (2011): *The Globalisation of World Politics,* New York: Oxford University Press.
3. Buzan, Barry and Richard Little (2020): *International Systems in World History: Remaking the Study of International Relations,* Cambridge: Cambridge University Press
4. Derek Mcdougal (2012): Responses to 'Rising China' in the East Asian Region: soft balancing with accommodation, Journal of Contemporary China, 21(73), January, 1–17.
5. Linklater, Andrew and HidemiSuganami (2016): *The English School of International Relations: A Contemporary Reassessment,* Cambridge: Cambridge University Press.
6. Muthiah Alagappa (2009): Nuclear Weapons and Security in 21st Century Asia The Long Shadow, Oxford University Press: New Delhi.
7. Paul R. Viotti and Mark V. Kauppi (2017): International relations and World Politics: Security,
8. Economy, Identity, Pearson: Delhi.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	M	H		
CO 3			H	
CO 4				H

PAET206T: EMERGING TRENDS IN INTERNATIONAL RELATIONS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO 1: Explain the origins and consequences of the Cold War and changing pattern of world order (Understanding)

CO 2: Identify the differences between Regionalism and Globalization and understand the crisis in the global economy (Applying)

CO 3: Examine the major contemporary issues in IR (Analyzing)

CO 4: Appraise the challenges to Regional Peace and Security (Evaluating)

Module I: Changing Patterns of World Order (15 hours)

Globalisation and the Crisis of the Unipolar World, Shift from the Balance of Power to Bipolarity, Multipolarity and Polycentrism, Democratisation and the World Order

Module II: New Thrust on International Cooperation and Emergence of IGOS (International Governmental Organizations):
(15 hours)

UNO's changing role, EEC (European Economic Community), SAARC, OIC (Organisation of Islamic Cooperation), BRICS, G20,… Shangai

Module III: Major Contemporary Issues (15 hours)

Multilateralism and polarity, Democracy, global regression and resistance
Protracted Brexit, Iran: scope and consequences of the sanctions

Module IV: Contemporary Challenges to Regional Peace and Security (15 hours)

Flexibility and Fluidity of Regional Politics, Arms Modernization and Nuclear Proliferation, Territorial Disputes, Rapid Economic Development and Regional Peace and Security, New Challenges to Peace and Security, China way of Globalisation, - China, Sri Lanka, Pakistan – BRI of China -one road policy, India way of Globalisation

Suggested Readings

1. Imtiaz, Mughiza Imtiaz (2018): Emerging Trends in International Relations: Uni-polarity to Multi-polarity
2. Hansen, B. (2010). Unipolarity and World Politics: A Theory and Its Implications. United Kingdom: Taylor & Francis.
3. Lerch, Marika (2017): Challenges of Globalization: New Trends in International Politics and Society. United States: Taylor & Francis.
4. Chatterjee, A. (2010). International Relations Today: Concepts and Applications. India: Pearson.
5. Ajulu, R. (2018). Globalization and Emerging Trends in African States' Foreign Policy-Making Process: A Comparative Perspective of Southern Africa. United Kingdom: Taylor & Francis.
6. New Realities in Foreign Affairs: Diplomacy in the 21st Century. (2019). Germany: Nomos Verlag.
7. Sunkel, O., Inotai, A. (2016). Globalism and the New Regionalism: Volume 1. United Kingdom: Palgrave Macmillan UK.
8. Dannreuther, R. (2014). International Security: The Contemporary Agenda. Germany: Polity Press.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	M
CO 4				H

PARC207T: REFUGEES AND INTERNATIONAL CONFLICTS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course students are able to:

CO1: Recall the history, scope and significance of refugee studies (Remembering)

CO2: Explain the trends and status of refugees in Asia and Africa (Understanding)

CO3: Identify the impact of Refugee crisis in the host states (Applying)

CO4: Examine the Responses to Refugee situations and strategies of Negotiations (Analyzing)

Module I: Refugee Crises: Conceptual analysis & Contemporary Dimensions (15 Hours)

Definition, history and overview, global scale, scope and significance of refugee studies, spatial mobility in social theory,

international law and conventions for refugees

Module II: Refugee Crises: Case Studies (10 Hours)
Causes, trends and status of refugees in Asia and Africa: Palestinian, Afghan, Rohingya, Libyan and Syrian refugees, Status of refugees in host states

Module III: **Impact of Refugee Crises (10 Hours)**
Attitude of host states, Impact on society, politics and economy of host states, case studies: Europe and West Asia

Module IV: Response to Refugee Situations: Role of Humanitarian Actors (20 Hours)
National, Regional and International Actors: UNHCR, UNRWA, Red Cross, Red Crescent, NGOs, achievements, failure and challenges

Module V: Strategies of Negotiations and Solutions (15 Hours)
Issue of citizenship and identity in a globalized world, questions of repatriation, rehabilitation and resettlement, Urgent needs

Suggested Readings

1. Aalborg University. (2020). *Global Refugee Studies*. https://www.en.aau.dk/education/ master/development-international-relations/specialisations/global-refugee-studies
2. Ahsan Ullah AKM. (2010). Rohingya Refugees to Bangladesh: Historical Exclusions and Contemporary Marginalization. *Journal of Immigrant and Refugee Studies*, 9(2).
3. Amnesty International (2015, June). *The Global Refugee Crisis: A Conspiracy of Neglect*.
4. Betts, Alexander & Loesher G (2010), *Refugees in International Relations*, Oxford University Press.
5. Betts, Alexander (2009). *Forced Migration and Global Politics*. Wiley-Blackwell.
6. Bocco, Riccardo (2010). UNRWA and the Palestinian Refugees: A History within History. *Refugee Survey Quarterly*, *28* (2 & 3), 229- 252.
7. Cameron, B. T (2014). Reflections on Refugee Studies and the Study of Refugees: Implications for Policy Analysts. *Journal of Management & Public Policy*, *6* (1), 4-13.
8. Christensen, Asger and Harild N (2009). Forced Displacement, the Development Challenge, Conflict, Crime and Violence Issues Note, *Social Development Department*, The World Bank.
9. Fagen W, Patricia (2007). *Iraqi Refugees: Seeking Stability in Syria and Jordan*. Institute for the Study of International Migration. Georgetown University.
10. Gartenstein-Ross, Daveed et al. (2015, April). *The Crisis in North Africa: Implications for Europe and Options for EU Policymakers*, Clingendae (Netherlands Institute of International Relations).
11. Iqbal, Zaryab (2009).The Geo-Politics of Forced Migration in Africa, 1992–2001. *Conflict Management and Peace Science*, *24*(2), 105 – 119.
12. Loescher, Gil et al. (2008). *Protracted Refugee Situations: Political, Human Rights and Security Implications*. United Nations University Press, Tokyo.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M				
CO 2		H			
CO 3		M	H		
CO 4				H	H

PAFP307T: FOREIGN POLICY OF INDIA

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course students are able to:
CO1: Recall the principles and Phases of Indian Foreign Policy. (Remembering)
CO2: Explain India's engagement with Super Powers and International Institutions. (Understanding)
CO3: Identify the various determinants of India's Policy towards its Neighbours. (Applying)
CO4: Examine the role of India in relation to Major International Issues. (Analyzing)

Module I: Foreign policy of India: An Overview (15 hours)
Legacies- Strategic Thinkers- Determinants- Principles- Structure and Process- Phases of Indian Foreign Policy

Module II: India's engagement with Superpowers and International Institutions (15 hours)
USA- Russia- China- EU- UN- SAARC- ASEAN- G-77- G- 20- BRICS- BIMSTEC

Module III: India and its Neighbours (15 hours)
Policy towards Immediate and Extended Neighbours- Defence- Energy Security- Trade; cyber security

Module IV: India and major International Issues (15 hours)
UNSC Reform- Terrorism- Maritime Security- International Migration- Palestine Problem-Environmental Governance- Military Intervention- Nuclear Issue

Suggested Readings
1. Mazumdar, A. (2014). Indian Foreign Policy in Transition: Relations with South Asia. United Kingdom: Taylor & Francis.
2. Menon, S. (2018). Choices: Inside the Making of India's Foreign Policy. India: Penguin Random House India Private Limited.
3. Jaishankar, S. (2020). The India Way: Strategies for an Uncertain World. India: HarperCollins India.
4. Pant, H. (2016). Indian Foreign Policy: An Overview. United Kingdom: Manchester University Press.
5. Mitra, S. K., Pauli, M. (2022). INDIA: Statecraft and Foreign Policy. Germany: Nomos.
6. Hall, I. (2019). Modi and the Reinvention of Indian Foreign Policy. United Kingdom: Bristol University Press.
7. Sikri, R. (2009). Challenge and Strategy: Rethinking India's Foreign Policy. India: SAGE Publications.
8. Alam A., Mohammad (2015). *Contours of India's Foreign Policy*. Oxford University Press.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3			H	M
CO 4				H

PACG406T: CHINA AND GLOBAL SYSTEM

(3 Credits - 45Hours) (L-T-P: 3-0-0)

Course Outcomes
At the end of this course students are able to:
CO1: Explain China's foreign policy and world view. (Understanding)
CO2: Identify Salient aspects of China's relations with US, Russia, EU and Japan. (Applying)
CO3: Examine issues of China's engagement with regions. (Applying)
CO4: Appraise the Rise of China in relation to Global. (Evaluating)

Module I: Rise of China and the debate on Asian Century (10 Hours)
a) Theoretical Explanations
b) China's Foreign policy and World view- Peaceful Rise and State power
c) China's perspectives on Asian Century

Module II: China and Global powers (10 Hours)
a) US- China relations
b) Russia- China relations
c) EU-China relations
d) Japan – China

Module III: Chinas engagement with the regions (15 Hours)
a) OBOR
b) Neighbourhood policy – South Asia- East Asia and South East Asia
c) Territorial disputes: Maritime disputes; South China Sea Boundary dispute; India China border dispute

Module IV: Rise of China and Global Governance (10 Hours)
a) United Nations
b) Climate Change negotiations
c) BRICS- SCO
d) Global Commons

Suggested Readings
1. Dahlman, C. (2011). The World Under Pressure: How China and India Are Influencing the Global Economy and Environment. United States: Stanford University Press
2. He, A. (2016). The Dragon's Footprints: China in the Global Economic Governance System Under the G20 Framework. Canada: McGill-Queen's University Press.

3. Blustein, P. (2019). Schism: China, America, and the Fracturing of the Global Trading System. Canada: McGill-Queen's University Press.
4. Scott, D. (2008). 'The Chinese Century'? The Challenge to Global Order. United Kingdom: Palgrave Macmillan UK.
5. Ho, B. (2021). China's Political Worldview and Chinese Exceptionalism: International Order and Global Leadership. Netherlands: Amsterdam University Press.
6. Smith, M. A. (2012). Power in the Changing Global Order: The US, Russia and China. United Kingdom: Wiley.
7. Doshi, R. (2021). The Long Game: China's Grand Strategy to Displace American Order. United Kingdom: Oxford University Press.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3			H	
CO 4				H

MINOR COURSES IN PUBLIC POLICY

PASP105T: POLICY MAKING – STRUCTURES AND PROCESSES

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students would be able to:
CO1: Recall the basic concepts of Public Policy. (Remembering)
CO2: Explain the role of different institutions involved in policy making in India. (Understanding)
CO3: Identify various techniques and approaches of policy formulation. (Applying)
CO4: Examine the impact of globalization in policy making. (Analyzing)

Module I: Introduction to Public Policy (15 Hours)

Meaning, Nature, Scope and Significance; Public Policy and Public Administration, Policy Cycle

Module II: Policy Making Structures (15 Hours)

Inter-Governmental Relations; Role of Legislature; Role of Executive; Role of Judiciary; Role of Bureaucracy; Challenges in Policy Making

Module III: Policy Making Strategies (15 Hours)

Techniques of Policy Formulation; Approaches/ Models of Policy Making; Agencies involved in Policy Making; Informal Channels of Policy Making.

Module IV: Public Policy and Globalization: (15 Hours)

Impact of Globalization on Public Policy Making Process; Public Policy and LPG, International Organizations influencing Policy Making; Role of Private Sector in Public Policy Making

Suggested Readings

1. Ramesh Kumar Tiwari and AashaKapur Mehta, Public Policy and Administration, Gyan Publishing House 2012.
2. Christoph Knill and JaleTosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.
3. Maniram sharma, Public Policy in India, Mahaveer Publications, 2023.
4. Haridwar Shukla,Public Policy and Administration in India, Mahaveer Publications, 2021
5. Michael Howlett, Designing Public Policies: Principles and Instruments, Routledge, 2019.
6. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
7. Michael Howlett and JaleTosun (Eds.), Policy Styles and Policy Making: Exploring the Linkages, Routledge, 2018.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PAIC208T: PUBLIC POLICY IMPLEMENTATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course the students are able to:
CO1: Explain the Concept and processes of policy implementation. (Understanding)
CO2: Identify the role played by different agencies in implementing policies. (Applying)
CO3: Examine the role played by stakeholders in policy implementation. (Analyzing)
CO4: Appraise Policy Implementation through case studies. (Evaluating)

Module I: Policy Implementation System (15 Hours)

The Concept of Policy Implementation; Approaches/ Models of Policy Implementation; Constraints of Policy Implementation

Module II: Agencies in Policy Implementation (15 Hours)

Policy Implementors; Political Executives in Policy Implementation; Permanent Executives in Policy Implementation; Relationship between Political and Permanent Executives in Policy Implementation Process

Module III: Stakeholders of Policy Implementation (15 Hours)

Role of Citizens; Role of Civil Societies; Role of Media and other relevant interest groups and actors

Module IV: Case Studies in Policy Implementation (15 Hours)

Suggested areas- Education, Health, Tribal Development, Weaker Sections. Evaluation and Feedback: Monitoring and Social Audit

Suggested Readings

1. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
2. Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015.
3. Christoph Knill and Jale Tosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.
4. Paul Cairney,. Understanding Public Policy: Theories and Issues, Red Globe Press, London, 2020
5. Jaideep Singh, Case Studies in Public Administration, Indian Institute of Public Administration, 1983.
6. Darlington Mgbeke, Public Policy Implementation in Democratic Governance Society: A Roadmap to Empower Citizen Participation: An Empirical Study, Author House, 2009.
7. R.K Sapru, Public Policy: A Contemporary Perspective, Sage Publications India Pvt Ltd, 2017.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4				H

PAIE308T: POLICY EDUCATION, IMPACT AND EVALUATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course students are able to:
CO1: Recall the basics of policy education. (Remembering)
CO2: Explain the use of the tools and techniques of policy monitoring and evaluation. (Understanding)
CO3: Identify the role of different institutions in policy evaluation. (Applying)
CO4: Examine the policy impact through case studies. (Analyzing)

Module I: Introduction to Policy Education (15 Hours)

Policy Education as an emerging discipline; Importance of Policy Education; Policy Education for Policy Implementation; Public Policy and Experiential Learning.

Module II: Monitoring, Evaluation and Review (15 Hours)

Methods and Approaches of Evaluation; Evaluation standards and Ethics; Approaches to Policy Monitoring; Policy Monitoring and Policy Outcomes; Importance of Policy Review, Strategies for Policy Review.

Module III: Policy Evaluation Institutions (15 Hours)
NITI Aayog, DMEO, Comptroller and Auditor General of India, Social Audit

Module IV: Policy Impact: Case Studies (15 Hours)
Poverty reduction, empowerment of women, environmental protection, educational development, Tribal Development

Suggested Readings
1. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
2. Christoph Knill and Jale Tosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.
3. Paul Cairney, Understanding Public Policy: Theories and Issues, Red Globe Press, London, 2020.
4. DN Khurana,Public Policy: Contemporary Issues, Excel Books, 2010.
5. Vishal Narain, Public Policy: A View From the South, Cambridge University Press, 2018.
6. Rachel Meltzer and Alex Schwartz, Policy Analysis as Problem Solving: A Flexible and Evidence-Based Framework, Routledge, 2018.
7. Jaideep Singh, Case Studies in Public Administration, Indian Institute of Public Administration, 1983.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3			M	
CO 4				H

PASP309T: STATISTICS FOR PUBLIC ADMINISTRATION RESEARCH

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course students are able to:
CO1: Explain the significance of Statistics and Measures of Central Tendency along with measures of dispersion.
CO2: Illustrate the Bi-variate Relationship in Correlational analysis.
CO3: Discuss the elements of Probability Theory.
CO4: Examine and illustrate the Test of Hypothesis in the statistical analysis through Parametric and Non-Parametric Testing Techniques.

Module I: Introduction to Statistics (15 Hours)
Concept, nature, significance and scope of statistics; General field of statistics: descriptive and inferential statistics; Measure of central tendency: mean, weighted mean, median and mode
Measures of dispersion: variance, standard deviation and coefficient of variation

Module II: Determining the Bi-variate Relationship (10 Hours)
Correlation analysis: Karl Pearson and Spearman's Rank correlation methods; Regression analysis: simple linear regression

Module III: Probability Theory(15 Hours)
Basic terminologies: combination, event and its type; sample space; Approach to probability: classical, relative frequency and subjective approaches; Laws of probability: additional rule, multiplication rule, conditional probability; Theoretical probability distribution: binomial, and normal distribution.

Module IV: Test of Hypothesis (20 Hours)
Introduction to the test of the hypothesis; concept and significance; Basic terminologies: null and alternative hypothesis, one-tailed and two-tailed test, type-I and type-II errors; Steps in the test of hypothesis; Test of significance of large sample: mean (single and double sample), population proportion (single and double sample); Test of significance of small Sample: mean (independent and dependent), sample correlation coefficient, the test of significance of two sample variances, Parametric and non-parametric test, chi-square test (goodness of fits and test of independence attribute); Kruskal Wallis Test: the test of significance of more than two sample means.

Suggested Readings
1. Chandan, J. S. (2009). Statistics for Business and Economics. New Delhi: Vikash Publishing House.
2. Gupta, S. C. (1999). Fundamentals of Statistics. New Delhi: Himalaya Publishing House Pvt. Ltd.
3. Gupta, S. P. (1998). Fundamentals of Statistics. New Delhi: Himalayan Publishing House Pvt. Ltd.
4. Kerlinger, F. N. (1986). Fundamental of Behavioral Research. New Delhi: Surjeet Publishers
5. Kothari, C. K. (2008). Research Methodology: Methods and Techniques. New Delhi: New Age International.
6. Macfie, B. P. & Nufrio P. M. (2017). Applied Statistics for Public Policy. New Delhi: Prentice Hall of India Pvt. Ltd.

7. Shahi, H. B. (2017). Statistics for Public Management. Kathmandu: Radhika Shahi.
8. Sharma, P. K. & Chaudhary, A. K. (2071). Statistical Methods. Kathmandu: Khanal Publication Pvt. Ltd.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3			H	
CO 4				H

PAPP310T: PUBLIC POLICY IN INDIA

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

CO1: To develop the understanding of public policy through its meaning, nature and significance. (Understanding)
CO2: To gain knowledge about various approaches of public policy. (Remembering)
CO3: To analyze the role of various policies for protecting women and children. (Analysing)
CO4: To evaluate the role of social policy and planning through various institutions in India. (Evaluating)

Module I: Introduction to Public Policy (15 Hours)

Meaning, Nature and Scope of Public Policy; Significance of Public Policy; Types of Policy; Public Policy and Public Administration; Policy Cycle

Module II: Approaches to Public Policy (15 Hours)

The Process Approach; The Logical Positivist Approach; The Phenomenological Approach; The Participatory Approach; The Normative Approach.

Module III: Social Policies in India (15 Hours)

Children's Policy in India for juvenile justice, child labour restraint and child marriage prevention; Critical Review of Governmental & Non-Governmental Efforts, Social Legislations and Women's Rights in India: Marriage Acts; Divorce Acts; Prevention of Domestic Violence; Prevention of Sexual Harassment at Workplace.

Module IV: Social Policy and Planning (15 Hours)

Role of Media Advocacy, Accountable Governance, Corporate Social Responsibility in India; Role of Important Institutional Machineries -NITI Aayog, National Commissions for Women, SCs, STs, Backward Classes, Evaluation of Social Policy in India.

Suggested Readings

9. Rajesh Chakrabarti and Kaushiki Sanyal, Public Policy in India, Oxford University Press, 2016.
10. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
11. Maniram sharma, Public Policy in India, Mahaveer Publications, 2023.
12. Haridwar Shukla,Public Policy and Administration in India, Mahaveer Publications, 2021
13. Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015
14. Veerendra Mishra, Transgenders in India: An Introduction, Taylor and Francis Group, Routledge Publications, 2023.
15. John Baldock et. al., Social Policy, London: Oxford University Press, 2011.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3		M	H	
CO 4				H

PAIC407T: INSTITUTIONS & COMPLEXITIES IN PUBLIC POLICY PROCESS

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course students are able to:
CO1: Explain the role of different institutions in policy making process. (Understanding)
CO2: Identify the issues involved in policy design. (Applying)
CO3: Examine the factors behind complexities in policy implementation. (Analysing)
CO4: Appraise the impact of conditions in policy evaluation and analysis. (Evaluating)

Module I: Institutions in Public Policy Process (15 hours)
Inter-governmental relations; The role of the legislature; The role of political and permanent executives; the role of judiciary; planning machinery at the central, state, and local levels.

Module II: Complexities in policy formulation (15 hours)
Identifying issues in agenda-setting; Faulty policy design- reasons and effects; inadequate collaborative policymaking

Module III: Complexities in policy implementation (15 hours)
Key factors behind policy failure; Policy failure and the policy-implementation gap; local contextual realities

Module IV: Complexities in Policy evaluation and analysis (15 hours)
Changing conditions and needs; Issues of cost-benefit analysis; Complexities in the analysis of outcomes of public policy

Suggested Readings

1. Sapru, R. (2019). *Public Policy: A Contemporary Perspective*. SAGE Publications Pvt. Limited.
2. Chakrabarty, B., & Chand, P. (2019a). *Public Policy: Concept, Theory and Practice*. SAGE Publications Pvt. Limited.
3. Chakrabarti, R., &Sanyal, K. (2017). *Public Policy in India*. Oxford India Short Introduction.
4. Knill, C., &Tosun, J. (2020). *Public Policy: A New Introduction*. Bloomsbury Publishing
5. Cairney, P. (2019). *Understanding Public Policy: Theories and Issues*. Bloomsbury Publishing.
6. Mathur, K. (2016). *Public Policy and Politics in India: How Institutions Matter*. Oxford India Paperbacks.
7. Singh, J. (1983), Case Studies in Public Administration. Indian Institute of Public Administration.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3		M	H	
CO 4				H

PAHT404T: HUMAN TRAFFICKING IN INDIA

(3 Credits – 45 Hours) (L-T-P: 3-0-0)

Course Outcomes
At the end of this course, students would be able to:
CO1: Understand various forms, types and indicators of human trafficking. (Understanding)
CO2: Demonstrate understanding of the theoretical perspectives of human trafficking. (Understanding)
CO3: Identify the anti-human trafficking efforts in India. (Applying)
CO4: Examine the national and international anti-human trafficking frameworks in policy intervention. (Analysing)

Module I: Introduction (10 hours)
History, Nature, and magnitude of human trafficking in India; Forms and types of human trafficking; Indicators of Human Trafficking; Vulnerability in Human Trafficking; Human trafficking and Sex work

Module II: Theoretical Perspectives of Human Trafficking (10 hours)
Inter-disciplinary Approach; Feminist Approach; Stigma, exclusion and push-pull theory from Sociological Approach; Neo-liberal Approach

Module III: Anti-Human Trafficking efforts in India (10 hours)
Anti-Human Trafficking Units; Rescue, Re-integration, and Repatriation of the Trafficked survivors; Modus operandi and low conviction rate of the traffickers; Shelter homes for the trafficked survivors

Module IV: National and International Policies on Human Trafficking (15 hours)
Constitution of India and Human Trafficking; Legal provisions in India; International Legal provisions; Palermo protocol of the UN; Critique of the policies; Case studies

Suggested Readings

1. Lee, Maggy, ed. *Human trafficking*. Routledge, 2013.
2. Shelley, Louise. *Human trafficking: A global perspective*. Cambridge University Press, 2010.
3. Burke, Mary C., ed. *Human trafficking: interdisciplinary perspectives*. Routledge, 2022.
4. Busch-Armendariz, Noël Bridget, et al. Human Trafficking: Applying Research, Theory, and Case Studies. Thousand Oaks, CA: SAGE Publications, Inc, 2018.

5. Banerjee, Paula (2016): Criminalising the Trafficked – Blaming the Victim, Economic & Political Weekly, (Special Issue on Review of Women's Studies), 5th November, Vol. 1.1, Nos 44 & 45. pp 62-68.
6. Crawford, Mary (2010): Sex Trafficking in South Asia: Telling Maya's Story, Routledge Research on Gender in Asia Series.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	
CO 4				H

PARM405T: RESEARCH METHODOLOGY

(2 Credits – 30 Hours) (L-T-P: 2-0-0)

Course Outcomes

At the end of this course students are able to:
CO1: Explain the key concepts in research methods, Research Process and Research Design. (Understanding)
CO2: Identification and mastery of the necessary skills to use research tools to undertake research study (Applying)
CO3: Evaluate governmental policy or programme/projects on the basis of primary and secondary data (Evaluating)

Module I: Foundations of Public Administration Research (15 Hours)

Key concepts in research methods; Meaning and types of research; Research process – Defining research problem, steps of research and application of research methods in Public Administration; Hypothesis; Research Design: Concept and importance; Types of research designs

Module II: Scientific Method, Measurement and Sampling Techniques (15 Hours)

Concept of scientific method; Basics of sampling and types of sampling, Data Collection, Processing and Analysis, Data analysis and Report writing

Suggested Readings

1. Kothari, C R and Garg, G (2018) Research Methodology: Methods and Techniques. New Age International Publishers: New Delhi
2. Kumar, Ranjit (2011) Research Methodology: A Step by Step Guide for Beginner. Sage Publications: London
3. McNabb, David E (2017) Research Methods in Public Administration and Non-profit Management (4th Edition). Routledge: UK
4. Miller, G J and Yang, K (Eds.) (2007) Handbook of Research Methods in Public Administration. CRC Press: New York

Mapping of COs to Syllabus

	Module 1	Module 2
CO 1	M	
CO 2		H
CO 3		H

MINOR COURSES IN HISTORY

PAHI108T: HISTORIOGRAPHY, EARLY CIVILIZATIONS, ANCIENT TO MEDIEVAL INDIAN HISTORY

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

CO1: Recall the various Sources for understanding pre-history, proto history and megalithic Cultures (Remembering)
CO2: Show the economic conditions of society, contribution of Educational institutions, art and literature and major political thinkers in Post Mauryan Period. (Understanding)
CO3: Identify the major Political Developments in North India, Agriculture and Urban Economy, religious movement and Philosophies in Late 8^{th} – 13^{th} Century (Applying)
CO4: Identify the emergence of regional kingdoms in the late 17^{th} and 18^{th} centuries. (Applying)

Module I: An Over-view of Sources and Pre-history up to Impact of Iranian and Macedonian invasions (15 Hours)

a) Archaeological Sources, Literary Sources, Indigenous sources and Foreign Accounts
b) Pre-history and Proto-history, Megalithic Cultures,
c) Expansion of Aryans in India, Period of Mahajanapadas and Iranian and Macedonian invasions and their impact

Module II: Post Mauryan Period, Vakatakas and Vardhanas and Regional states (15 hours)

a) Early State and Society in Eastern India, Deccan and South India, Polity and administration, Economic conditions, Contribution of educational institutions, Literature, scientific literature, art and architecture, Growth of Vaishnava and Saiva religions.
b) Institutions of temple and temple architecture; Arab conquest of Sind; Alberuni, Local Government; Growth of art and architecture, religious sects, Institution of temple and Mathas, Agraharas, education and literature, economy and society.
c) Themes in Early Indian Cultural History: Languages and texts, major stages in the evolution of art and architecture, major philosophical thinkers and schools, ideas in Science and Mathematics.

Module III: India from Late 8th – 13th Century (15 hours)

a) Major political developments in Northern India and the Peninsula and Cultural Traditions in India, 750-1200: Village economy and society, Agriculture and urban economy, the status of the Brahman and the new social order, Condition of women, Indian science and technology, Skankaracharya and Vedanta, Ramanuja and Vishishtadvaita, Madhva and Brahma-Mimansa, Literature in Sanskrit and in the newly developing languages, Kalhan's Rajtarangini, Alberuni's India and Khalji Revoluiton.
b) Political Developments and Economy in 15th & 16th Century: Rise of Provincial Dynasties: Bengal, Kashmir (Zainul Abedin), Gujarat, Malwa, Bahmanids, The Vijayanagra Empire, Lodis, The Sur Empire: Sher Shah's administration, Portuguese Colonial enterprise, Bhakti and Sufi Movements.
c) The Fifteenth to early seventeenth Century – Society and Culture: Regional cultural specificities, Literary traditions, Provincial architecture, Society, culture, literature and the arts in Vijayanagara Empire; Establishment of Jagir and Mansab systems under Akbar, Rapuput Policy, Evolution of religious and social outlook, theory of Sulh-i-kul and religious policy, Religious policies of Jahangir, Shahjahan and Aurangzeb

Module IV: Late 17th Century Crisis and Revolts to 18th Century (15 Hours)

Late 17th Century Crisis and Revolts , The Ahom Kingdom, Shivaji and the early Maratha Kingdom, Factors for the decline of the Mughal Empire, The regional principalities: Nizam's Deccan, Bengal, Awadh, Maratha ascendancy under the Peshwas, Emergence of Afghan Power, Battle of Panipat 1761, State of politics, culture and economy on the eve of the British conquest

Suggested Readings

1. India- An Archaeological History: Paleolithic Beginnings to Early History, Dilip K. Chakrabarti, Oxford University Press (2009)
2. A History of Ancient and Early Medieval India: From the Stone Age to the 12th Century, Upinder Singh, Pearson Publisher (2009)
3. A History of India, Romila Thapar, Penguin Books Limited (1990)
4. India Through the Ages, Jadunath Sarkar, Life Span Publishers and Distributors (2020)
5. India's Ancient Past, R. S. Sharma, Oxford University Press (2006)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PAMH210T: MODERN INDIAN HISTORY

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

CO1: Recall the important events leading establishment of British Colonial Rule. (Remembering)
CO2: Show the Economic, Social, religious and Cultural impact of British Colonial Rule. (Understanding)
CO3: Identify the various responses to the British Rule in India. (Applying)
CO4: Identify the impact of Politics of Separatism, Consolidation as a Nation and Economic & Political Changes. (Applying)

Module I: European Penetration into India (15 Hours)

a) The Early European Settlements; The Portuguese and the Dutch; The English and the French East India Companies; Their struggle for supremacy; Carnatic Wars; Bengal - The conflict between the English and the Nawabs of Bengal; Siraj and the English; The Battle of Plassey; Significance of Plassey.

b) British Expansion in India: Bengal – Mir Jafar and Mir Kasim; The Battle of Buxar; Mysore; The Marathas; The three Anglo-Maratha Wars; The Punjab, Annexation & Consolidation of the Lushai Hills.

c) Early Structure of the British Raj: The early administrative structure; From diarchy to direct control; The Regulating Act (1773); The Pitt's India Act (1784); The Charter Act (1833); The voice of free trade and the changing character of British colonial rule; The English utilitarian and India.

Module II: Impact of British Colonial Rule (15 Hours)

a) Economic Impact of British Colonial Rule: (a) Land revenue settlements in British India; The Permanent Settlement; Ryotwari Settlement; Mahalwari Settlement; Economic impact of the revenue arrangements; Commercialization of agriculture; Rise of landless agrarian labourers; Impoverishment of the rural society. (b) Dislocation of traditional trade and commerce; De -industrialisation; Decline of traditional crafts; Drain of wealth; Economic transformation of India; Railroad and communication network including telegraph and postal services; Famine and poverty in the rural interior; European business enterprise and its limitations.

b) Social and Cultural Developments: The state of indigenous education, its dislocation; Orientalist-Anglicist controversy, The introduction of western education in India; The rise of press, literature and public opinion; The rise of modern vernacular literature; Progress of science; Christian missionary activities in India.

c) Social and Religious Reform movements in Bengal and Other Areas: Ram Mohan Roy, The Brahmo Movement; Devendranath Tagore; Iswarchandra Vidyasagar; The Young Bengal Movement; Dayanada Saraswati; The social reform movements in India including Sati, widow remarriage, child marriage etc.; The contribution of Indian renaissance to the growth of modern India; Islamic revivalism – the Feraizi and Wahabi Movements.

Module III: Indian Response to British Rule (15 Hours)

a) Various Peasant Movements and Tribal Uprisings leading to the birth of Indian nationalism: Peasant movements and tribal uprisings in the 18th and 19th centuries including the Rangpur Dhing (1783) , the Kol Rebellion (1832), the Mopla Rebellion in Malabar (1841-1920), the Santal Hul (1855), Indigo Rebellion (1859-60), Deccan Uprising (1875) and the Munda Ulgulan (1899-1900); The Great Revolt of 1857 - Origin, character, causes of failure, the consequences; The shift in the character of peasant uprisings in the post-1857 period; the peasant movements of the 1920s and 1930s.
b) Factors leading to the birth of Indian Nationalism; Politics of Association; The Foundation of the Indian National Congress; The Safety-valve thesis relating to the birth of the Congress; Programme and objectives of Early Congress; the social composition of early Congress leadership; the Moderates and Extremists; The Partition of Bengal (1905); The Swadeshi Movement in Bengal; the economic and political aspects of Swadeshi Movement; The beginning of revolutionary extremism in India.
c) Rise of Gandhi; Character of Gandhian nationalism; Gandhi's popular appeal; Rowlatt Satyagraha; the Khilafat Movement; the Non-cooperation Movement; National politics from the end of the Non-cooperation movement to the beginning of the Civil Disobedience movement; the two phases of the Civil Disobedience Movement; Simon Commission; The Nehru Report; the Round Table Conferences; Nationalism and the Peasant Movements; Nationalism and Working class movements; Women and Indian youth and students in Indian politics (1885-1947); the election of 1937 and the formation of ministries; Cripps Mission; the Quit India Movement; the Wavell Plan; The Cabinet Mission.
d) Constitutional Developments in the Colonial India between 1858 and 1935 and Other strands in the National Movement
    i. The Revolutionaries: Bengal, the Punjab, Maharashtra, U.P, the Madras Presidency, Outside India.
    ii. The Left; The Left within the Congress: Jawaharlal Nehru, Subhas Chandra Bose, the Congress Socialist Party; the Communist Party of India, other left parties.

Module IV: Politics of Separatism, Consolidation as a Nation and Economic Development & Political Change (15 Hours)

a) Politics of Separatism; the Muslim League; the Hindu Mahasabha; Communalism and the politics of partition; Transfer of power; Independence.
b) Consolidation as a Nation; Nehru's Foreign Policy; India and her neighbours (1947-1964); The linguistic reorganisation of States (1935-1947); Regionalism and regional inequality; Integration of Princely States; Princes in electoral politics; the Question of National Language.
c) Caste and Ethnicity after 1947; Backward castes and tribes in post-colonial electoral politics; Dalit movements.
d) Economic development and political change; Land reforms; the politics of planning and rural reconstruction; Ecology and environmental policy in post - colonial India; Progress of science.

Suggested Readings

1. History of Modern India, Bipan Chandra, Orient Blackswan Private Limited (2020)
2. Modern Indian History, V.D. Mahajan, S. Chand Publishing (2020)
3. From Plassey to Partition and After, Sekhar Bandopadhyay, Orient Blackswan Private Limited (2014)

4. Modern India: 1885-1947, Sumit Sarkar, Pearson Education India (2014)
5. India: What can it Teach Us? (A Course of Lectures Delivered Before the University of Cambridge), F. Max Muller, General Press (2022)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PAWH211T: WORLD HISTORY
(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes
CO1: Recall the important ideas and events brought about enlightenment, modern Politics and Industrialisation (Remembering)
CO2: Show the rise of Nationalism, Imperialism, colonialism, Revolution and Counter Revolution (Understanding)
CO3: Identify the various causes and consequences of World Wars, Power Blocs, Non-alignment and End of Colonial Rule (Applying)
CO4: Identify the factors constraining Development, unification of Europe, disintegration of Soviet Union and rise of unipolar world. (Applying)

Module I: Enlightenment, Origins of Modern Politics and Industrialization (15 Hours)

a) Enlightenment and Modern ideas: Major ideas of Enlightenment: Kant, Rousseau; Spread of Enlightenment in the colonies; Rise of socialist ideas (up to Marx); spread of Marxian Socialism.
b) Origins of Modern Politics: European States System; American Revolution and the Constitution; French revolution and aftermath, 1789-1815; American Civil War with reference to Abraham Lincoln and the abolition of slavery; British Democratic Politics, 1815-1850; Parliamentary Reformers, Free Traders, Chartists.
c) Industrialization: English Industrial Revolution: Causes and Impact on Society; Industrialization in other countries: USA, Germany, Russia, Japan; Industrialization and Globalization.

Module II: Nation-State System, Imperialism and Colonialism and Revolution & Counter-Revolution (15 Hours)
a) Nation-State System: Rise of Nationalism in 19th century; Nationalism: state-building in Germany and Italy; Disintegration of Empires in the face of the emergence of nationalities across the world.
b) Imperialism and Colonialism: South and South-East Asia; Latin America and South Africa; Australia; Imperialism and free trade; Rise of neo-imperialism.
c) Revolution and Counter-Revolution: 19th Century European revolutions; The Russian Revolution of 1917-1921; Fascist Counter-Revolution, Italy and Germany; The Chinese Revolution of 1949

Module III: World Wars; Post World War II & Liberation from Colonial Rule (15 Hours)
a) World Wars: 1st and 2nd World Wars as Total Wars: Societal implications; World War I: Causes and consequences; World War II: Causes and consequence
b) The World after World War II: Emergence of two power blocs; Emergence of Third World and non-alignment; UNO and the global disputes.
c) Liberation from Colonial Rule: Latin America-Bolivar; Arab World-Egypt; Africa-Apartheid to Democracy; South-East Asia-Vietnam

Module IV: Factors Constraining Development, Unification of Europe, Disintegration of Soviet Union and Rise of Unipolar World (15 Hours)
a) Factors constraining development: Latin America, Africa
b) Unification of Europe: Post War Foundations: NATO and European Community; Consolidation and Expansion of European Community; European Union.
c) Disintegration of Soviet Union and the Rise of the Unipolar World: Factors leading to the collapse of Soviet communism and the Soviet Union, 1985-1991; Political Changes in Eastern Europe 1989-2001; End of the cold war and US ascendancy in the World as the lone superpower.

Suggested Readings
1. A Short History of the World, H.G. Wells, Fingerprint Publishing, 2015
2. Mastering Modern World History, Norman Lowe, Palgraves Master Series (2013)
3. History of the World, Arjun Dev and Indira Arjun Dev, Orient Blackswan (2009)
4. History of the Modern World, Dr. Hukam Chand Jain, Jain Prakashan Mandir (2022)

5. A History of the Modern World: An Outline, Ranjan Chakrabarti, Primus Books (2013)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	PAOH106L	Office, Home Management and Secretarial practice	3
2	S E Course 2	PACO107L	Corporate Communication	3
3	S E Course 3	PAES209L	Ethics & Self Awareness	3

PAOH106L: OFFICE, HOME MANAGEMENT AND SECRETARIAL PRACTICE

(3 Credits – 15+60 Hours) (L-T-P: 1-0-2)

Course Outcomes

At the end of the Course, students will be able:

CO1: To demonstrate the functioning of the office management, filing and indexing systems, secretarial practices, and meeting procedures. (Understanding)

CO2: To acquire Proficiency in using tools and techniques in office management, filing, and indexing systems and secretarial practices. (Applying)

Module I: Theory (15 Hours)

Modern managerial tools for office management; Modern office record management; Modern filling and indexing systems; Modern Secretarial practices and meeting procedures.

Module II: Practical (60 hours)

The practice of modern managerial tools for office management; The practice of modern office record management; The Practice of modern filling and indexing systems; Practicing Data Entry Operations and Typing; Organising mock organisational meetings: preparation of notices and correspondences, agendas, Resolutions, Minutes, and confirmation of the Minutes and holding meetings.

Suggested Readings

1. Hislop, Donald, Rachelle Bosua, and Remko Helms. *Knowledge management in organizations: A critical introduction*. Oxford university press, 2018.
2. Shark, Alan R. *Technology and public management*. Taylor & Francis, 2022.
3. Read, Judith, and Mary Lea Ginn. *Records management*. Cengage Learning, 2015.
4. Smith, Kelvin. *Public sector records management: A practical guide*. Ashgate Publishing, Ltd., 2007.
5. Chowdhury, Gobinda G. *Introduction to modern information retrieval*. Facet Publishing, 2010.
6. Price, Leah. *Literary secretaries/secretarial culture*. Routledge, 2017.

Mapping of COs to Syllabus

	Module 1	Module 2
CO 1	H	M
CO 2	M	H

PACO107L: CORPORATE COMMUNICATION

(3 Credits – 15+60 Hours) (L-T-P: 1-0-2)

Course Outcomes

At the end of the Course, students will be able:

CO1: To demonstrate skills in modern corporate communication. (Understanding)

CO2: To acquire Proficiency in using modern tools and techniques in corporate communication (Applying)

Module I: Modern corporate Communication tools: (15 Hours)

Social intranet, all-in-one employee communication tools, Task/ project management software and tools, Instant messaging, Newsletters, Voice & video conferencing tools (like Cisco Webex Meetings, Go To Meeting, ZOOM; SKYPE, Google Meet, and Microsoft Teams), Document collaboration tools (like Google Workspace), ERP, Knowledge centre tools, File sharing tools, Employee directory software, Internal blogs, videos & updates, Analytics, Discussion forums, Email management tools, Communication tools for the social media content (like Buffer or Hootsuite).

Module II: Practical (30 Hours)

Practising Modern Corporate Communication tools

Suggested Readings

1. Wrench, Jason S., ed. *Workplace communication for the 21st century: Tools and strategies that impact the bottom line*. ABC-CLIO, 2013.
2. Patterson, Kerry, et al. *Crucial conversations tools for talking when stakes are high*. McGraw-Hill Education, 2012.
3. Sullivan, Jay. *Simply said: Communicating better at work and beyond*. John Wiley & Sons, 2016.
4. Fine, Debra. *The Fine Art of Small Talk: How to Start a Conversation, Keep It Going, Build Networking Skills--and Leave a Positive Impression!*. Hachette UK, 2023.

Mapping of COs to Syllabus

	Module 1	Module 2
CO 1	H	M
CO 2	M	H

PAES209L: ETHICS AND SELF AWARENESS

(3 Credits – 15+60 Hours) (L-T-P: 1-0-2)

Course Outcomes:

At the end of the Course, students will be able:
CO1: To demonstrate knowledge of Ethics and Self Awareness. (Understanding)
CO2: To Make Use of Skills and values in the practice of Ethics and Self Awareness. (Applying)

Module I: Introduction - Ethics and Self-Awareness (15 Hours)

Ethical theories; Moral principles and strategies for weighing competing values and interests; Essence, determinants, and consequences of ethics in-human actions; Self-awareness – techniques

Module II: Practical (60 Hours)

Ethics Tournaments; Signing Honor Codes; Self-awareness – activities

Suggested Readings

1. Singer, Peter. *Practical ethics*. Cambridge university press, 2011.
2. Thompson, Mel. *Understand Ethics: Teach Yourself: Making Sense of the Morals of Everyday Living*. Hachette UK, 2010.
3. Rachels, James, and Stuart Rachels. *The Elements of Moral Philosophy 7e*. McGraw Hill, 2012.
4. Tugaleva, Vironika. *The art of talking to yourself: Self-awareness meets the inner conversation*. Soulux Press, 2017.
5. Holiday, Ryan. *Ego is the Enemy*. Elex media komputindo, 2019.
6. Williams, Ron. *Learning to lead: The journey to leading yourself, leading others, and leading an organization*. Greenleaf Book Group, 2019.

Mapping of COs to Syllabus

	Module 1	Module 2
CO 1	H	M
CO 2	M	H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	PAIN109I	Internship	4
4	Internship	PAIN212I	Internship	4
5	Internship	PAIN311I	Internship	2

PAIN109I/PAIN212I: INTERNSHIP (Exit of 1st Year or 2nd Year)
(4 Credits: 120 Hours)

The student will carry out a field Internship as per the need of the Organization with a specific Objective since he or she will exit after 1st year or 2nd Year of UG Programme. The Internship will be of 1 month duration with follow up of the supervisors allotted as per as specialization. The student will need to sort out the Organisation with due permissions of the Department/University authorities and submit a preliminary plan for approval. The plan of activities undertaken during the Internships would be areas related to Public Administration, Public Policies, Rural Development, Urban Development etc with specific objectives and Mission and Vision of the Organisation. The student will submit a final report of the Internships with supportive documents and signature of the Organization where he/she has undertaken the Internships within 10 days after the Internship is over.

Time duration: 1 Month/30 days
Final Report: Within 10 days after the Internship is over (Hard Copy in Hard/Spiral Bound), 30-40 Pages
Marks: 100

PAIN311I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)
(2 Credits-60 Hours)

The student will carry out a field Internship as per the need of the Organization with a specific Objective at the end of 4th Semester and Evaluated in the 5th Semester of UG Programme. The Internship will be of 1 month duration with follow up of the supervisors allotted as per as specialization. The student will need to sort out the Organization with due permissions of the Department/University authorities and submit a preliminary plan for approval. The plan of activities undertaken during the Internships would be areas related to Public Administration, Public Policies, Rural Development, Urban Development etc with specific objectives and Mission and Vision of the Organisation. The student will submit a final report of the Internships with supportive documents and signature of the Organization where he/she has undertaken the Internships within 10 days after the Internship is over.

Time duration: 1 Month/30 days
Final Report: Within 10 days after the Internship is over (Hard Copy in Hard/Spiral Bound), 30-40 Pages
Marks: 100

RESEARCH PROJECT /DISSERTATION

BA PUBLIC ADMINISTRATION (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	PCDI409P	Research Project Phase I	6
8	Research Project/Dissertation	PCDI410P	Research Project Phase II	6
BA PUBLIC ADMINISTRATION (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	PCDI411P	Dissertation I	18
8	Research Project/Dissertation	PCDI412P	Dissertation II	20

BA PUBLIC ADMINISTRATION (Honours)

PADI408P: Research Project Phase I

(6 credits – 180 hours) (L-T-P: 0-0-12)

The Research project is divided into two phases, taking place during Semester VII and Semester VIII, known as Research Project Phase-I and Research Project Phase-II, respectively. The primary objective of this course is to enhance students' independent critical thinking abilities and improve their oral and written communication skills by incorporating a research project alongside a strong academic foundation. The research project aims to achieve valuable learning outcomes with long-term impacts, preparing undergraduates for their future professional endeavours.

During the first phase of the research project, students are required to select a suitable study topic within their area of specialization. They must effectively articulate and formulate a research question related to their chosen topic. Additionally, students need to gather relevant literature pertaining to their research topic and, if applicable, develop research hypotheses. Proper planning of the research design is essential, including considerations for sampling, observational, statistical, and operational designs.

PADI409P: Research Project Phase II

(6 credits – 180 hours) (L-T-P: 0-0-12)

The Research project spans across two semesters, Semester VII and Semester VIII, referred to as Research Project Phase-I and Research Project Phase-II, respectively. In Phase-I, students select a research topic and begin their work. Phase-II serves as a continuation of Phase-I, where students refine their research project and prepare it for presentation.

During Phase-II, students are required to compile relevant data, analyze and interpret it, and, if applicable, test any hypotheses. By analyzing and interpreting the collected data, the student (researcher) will draw logical conclusions and propose appropriate recommendations for the research problem. The final outcome should be a well-structured project report that the students will defend in front of a panel of examiners.

BA PUBLIC ADMINISTRATION (Honours) with Research

PADI410P: DISSERTATION I

(18 Credits -540 Hours) (L-T-P: 0-0-36)

The students will have to submit a dissertation, which will be assessed by External Examiners appointed by the University. The dissertation work will be spread over two semesters, namely Semester VII and Semester VIII, referred to as Dissertation Phase-I and Dissertation Phase-II, respectively. The total dissertation carries 38 credits, with 18 credits assigned to Semester VII and 20 credits to Semester VIII.

The main objectives of the course are to enhance students' presentation skills and develop their academic writing abilities. Additionally, the course aims to enable students to apply the statistical research training they have received during the taught portion of the program. This application will involve designing an appropriate research strategy and methodology to conduct their research.

During Dissertation Phase-I, students are expected to come up with a research idea independently. By the end of Semester VII, they must defend a research proposal based on this idea, presenting it as a Synopsis.

Structure of Dissertation Phase-I

Sl. No.	Tentative Stages to be completed
1.	Research idea or concept note, i.e., Statement of the Problem
2.	Review of Literature
3.	Research Methodology Sampling, Sample size determination, Selection of sample, Analytical tools to be used, Questionnaire preparation, Preliminary exploration of data i.e. Pilot Survey
4.	a) Synopsis Presentation b) Submission of Modified Synopsis to the Department
5.	Students have to collect all the required data during the semester

PADI411P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

The students need to submit a dissertation, which will be evaluated by External Examiners chosen by the University. The dissertation work will be divided into two phases: Dissertation Phase-I in Semester VII and Dissertation Phase-II in Semester VIII. These phases account for a total of 38 credits, with 18 credits in Semester VII and 20 credits in Semester VIII.

The primary objective of the course is to refine the students' dissertations during Phase-I, while also teaching them how to apply statistical and scientific tools to their research. They will also learn research ethics. In Dissertation Phase-II, the students will conduct data analysis, write the dissertation, and defend it before the end of the semester.

The dissertation must encompass original research questions (if any), a critical review of relevant literature, use of analytical tools to address the research questions, data analysis, and interpretation. Following all guidelines provided by the University, the students must submit the completed dissertation. Throughout this process, the students will receive guidance from a designated supervisor from the department.

Structure of Dissertation Phase-II

Sl. No.	Tentative Stages to be completed
1.	Validation of data, data entry and preliminary analysis of data (drawing graphs, trend lines, making tables etc.)
2.	Main data analysis and interpretation
3.	Dissertation writing, Proof reading, and Plagiarism checking
4.	Submission and Viva Voce

DEPARTMENT OF PHILOSOPHY

PROGRAMME: BACHELOR OF ARTS in PHILOSOPHY (BA)
Degree: BA PHILOSOPHY (HONOURS) MINORS IN ENGLISH AND PSYCHOLOGY

VISION:

To be a centre of excellence in teaching, learning, and research that is committed to moulding ethically and socially responsible graduates with deeper knowledge about God, the world, and the human person in his or her social setting, which is religiously, culturally, economically, linguistically, and ethnically diverse.

MISSION:

The Department of Philosophy seeks to:

- Promote critical thinking by training students to analyse, evaluate, and interpret societal events, which aims at the integral development of students.
- Search for and find true values and meanings with a coherent and cogent exposition of one's philosophical convictions.
- Provide the students with a worldview that ensures a holistic vision of reality by engaging them with the multi- cultural and multi-linguistic traditions of northeast India and its people.
- Inculcate among the students true human values that promote and appreciate each other's differences.

PROGRAMME OUTCOMES (PO)

PO 1: **Critical Thinking**: Choose informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organisational, and personal) from different perspectives.

PO 2: **Effective Communication**: Speak, read, write, and listen clearly in English and one Indian language, and make meaning of the world by connecting people, ideas, books, media, and technology.

PO 3: **Social Interaction**: Discuss the views of others, mediate disagreements, and help reach conclusions in groupsettings.

PO 4: **Effective Citizenship**: Demonstrate empathetic social concern and equity-centred national development, as well as the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics**: Analyse different value systems, including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability**: Assess the issues of environmental context and sustainable development. PO 7: **Self-directed and Life-long Learning**: Develop the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

PO 7: **Enhancing Abilities and Skills:** To acquire hands-on competence in skills and abilities that will enhance the learning process.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1: **Demonstrating Comprehensive Acquaintance with the Subjects:** To explain and analyse with alacritythe various issues in philosophy, English, and psychology.

PSO 2: **Developing Philosophical Thinking:** To assess the thoughts and writings of different philosophers, psychologists, and literary writers, both Western and Indian, analytically

PSO 3: **Building a Multi-disciplinary Worldview:** To develop familiarity with knowledge of concepts andnotions regarding disciplines other than philosophy, English, and psychology.

PSO 4: **Creating Social and Cultural Sensibilities:** To appraise and estimate the complexities of the social and cultural sensibilities of people by engaging in a variety of philosophical discourses.

Mapping of Courses to PO/PSO

SL.	Name of Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
1.1	Ancient & Medieval Western Philosophy	H				H		H		H	H		H
1.2	General English I	M	H			H		M	M	H	H		M
1.3	Basics in Mathematics	H			M			H	H			H	
1.4	Communicative English I		H			M		M	M	H	H		
1.5	Basics in Motor Mechanics/ Tailoring and Plumbing				H	M	M	H	H			H	
1.6	Environmental Education	M		M	H	H	H	H				H	M
1.7	Understanding India		M	M	H	H	M	H				H	M

1.8	Service Learning: Theory		H	H	H	H	M	M				H	M
2.1	Vedic & Upanishadic Philosophy	H				H				H	H		H
2.2	General Psychology	H	M	H				H	M	H			
2.3	Basics in Accounting				H	M	M	H	H			H	
2.4	Communicative English II		H			M		M	M	H	H		
2.5	Basics in Office Automation		M		H	M		H	H	H		H	
2.6	Digital and Technological Solutions		M		H	M	M	H	H	H		H	
2.7	Health & Wellness, Yoga Education, Sports & Fitness			M	H	M	H	H	H	H		H	
2.8	Service Learning: Practice		H	H	H	M	M	M	M	M		M	
3.1	Systems in Indian Philosophy	H				H				H	H		H
3.2	Modern Western Philosophy	H				H				H	H		H
3.3	General English II	M	H			H		M	M	H	H		M
3.4	Introduction to General Science	H			M			H	H			H	
3.5	MIL I (Communicative HindiI / Communicative Assamese I)		H	H	M			H	M	H	H		
3.6	Basics in Electrical and Electronics				H	M	M	H	H			H	
4.1	Classical and Symbolic Logic	H		H	M	H	M	M		H	H		H
4.2	Contemporary Western Philosophy	H		H	M	H	M	M		H	H		H
4.3	Philosophy of Being	H		H	M	H	M	M		H	H		H
4.4	Developmental Psychology	H	M	H				H	M	H			
4.5	MIL II (Communicative Hindi II / Communicative Assamese II)		H	H	M			H	M	H	H		
5.1	Philosophy of Knowledge	H		H	M	H		M		H	H		H
5.2	Philosophy of God and Religion	H		H	M	H	M	M		H	H		H
5.3	Postmodernism	H		H	M	H	M	M		H	H		H
5.4	Alternative English I	M	H			M		M		H	H		
5.5	Internship: Teaching inSchools		H	H			M	M	M				M
6.1	Philosophy of the Human Person and Mind	H		H	M	H	M	M		H	H		H
6.2	Philosophy of Science and Nature	H		H	M	H	M	M		H	H		H
6.3	Heterodox Systems of India	H		H	M	H	M	M		H	H		H
6.4	Project Work based on Field Research	M	H	H	H	M	M	H	M	H		M	M
6.5	Theories of Personality and Positive Psychology	H	M	H				H	M	H			
7.1	Ethics	H		H	M	H	H	M		H	H		H
7.2	Vedanta Philosophy	H		H	M	H	M	M		H	H		H
7.3	Alternative English II	M	H			M		M		H	H		
7.4	Research Methodology		H	M		M		M					M
7.5	Dissertation based on Themes in Philosophy or Psychology	H	H	H	H	M	M	H	M	H	H	M	H
8.1	Contemporary Indian Philosophy	H		H	M	H	M	M		H	H		H
8.2	The Philosophy of the Bhagavad Gita	H		H	M	H	M	M		H	H		H
8.3	Social Psychology	H	M	H				H	M	H			
8.4	Comprehensive Evaluation on Dissertation and Philosophy (Viva Voce)	H	H	H	M	M	M	H	M	H	H	M	H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code		Credits
1	Major Course 1	PYAM100T	Ancient & Medieval Philosophy	4
2	Major Course 2	PYVU103T	Vedic & Upanishadic Philosophy	4
3	Major Course 3	PYSI200T	Systems of Indian Philosophy	4
3	Major Course 4	PYMW201T	Modern Western Philosophy	4
4	Major Course 5	PYCS202T	Classical and Symbolic Logic	5
4	Major Course 6	PYWP203T	Contemporary Western Philosophy	5
4	Major Course 7	PYPB204T	Philosophy of Being	4
5	Major Course 8	PYPK300T	Philosophy of Knowledge	5
5	Major Course 9	PYGR301T	Philosophy of God and Religion	5
5	Major Course 10	PYPM302T	Postmodernism	4
6	Major Course 11	PYHP304T	Philosophy of the Human Person and Mind	4
6	Major Course 12	PYSN305T	Philosophy of Science and Nature	4
6	Major Course 13	PYHS306T	Heterodox Systems of India	4
6	Major Course 14	PYFR307P	Project work based on Field Research	4
7	Major Course 15	PYET400T	Ethics	5
7	Major Course 16	PYVP401T	Vedantic Philosophy	5
8	Major Course 17	PYCI404T	Contemporary Indian Philosophy	5
8	Major Course 18	PYPB405T	The Philosophy of the Bhagvad Gita	5

PYAM100T: ANCIENT AND MEDIEVAL WESTERN PHILOSOPHY

(4 Credits – 60 Hours)

Course Objectives

The course intends to expand the discursive and reasoning skills of the students. It assists the students in their development of problem-solving experience in at least one of the main areas of philosophy. Ancient Greek Philosophy arose in the 6th century BCE and its influence is noticed in the later part of continental philosophy. Alfred North Whitehead would say that the philosophy after Plato is only a footnote to Plato's philosophy. Ancientthinkers have dealt with philosophy, ethics, metaphysics, ontology, biology, logic, rhetoric and aesthetics.Medieval Christian thinkers made use of Greek philosophy to interpret Christian theology and arrive at a coherentChristian philosophy.

Course Outcomes

CO 1: Outlines the basic philosophies of different schools of Greek and Medieval Philosophy (understanding)
CO 2: Analyses the various issues that the Ancient Greek and Medieval thinkers were grappling with (analysing)
CO 3: Develops the techniques for solving problems in at least one of the main areas of philosophy (applying)
CO 4: Improves critical thinking and analytical skills (creating)

Module 1: The Origin and Development of Early Greek Thought (10 hours)

The problem of substance: Thales, Anaximander, Anaximenes, Pythagoras
The Problem of Change: permanence and change – Heraclitus and Eleatic School
The Theory of Atomism: Democritus - metaphysics and cosmology, psychology, theory of knowledge, theologyand ethics

Module 2: Problems of Knowledge and Conduct (8 hours)

The Age of the Sophists Socrates and Socratic School

Module 3: The Age of Greek Systems (15 hours)

Plato: dialectic and theory of knowledge, the doctrine of Ideas, philosophy of nature, the doctrine of immortality, ethics and politics
Aristotle: philosophy and sciences, logic, metaphysics, the four causes, theology, psychology, ethics and politics

Module 4: The Ethical Period (12 hours)

Epicureanism stoicism sceptism Neoplatonism

Module 5: The Rise of Medieval Philosophy (15 hours)

The Patristic Period: Early Fathers of the Church, St Augustine
Scholasticism: meaning, characteristics, faith and reason, John Scotus Erigena, St Anselm, Peter Abelard The Golden Age of Scholasticism: St Thomas Aquinas and John Duns Scotus; Nominalism: William of Occam and Roger Bacon

Suggested Readings

1. Frederick Copleston, A History of Philosophy, vol. I, New York: Image Books, 1985.
2. History of Philosophy without any Gaps, https://historyofphilosophy.net/series/classical-greek-philosophy.
3. T.Z. Lavine, From Socrates to Sartre: The Philosophic Quest, New York: Bantam Books, 1989.
4. Krishna P. Bahadur, The Geeks: Their Philosophy, History and Culture, New Delhi: Ess Ess Publications,1989.
5. Frank Thilly, A History of Philosophy, Allahabad: Central Book Depot, 1981.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	H	H	H	H	H
CO3		M	H	M	H
CO4	M	M	H	M	H

PYVU103T: VEDIC AND UPANISHADIC PHILOSOPHY

(4 Credits – 60 Hours)

Course Objectives

The course intends to offer the students basic knowledge of the culture, religion, and philosophy of ancient India so that they can have a genuine appreciation of India's rich heritage and be legitimately proud of being Indians. Hence, the course makes a survey of the origin and development of Indian culture, religion, and philosophy from the Indus Valley civilization to the Upanishadic period. The earliest available texts of religion and philosophy in India are the Vedas. These texts are studied from such different angles as religion, philosophy, scripture and religious experience. A short survey of the principal characteristics of the Brahmanas and Aranyakas introduces an integrated approach to the Upanishads.

Course Outcomes

CO 1: Explains in detail the ancient Indian Scriptures particularly the Vedas and the Upanishads (understanding)
CO 2: Builds a brief survey of the developments of the religion and philosophy of Ancient India (applying)
CO 3: Outlines the Indian traditions, value systems, social life and belief systems (understanding)CO4: Appraises the philosophy impeded in the Sruti literature (evaluating)

Module 1: Fundamental Beliefs of Hinduism (10 hours)

Cosmic Order (Rta) The Theory of Dharma The Theory of Karma
The Theory of Rebirth (Punarjanma) The Theory of Liberation (Mukti)

Module 2: Purusharthas, Varnasramas, Asramadharma (10 hours)

Purusharthas: artha, kama, dharma and moksha Varnasramas: Brahmins , Kshatriyas, Vyasyas and Sudras
Asramadharma: brahamacarya, grahastha, vanaprastha and sanyasa

Module 3: The Historical Development of the Hindu Philosophy (10 hours)

The Indus Valley civilization The Vedic Age: the Four Vedas
The Brahmanic period, the Aranyaka period and the Upanishadic period

Module 4: Philosophy and Religion of Vedas (10 hours)

The origin and development of the idea of the divine in the Vedas and Upanishads: nature worship, polytheism, henotheism/kathanotheism, monotheism, monism and absolutism
The creation theories in Vedas: Purushasukta (Rig Veda 10. 90), Nasadiyasukta (Rig Veda 10.129), Hiranayagarbhasukta (Rig Veda 10. 121) and Visvakarmasukta (Rig Veda 10.82)
The Theory of Law and Sacrifice (yajna)

Module 5: The Philosophy of the Upanishads (20 hours)

The Principal Upanishads Sreyas and Preyas
The Atman Brahman Identity
Mahavakyas: Tattvamasi, Ahambrahamasmi, Ayamatmabrahama, Sarvamkhalvidam Brahma) The Pancikarana/Trivrittikarana
The Concept of the Human Person
The Concept of Transmigration and Liberation
Four Levels of the Existence of Atman (jagrat, svapana, sushupti and turiya)

Suggested Readings

1. K.P. Bahadur, The Wisdom of the Upanishads, New Delhi: Sterling Publishers, 1989.
2. H.D. Griswold, The Religion of the Rigveda, Delhi: Motilal Banarsidas, 1971.
3. Hiriyanna, Outlines of Indian Philosophy, Delhi: Motilal Banarsidas Publishers, 1993.

4. Robert Ernest Hume, The Thirteen Principal Upanishads, Delhi: Oxford University Press, 1983.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	M	M	H	H	H
CO2	H	H	H	H	H
CO3	H	H	H	H	H
CO4	M	M	H	H	H

PYSI200T: SYSTEMS OF INDIAN PHILOSOPHY

(4 Credits – 60 Hours)

Course Objectives

This paper aims at an in-depth study of the orthodox systems in Indian philosophy, which, on the one hand, provided a philosophical and scientific foundation to the Vedic teachings, and, on the other, developed into independent schools of philosophy. They began to philosophize using human reason as well as revelation to address the perennial questions that confronted them. This was a departure from the traditional exegetical type of doing philosophy.

Course Objectives

CO 1: Outlines the salient features of Indian Classical Philosophy (understanding)
CO 2: Illustrates the philosophies of Nyaya, Vaiseshika, Samkhya, Yoga and Purva Mimamsa (understanding)
CO 3: Appraises the contributions of Classical Indian Philosophy to later thinking in India (evaluating)
CO 4: Develops a genuine appreciation for the various philosophical issues Indian Schools (creating)

Module 1: General Characteristics of Indian Philosophy (10 hours)

The unity of moral and spiritual outlook among the systems
Philosophy springs from Spiritual disquiet at the existing order of things Belief in an eternal moral order in the universe
The universe as a moral stage
Ignorance as the reason for bondage and knowledge as means to liberation Sadhanas for liberation

Module 2: The Philosophy of Vaiseshika System (10 hours)

Vaiseshika as a system of pluralism, atomism and realism
The Padarthas: substance, quality, action, universal, particular, inherence and negationThe theory of atomism
The creation and destruction of the universe

Module 3: The Philosophy of Nyaya System (10 hours)

The Theory of Perception: definition of perception, modes of perception, types of perception, types of contact(sannikarsha)
The Theory of Reasoning: terms of inference, limbs of syllogism, types of inference, fallaciesComparison
Verbal Testimony: types of verbal testimony, conditions of meaningful sentenceThe theory of causality (Asatkaryavada)
Proofs for the existence of God

Module 4: The Philosophy of Samkhya (10 hours)

The Theory of Causality (Satkaryavada) The Concept of Prakriti
The Concept of Purusha The Concept of Gunas The Evolution of Prakriti The Concept of Liberation

Module 5: The Yoga Philosophy (10 hours)

Definition and Importance of Yoga The Levels of the Mind (cittabhumi) The Eight Limbs of Yoga; The Yoga Categories

Module 6: The Philosophy of Early Mimamsa (10 hours)

The Purva Mimamsa: a way of interpreting scriptural texts
The Philosophy of Kumarila Bhatta: theory of cognizedeness, theory of anuaplabdhi, theories of svathapramana and partathahaparmana, theory of vivaritakhyati
The Philosophy of Prabhakara: theory of triputi, theory of svathapramana and svatahapramana, theory of akhyati

Suggested Readings

1. S. Dasgupta, History of Indian Philosophy, vol.1, New Delhi: Motilal Banarsidas, 1992.
2. Erich Frauwallner, History of Indian Philosophy, Delhi: Motilal Banarsidas, 1984.
3. Raju Puligandla, Fundamentals of Indian Philosophy, New York: Abingdon Press, 1975.
4. A.K. Warder, Outline of Indian Philosophy, Delhi: Motilal Banarsidas, 1986.
5. Heinrich Zimmer, Philosophies in India, Delhi: Motilal Banarsidas, 1990.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2	H	H	H	H	H	H
CO3	M	M	M	M	M	M
CO4	H	H	H	H	H	H

PYMW201T: MODERN WESTERN PHILOSOPHY

(4 Credits – 60 Hours)

Course Objectives

The main objective of this course is to acquaint the students with knowledge about modern Western philosophy, which is marked by the revolt against authority, love for humanism, emphasis on the awakening of the reflective spirit, and demand for freedom of thought, feeling, and action. The students will study the thinkers of this period who refused to accept blindly the dictates of religion and tradition but searched for certain foundations of life and realities. Philosophy is thus based on human reasoning rather than on faith.

Course Outcomes

CO 1: Outlines the salient features of Modern Western Philosophy (understanding)
CO 2: Illustrates the philosophies of Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, Kant and Hegel (understanding)
CO 3: Appraises the contributions of Modern Western Philosophy to Contemporary Western Thought (evaluating)
CO 4: Develops a genuine appreciation for the various philosophical issues raised in the modern period (creating)

Module 1: Beginnings of Modern Philosophy (5 hours)

Francis Bacon: reform of science, inductive method, the programme of philosophy, philosophy of man, metaphysics, theology; Salient Features of Modern Philosophy

Module 2: Continental Rationalism (15 hours)

Rene Descartes: Cartesian method, classification of sciences, the criterion of knowledge, proofs for the existence of God, the existence of the external world, body-mind relation and the theory of innate ideas
Benedict Spinoza: rationalism, method, the universal substance, attributes of god, the doctrine of modes, the human mind, ethics and politics; Blaise Pascal: wager argument

Module 3: The British Empiricism (10 hours)

John Locke: origin of knowledge, nature and validity of knowledge, limits of knowledge, metaphysics, ethics, freewill and political philosophy
George Berkeley: the rejection of abstract ideas, *esse est percipii*, the world of spirits, knowledge of ideas, spirits, and relations, refutation of dualism, atheism and scepticism
David Hume: the origin of human knowledge, the relation of cause and effect, the validity of knowledge, knowledge of the external world, denial of soul-substance

Module 4: Rationalism in Germany (5 hours)

G W. Leibniz: the doctrine of force, the doctrine of monads, theology, ethics, logic and theory of knowledge Christian Wolff: Mysticism and Romanticism

Module 5: Critical Philosophy of Immanuel Kant (15 hours)

Kant's problem, the problem of knowledge, the transcendental method, the theory of sense perception, the theory of understanding, the validity of the judgement, unity of self-consciousness, knowledge of thing-in-itself, the impossibility of metaphysics, practical reason, moral theology and ethics

Module 6: German Idealism (10 hours)

Johann Gottlieb Fichte Friedrich Wilhelm Schelling
Georg Wilhelm Hegel: the problem of philosophy, dialectical method, thought and being, logic and metaphysics, philosophy of nature, philosophy of mind, religion and philosophy

Suggested Readings

1. Frederick Copleston, A History of Philosophy. Vol. I. New York: Image Books, 1985.
2. Will Durant, The Story of Philosophy. New York: Pocket Books, 1976.
3. T.Z. Lavine, From Socrates to Sartre: The Philosophic Quest. New York: Bantam Books, 1989.

4. Archana Roy, Western Philosophy from Descartes to Kant. New Delhi: Gitanjali Publications, 1994.
5. Bertrand Russel, A History of Western Philosophy. London: Unwin, 1984.
6. Frank Thilly, A History of Philosophy. Allahabad: Central Book Depot, 1981.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	M	M	M	M	M
CO2	H	H	H	H	H	H
CO3		M	M	M	M	M
CO4	H	H	H	H	H	H

PYCS202T: CLASSICAL AND SYMBOLIC LOGIC

(Credits: 5 – 75 Hours)

Course Objectives

This course introduces students to the fundamentals of deductive, inductive, and symbolic logic. Students will learn basic logical concepts and common argumentative forms, which help them to know the merits of good arguments, recognise their presence or absence in argumentative discourse, and exhibit them in their writing and speech.

Course Outcomes

CO 1: Shows the various modes of arguments both deductive and inductive (remembering)
CO 2: Contrasts the valid and the invalid reasoning in Indian and Western Logic (understanding)
CO 3: Constructs truth tables using symbols (applying)
CO 4: Changes the ordinary language into symbolic language by using the quantification theory (creating)

Module 1: Logic and Language (5 hours)

Introduction – the subject matter of Logic - deduction and induction, function and uses of language - language makes things possible - various functions of language

Module 2: Propositions and Terms (10 hours)

Terms: types of terms, distribution of terms, denotation and connotation of terms, contradictory terms Propositions: traditional classification of propositions and modern classification of propositions Aristotelian Square of Opposition
Immediate Inference: Conversion, Obversion, Contraposition and Inversion

Module 3: Syllogisms (10 hours)

The Three Laws of Thought
Structure of Syllogism - Figures and Moods of Syllogism General Rules of Syllogism - Deductive Fallacy
Types of Syllogisms Determination of Valid Moods.

Module 4: Nyâya Logic (5 hours)

Elements of Indian Inference – Terms – Fallacy - Conclusion

Module 5: Methods of Induction (10 hours)

Analogical reasoning, causal reasoning, science and hypothesis, probability, types of induction

Module 6: Introducing Symbolic Logic (10 hours)

What is Symbolic Logic?
Truth Functions: negation, conjunction, alternation (or disjunction), conditional (or material implication), biconditional (or material equivalence), Sheffer's Stroke function.
Interdefinability of different truth functions.

Module 7: Truth Tables (10 hours)

Truth trees method. Alternational (or disjunctional) and conjunctional normal forms as decision procedures. Use of these methods for (a) deciding consistency (contingency), inconsistency (contradiction), and validity (tautology) of propositions. (b) showing implication and equivalence between propositions and (c) showing validity/invalidity of truth-functional argument.

Module 8: Quantification Theory (5 hours)

Syllogistic and the method of antilogism.
Translating Ordinary Language into the Language of Quantification.

Suggested Readings

1. Basson & O'Connor, An Introduction to Symbolic Logic, Oxford: University Tutorial Press, 1962.
2. Bergmann, Merrie, Moor James and Jack Nelson, The Logic Book, 4th edition, New York: McGraw Hill, 2004.

3. Chhanda Chakraborty, Logic: Informal, Symbolic and Inductive, 2nd edition, New Delhi: Prentice Hall of IndiaPrivate Limited, 2007.
4. Irving Copi, Introduction to Logic, 5th edition, New York: Macmillan, 1982.
5. Irving M. Copi and Carl Cohen, Introduction to Logic, 13th edition, Delhi: Dorling Kindersley (India) Pvt Ltd.2009.
6. Irving Copi, Carl Cohen, et.al., Introduction to Logic, 13th edition, New Delhi: Prentice Hall, 2010.
7. Anton Dumitriu, History of Logic, New Delhi: Heritage Publishers, 1991.
8. Brian Garrett, Elementary Logic, Bristol: Acumen Publishing Limited, 2012.
9. Gilbert Harman, Thought, Princeton, New Jersey: Princeton University Press, 1973.
10. Krishna Jain, A Textbook of Logic, 4th revised edition, New Delhi: D.K. Print World (p) Ltd. 1998.
11. R. Jeffery, Formal Logic: Its Scope and Limits, New York: McGraw Hill Book Company.
12. W.V. Quine, Methods of Logic, 4th edition, Cambridge, Mass: Harvard University Press. 1982.
13. Jno J. Tigert, Handbook of Logic, New Delhi: Cosmo Publications, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7	Module 8
CO1	H	H	H	H	H	H	H	
CO2		H	H	H	H	H	H	H
CO3							H	H
CO4	M							H

PYWP203T: CONTEMPORARY WESTERN PHILOSOPHY

(Credits: 5 – 75 Hours)

Course Objectives

The course provides the students with basic knowledge in the main areas of contemporary philosophy, which were developed in the 19th and 20th centuries in the West. Several traditions of philosophizing sprang up during this period. Without entering into postmodernism, this course familiarizes the students with the thoughts of contemporary Western thinkers.

Course Outcomes

CO 1: Explains the main areas of contemporary philosophy (understanding)
CO 2: Summaries the life and thought of different philosophers of this period (Understanding)
CO 3: Appraises the human situations of freedom, anxiety, dread and death in the quest for authenticity (evaluating).
CO 4: Improves students' critical thinking and analytical skills (creating)

Module 1: Introduction (10 hours)

Contemporary Western Philosophy
Anglo-American Traditions and Continental Traditions Characteristics of Existentialism

Module 2: Analytic Tradition (10 hours)

Gottlob Frege Bertrand Russell Ludwig Wittgenstein
Logical Positivism: Moritz Schlick, A. J. Ayer

Module 3: Phenomenology (10 hours)

Edmund Husserl Merleau-Ponty
Process Philosophy: Alfred Whitehead

Module 4: Existentialism (15 hours)

Soren Kierkegaard Martin Heidegger Jean-Paul Sartre

Module 5: Pragmatic Tradition (10 hours)

C. S. Peirce William James, John Dewey
W. V. O. Quine

Module 6: Hermeneutic Tradition (10 hours)

Hans Georg Gadamer Paul Ricoeur

Module 7: Structuralism and Post-structuralism (10 hours)

Ferdinand de Saussure Levi Strauss

Suggested Readings

1. James Collins, The Mind of Kierkegaard, Chicago: Regnery, 1935.

2. Danske, J. Being, Man and Death: A Key to Heidegger, Kentucky: The University of Kentucky Press, 1970.
3. M.A.E. Dummett, The Origins of Analytical Philosophy, London: Duckworth, 1993.
4. G. Frege, "On Sense and Reference," Translations from the Philosophical Writings of Gottlob Frege, eds. M.Black and P. Geach, Blackwell: Oxford, 1952.
5. H. Glock, A Wittgenstein Dictionary, Oxford: Blackwell Publishers, 1996.
6. Michael Hammond, Understanding Phenomenology, Oxford: Blackwell, 1991.
7. Michael Hammond, Understanding Phenomenology, Oxford: Blackwell, 1991.
8. Martin Heidegger, Being and Time, trans., John Macquarrie, London: SCM, 1962.
9. Edmund Husserl, Ideas, General Introduction to Pure Phenomenology, London: George Allen & Unwin, 1958.
10. William James, Pragmatism and Other Essays, New York: Washington Square Press, 1963.
11. Walter. Kaufmann, ed., Existentialism from Dostoevsky to Sartre, Cleveland: World Publishing Company,1968.
12. Soren Kierkegaard, Either Or, trans., David Swenson, London: Oxford University Press, 1946.
13. Michael Luntley, Contemporary Philosophy of Thought, Oxford: Blackwell, 1999.
14. Brian Masters, A Student's Guide to Sartre, London: Heinemann, 1970.
15. Maurice Merleau-Ponty, Phenomenology of Perception, London: Routledge & Kegan Paul, 1962.
16. R.M. Rorty, The Linguistic Turn, Chicago, IL: University of Chicago Press, 1967.
17. B. Russell, The Principles of Mathematics, London: Allen & Unwin, 1903.
18. Jean-Paul Sartre, Being and Nothingness, trans., Hazel Barnes, New York: Washington Square Press, 1966.
19. Jean-Paul Sartre, Existentialism and Humanism, trans., Bernard Frechtman, New York: The PhilosophicalLibrary, 1957.
20. Herbert Spiegelberg, Doing Phenomenology, The Hague: Matinus Nijhoff, 1975.
21. A.N. Whitehead, Process and Reality, New York: The Free Press, 1979.
22. L. Wittgenstein, Philosophical Investigations, trans., G.E.M. Anscombe, Oxford: Blackwell, 1953.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO1	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H
CO3				H			
CO4	H	H	H	H	H	H	H

PYPB204T: PHILOSOPHY OF BEING

(Credits: 4 – 60 Hours)

Course Objectives

Among the different branches of philosophy, metaphysics helps students discover the core of philosophical knowledge that influences all other branches. Metaphysics, as the summit of human knowledge in the natural order, plays the role of guiding human knowledge and activity in the light of its basic principles, and the knowledge of the natural order paves the way for the knowledge of the supernatural order. It is the most general and fundamental of all the disciplines. It aims to identify the nature and structure of all there is. Central to this discipline is the explanation of the relationship between Being and beings, of one and many.

Course Outcomes

CO 1: Defines the basic concepts in metaphysics (remembering)
CO 2: Demonstrates the first principles of being and knowing (understanding)
CO 3: Develops the notion of being (applying)
CO 4: Compares the concept of being at various levels of existence (evaluating)

Module 1: Introducing Metaphysics (10 hours)

Etymology, definition and nature of metaphysics; a brief history of metaphysics: Indian and Western; the starting point of metaphysics (10 hours)

Module 2: Notions, Principles, Methods and Categories (10 hours)

Fundamental notions and principles in metaphysics; methods of metaphysics; basic categories: Indian and Western

Module 3: Metaphysical Structure of Finite Being (16 hours)

Being and essence; substance and accidents, matter and form, act and potency

Module 4: Metaphysical Nature of Finite Being (8 hours)

Supposit and person; spirituality and immortality of the person

Module 5: Metaphysical Properties (8 hours)
Modes of Being: analogy of being; transcendentals: oneness, truth, goodness and beauty

Module 6: Metaphysical Problems (8 hours)
The problem of one and many; the problem of evil

Suggested Readings
1. Ando Takatura, Metaphysics: A Critical Survey of its Meaning, The Hague: Martinus Nijhoff, 1963.
2. Henry J. Koren, An Introduction to the Science of Metaphysics, London: Herder Book Co. 1960.
3. M. Hiriyanna. The Essentials of Indian Philosophy, Bombay: Blackie and Son, 1973.
4. Henry Renard, The Philosophy of Being, Milwaukee: The Bruce Publishing Company, 1953.
5. T.M.P. Mahadevan, Invitation to Indian Philosophy, New Delhi: Arnold Heinemann Publishers, 1979.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	H	H	H	H	H
CO2	M	H	M	M	H	M
CO3		M	H	H	H	M
CO4		M	M	M	H	H

PYPK300T: PHILOSOPHY OF KNOWLEDGE
(Credits: 5 – 75 Hours)

Course Objectives
The philosophy of knowledge investigates the grounds of human knowledge. It deals with the nature, sources, and limits of human knowledge. This course has the objective of initiating students of philosophy into various theories of knowledge. There are four components of a knowledge situation: the knower, the known, the means of knowledge, and the knowledge itself. The knowledge of an object is produced in the subject by a certain medium.Hence, the students need to study in detail the source or how one tries to know the object and then evaluate whether the knowledge obtained is valid or invalid. Such an approach warrants one to look into the various conditions of knowledge on the one hand, and on the other, we need to evaluate whether knowledge is possible.

Course Outcomes
CO1: Explains the history of Indian and Western epistemological traditions (understanding)
CO2: Identifies the various sources of knowledge, theories of truth, possibilities of knowledge and justification of knowledge (applying)
CO3: Develops the mental faculties to steer clear of opinions and beliefs from true knowledge (creating)
CO4: Discusses contemporary issues in the philosophy of knowledge such as relativism, foundationalism, coherentism, reliabilism, contextualism, etc. (creating)

Module 1: Definition and Nature of Epistemology (10 hours)
Concepts and definitions: knowledge, knower, means of knowledge, the object of knowledge, scepticism, foundationalism, certainty; A brief history of epistemology: Indian and Western

Module 2: Knowledge and Belief (10 hours)
Theories of belief: belief as a mental act, belief as a mental state, belief as a behavioural disposition
Four conditions of knowledge: truth condition, belief condition, justification condition, MM Gettier's counter-example and the condition of justification without falsity

Module 3: Sources of Knowledge (15 hours)
Perception Inference Comparison Verbal testimonyPostulation
Non-cognition

Module 4: Theories of Truth (15 hours)
The correspondence theory of truth: theories of evidence - external and internal
The coherence theory of truth
The pragmatic theory of truth - Dewey, William James and Charles Pierce
Deflationary theory of truth, redundancy theory, performative theory and pro-sentential theory of truth

Module 5: Epistemic Justification (10)
Foundationalism, Coherentism, Reliabilism, Contextualism
The notion of certitude: logical certitude, ontological certitude, physical certitude, moral certitudehermeneutics

Module 6: Theory of Knowledge in Indian Thought (15 hours)
The Vedic period
The doctrine of atman in the Upanishadic period
Systematic speculations (the absolute vs. the synthetic view of knowledge)

Suggested Readings
1. B. Carr and D.J. O'Connor, Introduction to the Theory of Knowledge, Sussex, 1982.
2. D.M. Datta, Six Ways of Knowing, The University of Calcutta. 1998
3. Everson Stephen, ed., Epistemology, Cambridge, 1989.
4. Keith Lehrer, Theory of knowledge, London, 1990.
5. Paul K. Moser, The theory of knowledge: A Thematic Introduction, Oxford: Oxford University Press, 1998.
6. John L. Pollock, Contemporary Theories of Knowledge, New Jersey: Rowman and Littlefield Publishers, 1986.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	H	H	H	H	H
CO2	M		H	H	H	H
CO3	M	H	M	M	M	M
CO4					H	

PYGR301T: PHILOSOPHY OF GOD AND RELIGION
(Credits: 5 – 75 Hours)

Course Objectives
The course aims to describe, analyse, and evaluate the role of religion in the lives of humans since the earliest times and to discover, through rational interpretation of religion, the truth of religious beliefs (especially in God) and the value of religious attitudes and practices in the human quest for growth and fulfilment.

Course Outcomes
CO1: Outlines a rational interpretation of religious truths (understanding) CO2: Develops a series of arguments for the existence of God (applying)
CO3: Examines the possibility of meaningful religious discourse (evaluating)
CO4: Evaluates the role of religion in the life of humans since the earliest times (evaluating)

Module 1: Introduction (10 hours)
Shift from Theodicy to Philosophy of God Objects of Philosophy of God and ReligionPhilosophy of God and Theology

Module 2: Methods in the Study of Religions (10 hours)
Towards a definition of religion
Nature, necessity and Scope of comparative religions
Possibility of and the need for the study of comparative religionsCommonality and differences among religions

Module 3: Knowing God (10 hours)
Meanings of meaning - Meaning vis à vis reference - Indirect and direct reference - negative way, positive way, and way of eminence
Faith and reason as two modes of God-talk - trust in the ability of reason - critique of reason as capable of reachingGod - between rigorous proofs and complete non-rationality
'Both-And': modal language and model language.

Module 4: Rationality for God's Existence (10 hours)
Pre-philosophical arguments: phenomenological approach, the argument from common human consent, natural desire for perfect happiness.
Philosophical Arguments: the ontological arguments (St Anselm, Descartes, Leibniz), the cosmological arguments (St Thomas, Samuel Clarke), the teleological arguments (St Thomas, William Paley).

Module 5: Challenges to the Existence of God (10 hours)
God and Problem of Evil - faith solutions, philosophical motifs, process solution.God and Atheism Auguste Comte: the religion of humanity Friedrich Nietzsche: Prophet of atheistic humanismAlbert Camus: God as surety for suffering Jean-Paul Sartre: God as self-contradiction.

Module 6: Issues in Religions (10 hours)
Incarnation, prophet hood, death, re-birth, after-life, eschatology, liberation

Module 7: Religious Hermeneutics (10 hours)
Religion and moral value Religion and social values Religion and science Possibility of universal religion

Suggested Readings

1. Edgar Brightman, A Philosophy of Religion, New York: Greenwood Press, 1969.
2. William Lane Craig, Philosophy of Religion: A Reader and Guide, Edinburgh: Edinburgh University Press,2002.
3. Brian Davies, The Philosophy of Religion, Oxford: Oxford University Press, 2000.
4. Stephen T. Davis, ed., Encountering Evil: Live Options in Theodicy, Atlanta: John Knox Press, 1981.
5. John Hick, Arguments for the Existence of God, New York: Herder and Herder, 1971.
6. John Hick, Philosophy of Religion, New York: Prentice-Hall, 1973.
7. William James, The Varieties of Religious Experience, New York: Dolphin Books, 1902.
8. Kurian Kachappilly, God-Talk Reconstructed: An Introduction to Philosophy of God, Bangalore: Dharmaram Publications, 2006.
9. J. L. Mackie, Miracle of Theism: Arguments for and against the Existence of God, Oxford: Clarendon Press,1982.
10. John Macquarie, Twentieth Century Religious Thought: The Frontiers of Philosophy, London: SCM Press,1971.
11. Alfred N. Whitehead, Religion in the Making, New York: Macmillan, 1926.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO1	H	H	H	H	H	H	H
CO2	M	M	H	H	H	M	M
CO3	M	M	M	M	M	H	H
CO4	H	H	M	M	H	M	M

PYPM302T: POSTMODERNISM
(Credits: 4 – 60 Hours)

Course Objectives
As postmodern philosophy questions the importance of power relationships, personalization, and discourse in theconstruction of truth and worldviews, the students are provided with ample opportunities for critical thinking. Theorigin of postmodernism can be placed in the closing decades of the twentieth century, when it was first apparentlyconceived in the visual arts, and then spread to other areas, including philosophy and theology. The term is at once fashionable and elusive but has become a catchword in art, architecture, philosophy, literature, film and music. It has become a powerful concept that can no longer be ignored. It implies a shattering of innocent confidence in thecapacity of the self to control destiny. It shatters all trust in global strategies of social planning and undertakes a radical critique of the philosophical systematization of grand theories or meta-narratives paving the way for a celebration of pluralism in all spheres of life.

Course Outcomes
CO1: Explains the origin, growth and development of the postmodern philosophy (understanding)
CO2: Develops the philosophies of prominent postmodern thinkers (applying)
CO3: Evaluates postmodern philosophy about postmodern literature, films, music and culture (evaluating)
CO4: Compiles the influences that postmodernism on contemporary thought (creating)

Module 1: Introduction (10 hours)
Preliminary clarification of postmodernismOrigin of postmodernism
Characteristics of the modern age
General nature and traits of postmodernism
The transition from modernism to postmodernism Postmodernism as a break with the past Philosophical characteristics of postmodernism

Module 2: Heralds of Postmodernism (15 hours)
Friedrich NietzscheMartin Heidegger Emmanuel Levinas

Module 3: Postmodern Activists (15 hours)
Michael Foucault Jean Francois Lyotard Jacques Derrida

Module 4: Postmodern Feminists (10 hours)
Luce Irigaray Julia Kristeva Judith Williamson

Module 5: Postmodern Thinkers of India (10 hours)
Homi K. Bhabha Gayatri Spivak Jayanta Mahapatra

Suggested Readings

1. Christopher Butler, Postmodernism: A Very Short Introduction, Oxford: Oxford University Press, 2002.
2. Paul Heelas, ed., Religion, Modernity and Postmodernity, Oxford: Blackwells, 1998.
3. Linda Hutcheon, The Politics of Postmodernism, London: Routledge, 2002.
4. Charles Lemart, Postmodernism is Not What You Think, Oxford: Blackwell,1997.
5. Johnson J. Puthenpurackal, ed., The Postmodern: A Siege of the Citadel of Reason, New Delhi: Media House,2002.
6. Madan Sarup, An Introductory Guide to Post-Structuralism and Postmodernism, Hertfordshire: HarvesterWheatsheaf, 1993.
7. Glenn Ward, Teach Yourself Postmodernism, London: Hodder & Stoughton, 2003.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	M	M	M	M
CO2	M	H	H	H	H
CO3	M	H	H	H	H
CO4	H	H	H	M	M

PYHP304T: PHILOSOPHY OF THE HUMAN PERSON AND MIND

(Credits: 4 – 60 Hours)

Course Objectives

The course aims to challenge and stimulate students philosophically to raise the fundamental question, "Who am I?" and to have clarity about human existence and nature by critically and creatively investigating metaphysical and epistemological questions regarding human subjectivity. Human existence is fundamentally co-existence and pro-existence. We are rooted in nature, formed by nurture, and sustained by God; we act upon the world, build upthe community, and move towards God.

Course Outcomes

CO1: Explains the metaphysical and epistemological questions regarding human subjectivity (understanding)
CO2: Outlines the role of gender issues in understanding the human person (understanding)
CO3: Examines the fundamental questions about Human Person (analysing)
CO4: Elaborates the various human faculties that distinguish humans from other beings (creating)

Module 1: Introducing the Philosophy of the Human Person and Mind (10 hours)

After defining what the philosophy of the human person and mind is, the module deals with its distinguishing characteristics vis-à-vis other branches of anthropology and psychology and investigates the scope and methods ofenquiry. the module also examines briefly the development of the topic in the historical context. both the Eastern and Western course of development is examined for a synthesis of the concept of the human person.

Module 2: Evolution of Life and Human Person (10 hours)

The origin and evolution of life and the human person are studied from scientific, philosophical and religious perspectives. Directed evolution as proposed by Teilhard de Chardin is given importance as a synthesis of scientific, philosophical and religious views.

Module 3: Intellect and Will (15 hours)

Although there are several functions that human bodies perform and are common to all animals, human beings are uniquely endowed with intellect and will. The intellect is an immaterial cognitive faculty that strives actively towards intelligibility and

the will is the capacity to choose between the good and the evil that is known by the intellect. The nature of human knowledge with special reference to sense knowledge and intellectual knowledge, the relationship between intellect and will, acts of will, and freedom of will are explored in this unit. These two faculties reside in a spiritual coordinating substance: the soul. The origin, nature and immortality of the human soul are studied especially from a scholastic point of view.

Module 4: Human Person as Inter-Subjective (15 hours)
Human nature is inter-subjective and social and we belong to a community. This aspect of the human person is fundamental because all the species-specific characteristics such as language, culture, work and play have a social dimension. *Homo sapiens* are also *homo loquens, homo fabiens* and *homo ludens* and they are constitutive of being human.

Module 5: Gender Issues and Human Person (10 hours)
It studies gender relations, gender issues, and gender as a structuring principle in human societies. Feminist points of view are presented to foster co-responsibility, mutual respect and partnership of women and men for building up a gender-just society.

Suggested Readings

1. Martin Buber, I and Thou, Edinburgh: T & T Clark, 1937.
2. Teilhard De Chardin, The Phenomenon of Man, Chicago: Harper Books, 1976.
3. Gareth Evans, Varieties of Reference, London: Oxford University Press, 1982.
4. G. Graham, The Philosophy of Mind, 2nd ed., Oxford: Blackwell, 1998.
5. S. Guttenplan, A Companion to the Philosophy of Mind, Oxford: Blackwell, 1994.
6. D. Hume, A Treatise of Human Nature, 2nd edn, eds, L. A. Sell Bigge and P. H. Nidditch, Oxford: Clarendon Press, 1978.
7. John Mcdowell, Mind and World, Cambridge: Harvard University Press, 1994.
8. Battista Mondin, Philosophical Anthropology, Bangalore: Theological Publications of India, 1998.
9. S. Radhakrishnan, Indian Philosophy, vols., 1& 2, London: George Allen & Unwin, 1966.
10. Gilbert Ryle, Concept of Mind, London: Penguin Books, 1949.
11. Wilfrid Sellars, Empiricism and the Philosophy of Mind, Cambridge: Harvard University Press, 1997.
12. Amartya Sen, The Argumentative Indian: Writings on Indian Culture, History and Identity, London: Penguin Books, 2005.
13. Claude Sumner, The Philosophy of Man, Addis Ababa: Central Printing Press, 1989.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	M	M	M	H	M
CO2	M	M	M	M	H
CO3	M	H	H	H	H
CO4		M	H	H	M

PYSN305T: PHILOSOPHY OF SCIENCE AND NATURE
(Credits: 4 – 60 Hours)

Course Objectives
Philosophy of Science and Nature intends to initiate students into bridging between philosophy, nature, and scientific developments. Apart from introducing students to various scientific paradigms, they are given opportunities to approach those theories from a critical philosophical angle to understand the basic vision of reality that is unveiled and also approach science from a holistic and integral angle. Philosophy began with wonder at the reality that was obvious to human eyes, yet its origin, makeup and growing up during the times gone by have surprised most thinkers. It is different from science as well as myth. The goal of all three is to explain reality, but the methods and courses that they hold on to are quite different. There is a slow development from myth to philosophy and then to science. Myths are not existentially true and meaningful; philosophy tries to be factually true and meaningful by rational investigation. Science attempts to be factually true and does not directly influence existential meaning. Myths provide us with intuitive and existential meaning. Philosophy gives us rational meaning. Science shows us empirical facts.

Course Outcomes
CO1: Shows the role philosophy plays in understanding nature and scientific developments (remembering)
CO2: Outlines the various scientific paradigms in understanding the universe (understanding)
CO3: Identifies the various philosophical and scientific theories that explain matter (applying) CO4: Proposes the prospects of the philosophy of science and nature (creating)

Module 1 Introduction to Philosophy of Science and Nature (8 hours)
Introduction; Pre-Socratic and Socratic Understanding of Nature Pre-Copernican Philosophy of Science and Nature Philosophy of Science and Nature in the Middle Ages

Module 2 Philosophy of Science and Nature During the Renaissance (15 hours)
Revolution and its Philosophical ImplicationsMechanical Philosophy of Nature Contributions made by Copernicus and others Isaac Newton and Classical Mechanics: the concept of forceOther schools and their implications.

Module 3 Philosophy of Science and Nature in the Modern Period (15 hours)
Contemporary Philosophy of Science
Logical Positivism: basic ideas, clarifying of terms, implications and critique. Historicism: basic ideas, persons, implications and critique
Historical Realism: basic ideas, persons, implications and critique

Module 4 Philosophy of Science and Nature in the Contemporary Period (15 hours)
Contemporary Philosophy of Nature
Relativistic Revolution: scientific-philosophical implications Quantum Mechanics and its philosophical implications Finite / Infinite Nature of the universe
Scientific theories on the origin and end of the universe

Module 5 The Future of Philosophy of Science and Cosmology (7 hours)
A virtual journey - our journey in science and nature The novel challenges: ecological crisis vs human greed Mechanization of the human mind and thinking patterns

Suggested Readings

1. I.B. Cohen, The Birth of a New Physics, London: Penguin Books, 1992.
2. John Earman, World Enough and Space-Time: Absolute versus Relational Theories of Space and Time,Cambridge, Mass.: MIT Press, 1989.
3. Brian Green, The Fabric of the Universe, London: Penguin Books, 2004.
4. Brian Greene, The Fabric of the Universe, London: Penguin Books, 2004.
5. Stephan Hawking, A Brief History of Time, New York: Bantam Press, 1988.
6. Stephen Hawking, The Universe in a Nutshell, New York: Bantam Books, 2001.
7. Carl Hempel, Aspects of Scientific Explanations, New York: Free Press, 1965.
8. Michio Kaku, Hyperspace – A Scientific Odyssey Through the Parallel Universes, Time Warps, and the 10^{th}Dimension, New York: Anchor Books, 1994.
9. Job Kozhamthadam, "The Changing Face of Science- Christianity Dialogue," Science, Technology and Values,ed., Job Kozhamthadam, Pune: ASSR Publications,2003.
10. E. Nagel, The Structure of Science, London: Routledge, 1982.
11. Kar Popper, The Logic of Scientific Discovery, New York: Basic Books, 1959.
12. J.J. Sakurai, Modern Quantum Mechanics, New York: Addison- Wesley, 2000.
13. S. Sambursky, The Physical World of the Greeks, London: Routledge and Kegan Paul, 1960
14. C. Singer, A Short History of Scientific Ideas to 1900, London: Oxford University Press, 1959.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	M	M	M	H	H
CO3	H	M	M	H	M
CO4	H	H	H	H	H

PYHS306T: HETERODOX SYSTEMS IN INDIA

(Credits: 4 – 60 Hours)

Course Objectives

The study of heterodox systems in India helps the students foster an understanding of Indian schools that oppose the authority of the Vedas. It enables the students to interpret diverse atheistic and theistic beliefs and practices and to foster an understanding of diverse systems of thought. Due to their universal outlook and philosophical relevance, Buddhism and Jainism have received increasing attention, even in the Western world. This course offers students an alternative thinking pattern,

different from the main line of Hindu thought.

Course Objectives
CO1: Explains the Materialistic Philosophy of India (understanding)
CO2: Examines the origin and development of the Heterodox Systems of India (analysing)
CO3: Compares the Buddhist and Jaina Philosophies in understanding human beings, the world and God(evaluating)
CO4: Assess the contributions of the Buddhist and the Jain thought to the Indian Society (evaluating)

Module 1: The Carvaka Philosophy (10 hours)
The origin and scope
The Carvaka epistemologyThe Carvaka metaphysics The Carvaka ethics

Module 2: The Jaina Philosophy of Knowledge (10 hours)
Introduction - origin and history
The Jaina theory of knowledge: nature and kinds of knowledgeThe Jain theory of judgement: syadvada, saptabhanginaya

Module 3: Jaina Metaphysics (10 hours)
The Jaina conception of substance Classification of substance
The concept of the soul
The inanimate substances: matter, space, time, dharma and adharma

Module 4: Jaina Ethics and Religion (5 hours)
Bondage of the soulLiberation
Jainism as a religion without a God

Module 5: The Ethical Teachings of Buddhism (10 hours)
Origin and history of Buddhism – Buddha, Hinayana, Mahayana
The teachings of Buddhism: the four noble truths, the eightfold path to liberation
The philosophical implications of Buddha's teachings: theory of dependent origination, theory of karma, theory of universal change, theory of the non-existence of the soul

Module 6: The Buddhist Schools of Philosophy (15 hours)
The Madhyamika School of PhilosophyThe Yogacara School of Buddhism
The Sarvastivada school of Buddhism - sautrantika and vaibhashika schools

Suggested Readings
1. Ashok Kumar Chatterjee, Yogacara Idealism, Delhi: Motilal Banarsidass, 1999.
2. Dakshinaranajan Shastri, A Short History of Indian Materialism, Calcutta: Book Company,1930.
3. E. J. Thomas, History of Buddhist Thought, London: Kegan Paul, 1953.
4. J. L. Jaini, Outlines of Jainism, Cambridge: Cambridge University Press, 1916.
5. Mohanlal Mehta, Outlines of Jaina Philosophy, Bangalore: Jaina Mission Society, 1954.
6. Radhakrishnan and Charles A. Moore, A Sourcebook in Indian Philosophy, Princeton: Princeton UniversityPress, 1957.
7. S. Radhakrishnan, Indian Philosophy, London: George Allen and Unwin Ltd., 1923.
8. T. R. V. Murti, The Central Philosophy of Buddhism, London: George Allen and Unwin, 1955.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2	H	H	H	H	H	H
CO3		H	H	H	H	H
CO4		H	H	H	H	H

PYFR307P: PROJECT WORK BASED ON FIELD STUDY
(Credits: 4 – 60 Hours)

Course Objectives
Project-based learning, especially field study, helps students to assess and to deepen the quality of acquiredknowledge. It offers the students the possibility of learning beyond the classroom setting.

Course Outcomes

CO1: Identifies the subjects and helps draw correlations between subjects and surroundings, and how the surroundings may influence the behaviour (applying).

CO2: Outlines in-depth information on subjects because they are observed and analysed for a long period (understanding).

CO3: Influences the researcher to fill the gaps in data which can be understood by conducting in-depth primary research (evaluating).

CO4: Combines theory and practical research study by qualitatively analysing the data (creating)

The students are expected to carry out field research during the semester break after 6th semester on themes about the relevance, usefulness, popularity and application of philosophy, Psychology or English Literature in seminaries, colleges or universities under the guidance of a faculty using research tools such as interviews, focus groups, surveys and observation.

The following steps are to be followed while conducting the field study:

Identify and acquire researchers in the field: It is essential to acquire researchers who are specialized in the field of research. Moreover, their experience in the field will help them undergo further steps of conducting field research.

Identify the topic of research: The researcher works on identifying the topic of research. The researchers are responsible for deciding what topic of research to focus on based on the gaps observed in the existing research literature.

Identify the right method of research: After fine-tuning the research topic, researchers define the right method to approach the aim and objectives of the research.

Visit the site of the study and collect data: Based on the objectives, the observations begin. The researcher goeson the field and starts collecting data either by visual observation, interviews or staying along with the subjects and experiencing their surroundings to get an in-depth understanding.

Analyze the data acquired: The researcher undergoes the process of data analysis once the data is collected. **Communicate the results**: The researchers document a detailed field study report, explaining the data and itsoutcome. Giving the field study a suitable conclusion.

The field research should be for a minimum duration of 60 hours which can be extended depending upon the convenience and requirement of the student and the organisation respectively. The rest of the hours are allotted for completing the Project Report. However, the entire duration of the course should not exceed 120 hours.

The Project Report must be in a spiral bind. It should be accompanied by a recommendation letter from the department and a certificate of authentication from a competent authority from where the research was carried out. The Contents of the Report must include:

1. Introduction.
2. Need of the study
3. Objectives of the study
4. Significance of the study
5. The methodology which was undertaken for the study
6. Description of the work done
7. Learning Outcomes
8. Feedback from the target audience/community members
9. Geotagged photographs

The assessment will be done as follows:

There would be a presentation (PPT) and Viva-Voce Examination during the 7th semester.

The Assessment for the project work based on field study will have the following components:

a) Report: 40 marks
b) Seminar Presentation: 30 marks
c) Viva-Voce Examination: 30 marks

Mapping of COs to Syllabus

Course Outcomes	
CO1	H
CO2	H
CO3	H
CO4	H

PYET400T: ETHICS
(Credits: 5 – 75 Hours)

Course Objectives
This course aims at introducing the students to the philosophical need for Ethics starting with a brief discussion ofMoral law and how the human person in his or her process of growth intuits ethical principles. Discussions aboutthe dynamics of morality are undertaken to show how on the one hand new situations call for new responses froma moral point of view and on the other hand certain fundamentals of ethics remain the same in so far as there is something of a common human nature adequately understood. It seeks to respond to some of the important challenges to ethics as a philosophical discipline. Thus, we attempt to look at Indian as well as Western traditions. We, then, shall explore the chief ideas of virtue ethics in various philosophical thoughts and religious traditions. Italso aims to understand the important aspects of human rights and the moral importance of duties then proceed with a discussion on current ethical questions. Living in social groups is an essential characteristic of humans. Sociality and individuality are not opposite poles but are related to each other. Therefore, the right knowledge of society with its institutions is essential. We also make a critical look at the political philosophy and moral questionsarising out of it. By the end of the course, the students are oriented to gain a detailed understanding of the philosophical issues involved in many contemporary debates in the public sphere as well as developing moral reasoning skills and application of those skills to contemporary social and political issues.

Course Outcomes
CO1: Explains the nature and principles of human behaviour (understanding)
CO2: Summarises the history of Indian and Western traditions on ethics (understanding)
CO3: Develops the foundations of human behaviour (applying)
CO4: Discusses the various ethical issues in contemporary times and the challenges that legislations of liberalnations pose. (creating)

Module 1: Introduction to Ethics (10 hours) Nature, scope and subject matter of Ethics Challenges and importance of ethics
Ethics in the History of Indian Philosophy Ethics in the History of Western PhilosophyKinds of ethics
Relation with other disciplines

Module 2: Human Conduct and Responsibility (10 hours)
Human acts Emotions, moods and desiresKnowledge
Freedom and determinism Levels of willing and not willing
Modifiers of Responsibility: Ignorance, Strong Emotions, Fear, Force, habitThe indirect voluntary
Principle of doubt effect

Module 3: Criteria for Morality (10 hours)
The objective criterion of morality: eternal law, natural law, divine positive lawThe subjective criterion of morality: conscience

Module 4: Virtue (10 hours)
Definition Moral virtues Cardinal virtues

Module 5: The Objective Good in Moral Life (10 hours)
Good, pleasure, convention, consequencesIntuition, reason, law, freedom
Situation ethics; Love, habit, happiness

Module 6: Ethical Issues Related to Human Life (10 hours)
Bio-Ethics: body care, abortion, suicide, mutilation, euthanasia, artificial birth control and sterilization.
Sexual Ethics: rape, masturbation, pre-marital sex, homosexuality, lesbianism, sodomy, bestiality, fornication,adultery and incest
Medical Ethics: what is medical ethics; duties of physicians, duties of nurses, patient and doctor relationship,cloning, stem cell; Hippocratic oath

Module 7: Social Ethics (15 hours)
Personal Ethics: relation to self; relation to the world; relation to others; relation to God; situation ethics
Societal Ethics: liberation ethics, human rights; rights of workers, strikes, social justice, alcoholism, substance abuse, punishments and capital punishment
Business Ethics: what is business ethics; patent rights, consumer protection and bribe War and Peace: self-defence, just war theory, nuclear war, peace and non-violence Global Issues: HIV/AIDS, poverty, corruption, child labour and militancy

Suggested Readings

1. Simon Blackburn, Being Good: A Short Introduction to Ethics, Oxford: Oxford University Press, 2002.
2. John Finnis, Fundamentals of Ethics, Oxford: Clarendon Press, 1983.
3. E. Hargrove, The Foundations of Environmental Ethics, New Jersey: Prentice-Hall 1989.
4. Alasdair MacIntyre, "The Nature of the Virtues," After Virtue: A Study in Moral Theory, Notre Dame: University of Notre Dame Press, 1984.
5. Mark R. Amstuzt, International Ethics: Concepts, Theories, and Cases in Global Politics, 2nd ed., Rowman&Littlefield, 2005
6. J. Passmore, Man's Responsibility for Nature, London: Duckworth 1974.
7. Shyam Ranganathan, Ethics and the History of Indian Philosophy, Delhi: Motilal Banarsidass, 2007.
8. Richard Scott, Institutions and Organisations, London: Sage, 2001.
9. S. P. Sharma, Nature and Scope of Ethics, New Delhi: Mohit Publications, 2003.
10. Henry J. Steiner and Philip Alston, International Human Rights in Context: Law, Politics, Morals, New York: Oxford University Press, 2000.
11. Wilbur Marshall Urban, Fundamentals of Ethics: An Introduction to Moral Philosophy. Highland: Holt, 1993.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO1	M	H	H	H	H	H	H
CO2	H	M	H	M	H	M	M
CO3	M	H	H	H	H	H	H
CO4	M	M	H	M	H	H	H

PYVP401T: VEDANTA PHILOSOPHY

(Credits: 5 – 75 Hours)

Course Objectives

This course makes the students familiar with the philosophy and spirituality of the Vedanta Schools of Philosophy. It is an introduction to various schools of Vedanta highlighting the history, the context of their origin, the authors and the main teaching of these schools. The focus is on interactive learning where the students will engage themselves in a rigorous and analytical examination of the key ideas present in these schools of Philosophy. The Vedanta Philosophy is an interpretation and exposition of the *Jnanakhanda* section of the Upanishads. The primarythrust of the systems is to delve into the Nature of the self, and its relation to the Ultimate Reality. The systems also speak about the nature of the world in which we live. In the process, the systems deal with how a seeker having lived in this mundane world, attains his liberation (*Moksha*) Vedanta philosophy, though, is an exposition of the *Brahmasutrabhashyas, Upanishads* and *Bhagavad Gita*, each one of them is different in their viewpoints.

Course Outcomes

CO1: Outlines the richness of the philosophy and spirituality embedded in the Vedantic texts (understanding).
CO2: Evaluates the Metaphysics, Epistemology, Ethics, and Means of Liberation proposed in Vedantic thought(evaluating)
CO3: Discuss the contributions of great thinkers like Shankara and Ramanuja for the resurgence of Hinduism (creating)
CO4: Assesses the subtle nuances that differentiate diverse schools of Vedanta (evaluating)

Module 1: Introduction (10 hours)

Origin, Meaning and Purpose of Vedanta Philosophy

Module 2: Advaita Philosophy of Shankara (20 hours)

Life, Works, Influences, Brahman and Atman, Knowledge, Maya, World, Liberation

Module 3: Visishtadvaita Philosophy of Ramanuja (15 hours)

Life, Works, Influences, Brahman and Atman, Knowledge, Maya, World, Way of Devotion

Module 4: Dvaia Philosophy of Madhava (10 hours)

Life, Works, Influences, Brahman and Atman, Maya

Module 5: Other Schools of Vedanta Philosophy (10 hours)

Dvaita Advaita of Nimbarka Suddha Advaita of Vallabha Achintya Bhedabheda of Chaitanya

Module 6: The Vaishnavite Philosophy of Srimat Shankerdev (10 hours)
Life, Works, Influences, Understanding of God, Way of Devotion

Suggested Readings

1. S. Dasgupta, History of Indian Philosophy, 5 vols., Delhi: Motilal Banarsidas, 1975.
2. Subodh Kapoor, The Systems of Indian Philosophy, New Delhi: Cosmo Publications, 1987.
3. Max F. Muller, The Six Systems of Indian Philosophy, Varanasi: Chronicle Books, 2004.
4. Matthew Narimattam, The Valley in Blossom, Dimapur: Don Bosco Publications.
5. S. Radhakrishnan, Indian Philosophy, vols 1 & 2, New York: George Allen and Unwin Ltd., 1977.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	H	H	H	H	H
CO2	M	H	H	H	H	H
CO3	M	H	H	M	M	M
CO4	H	H	H	H	H	H

PYCI404T: CONTEMPORARY INDIAN PHILOSOPHY

(Credits: 5 – 75Hours)

Course Objectives

This course aims at allowing the students to absorb the new spirit of philosophising that emerged due to the mushrooming of different philosophical movements in contemporary India. It allows them to get a feel for the newreligious and social outlook that has emerged over time in India. The students would imbibe the spirit of opennessand determination shared by contemporary philosophers in India. The main philosophical movements were the Bhakti, Sufi, and Reform movements. The Bhakti movement brought about revolutionary changes in the moral, social, and political perspectives of the people of India. It underscored the need to stand for unity among the religions. The Sufi movement emphasises man's role in enhancing social unity, cultural synthesis, and communal harmony. Reform movements impel us to look at religion critically and scientifically. In the 19th century, after the reform movements, India produced some eminent thinkers who, through their ideas, philosophical and political, shaped the minds of millions and contributed to the nation-building process.

Course Outcomes

CO1: Explains in-depth the philosophical ramifications of events like the Bhakti, Sufi and Reform Movements(understanding)
CO2: Analyses the political, social and philosophical movements of India from the 19th century (analysing)
CO3: Assesses the philosophical thoughts of contemporary Indian thinkers like Gandhi, Vivekananda, K.CBhattacarya, Radhakrishnan, Aurobindo, Tagore, and others (evaluating)
CO4: Estimates the influences of ancient philosophy on contemporary Indian thought (creating)

Module 1: Bhakti Movement (15 hours)
Introduction
History of the Bhakti Movement
Nature and Characteristics of the Bhakti Movement
Leaders of Bhakti Movements: Ramanuja, Ramananda, Kabir, Namdeva, Gurunanak, Chaitanya, Tulsi Das, Guru Ramdas, Tukaram
Bhakti movement in South India: Nayanmars, Alwars, Basava Women leaders: Akkamahadevi, Janabai, Mirabai, Bahinabai
Implications of the Bhakti Movement: ethical and Philosophical

Module 2: Sufi Movement in India (15 hours)
Roots of Sufism
History and Development of SufismSufism in India
Interaction between Hindu and Muslim saints

Module 3: Reform Movement in India (15 hours) Modern reform movement: the historical context Brahma Samaj: the universalistic reform movementArya Samaj: the nationalistic reform movement
19th Century Hindu universalism: Ramakrishna Paramahamsa, Ramkrishna Mission (Vivekananda), ISKCONMovement
The Guru movements: Osho, Satya Sai Baba,

Module 4: The Philosophy of Contemporary Thinkers (30 hours)
Vivekananda: the concept of God, the concept of the world, the concept of Maya, the concept of the human person, freedom and karma, liberation and the means of liberation, his idea of religion
Aurobindo: His idea of integral yoga, Involution and evolution, levels of reality, the destiny of human being Mahatma Gandhi: life, political ideas - Satyagraha, ahimsa, Sarvodaya, religion, the concept of God
B.R. Ambedkar: social philosophy, political ideas and socio-political criticism, economic ideals and social development, religious criticism and social transformation
S. Radhakrishnan: metaphysics, epistemology, religion and ethics, social and political philosophy

Suggested Readings
1. D.R. Bali, Modern Thought, New Delhi: Sterling Publishers, 1988.
2. Basant Kumar Lal, Contemporary Indian Philosophy, New Delhi: Sterling Publishers, 1983.
3. T.M. Mahadevan, and V. Saroja. Contemporary Indian Philosophy, New Delhi: Sterling Publishers, 1983.
4. Glyn Richards, ed., A source-Book of Modern Hinduism, London: Curzon Press, 1985.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2	M	M	H	H
CO3	M	M	H	H
CO4	H	H	H	H

PYPB405T: THE PHILOSOPHY OF THE BHAGAVAD GITA
(Credits: 5 – 75 Hours)

Course Objectives
The objective of this course is to make the students familiar with the philosophy and spirituality of the Bhagavad Gita. This course is an introduction to the Bhagavad Gita, highlighting the history, the context of the text, the author, and the main teaching of the text. The focus is on interactive learning, where the students will engage themselves in a rigorous and analytical examination of the key ideas present in the Bhagavad Gita. It gives answers to many existing philosophical dilemmas. The text highlights some important issues, like the nature of the self and the nature of the non-self, the different paths to liberation, the purpose of incarnation, the true nature of God, and the different qualities of a good person as well as a bad person. Hence, this text helps a student further reflect on Indian philosophy. The Bhagavad Gita is a spiritual classic. Though it is not a sruti text, it is highly regarded by devout Hindus and accepted by many other seekers of truth. This text helps the students delve deep into Indian spirituality. A text-based study of the Gita enables the students to understand and appreciate its rich spiritual and philosophical wealth.

Course Outcomes
CO1: Outlines the richness of the philosophy and spirituality embedded in the Gita (understanding)
CO2: Develops an appreciation for the Metaphysics of the Bhagavad Gita, particularly the Nature of God, the Nature of the true self, different paths to liberation, and the status of liberation (applying)
CO3: Evaluates the ethical values present in the Gita (evaluating)
CO4: Examines the leadership and management qualities Krishna and make them relevant in the present context(analysing)

Module 1: Introduction to the Bhagavad Gita (15 hours)
History, general context and author of the text The immediate context of the Bhagavad Gita The dilemma of Arjuna
Arjuna is a representative of every human person in crisis

Module 2: Main Philosophical Ideas in the Bhagavad Gita (15 hours)
The true nature of self
The true nature of the world Different Paths to Liberation The purpose of the incarnation

Module 3: Krishna as a Model of Leadership (10 hours)
Kirshna's type of leadership and management Educative transformative leadership
The distinction between normal work and nishkama karma

Module 4: The Qualities of Persons with Sattva Guna and Tamas Guna (10 hours)
Qualities of people with demonic nature

Result of entertaining demonic qualities and living in delusion How to guard oneself against taking the road of demonic nature: Qualities of people with divine qualities, and final success for them

Module 5: Text-based Study (25 hours)
The text of the Bhagavad Gita will be critically explained for an in-depth understanding of its philosophy.

Suggested Readings
1. Keya Maitra, Philosophy of the Bhagavad Gita: A Contemporary Introduction.
2. M.K. Gandhi, The Gospel of Selfless Action.
3. Shri Aurobindo, Bhagavad Gita and its Message.
4. Swamy Krishnananda, The Philosophy of Bhagavad Gita.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	H	H	H	H	H
CO3	M	H	H	H	H
CO4		M	H	M	

MINOR COURSES (IN ENGLISH AND PSYCHOLOGY)

Semester	Category	Course Code		Credits
1	Minor Course 1	EGGE106T	General English I	4
2	Minor Course 2	PCGP100T	General Psychology	4
3	Minor Course 3	EGGE207T	General English II	4
4	Minor Course 4	PCDP200T	Developmental Psychology	4
5	Minor Course 5	EGAE307T	Alternative English I	4
6	Minor Course 6	PCPP300T	Theories of Personality and Positive Psychology	4
7	Minor Course 7	EGAE407T	Alternative English II	3
7	Minor Course 8	PYRM402T	Research Methodology	2
8	Minor Course 9	PCPS400T	Social Psychology	3

EGGE106T: GENERAL ENGLISH I

(Credits: 4 - 60 Hours)

Course Objectives

The objective of this course is to acquaint the students with language and literature and to whet their appetite for the same. The students are led to a gradual discovery of the three genres: fiction drama and poetry. They are expected to undertake an in-depth analysis of the texts. They are also encouraged to closely examine the various themes and motifs and to have a contextualized reading of the texts. If this exercise is taken seriously the students will acquire the skill to communicate effectively. The outcome will be the ability to critically evaluate and appreciate a particular work.

Course Outcomes

CO 1: Shows familiarity with vocabulary and phraseology (remembering)
CO 2: Illustrates the use of the language effectively in reading, writing and speaking (understanding)
CO 3: Develops the ability to the ability to critically evaluate and appreciate a particular piece of writing (applying)
CO 4: Tests the knowledge of English grammar (creating)

Module I: Selected Novels (15 hours)

Anita Desai - Fasting Feasting
Jane Austen - Sense and Sensibility

Module 2: Selected Dramas (15 hours)

Oscar Wilde - The Importance of Being Earnest.Henrik Ibsen - A Doll's House
Harold Pinter - The Birthday Party

Module 3: Selected Poems (18 hours)

Kamala Das - My Mother at Sixty Six John Donne - Death Be Not Proud
William Wordsworth - The World is Too Much with Us Dante Gabriel Rossetti - The Blessed Damozel

Module 4: Basic English Grammar (12 hours)

Grammar I Grammar II

Suggested Readings

1. Anita Desai, Fasting Feasting.
2. D.G. Rossetti, The Blessed Damozel.
3. Das & Mohanty, Literary Criticism: A Reading, Oxford University Press.
4. Edward Albert, A History of English Literature, Oxford University Press.
5. Harold Pinter, The Birthday Party.
6. Henrik Ibsen, A Doll's House.
7. Jane Austin, Sense and Sensibility.
8. John Donne, Death Be Not Proud.
9. Kamala Das, My Mother at Sixty Six.
10. M.H. Abrahams, A Glossary of English Terms, Bangalore: Macmillan Publishers India.
11. Oscar Wilde, The Importance of Being Earnest.
12. William Wordsworth, The World is Too Much With Us.
13. Wren & Martin, English Grammar.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	H
CO2	H	H	H	M
CO3	H	H	H	M
CO4	M	M	M	H

PCGP100T: GENERAL PSYCHOLOGY

(Credits: 4 – 60 Hours)

Course Objectives

This introductory course in psychology gives a brief historical sketch of the science of psychology and a glimpse into the methods used in psychology. It also provides knowledge about the various psychological processes that every human being experiences. The paper also has several practicals.

Course Outcomes

CO 1: Explains the developments and methods in psychology (understanding)
CO 2: Outlines the biological foundations of behaviour, and processes underlying sensation, perception, cognition,memory and motivation (understanding)
CO 3: Evaluates the different psychological processes and behaviours (evaluating)
CO 4: Proposes practicals based on the processes discussed theoretically thus offering the students a hands-on experience (creating)

Module 1: Introduction to Psychology (10 hours)

Definition and Goals of Psychology, Role of a Psychologist in Society
Modern Perspectives: Biological, Psychodynamic, Behaviouristic, Gestalt, Cognitive, Cross-Cultural, Humanistic and Evolutionary
Methods: Experimental, Observation, Questionnaire and Inventories, Interview, Clinical Case Study

Module 2: Biology and Behaviour (10 hours)

Neurons: structure of neurons, neural impulses, synapses and neurotransmitters nervous system: central and peripheral nervous systems
Cerebral Cortex: structure and psychological importance in thought and language, the significance of left and right brain, split brain.
Effects of Hormones on Behaviour

Module 3: Sensory-Perceptual Processes (10 hours)

Sensation: basic concepts and processes in sensation
Types of Senses (An Overview): visual, auditory, gustatory, olfactory, tactile, vestibular, kinaesthetic and organic senses
Sensory Adaptation: advantages and disadvantages, integration of senses, sensory thresholds Perception: understanding perception, gestalt laws of organization
Different Process of Perception
Correlates of Perception: awareness, set, motives, needs, learning and attention Illusion: subliminal perception, extra-sensory perception

Module 4: Memory and Forgetting (10 hours)

Basic Processes: encoding, storage, retrieval Sensory Storage: iconic memory and echoic memory
STM-working memory, serial position curve, rehearsal, chunking
LTM-Units of Memory: declarative, procedural, semantic, episodic memory
Associative Models: explicit and implicit memory, retrieval cues, state-dependent and context-dependent memory, tip-of-the-tongue phenomena, flashbulb memory levels of processing, constructive processes in memory, schemas Forgetting: decay theory, interference theory, prospective memory, absence of retrieval cues, memory dysfunctions Improving Memory: mnemonic strategies

Module 5: Learning and Cognitive Processes (10 hours)

Attention: definition, characteristics, selective attention and divided attention process of thinking, Types: Reasoning-types, problem-solving, decision making, creative thinking, concept formation
Classical Conditioning: basics of conditioning, operant conditioning Language and thinking, imagery and thinking
Cognitive Learning: latent learning, observational learning, insight learning

Module 6: Motivation and Emotion (10 hours)
Motivation: meaning, approaches-instinct, drive reduction, arousal, incentive, cognitive, humanistic Maslow's Need Hierarchy: types, physiological motivation (hunger, thirst, sex, maternal drive), psychological motivation (achievement, affiliation, power, parenting)
Emotion: meaning, the physiological basis of emotions
Theories-James Lange Theory, Cannon-Bard Theory, Cognitive Theory Emotional Expression

Suggested Readings

1. R.S. Feldman, Understanding Psychology, 4th ed., New Delhi: McGraw Hill, 2006.
2. Atkinson Hilgard, Introduction to Psychology, Oxford: IBH Publishing, 1975.
3. King Morgan, Weiss and Schopler, Introduction to Psychology, 7th ed., New Delhi: McGraw Hill, 1989.
4. Robert A. Baron, Psychology, 3rd ed., New Delhi: Prentice Hall, 2001.
5. Swarnalatha Iyer, Introduction to Psychology, New Delhi: Premier Publishing Company, 2006.
6. Wayne Weiten, Psychology: Themes and Variations. 4th ed., New York: Brooks & Cole Publishing, 2001.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	M	M			
CO2		H	H	H	H	H
CO3		H	M	M	M	M
CO4		M	M	M	M	H

EGGE207T: GENERAL ENGLISH II

(Credits: 4 – 60 Hours)

Course Objectives
The course intends to broaden the mental horizons of the students by unfolding before them the philosophy, wit, and wisdom that is contained in the selected literary works. It helps in the correction of taste, that is, the ability to distinguish between the excellent and the mediocre. The course assists the students in bringing the necessary literary gravitas to their academic pursuits.

Course Outcomes
CO 1: Shows familiarity with vocabulary and phraseology in written English (Remembering).
CO 2: Illustrates the use of the language effectively in selected short stories and essays (understanding).
CO 3: Develops the ability to articulate thoughts and ideas meaningfully coherently and cogently with certain lexical elegance (applying).
CO 4: Tests the knowledge of the English language and composition (creating).

Module 1: Selected Short Stories (20 hours)
The Happy Prince - Oscar Wilde The Necklace - Guy de Maupassant
The Open Window - Hector Hugh Munro The Last Leaf - O. Henry

Module 2: Selected Essays (20 hours)
The Origin of Species - Charles Darwin of Studies - Francis Bacon

Module 3: Language and Composition (20 hours)

Suggested Readings

1. Charles Darwin, The Origin of Species.
2. Das & Mohanty, Literary Criticism: A Reading. Oxford University Press.
3. Edward Albert, A History of English Literature, Oxford University Press.
4. Francis Bacon, Of Studies.
5. Guy de Maupassant, The Necklace.
6. Hector Hugh Munro, The Open Window.
7. M.H. Abrahams, A Glossary of English Terms, Bangalore: Macmillan Publishers India.
8. O. Henry, The Last Leaf.
9. Oscar Wilde, The Happy Prince.
10. Wren & Martin, English Grammar and Composition.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H

CO2	H	H	H
CO3	H	H	H
CO4	M	M	H

PCDP200T: DEVELOPMENTAL PSYCHOLOGY

(Credits: 4 – 60 Hours)

Course Objectives

Developmental psychology is a branch of psychology that seeks to provide a general introduction to various developmental concepts across the different stages of life, with the nature versus nurture debate as a concurrent theme. It focuses on advancing knowledge of the processes of change for individuals across the lifespan. Topics of research interest include developmental theories, methods of investigating life-span change, as well as such processes as cognition, memory, theories of mind, identity, risk-taking, social relationships, and problem behaviour.

Course Outcomes

CO 1: Explains human development from conception till adulthood (understanding)
CO 2: Develops topics such as biological beginnings, development and change across infancy, childhood, adolescence and adulthood (applying)
CO 3: Compares the psychological ramifications at the various stages of human development (analysing)
CO 4: Proposes healthy psychological growth of a human person (creating)

Module 1: Introduction (10 hours)

Concept of Human Development: introduction, meaning, stages of lifespan development
Aspects of human development: physical, social, cognitive, moral principles of human Development (Balte) Factors influencing human development: ecological factors, hereditary factors
Theories of human development: Erickson, Piaget, Vygotsky (Dialectical), Kohlberg Biological Beginnings of Development
Genetic Foundations: genetic processes and genetic principles; chromosomal and gene-linked abnormalities

Module 2: Pre-natal Development and Infancy (10 hours)

Prenatal development: course of prenatal development; teratogens and prenatal environment, heredity, environment and individual differences
Infancy: characteristics of Infancy
Physical, motor development, emotional development, language development new-born reflexes and their adaptive value: (optical, Palmer, Babinsky, Moro, sucking, rooting, swimming, walking, placing), the importance of assessing new-born reflexes

Module 3: Childhood (10 hours)

Subdivisions of childhood, characteristics of each period
Aspects of development: physical development, cognitive development, language development, emotional development, psychosocial development

Module 4: Puberty and Adolescence (10 hours)

Puberty: meaning, biological changes (sexual maturation, growth spurt, secondary sexual characteristics) Reactions to physical changes
Adolescence: characteristics of adolescence Marcia's stages of development of personal identity
Development of a career stage in vocational planning influences vocational planning Adolescent relationships: family, peers, adult society

Module 5: Adulthood (20 hours)

Subdivisions, characteristics of each stage Early adulthood
Vocational Adjustment: choosing an occupation, stability of vocational selection foundations of intimate relationships: friendship, love, sexuality
Marriage: marital adjustment and conditions influencing it Parenthood: adjustment to parenthood
Middle adulthood occupational adjustment: stable and unstable patterns, preparation for retirement Psychosocial changes: coping with midlife crisis
Changes in relationships: marriage, relationship with maturing children, ageing parents, siblings, grandparenthood, friendships; late adulthood
Primary and secondary ageing, theories of ageing
Psychosocial aspects: models of coping, models of successful ageing, lifestyle and social issues (work retirement and leisure)
Personal relationships: relationship with adult children, siblings, great-grandparenthood Aspects of death: biological, socio-cultural aspects, psychological aspects, patterns of grieving

Suggested Readings

1. Hetherington and Parke, Developmental Psychology, 5th ed., New York: McGraw Hill Publication, 1999.
2. Hurlock, E. B., Developmental Psychology, 6th ed., New Delhi: Tata McGraw Hill, 1999.
3. Laura C. Berk, Child Development, 3rd ed., New Delhi: Prentice Hall of India, 1996.
4. D. E. Papalia, Human Development, 9th ed., New Delhi: Tata McGraw Hill, 2004.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	M	H	H	H	H
CO3	H	H	H	H	H
CO4	H	H	H	H	H

EGAE309T: ALTERNATIVE ENGLISH I

(Credits: 4 – 60 Hours)

Course Objectives

The study of literature has to be discursive. This course presupposes a movement on the part of the students to engage in more serious literature to be able to identify the technique and craft of different authors. It intends to take the students to a higher level of appreciation for the work. It will also set in motion a preparedness for seriousresearch.

Course Outcomes

CO1: Shows familiarity with vocabulary and phraseology in written English (Remembering).
CO2: Illustrates the use of the language effectively in selected poems, dramas and novels (understanding).
CO3: Develops the ability to articulate thoughts and ideas meaningfully coherently and cogently with certain lexical elegance (applying).
CO4: Tests the knowledge of the English language and composition (creating).

Module I Introduction to Poetry (20 hours)

Key terms, concepts and literary devices Selected Poems:
P.B Shelley- Ode to the West WindNissim Ezekiel - The Professor
William Butler Yeats - The Second ComingMatthew Arnold – The Dover Beach

Module 2: Introduction to Drama (20 hours)

Key Terms and Concepts
Selected Dramas: George Bernard Shaw- Candida and Oliver Goldsmith - She Stoops to Conquer

Module 3: Introduction to Novel (20 hours)

Key terms Selected Novels:
George Orwell, The Animal Farm
Earnest Hemingway, The Old Man the Sea

Suggested Readings

1. Das & Mohant, Literary Criticism: A Reading. Oxford University Press.
2. Earnest Hemingway, The Old Man and the Sea.
3. Edward Albert, A History of English Literature, Oxford University Press.
4. George Bernard Shaw, Candida.
5. George Orwell, The Animal Farm.
6. M.H. Abrahams, A Glossary of English Terms, Bangalore: Macmillan Publishers India.
7. Matthew Arnold, The Dover Beach.
8. Ezekiel Nissim, The Professor.
9. Oliver Gold Smith, She Stoops to Conquer.
10. P. B. Shelley, Ode to the West Wind.
11. William Butler Yeats, The Second Coming.
12. Wren & Martin, English Grammar.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H	H	H
CO3	H	H	H
CO4	H	H	H

PCPP300T: THEORIES OF PERSONALITY AND POSITIVE PSYCHOLOGY

(Credits: 4 – 60 Hours)

Course Objectives

Understanding the theories of personality helps understand the behaviour patterns of individuals. It is important for the well-balanced psychological growth of an individual. Positive psychology, on the other hand, is the scientific study of what makes life worth living, focusing on individual and societal well-being. It acquaints the students with positive subjective experiences, positive individual traits, and positive institutions. It aims to improvethe quality of life.

Course Outcomes

CO1: Explains the inner dynamics of human nature (understanding)
CO2: Demonstrates the uniqueness and the immense value of every person (understanding)
CO3: Identifies the various forces – both environmental and hereditary – that shape human personality (applying)
CO4: Examines the various theories of personality (analysing)

Module 1: Freud's Classical Psychoanalytical Theory (15 hours)

The structure of personality: The Id, the Ego and the SuperegoThe dynamics of personality: psychic energy and instincts
The stages of development: oral, anal, genital, phallic, latency period, etc.
Contemporary Psychoanalytical Theory: Erikson's concept of the life cycle and eight stages of humandevelopment

Module 2: Jung's Analytical Theory (10 hours)

Analytical psychology versus psychoanalysis
The structure of personality: the ego, the personal unconscious and complexes, the collective unconscious The Archetypes: persona, anima and animus, shadow, self

Module 3: Social Psychological Theories (10 hours)

Adler's five major contributions to personality theory; the five major sources of his thought: inferiority feelings and compensation, striving for superiority, family, order of birth and personality, style of life
Fromm's analysis of human loneliness and isolation the basic conditions of human existence and the specific needs; the five character types; the problem of human beings' relations to society; humanistic communitarian socialism as the perfect society
Horney's strategies for coping with basic anxiety; the ten 'neurotic' needs; moving towards people, moving awayfrom people, and moving against people

Module 4: Organismic Theory (10 hours)

The principal features of the organismic theory
Kurt Goldstein: the structure of an organism; the dynamics of the organism; the development of the organism Andras Angyal: the structure of the biosphere; the dynamics of the biosphere; the development of personality Maslow's humanistic psychology as the "third force," the human potential movement, the hierarchy of motives, characteristics of self-actualized persons and peak experiences

Module 5: Rogers' Person-Centred Theory (10 hours)

The structure of personality: organism and self; congruence and incongruence the dynamics of personality the development of personality

Module 6: Constitutional Psychology (10 hours)

Spranger's six types of personalities: theoretical, economic, aesthetic, social and power-politics typesKretschmer's three types of physiques and the corresponding personality types
Sheldon's Atlas of men and Atlas of women

Module 7: Eastern Psychology (15 hours)

Eastern psychologies and Western personality theories
Abhidhamma theory: unhealthy and healthy factors; personality types, means to healthy personality; concentration and altered states of consciousness

Suggested Readings

1. Alfred Adler, Practice and Theory of Individual Psychology, New York: Harcourt, Brace & World, 1927.
2. Erik Erikson, Identity: Youth and Crisis, New York: Norton, 1968.
3. Sigmund Freud, Introductory Lectures on Psychoanalysis, London: Hogarth Press, 1963.
4. Erich Fromm, The Sane Society, New York: Rinehart, 1955.
5. Calvin S. Hall and Gardner Lindzey, Theories of Personality, New York: Wiley, 1998.
6. Karen Horney, Neurotic Personality of our Times, New York: Norton, 1937.
7. Carl G. Jung, Memories, Dreams and Reflections, New York: Random House, 1961.
8. Abraham Maslow, Motivation and Personality, New York: Harper, 1954.
9. M. A. Narada, Manual of Abhidhamma, Kandy, Sri Lanka: Buddhist Publication Society, 1968.
10. L. A. Pervin, The Science of Personality, New York: Wiley, 1996.
11. C. Peterson, Personality, New York: Harcourt Brace Jovanovich, 1992.
12. Rabin, J Arnoff, et al, eds., Further Explorations in Personality, New York: Wiley, 1981.
13. William H. Sheldon, Atlas of Men: A Guide for Somatotyping the Adult Male at All Ages, New York: Harper,1954.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO1	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H

EGAE407T: ALTERNATIVE ENGLISH II

(Credits: 3– 45 Hours)

Course Objectives

The study of literature has to be discursive. This course presupposes a movement on the part of the students to engage in more serious literature to be able to identify the technique and craft of different authors. It will take the students to a higher level of appreciation for the work. It will also set in motion a preparedness for serious research.

Course Outcomes

CO1: Shows familiarity with vocabulary and phraseology in written English (Remembering).
CO2: Illustrates the use of the language effectively in selected essays and plays (understanding).
CO3: Develops the ability to articulate thoughts and ideas meaningfully coherently and cogently with certain lexical elegance (applying).
CO4: Tests the knowledge of the English language and composition (creating).

Module 1: Essays (25 hours)

A Room of One's Own - Virginia WoolfThe Purloined Letter - Edgar Allan Poe
The Praise of Chimney Sweepers - Charles LambThe Rocking Horse Winner - D. H. Lawrence
The Homecoming - Rabindranath TagoreThe Doll's House - Katherine Mansfield

Module 2: Language & Linguistics (15 hours)Module 3: Plays (20 hours)

Theatre of the Absurd – Martin Esslin

Suggested Readings

1. Catherine Mansfield, The Doll's House.
2. Charles Lamb, The Praise of the Chimney Sweepers.
3. D. H. Lawrence, The Rocking Horse Winner.
4. Das & Mohanty, Literary Criticism: A Reading, Oxford University Press.
5. Edgar Allan Poe, The Purloined Letter.
6. Edward Albert, A History of English Literature, Oxford University Press.

7. M. H. Abrahams, A Glossary of English Terms, Bangalore: Macmillan Publishers India.
8. Rabindranath Tagore, The Home Coming.
9. The Complete Works of Shakespeare.
10. Virginia Woolf, A Room of One's Own.
11. Wren & Martin, English Grammar and Composition.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H	M	H
CO3	H	H	H
CO4	M	H	M

PYRM402T: RESEARCH METHODOLOGY

(Credits: 2– 30 Hours)

Course Objectives

The objectives of the course in Research Methodology include an understanding of the research process and acquiring the attitudes and skills essential for research, developing skills for interpretation, documentation and presentation of results of the research, the process of report writing and publication, and basic statistics.

Course Outcomes

CO1: Identifies the various components involved in research (applying).
CO2: Outlines the basics in Statistics (understanding).
CO3: Illustrates the different steps involved in the research process (understanding).

Module 1: Introduction to Research (5 hours)

Philosophical Foundations of Research; Natural and social science research- characteristics and scientific attitude. Scope of social science research

Module 2: Research designs, approaches and types (8 hours)

Research designs: Descriptive, Exploratory and Experimental: meaning, scope, characteristics, application in a social work setting.
Research Approaches: Qualitative and Quantitative Research: meanings, scope, methods, steps, sampling, data collection, analysis, interpretation and reporting. Strengths and weaknesses.
Evaluative research: Programme and project evaluation: concept, types, steps, reports.

Module 3: Steps in Research Process (12 hours)

Problem Formulation: Identifying the research issue, formulating the research topic and problem, reviewing the literature (library work), theoretical framework, formulating objectives, clarifying concepts, and variables- conceptual and operational, and formulating hypothesis.
Population and Sampling: Inclusion and exclusion criteria of population, the logic of sampling size and techniques: probability and non-probability sampling.
Tools for data collection: Levels, Types of measurements, reliability and validity of tools. Constructing tools for data collection: questionnaire, interview schedule, scales. Quantification of qualitative data.
Sources, Collection and Analysis of Data: Secondary and primary sources. Data collection data editing, coding, master sheet, analysis, report writing. Using a computer for data analysis: coding, analysis- graphs and results.
Professional report writing

Module 4: Introduction to Statistics for Research (5 hours)

Statistics: Definition, Uses and Limitations. Classification and tabulation of data, univariate and bivariate, diagrammatic and graphic presentations. Measures of central tendencies, Mean, Median and Mode and their uses. Measures of variability range, variance and standard deviation.

Suggested Readings

1. Ram Ahuja, Research Methods, Rawat, Jaipur, 2001.
2. Alston M. Bocoles, Research in Social Workers: An Introduction to the Methods, Rawat, Jaipur, Indian edition, 2003.
3. T.L. Baker, Doing Social Research, McGraw Hill, Singapore, 1994.
4. W.J. Goode and P.K. Hatt, Methods in Social Research, McGraw Hill Singapore, 1981.

5. R. M. Grinnell (Jr.), Social Work Research and Evaluation, F.E. Peacock Pub. Inc., Illinois, 1988.
6. C.B. Gupta, Introduction to Statistical Methods, Vikas Publishing House, 1995.
7. S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, Delhi, 1997.
8. S.P. Gupta, Statistical Methods, Sultan Chand and Sons, New Delhi 1997.
9. K.K. Jacob, Methods and Fields of Social Work in India, Asia Publishing, Bombay, 1996.
10. C.R. Kothari, Research Methodology: Methods and Techniques, 2nd edition reprint, New Age International New Delhi, 2004.
11. O.R. Krishnaswamy, Methodology for Research in Social Science, Himalaya, Bombay, 1993.
12. D.K. Laldas, Practice of Social Research, Rawat, Jaipur, 2000.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1		H	H	
CO2				H
CO3			H	

PCSP400T: SOCIAL PSYCHOLOGY

(Credits: 3– 45 Hours)

Course Objectives

The course seeks to give comprehensive knowledge about the psychological ramifications that follow from the factthat a human being is a social animal. Social psychology is the study of how individual or group behaviour is influenced by the presence and behaviour of others. The major question social psychologists ponder is this: How and why are people's perceptions and actions influenced by environmental factors, such as social interaction?

Course Outcomes

CO1: Explains the psychological ramifications of human beings considered social beings (understanding)
CO2: Demonstrates the processes such as social relationships and problem behaviour (understanding)
CO3: Evaluates the role of society in the growth of a human person (evaluating)
CO4: Discusses concepts such as motivation, self-concept, attitude and conflict (creating)

Module 1: Introduction (15 hours)

Definition and History of social psychology
Theories: motivational, learning, cognitive, decision-making, interdependence, socio-cultural, evolutionary, and mid-range theories

Module 2: Social Perception (15 hours)

Self-concept: beginning, formation; self: schemas and multicultural perspectives self-presentation: false modesty, self-handicapping, impression management self-esteem: development and consequences perceiving persons: attribution logic, integration, confirmation bias

Module 3: Positive Social Relations (10 hours)

Pro-Social behaviour: origin, helping, influences (personal, interpersonal and situational), receiving help interpersonal attraction and affiliation: characteristics of the individual, others and situational influences

Module 4: Negative Social Relations (10 hours)

Perceiving Groups: stereotypes, prejudices (individual differences and reducing prejudice) Aggression: origin, influences (social and situational), forms, prevention and control

Module 5: Social Influences (10 hours)

Attitudes: formation, attitude and behaviour, attitude change
Group: formation, function (roles, status, norms and cohesiveness), productivity, groupthink, conflict and conflictresolution

Suggested Readings

1. Robert A. Baron and D. Byrne, Social Psychology, 8th ed., New Delhi: Prentice-Hall of India, 2001.
2. S. S. Brehm, and S. N. Kassin, Social Psychology, 3rd ed., Boston: Houghton Mifflin Company, 1996.
3. R. J. Crisp and R. N. Turner, Essential Social Psychology, New Delhi: Sage Publications, 2007.
4. D. G. Myers, Social Psychology, 7th ed., New York: McGraw Hill Companies, 2002.

5. S. E. Taylor, L. A. Peplau and D. O. Sears, Social Psychology, 12th ed., New Delhi: Pearson Prentice-Hall ofIndia, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	M	H	H	H	H
CO3	H	H	H	H	H
CO4	H	M	M	M	H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code		Credits
1	S E Course 1	PYMT102L	Basics in Motor Mechanics/Tailoring and Plumbing	3
2	S E Course 2	PYOA104L	Basics in Office Automation	3
3	S E Course 3	PYBE205L	Basics in Electrical and Electronics	3

PYMT102L: BASICS IN MOTOR MECHANICS/TAILORING AND PLUMBING

(Credits: 3 - 90 Hours)

Course Objectives

The course intends to offer hands-on training to the students in skills. In this skill enhancement course, the students are acquainted with two skills, namely, motor mechanics (for boys) and tailoring (for girls) and plumbing (for bothboys and girls). The students will have 45 hours of theory classes and 45 hours of practicum.

Course Outcomes

CO 1: Demonstrates basic skills in motor mechanics, tailoring and plumbing (understanding)
CO 2: Shows the basic safety practices in motor mechanics, tailoring and plumbing (understanding)
CO 3: Identifies the basic errors in motor mechanics, tailoring and plumbing (applying)
CO 4: Analyses the basic operations in motor mechanics, tailoring and plumbing (analysing)

Module 1: Basics in Motor Mechanics/Tailoring (25 hours of theory and 25 hours of practicum)

Motor Mechanics: aggregates and components of a vehicle, hand tools and special tools, workshop calculations, terms and terminologies, components of a vehicle.

Tailoring: machine classification, needle anatomy, industrial sewing machine, cleaning of the sewing machine, sewing machine motors, threads, safety tips, sewing fundamentals, exercise, stitch and seam classification, sewingand fabric defects, recognising garment parts, sewing methods and garment construction.

Module 2: Basics in Plumbing (20 hours of theory and 20 hours of practicum)

Plumbing tools, piping materials and fittings, plumbing fixtures, designing plumbing systems, preparing for plumbing system installation, installing water supply piping, installing fixtures, faucets, and appliances.

Suggested Readings

1. Automobile Repair, New Delhi: Don Bosco Tech Society.
2. Modern Plumbing (Seventh Edition), ISBN 9781605252360.
3. Sewing Machine Operator, New Delhi: Don Bosco Tech Society.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H

PYOA104L: BASICS IN OFFICE AUTOMATION

(Credits: 3 – 90 Hours)

Course Objectives

This skill enhancement course in office automation is aimed at teaching the students digital concepts as well as various other skills that they will need to succeed in the modern workplace. The course offers an added advantage to students while applying for jobs in various sectors, be they governmental or non-governmental. The students will have 45 hours of theory classes and 45 hours of practicum.

Course Outcomes

CO 1: Defines the various computer programmes that are employed for office management (remembering)
CO 2: Explains the various uses of computers in office management (understanding)
CO 3: Develops typing skills, designing and publishing using computer software (applying)
CO 4: Discusses office procedures and the various devices used in a modern office (creating)

Module 1: Computer Science and Operating System (10 hours of theory and 10 hours of practicum)
Typing Skills, Basics of Computer, Programming, Windows

Module 2: Personal Computer Software Tools (10 hours of theory and 10 hours of practicum)
MS Word, MS Excel, MS PowerPoint

Module 3: Designing and Publishing software (15 hours of theory and 15 hours of practicum)
PageMaker, Photoshop and Corel Draw

Module 4: Office Procedures and the Devices Engaged in Modern Office (10 hours of theory and 10 hours of practicum)
Photocopier, Risograph, Scanners, Laminating Machine, etc.

Suggested Readings
1. Course on Computer Concepts. Kolkata: BPB Publication.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	H
CO2	H	H	H	H
CO3	H	M	H	
CO4	M			H

PYBE205L: BASICS IN ELECTRICAL AND ELECTRONICS

(Credits: 3 – 90 Hours)

Course Objectives
The course intends to offer hands-on training to the students in skills. In this skill enhancement course, the students are acquainted with two skills, namely, electrical and electronics. The students will have 45 hours of theory classesand 45 hours of practicum.

Course Outcomes
CO 1: Demonstrates basic skills in electrical and electronics (understanding)
CO 2: Shows the basic safety practices in electrical and electronics (understanding)
CO 3: Identifies the basic errors in electrical and electronics (applying)
CO 4: Analyses the basic operations in electrical and electronics (analysing)

Module 1: Basics in Electricals (25 hours of theory and 25 hours of practicum)
Basic tools & safety: introduction to electricity, safety precautions, elementary first aid, identification of different hand tools with their specifications-care and maintenance of hand tools, ohms law, resistance electric signs & symbols
Electrical Wires: identification of various types of wires used for house wiring, motor winding in electrical appliances, their uses and sizes
Electric Accessories & Meters: common electric accessories and fixtures with their specifications installation of different types of electric meters and instruments (portable type panel/board type)function and uses of ampere meter, voltmeter, energy meter, wattmeter, megger
Protective Devices: Understanding of fuses and circuit breakers (Kit-Kat Type, H.R.C. Fuse, Cartridge Fuse, M.C.B. ELCB) earthing: the purpose of earthing, methods of earthing (plate & pipe earthing)
Complete house-wiring layout, Splitting load wire by NEC I.E.E. rules, multi-storeyed system, fault finding and troubleshooting.

Module 2: Basics in Electronics (20 hours of theory and 20 hours of practicum)
Basic technical know-how in fitting, assembling, repairing and maintaining electronic equipment such as computers, televisions, solar panels, UPS, inverters and mobiles.
Domestic Appliances: working principles and circuits of common domestic equipment and appliances: calling bell, buzzer, alarms, electric iron, heater, light. electric kettle, heater/immersion heater, hot plate, oven, geyser, cooking range, mixer, washing machine, motor pump set, etc.

Suggested Readings
1. Charles K. Alexander, Matthew N.O. Saidiku, Fundamentals of Electrical Circuits, Tata McGraw Hillcompany.
2. R.L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, 9th edition, PEI/PHI 2006.
3. R.S. Sedha, Applied Electronics, S. Chand & Co., 2006.
4. Surinder Pal Bali, Electrical Technology, Pearson Publications.
5. V.N. Mittle, Basic Electrical Engineering, Tata McGraw Hill edition, New Delhi, 1990.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H

INTERNSHIPS (Conducted after 4th Semester and evaluated in 5th Semester)

Semester	Category	Course Code	Course Name	Credits
5	Internship	PYIN303L	Teaching in Schools	2

PYIN303L: TEACHING IN SCHOOLS

Course Objectives

This course is intended to acquire practical know-how in teaching and the art of accompanying children. It provides a compelling reason to learn, teaches the skills of civic participation and develops an ethic of service and civic responsibility. It increases motivation and retention of academic skills as specific learning goals are tied to community needs. The students are expected to spend some days in schools that are assigned to them. They will be engaged in teaching and in other co-curricular activities that are beneficial to the children.

Course Outcomes

CO1: Develops familiarity with the social and economic situation of the localities where the internships are carriedout (applying).
CO2: Extends the facilities of learning and teaching techniques to lesser privileged children (understanding)
CO3: Evaluates the teaching abilities or social sensibilities of students (evaluating)
CO4: Improves the intellectual and psychological well-being of the children as well as the beneficiaries of socialwork (creating)

The students have to undergo the internship during the semester break after the 4th semester. They are expected tokeep a daily report of the activities that they carry out and the learning outcomes during the entire period of the internship. The faculty members will supervise them during this period. After completing their internship, they need to produce a certificate of completion from the headmasters or principals of the concerned schools.

The internship should be for a minimum duration of 30 hours which can be extended depending upon the convenience and requirements of the student and the school respectively. The rest of the hours are allotted for completing the Report. However, the entire duration of the course should not exceed 60 hours.

The Report must be in a spiral bind. It must be accompanied by a certificate of authentication from the headmaster/principal of the school in which the candidate underwent the internship. The Report must contain a detailed description of the activities performed, learning outcomes, feedback from the target group and Geotagged photographs.

The assessment will be based on the presentation (PPT) and Viva-Voce Examination after the completion of theinternship.

The Assessment for the internship will have the following components:

a) Report: 40 marks
b) PPT Presentation: 30 marks
c) Viva-Voce Examination: 30 marks

Mapping of COs to Syllabus

Course Outcomes	Teaching	Social Work
CO1	M	H
CO2	H	
CO3	H	
CO4	H	H

RESEARCH PROJECT/DISSERTATION

BA Philosophy (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	PYDI403P	Dissertation Based on Themes in Philosophy or Psychology	6
8	Research Project/Dissertation	PYDI406P	Comprehensive Evaluation of Dissertation and Philosophy (Viva-Voce)	6

PYDI403P: DISSERTATION BASED ON THEMES IN PHILOSOPHY OR PSYCHOLOGY
Credits: 6

Course Objectives
Dissertations are an important method of demonstrating that the students can identify a topic of concern to the field, and read, understand and incorporate the relevant literature into a new research question to be investigated. It involves active research, coming up with a question, following a defined methodology and engaging with the work of other researchers. It is a rite of passage within education and shows that the students can 'do' what they have been studying.

Course Outcomes
CO1: Develops descriptive, analytic and synthetic skills in writing (remembering).
CO2: Demonstrate a sense of originality, self-discipline and hard work (understanding)
CO3: Assumes a thorough knowledge of the subject matter under research (analysing)
CO4: Shows that the researcher can undertake independent work and, depending on the final result, move to a highstandard in terms of quality (understanding)

- One thesis, not exceeding 18,000 words, on a specialised subject during the seventh semester
- Registration for the thesis will be done during the sixth semester.
- The student selects the theme and a guide (promoter) among the faculty members in consultation with the HoD, Department of Philosophy.
- The scheme of the thesis (with a minimum of 300 words) has to be submitted for approval before thecompletion of the sixth semester.
- The scheme shall include the relevance of the theme, methodology, titles, an outline of the chapters, and a working bibliography.
- The departmental meeting shall approve the schemes of the theses in the sixth semester itself.
- The students will be allotted 180 class hours during the seventh semester for the completion of the thesis.
- The thesis shall be submitted at least one month before the end of the seventh semester.
- The thesis should be typewritten in the format prescribed by the Department of Philosophy.
- Three bound copies of the thesis are to be submitted to the office.
- The thesis will be evaluated by the respective guide (promoter). There will also be a public defence of thethesis for 30 minutes in the eighth semester.

The Assessment for the dissertation will have the following components:
a. Evaluation of the guide (promoter): 60 marks
b. Viva-Voce Examination: 40 marks

Mapping of COs to Syllabus

Course Outcomes	
CO1	H
CO2	H
CO3	H
CO4	H

PYDI406P: COMPREHENSIVE EVALUATION OF DISSERTATION AND PHILOSOPHY (VIVA-VOCE)
Credits: 6

Course Objectives
The purpose of the comprehensive evaluation is for students to demonstrate mastery of knowledge in philosophy,the subject in which they are majoring. It also gives the students opportunities to exhibit their familiarity with research. The comprehensive evaluation of dissertations and philosophical subjects consists of a viva voceexamination.

Course Outcomes
CO1: Develops systematic and critical philosophical thinking (applying)
CO2: Examines the extent of philosophical knowledge acquired during the course of study (analysing)
CO3: Evaluates the capacity of a candidate for a comprehensive understanding of things (evaluating).
CO4: Assesses the internalising capacity of the intellectual inputs (evaluating).

The students shall have a comprehensive viva voce examination at the end of the eighth semester. The students will be allotted 180 class hours for the examination. The duration of the viva voce examination will be an hour before two panels (2x2) of four examiners, which can be held in two different phases. In the first phase, the candidates will appear before the first panel, and they will be asked to present in brief the findings of the dissertationprepared in the seventh semester, and questions based on them will be asked. In the second phase, before the two-member panel, the candidates will be examined for 30 minutes on the principal courses in philosophy. This will also last for 30 minutes. Both panels will evaluate the performance of the candidates out of 100, and the average is taken for the final reckoning. The comprehensive viva voce examinations will carry a weightage of 6 credits.

Mapping of COs to Syllabus

Course Outcomes	
CO1	H
CO2	H
CO3	H
CO4	H

DEPARTMENT OF HOSPITALITY AND HOTEL ADMINISTRATION

PROGRAMME: BACHELOR OF SCIENCE in HOSPITALITY AND HOTEL ADMINISTRATION (BSC)

DEGREE: BSC HHA (HONOURS)/ BSC HHA (HONOURS) WITH RESEARCH

VISION

To develop design and deliver research-based personalized education that equips students to become global hospitality professionals. Our aim is to impart knowledge, skills and abilities to the students through the holistic approach for nurturing them as dependable human leaders. We do develop our students to interface with stakeholders and to deliver hospitality Professionals that add to the financial, intellectual, environmental, ethical, cultural and social growth of the nation

MISSION

The mission of this department is to be a leading hospitality institution imparting quality education of global excellence leading to hospitality ready professionals carrying ethical and social values.

PROGRAMME OUTCOMES (PO)

PO 1: Critical Thinking: Demonstrate professional aptitude, critical thinking, problem solving skills, and leadership skills needed for all sectors in the hospitality industry.
PO 2: Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one more foreign language.
PO 3: Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in the organizational and operational structure of hospitality industry.
PO 4: Effective Citizenship: Demonstrate awareness and understanding necessary for social concern and equity towards national development.
PO 5: Ethics: Apply ethical standards in the professional field and accept responsibility for them.
PO 6: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
PO 7: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the field of hospitality management.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1: Conceptual skills: Proficient in the core functional and support areas of hospitality sectors to plan and coordinate business related events.
PSO 2: Management skills: Manage structures and finance of the industry, as well as disaster management.
PSO 3: Problem solving skills: Develop legal awareness for handling real-life challenges of hospitality industry.
PSO 4: Entrepreneurial skills: Achieve necessary skills to become a hospitality entrepreneur.

LIST OF COURSES

1.1: Introduction to Food & Beverage service
1.2: Introduction to gastronomy & hygiene practices
1.3: **Multidisciplinary**
1.4: **Ability Enhancement**
1.5: Introduction to room division
1.6: **Common value added**
1.7: **Common value added**
1.8: **Community Engagement**
1.9: Introduction to Food & Beverage service Practical
1:10: Introduction to gastronomy & hygiene practices Practical
2.1: Restaurant Ethics & Menu planning
2.2: Culinary & Baking skills
2.3: **Multidisciplinary**
2.4: **Ability Enhancement**
2.5: Functional areas & cleaning agents
2.6**: Common value added**
2.7: **Common value added**
2.8: **Community Engagement**

2.9: Restaurant Ethics & Menu planning Practical
2.10: Culinary & Baking skills Practical
2:11: *Vocational Training* **
3.1: In room dinning & beverages
3.2: Indian Gastronomy
3.3: Room reports & surface cleaning
3.4: **Multidisciplinary**
3.5: **Ability Enhancement**
3.6: Introduction to Marketing
3.7: In room dinning & beverages Practical
3.8: Indian Gastronomy Practical
3.9: Room reports & surface cleaning Practical
4.1: Bar operation & Outlet Management
4.2: Quantity Food Production
4.3: Front Office Management
4.4: Housekeeping supervision and Budgeting
4.5: **Ability Enhancement**
4.6: Bar operation & Outlet Management Practical
4.7: Quantity Food Production Practical
4.8: Front Office Management Practical
4.9: Housekeeping supervision and Budgeting Practical
4.10: *Vocational Training* **
5.1: Restaurant Planning & Management
5.2: Garde Manger & Confectionary
5.3: Revenue Management & Budgeting
5.4: Advance Housekeeping Management
5.5: Field Project/ Apprenticeship
5.6: Restaurant Planning & Management Practical
5.7: Garde Manger & Confectionary Practical
5.8: Revenue Management & Budgeting Practical
5.9: Advance Housekeeping Management Practical
6.1: Training & Development – Food & Beverage service
6.2: Training & Development – Gastronomy
6.3: Training & Development – Room divisions
6.4: Training report presentation
6.5: Eco – Gastronomy – North East Indian regions
6.6: Eco – Gastronomy – North East Indian regions Practical

4 YEAR UG Degree (Honours)

7.1: Modern Trends in Gastronomy – I / Modern Trends in Front Office –I
7.2: Modern Trends in Food & Beverage service –I / Modern Trends in Housekeeping – I
7.3: Basics of Tourism
7.4: Research Methodology
7.5: Project Phase –I / Dissertation Phase – I
7.6: Modern Trends in Gastronomy – I Practical / Modern Trends in Front Office –I Practical
7.7: Modern Trends in Food & Beverage service –I Practical / Modern Trends in Housekeeping – I Practical
8.1: Modern Trends in Gastronomy – II / Modern Trends in Front Office –II
8.2: Modern Trends in Food & Beverage service –II / Modern Trends in Housekeeping – II
8.3: Organizational Behaviour
8.4: Project Phase –II / Dissertation Phase – II
8.5: Modern Trends in Gastronomy – II Practical / Modern Trends in Front Office –II Practical
8.6: Modern Trends in Food & Beverage service –II Practical / Modern Trends in Housekeeping – II Practical

4 YEAR UG Degree (Research)

7.1: Research Methodology
7.2: Dissertation Phase – I
8.1: Dissertation Phase – II

Note: ** These courses are only applicable if the student opts out from the program after 1st, 2nd or 3rd year.

MAPPING of COURSES to PO/PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
1.1	L						M		M		
1.2	L			M				M			
1.3											
1.4											
1.5			M		L			M			
1.6											
1.7											
1.8											
1.9							M		L	M	
1.10				M						M	
2.1		L			M				M		
2.2	M							M			
2.3											
2.4											
2.5			L		M				M		
2.6											
2.7											
2.8											
2.9	M								M		
2.10	M										M
2.11**				L			M				M
3.1	M		L							M	
3.2	L				M			M			
3.3			M					M			
3.4											
3.5											
3.6			M					M			
3.7		L		M					M		
3.8					M				M		
3.9			M				L		M		
4.1	L				M					M	
4.2							M				M
4.3		L	M					M			
4.4						M	L		M		
4.5											
4.6		L					M				M
4.7							M				M
4.8		M				L					M
4.9			L				M				M
4.10**				L			M				M
5.1	L		M							M	
5.2	L						M	M			
5.3	L				M					M	
5.4			L				M		M		
5.5	L					M	H	L		M	
5.6	M							L	M		
5.7							M	L		M	
5.8				L	M				M	L	
5.9			L		M				M		
6.1	L		M				H	L		M	H
6.2	L		M				H	L		M	H
6.3	L		M				H	L	M		H

6.4	L				M		H	M			
6.5			L	M				M			
6.6				M				L		M	

4 YEAR UG Degree (Honours)

7.1	L					M	H		L		M
	L				M	M	H		L		M
7.2			M			M	H		M		
					L	M	H			M	
7.3			L		M			M			
7.4	L				M			L		M	
7.5	L				M		H		M		
7.6	L						M	M			H
			L				M		M		H
7.7	L						M		M		H
			L			M					H
8.1	L					M	H		L		M
	L				M		H		L		M
8.2			M			M	H			M	
					L	M	H			M	
8.3	L		M				M		M		
8.4	L				M		H		M		
8.5	L				M		H		M		
			L				M		M		H
8.6	L						M		M		H
			L			M	H				H

4 YEAR UG Degree (Research)

7.1	L				M				M	
7.2	L		M				H	L	M	
8.1	L		M				H	L	M	H

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	HAFB100T	Introduction to food & beverage service	2
		HAFB101L	Introduction to food & beverage service Practical	2
2	Major Course 2	HARM102T	Restaurant Ethics & Menu planning	2
		HARM103L	Restaurant Ethics & Menu planning Practical	2
3	Major Course 3	HADB200T	In room dinning & beverages	2
		HADB201L	In room dinning & beverages Practical	2
3	Major Course 4	HAIG202T	Indian Gastronomy	2
		HAIG203L	Indian Gastronomy Practical	2
4	Major Course 5	HABO204T	Bar operation & outlet management	3
		HABO205L	Bar operation & outlet management Practical	2
4	Major Course 6	HAQF206T	Quantity food production	3
		HAQF207L	Quantity food production Practical	2
4	Major Course 7	HAFO208T	Front office management	2
		HAFO209L	Front office management Practical	2
5	Major Course 8	HARP300T	Restaurant planning & management	3
		HARP301L	Restaurant planning & management Practical	2
5	Major Course 9	HAGC302T	Garde manger & confectionary	3
		HAGC303L	Garde manger & confectionary Practical	2
5	Major Course 10	HARB304T	Revenue management & Budgeting	2
		HARB305L	Revenue management & Budgeting Practical	2
6	Major Course 11	HAPR306L	Training & Development (Food and Beverage)	4
6	Major Course 12	HALB307L	Training & Development (Gastronomy)	4
6	Major Course 13	HAIT308L	Training & Development (Room Division)	4
6	Major Course 14	HAPR309P	Training Report Presentation	4
7	Major Course 15	HAGT400T	Modern trends in gastronomy - I	3
		HAGT401L	Modern trends in gastronomy - I Practical	2
			OR	
		HAFO402T	Modern trends in Front office - I	3
		HAFO403L	Modern trends in Front office - I Practical	2
7	Major Course 16	HAFS404T	Modern trends in Food & beverage service – I	3
		HAFS405L	Modern trends in Food & beverage service – I Practical	2
			OR	
		HAHK406T	Modern trends in Housekeeping – I	3
		HAHK407L	Modern trends in Housekeeping – I Practical	2
8	Major Course 17	HAGY408T	Modern trends in gastronomy - II	3
		HAGY409L	Modern trends in gastronomy - II Practical	2
			OR	
		HAFR410T	Modern trends in Front office - II	3
		HAFR411L	Modern trends in Front office - II Practical	2
8	Major Course 18	HABS412T	Modern trends in Food & beverage service – II	3
		HABS413T	Modern trends in Food & beverage service – II Practical	2
			OR	
		HAHG414T	Modern trends in Housekeeping – II	3
		HAHG415T	Modern trends in Housekeeping – II Practical	2

HAFB100T: INTRODUCTION TO FOOD & BEVERAGE SERVICE

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s)

The objective of the course is to learn the basic knowledge about the departmental structures and outlets in the food & beverage service sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the Food and Beverage Industry and Service Areas. (Understand)
CO 2: Identify and demonstrate types and usage of food and beverage service equipments (Knowledge)
CO 3: Analyze types of Attributes required becoming a Food and Beverage Service Personnel. (Analyze)
CO 4: Develop, understand and demonstrate the different types of menus provided by different food outlets and their service techniques. (Create)

Module I: THE HOTEL & CATERING INDUSTRY (07 hours)

a. Introduction to the Hotel Industry and Growth of the hotel Industry in India
b. Role of catering establishment in the travel/tourism industry
c. Types of F&B operations (Types of different F&B Outlets)
d. Classification of Commercial, Residential/Non-residential
e. Welfare Catering - Industrial/Institutional/Transport such as air, road, rail, sea, etc.
f. Structure of the catering industry - a brief description of each

Module II: DEPARTMENTAL ORGANIZATION & STAFFING (08 Hours)

a. Organization of F&B department of the hotel
b. The principal staff of various types of F&B operations
c. French terms related to F&B staff
d. Duties & responsibilities of F&B staff
e. Attributes of a waiter
f. Inter-departmental relationships (Within F&B and other departments)

Module III: FOOD SERVICE OUTLETS & ANCILLARY DEPARTMENTS (8 hours)

a. Specialty Restaurants
b. Coffee Shop
c. Cafeteria
d. Fast Food (Quick Service Restaurants)
e. Grill Room
f. Banquets
g. Bar
h. Vending Machines
i. Discotheque
j. Pantry
k. Food pick-up area
l. Store
m. Linen room
n. Kitchen stewarding

Module IV: F & B SERVICE EQUIPMENTS (06 Hours)

a. Familiarization & Selection factors of - Cutlery - Crockery - Glassware - Flatware – Hollowware- All other equipment used in F&B Service
b. French terms related to the above

Suggested Readings

1. Lillicrap Dennis R., Food & Beverage Service, Hodder Arnold Publication, 2006.
2. Singaravelavan R. Food & Beverage Services, Oxford Publications, 2011
3. Dhawan, Vijay, Food & Beverage Service - Franc Brothers, 2009.
4. Walker R. John, The Restaurant (From Concept to Operation), Wiley, 2013

Mapping of Cos to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2			M	H
CO 3	L	H		
CO 4				H

HAFB101L: INTRODUCTION TO FOOD & BEVERAGE SERVICE PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):
The objective of the course is to learn the table layouts and identifications of basic tools and hygiene practices required in food & beverage service sector.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Discuss the principles of basic hygiene practices and body language in the department (Understand)
CO 2: Identify the process of laying tables arranging things in order. (Knowledge)
CO 3: Analyze & demonstrate service of water and serving plates (Analyze)
CO 4: Analyze & explain care and maintenance procedures of different equipment (Analyze)
CO 5: Develop & familiarize with different tools of F&B service. (Create)

Practical:
1. Hygiene and Etiquettes in Restaurant
2. Mis- En –Place and Mis- En –Scene activities
3. Identification of F&B Tools, types of equipment, Cutlery, Crockery, Glass & Chinaware, Flatware, Hollowware, Table Appointments, Linen, etc
4. Care and Maintenance of various Tools, a type of equipment, Flatware, Hollow wares.
5. Side board Organization and its importance
6. Laying & Relaying of Table.
7. Rules for Laying Cover, Various types of Napkin folds
8. Importance of Body Language and Dinning etiquettes.
9. Carrying a Salver/Tray, Plates, Glasses & other types of equipment
10. Service of Water
11. Handling the Service Gear
12. Clearing an Ashtray, and precautions to be taken care of for handling operation.

Mapping of Cos to Syllabus

CO'S	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	H							M				
CO 2		H				H						
CO 3										H	M	
CO 4				H			M		M			
CO 5			H									M

HARM102T: RESTAURENT ETHICS & MENU PLANNING

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):
The objective of the course is to learn different types of menu's & controlling procedures required in food & beverage service sector.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Explain the different types of breakfast and other meals and their service techniques (Understand)
CO 2: Identify and demonstrate the different types of menus provided by different food outlets. (Knowledge)
CO 3: Analyze and understand the different aspects of control methods used in food and beverage departments (Analyze)
CO 4: Analyze & classify the different types of Cigars and cigarettes. (Analyze)
CO 5: Develop & illustrate customer care and situation handling (Create)

Module I: TYPES OF MEALS & MENU (7 hours)
a. Breakfast-Introduction, Types, Service Methods,
b. Brunch, Lunch, Hi-Tea, Dinner, Supper, and others
c. Introduction to menu; Types-Ala Carte & Table D'hôte
d. Ala carte and TDH setups
e. Menu Planning, considerations, and constraints, Menu Terms
f. French Classical Menu- 11, 13, and 17 courses separately
g. Classical Foods & its Accompaniments with Cover
h. Indian regional dishes, accompaniments, and service

Module II: PREPARATION FOR SERVICE (7 hours)

a. Organizing Mise-en-scene
b. Organizing Mise en place
c. TYPES OF FOOD SERVICE – silver service, pre – plated service, Cafeteria service, room service, buffet service, gueridon service, lounge service

Module III: SEQUENCE OF SERVICE & Food & Beverage Terminology (05 hours)
a. Handling Table reservation
b. KOTs & BOTs Duplicate & Triplicate System, Computerized K.O.T's
c. The sequence of Food Service
d. Table Clearing Process
e. Billing Methods, Payment methods, and Cash

Module IV: CUSTOMER CARE AND HANDLING SITUATIONS (05 hours)
a. Unavailability of Table/reservation
b. Wrong Order Taking, Handling Unavailability of Food items
c. Handling Special Requests
d. Order Delays, Spillages, Return Food
e. Lost and found properties
f. Illness
g. Drunken Guest, Unethical appearance of Guest
h. Dealing with children and Infants
i. Handling specially able, Old age guest

Module V: TOBACCO & (06 hours)
a. History
b. Processing for cigarettes, pipe tobacco & cigars
c. Cigarettes – Types and Brand names
d. Pipe Tobacco – Types and Brand names
e. Cigars – shapes, sizes, colors, and Brand names
f. Care and Storage of cigarettes & cigars

Suggested Readings
1. Singaravelavan R. Food & Beverage Services, Oxford Publications, 2011.
2. LillicrapDennis R., Food & Beverage Service, Hodder Arnold Publication, 2006.
3. Prasad, Vara, Krishna R. Gopi, Food & Beverage: F&B Simplified, Pearson, 2013.
4. Andrioli, Sergio, Douglas, Peter, Professional Food Service, Heinemann Professional, 1990.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2	M	M		
CO 3			M	
CO 4				H
CO 5	M		H	

HARM103L: RESTAURENT ETHICS & MENU PLANNING PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):
The objective of the course is to learn different types of menu services, KOT analysis, and service of hot and cold non – alcoholic beverages.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Discuss the different types of breakfast and other meals layout and tray set up with service techniques sequence (Understand)
CO 2: Understand and demonstrate the different types of service provided in restaurants as per types of menus provided in 5-star hotels in different food outlets. (Understand)
CO 3: Identify different aspects of the control method used in restaurants (Knowledge)
CO 4: Analyze Food and beverage departments by using KOT (Analyze)
CO 5: Develop & demonstrate service of cold & hot non-alcoholic beverages. (Create)

PRACTICAL

1. Writing a Menu
2. Breakfast Table Lay-out.
3. TDH & A la Carte Cover lay-out.
4. Receiving the guests
5. Sequence of Service
6. Taking an Order of Food & Making a KO T.
7. Table Service, Practice of meet greets and repeats.
8. Clearing, Crumbing, Presenting the bill
9. Service of Cold & Hot - Non-Alcoholic Beverages, Cigar and cigarettes

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9
CO 1	L	H	M						
CO 2				L	M		M	M	M
CO 3						M			
CO 4						M			
CO 5									H

HADB200T: IN- ROOM DINNING & BEVERAGES

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s)

The objective of the course is to learn the concept of wine and beers and other fermented beverages and the service procedures for room service department.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain the operation of the room service department. (Understand)
CO 2: Understand the concepts of wine making process, viticulture wine-based beverages. (Understand)
CO 3: Identify & describe the beer production procedure and classify beer. (Knowledge)
CO 4: Analyze and classify other fermented beverages (Analyze)
CO 5: Develop suggestive selling techniques & demonstrate order taking procedure (Create)

Module I: IN-ROOM DINING SERVICE (5 hours)

a. Introduction, general principles, and types care to be taken while dealing with active and passive guest
b. The cycle of Service, scheduling, and staffing
c. Forms and Formats
d. Order Taking, Suggestive Selling, breakfast cards
e. Time management- the lead time from order taking to clearance

Module II: ALCOHOLIC & NON-ALCOHOLIC BEVERAGES (10 Hours)

a. Definition & Classification of Alcoholic Beverages
b. Introduction to fermented beverages
c. Classification (Nourishing, Stimulating and Refreshing beverages)
d. Tea - Origin & Manufacture - Types & Brands
e. Coffee - Origin & Manufacture - Types & Brands
f. Juices and Soft Drinks
g. Cocoa & Malted Beverages - Origin & Manufacture

Module III: BEERS (05 hours)

a. Introductions to beer
b. A brief introduction to Beer Production
c. Types and Brands – Indian and International

Module IV: WINE (05 Hours)

a. Introduction,
b. Grapes (Varieties) viticulture vinification,
c. Classification,
d. Wine making, Storage, Brand Names.

Module V: AROMATIZED BEVERAGES & SAKE (08 Hours)

a. Definition, Types- Wine based & spirit-based
b. Usage and storage
c. Introduction, definition, manufacturing, Storage & Brands of SAKE

Suggested Readings

1. Singaravelavan R. Food & Beverage Services, Oxford Publications, 2011.
2. Jana A & Srivastava P. United Colors of Alcohol, TRIDENT, 2015.
3. Albert W.A. Schmid & Laloganes John P. The Beverage Manager's Guide to Wines, Beers, and Spirits, Pearson. 2011.

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2				H	M
CO 3		M	H		
CO 4		M		M	M
CO 5	H				

COURSE CODE: IN – ROOM DINNING & BEVERAGES PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn the concept of arranging buffet setups & demonstration of preparing and serving beverages and cold, carved meats & salads.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain the application and able to prepare Flambé Dishes (Understand)
CO 2: Identify and apply the concepts of Banquet Service and Bar Setup operations (Knowledge)
CO 3: Analyze & demonstrate beverage services (Analyze)
CO 4: Create & execute buffet setups (Create)

Practical

1. Service of Spirits
2. Service of Wine
3. Service in Guest Room
4. Preparing Function prospectus
5. Different types of buffet setup
6. Preparations of Flambé dishes, Carving, Salad
7. Preparation/Demonstration of Classic and modern Cocktail

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
CO 1						H	
CO 2				M	M		
CO 3	M	M					H
CO 4				M	H		

HAIG202T: INDIAN GASTRONOMY

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the history & cooking techniques of Indian foods and its regional variations.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain the history & Heritage of Indian Regional Gastronomy (Understand)
CO 2: Discuss the various Regional & specialty cooking in Indian Cuisines (Understand)
CO 3: Identify & explain the knowledge on Dum cooking and Tandoor Cooking (Knowledge)
CO 4: Analyze the History and cooking of Indian Sweets (Analyze)
CO 5: Develop & explain the kitchen layout and functioning of Indian kitchen organization (Create)

Module I: Basics of Indian Cuisine (6 hours)
a. Introduction to Indian cuisine
b. Masalas: classical blends, varieties and composition
c. Indian herbs and spices
d. Introduction to basic gravies of India
e. Factors affecting the varieties in Indian regional cuisine

Module II: Indian kitchen layout & Organization (04 hours)
a. Duties and responsibilities of Indian kitchen brigade
b. Different Indian kitchen layouts
c. Equipments used in Indian volume catering establishments

Module III: Regional cuisine in India (10 hours)
a. Northern India: Kashmir, Punjab, Rajasthan
b. Eastern India : Bengal, Assam, Tripura, Mizoram, Nagaland, Manipur, Arunachal Pradesh, Meghalaya
c. Western India: Gujarat, Maharashtra
d. Southern India: Tamil Nadu, Kerala, Andra Pradesh, Telangana
e. Central India: Madhya Pradesh, Uttar Pradesh, Bihar

Module IV: Gastronomic specialties and cooking in India (04 hours)
a. Indian street foods – Introduction , types
b. Festival cooking – Introduction, types, importance
c. Dum Cooking – Introduction, Origin, equipments used & classical dishes
d. Tandoor - Introduction, Origin, equipments used & classical dishes

Module V: Indian Mithai (06 hours)
a. Introduction
b. Regional variation in Indian Mithai – Ingredients, technique, types
c. Classical dishes – Names & description.

Suggested Readings:
1. Food Production Operations: Parvinder S Bali , Oxford Publication
2. Prashad Cooking With Indian Masters, J. Inder Singh Kalra .
3. A Taste Of India, Madur Jaffery, Great Britain Pavilion Books Ltd.
4. Zaike Ka Safar, Jiggs Kalra Daawat, Jiggs Kalra, New Delhi, Allied Publishers
5. The Professional Chef, Arvind Saraswat, New Delhi, Ubs Publishers

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV	Module V
CO 1	M		L		L
CO 2	M		M	L	
CO 3				M	
CO 4					H
CO 5		H			

HAIG203L: INDIAN GASTRONOMY PRACTICAL

(2 Credits – 60 hours)(L-T-P: 0-0-2)

Objective(s):
The objective of the course is to learn the various commodities & spices used in Indian food preparations and cooking skills of various forms of Indian foods.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Develop knowledge of Indian spices, pulses, sweetening agents and compose different preparations using Indian gravies (Understand)
CO 2: Identify & demonstrate the traditional home style cooking and breakfast cooking (Knowledge)
CO 3: Identify & Demonstrate fusion of traditional Indian food & street food with modern techniques (Knowledge)
CO 4: Analyze plan and organize a theme menu as in Industrial cooking (Analyze)
CO 5: Create various sweet preparations of India (Create)

Practical:

Gravies and their preparations

1. Popular breakfast preparations across India
2. Prepare Indian sweets and savories
3. Prepare varieties of Indian pickles & chutney
4. Street food in India
5. Introduction to large scale / quantity food production
6. Menu1 – Assamese cuisine
7. Menu 2- Punjabi cuisine
8. Menu 3 – Awadhi cuisine
9. Menu 4 – Bengali cuisine
10. Menu 5- Rajasthan cuisine
11. Menu 6- Kerala cuisine
12. Menu7- Maharashtra cuisine
13. Menu 8- Hyderabadi cuisine
14. Menu 9- Goa cuisine
15. Menu 10 – Tamil Nadu cuisine

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15	Exp 16
CO 1	M						M	M	M	M	M	M	M	M	M	M
CO 2		M	M													
CO 3				M	M											
CO 4						M	M	M	M	M	M	M	M	M	M	M
CO5			M													

SUGGESTED MENU:

Menu 1 (Breakfast) Kanda Poha Bedmi Puri & Alu Subji Aloo Paratha	**Menu 2 (Breakfast)** Luchi & Alu Dum Besan ka Chilla Chole Bhature	**Menu 3 (Breakfast)** Masala Uttapam Vada & Sambhar Seviyan Upma	**Menu 4 (Street Food)** Paneer Pakora Aloo tikki Chaat Pao Bhaji
Menu 5 (Street Food) Vada Pao Bhel Puri Dabeli	**Menu 6 (Street Food)** Punugulu Dhokla Jhal Muri	**Menu 7 (Basic Gravy)** Kadhai Aloo Subz Hariyali Murgh Makhani Jeera Rice	**Menu 8 (Assamese cuisine)** Xaak aru Bhaji Aloo Pitika Masor Tenga Oou Khatta
Menu 9 (Punjabi cuisine) Lassi Channa Masala Sarson ka Saag Makki Di Roti Gajar Ka Halwa	**Menu 10 (Awadhi Cuisine)** Galouti Kebab Navratna Korma Awadhi Murgh Biriyani Naan Badam Halwa	**Menu 11 (Bengali cuisine)** Piyazi Kossa mangsho Basanti Pulao Aamsotto Khejur Chutney Payesh	**Menu 12 (Rajasthan cuisine)** Mirchi Bada Dal Bati Churma Gatte ki Subji Bajra Roti Chenna Malpua
Menu 13 (Kerala cuisine) Ethaka Appam Erissery Nadan Kozhi Varuthathu Malabar Parota Palada Payassam	**Menu 14 (Maharashtra cuisine)** Koshimbir Bhareli Vangi Kholapuri Mutton Curry Masala Bhaat Shrikhand	**Menu 15 (Hyderabadi cuisine)** Hyderabadi Chicken Biriyani Mirchi ka Salan Burani Raita Double ka Meetha	**Menu 16 (Goa Cuisine)** Ros Omlete Goan fish Curry Pork Vindaloo Bibinca
Menu 17 (Tamil Nadu cuisine) Rasam Beans Proiyal Chicken Chettinadu Lemon rice Paruppu Payassam	**Menu 18 (Pickles)** Aam ka Achar Nimbu ka Mitha Achar Bharwan Mirchi Achar Imli ka achar	**Menu 19 (Mithai)** Shahi Tukra Kaju Barfi Balushahi Gulab Jamun	**Menu 20 (Tandoor)** Tandoori chicken Achari Paneer tikka Bharwan Aloo Tikka Lasuni Naan

HABO204T: BAR OPERATIONS & OUTLET MANAGEMENT

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the layout, work scenario, and various cocktails prepared in Bar's of food outlets and the concept of function catering.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand and describe the layout of functional areas (Understand)
CO 2: Identify the concepts of function catering in the hotel industry. (Knowledge)
CO 3: Understand the gueridon service origin, specialty and their preparation. (Understand)
CO 4: Analyze & Illustrate bar operations (Analyze)
CO 5: Develop and demonstrate different Cocktail preparations (Create)

Module I: PLANNING & OPERATING VARIOUS F&B OUTLET (10 hours)

a. The physical layout of functional and ancillary areas, Objective of a good layout
b. Steps in planning, Factors to be considered while planning
c. Calculating space requirement
d. Various set ups for seating
e. Planning staff requirement
f. Menu planning, Constraints of menu planning
g. Selecting and planning of heavy-duty and light equipment
h. Requirement of quantities of equipment required like crockery, Glassware, Cutlery - steel or silver, etc.
i. Planning Décor, furnishing fixtures, etc.

Module II: FUNCTION CATERING (06 Hours)

a. Banquets
b. Banquet protocol
c. Informal banquet
d. Buffets

Module III: GUERIDON SERVICE (08 hours)

a. History of gueridon
b. Definition
c. General consideration of operations
d. Advantages & Dis-advantages
e. Types of trolleys
f. Factor to create impulse, Buying – Trolley, open kitchen
g. Gueridon equipment
h. Common preparations, flambé dishes, Carving, Salad making, etc., Trolley service - Beverages, Starters, Desserts, etc.

Module IV: BAR OPERATIONS (06 Hours)

a. Types of Bars
b. Cocktail
c. Dispense
d. Area of Bar
e. Front Bar
f. Back Bar
g. Under Bar (Speed Rack, Garnish Container, Ice well, etc.)
h. Bar Stock
i. Bar Control
j. Bar Staffing
k. Opening and closing duties

Module V: COCKTAILS & MIXED DRINKS (07 hours)

a. Definition and History
b. Classification
c. Recipe, Preparation, and Service of Popular Cocktail

Suggested Readings

1. Singaravelavan R. Food & Beverage Services, Oxford Publications, 2011
2. Jana A & Srivastava P. United Colors of Alcohol, TRIDENT, 2015
3. Sudhir A. Food & Beverage Service: A Training Manual, McGraw Hill Education, Second Edition.
4. Lillicrap Dennis R., Food & Beverage Service, Hodder Arnold Publication, 2006.
5. Albert W.A. Schmid & Laloganes John P. The Beverage Manager's Guide to
6. Wines, Beers and Spirits, Pearson. 2011
7. Prasad, Vara, Krishna R. Gopi, Food & Beverage: F&B Simplified, Pearson, 2013.

Mapping of Cos to Syllabus

CO'S	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M	H			
CO 3			H		
CO 4				H	M
CO 5				M	H

HABO205L: BAR OPERATIONS & OUTLET MANAGEMENT PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn the briefing standards of hospitality sector and demonstrate the skills of serving alcoholic beverages including cocktails.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explore the set up tray and trolley lay up for room service (Understand)
CO 2: Analyze & demonstrate the knowledge for taking orders (Knowledge)
CO 3: Analyze & demonstrate service standards for serving Beer, Wines and cold & hot non-alcoholic beverages. (Analyze)
CO 4: Create & Explain the importance of conducting briefing and de-briefing. (Create)

Practical

1. Understanding Room Service Amenities, Room Service equipments
2. Room Service Tray & Trolley Lay-out.
3. Functional Layouts for room service
4. Role play: Knocking & opening the guest door, wishing the guest, placing tray, checking order, presenting the bill, greeting
5. at the exit.
6. Order taking on the telephone
7. Set-up for In Rooms.
8. Conducting Briefing/De-Briefing.
9. Taking an Order & Service of Beer, Other Fermented & Brewed Beverages.
10. Taking an order & Service of –Sparkling, Aromatized, Fortified, Still Wines. Order of service (starting with wine approval
11. from the host, wrapping the bottle with the napkin, etc.)
12. Opening different types of wine bottles. (Different types of corkscrews)
13. Use of different glasses, holding & carrying glasses
14. Set up a table with a Prepared Menu with wines.

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M	H									M	M
CO 2			M		H	M						
CO 3				M				M	L	M		
CO 4							M					L

HAQF206T: QUANTITY FOOD PRODUCTION

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the concept of bulk cookery and various types of menus associated with bulk cookery

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:
CO 1: Explain the requirement of equipments for volume feeding. (Understand)
CO 2: Discuss the concepts of bulk cooking and banqueting menus. (Understand)
CO 3: Identify & conceptualize all aspects regarding the institutional and industrial catering (Identify)
CO 4: Analyze, evaluate, analyze and interpret theoretical and practical skills of usage of different commodities in the kitchen (Analyze)
CO 5: Develop & explain the quantity purchase system. (Create)

Module I: QUANTITY FOOD PRODUCTION EQUIPMENTS (08 hours)
a. Equipment required for mass/volume feeding
b. Heating and cooling equipment
c. Care and maintenance of equipment
d. Modern developments in equipment manufacture

Module II: MENU PLANNING (10 Hours)
a. Basic principles of menu planning-recapitulation
b. Points to consider in menu planning for various volume feeding outlets such as Industrial, Institutional, Mobile Catering Units
c. Planning menus for School/ College students, Industrial workers, Hospitals, Outdoor parties, Theme dinners, Transport facilities, cruise lines, airlines, railway
d. Nutritional factors

Module III: INDENTING (08 hours)
a. Principles of Indenting for volume feeding
b. Portion sizes of carious items for different types of volume feeding
c. Modifying recipes for indenting for large scale catering

Module IV: PLANNING (08 Hours)
Principles of planning for quantity food production concerning Space allocation, Equipment selection, and Staffing

Module V: VOLUME FEEDING (10 Hours)
a. Institutional and industrial Catering
b. Hospital Catering,
c. Highlights of Hospital Catering for patients, staff, visitors Diet menus, and nutritional requirements
d. Off-Premises Catering, Problems associated with off-premises catering
e. Reasons for growth and development Menu Planning and Theme Parties
f. Concept of a Central Production Unit
g. Mobile Catering
h. Characteristics of Rail, Airline (Flight Kitchens and Sea Catering)
i. Quantity Purchase & Storage Introduction to the purchasing system

Suggested Readings
1. P. S. Bali, Quantity Food Production Operations and Indian Cuisine, Oxford University Press, New Delhi, 2012
2. Kinton & Cessarani, Theory of Catering, ELBS, 2012
3. P. S. Bali, International Cuisine and Food Production Management, Oxford University Press, New Delhi, 2012
4. Librairie Larousse Gastronomique: The World's Greatest Culinary Encyclopedia, Clarkson Potter, 2009

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M	M			M
CO 3					M
CO 4			M	L	
CO 5					M

HAQF207L: QUANTITY FOOD PRODUCTION PRACTICAL
(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate various forms of bulk cooking and planning of menu's where bulk cooking is essential.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain & demonstrate the preparation of different menus. (Understand)
CO 2: Identify the quantity required for volume cooking (Knowledge)
CO 3: Analyze the Ability to describe and handle the food outlet (Analyze)
CO 4: Develop & apply the practical knowledge for planning an elaborate Menu's (Create)

Practical

To formulate/demonstrate 15 sets of menus as volume cooking with demo situations handling procedure.

SUGGESTED MENU:

Exp 1 (continental) Cream of Mushroom Baked potatoes nuggets Meat ball casserole Herb Pilaf	**Exp 2 (continental)** Sprout & cherry tomato salad Golden crevettes frites Steamed greens in mustard sauce Soft cheese buns	**Exp 3 (continental)** Roasted Mushroom & corn salad Pan fried fish cakes Veg stroganoff Herb Rice	**Exp 4 (continental)** Pumpkin & Garlic soup Zucchini fritters Steamed chicken in garlic sauce Spaghetti Aglio – olio
Exp 5 (continental) Spicy Corn salad Buffalo chicken wings Penne Alfredo Date crepes with fruit compote	**Exp 6 (continental)** Macaroni Bell pepper salad Veg croquettes Chicken piccata with bread sauce Cream & Nut Pudding	**Exp 7 (continental)** Chicken pasta salad Cheese balls Spaghetti Arrabiatta Lemon cheesecake	**Exp 8 (continental)** Apple and Pear salad Crispy chicken popcorn Eggplant Parmigiana Fruit Parfait
Exp 9 (Indian) Kachumber salad Methi Corn Bhajia Chicken tikka Masala Butter Naan	**Exp 10 (Indian)** Aloo Bonda Kadhai Paneer Jeera Rice Malpua	**Exp 11 (Indian)** Mutter cheese Tikki Gobhi Adraki Dal Hariyali Dhania Pulao	**Exp 12 (Indian)** Masala Channa Chaat Dalcha Gosht Achari Aloo Kulcha Kalakand Halwa
Exp 13 (Healthy diet) Mint Jaggery Sherbet Oats Tikki Aloe Vera Subji Beetroot Paratha	**Exp 14 (Healthy diet)** Cucumber & coconut Gazpacho Steamed chicken Spinach & kidney beans crepes Oats Ladoo	**Exp 15(Chinese)** Kimchi Salad Gobhi Manchurian Sichuan Fish Veg fried rice	**Exp 16(Chinese)** Chili cucumber salad Spring rolls Hot garlic chicken Lemon coriander fried rice

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15
CO 1	M	M					M			M		M			
CO 2			H					H	M		M				
CO 3				M									M		
CO 4					H	M								M	M

HAFO208T: FRONT OFFICE MANAGEMENT

(2 Credit – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the property management system and front desk operations along with the responsibilities of night auditor.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain and describe the entire property management system and the importance of computer in front office. (Understand)
CO 2: Identify and apply the entire check-in and check-out procedure of guest. (Knowledge)
CO 3: Analyze the process of settling bills of the guests, accounting procedures, handling front office cash and foreign exchange. (Analyze)
CO 4: Develop and analyze the idea about the night auditing and the job responsibilities of the night auditor. (Create)

Module I: PROPERTY MANAGEMENT SYSTEM (08 hours)

a. Importance of Computer in Front Office
b. Introduction to PMS
c. PMS application in Front Office (Reservation, Front Desk, Room, Cashier, Night Audit, set up, Reporting, back-office Module)
d. Different PMS systems

Module II: CHECK-IN AND CHECK-OUT PROCEDURE (12 Hours)

a. Check-in Procedure in different situations like: - guest having confirmed reservation, Walk-in Guest, Group/crew, Scanty Baggage Guest, International Travelers, Club floor guest
b. Check out activity at various desks: - Bell Desk, lobby, Reception, Cashier
c. Different Methods of Settlement: -Cash, Credit Card, Cheques, Travel's cheques, Bill to company, Combined settlement method, checking of mini bar and taking of guest feedback.
d. Check out options: - On Desk Express Check out, Self-Check out
e. Forms & Formats

Module III: MANAGING CASH & CREDIT (08 Hours)

a. Front office Accounting Cycle
b. Credit control process in various cases: - guest pay by Credit Card, Travel agent voucher, airline, Scanty baggage, Credit control during the stay, credit facility to companies, check-in tour group. Problems may arise in credit control
c. The process required in cash Control
d. Handling Foreign Exchange

Module IV: NIGHT AUDITING (08 Hours)

a. Importance of Night Auditing,
b. Duties & Responsibility of Night Auditor
c. Common Revenue Centers of a Hotel
d. Basis steps involved in preparing Night Audit: - Complete posting, reconcile room status discrepancies, verify room rates, verify no show reservations, Cash Deposit, Clear & Back up the system, Distribute report
e. Vouchers/Folios/Ledgers/Allowances/Reports

Suggested Readings

1. S.K Bhatnagar, Front Office Management, Frank Bros. & Co. 2011
2. James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
3. Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011
4. Raymond S Schmidgall, Hospitality Industry Managerial accounting, AHLA, 2006
5. Michael Kasavana and Cahell, Managing computers in hospitality industry, AHLA, 1996

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2		H	M	
CO 3			H	M
CO 4				H

HAFO209L: FRONT OFFICE MANAGEMENT PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate various forms and formats required to maintain in front desk.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: CO 1. Explain & take part in the check-in and check-out process and the application of PMS in the process. (Understand)
CO 2: CO 2. Identify the role of GRA, Bell boy, Cashier, Concierge (Knowledge)
CO 3: CO 3. Analyze to handle and compile different forms and formats of the department (Analyze)

PRACTICAL

1. Preparing & filling up Registration cards during Check-in,
2. Handling Check in – walk-in, confirmed reservation, group
3. Handling Check out – BTC, combined settlement method, cheque, card, cash
4. Role play of bell desk

5. Front office cashiering practices and night audit practice
6. Role play of concierge
7. Filling various vouchers, folios, handling allowances,
8. Foreign Currency exchange

Mapping of COs to the syllabus

	Exp I	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8
CO 1	H	H	H					
CO 2		L	L	H	H	H		H
CO 3	M	M	M	M	M	M	H	

HARP300T: RESTAURENT PLANNING & MANAGEMENT

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn & demonstrate various forms and formats required to maintain in front desk .

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss in-depth understanding of planning and operating a restaurant. (Understand)
CO 2: Identify the different concepts of catering operations. (Knowledge)
CO 3: Understand menu management and material management. (Understand)
CO 4: Analyze & illustrate inventory control. (Analyze)
CO 5: Develop the budget of the department. (Create)

Module I: RESTAURANT PLANNING (10 hours)

a. The physical layout of functional & ancillary areas
b. Objectives of a good layout,
c. Steps in planning
d. Factors to be considered while planning, calculating space requirements
e. Various set-ups for sitting,
f. Planning staff requirements,
g. Menu planning
h. Selection of equipment, lighting, fixtures, crockery, cutlery, etc.

Module II: MENU MANAGEMENT (08 Hours)

a. Introduction, Types of Menus, Menu Planning Considerations & Constraints
b. Menu Costing and Pricing
c. Menu Merchandising, Menu Engineering
d. Menu Fatigue, Menu as an In-House Marketing Tool.

Module III: MATERIALS MANAGEMENT (04 Hours)

a. Introduction, Necessity & Function and Techniques
b. Classification and Technology used in materials management.

Module IV: INVENTORY & BUDGETARY CONTROL (14 hours)

a. Importance, objectives, methods, levels & technique
b. Perpetual inventory, monthly inventory, pricing of commodity, comparison of physical and perpetual inventory
c. Introduction, Objective
d. Budgetary Control Process, Stages in the preparation of Budgets
e. Budgeting for F&B Operations,
f. Variance Analysis.

Suggested Readings

1. J Fuller & D Kirk, Kitchen Planning and Management, Butterworth- Heinemann, 1991
2. Davis B, Lockwood A, Stone S, Butterworth-Heinemann. Food & Beverage Management, Elsevier, 2012.
3. Cousins J, Foskett, D, Gillespie C. Food and Beverage Management, Pearson Education India, 2006
4. Varghese B. Food & Beverage Service Management, Macmillan India Limited, 2009.

Mapping of Cos to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H	M		M

CO 2	M	M	H	
CO 3		H		
CO 4				H
CO 5				H

HARP301L: RESTAURENT PLANNING & MANAGEMENT PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn how to prepare duty roasters, layouts of different types of food outlets and Managerial skills to manage them.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the layout plan for different food outlets. (Understand)
CO 2: Identify & analyze staff requirements and make a duty roaster for implementation. (Knowledge)
CO 3: Analyze & explain and demonstrate operations of the restaurant, bar, and special events (Analyze)
CO 4: Develop the skills to familiarize with different cocktails and preparation methods. (Create)

Practical

1. F&B Staff Organization-Class Room Exercise (Case Study method)
2. Developing Organization Structure of various Food & Beverage Outlets
3. Determination of Staff requirements in all categories
4. Making Duty Roster
5. Preparing Job Description & Specification
6. Conducting Briefing & Debriefing
7. Restaurant, Bar, Banquets & Special Events
8. Drafting Standard Operating Systems (SOPs) for various F & B Outlets
9. Supervising Food & Beverage operations
10. Preparing Restaurant Log
11. Designing & setting the bar
12. Preparation & Service of Cocktail & Mixed Drinks

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1		H						M				
CO 2	M		M	H	M							
CO 3							M		M	M		
CO 4						M					L	M

HAGC302T: GARDE MANGER & CONFECTIONARY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn different layout and procedures require maintaining the standards in garde Manger and confectionary sections of commercial kitchens.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the layout and use of equipment in the larder section of the kitchen. (Understand)
CO 2: Understand the preparation of charcuterie. (Understand)
CO 3: Identify, compare and translate between appetizer and garnishes (Knowledge)
CO 4: Analyze the basic icing and topping terms with special reference to patisserie (Analyze)
CO 5: Develop & illustrate different sandwiches with making and storing methods (Create)

Module I: LARDER & CHARCUTIERIE (06 hours)

a. Layout & equipment
b. Terms & larder control
c. Duties and responsibilities of the larder chef
d. Sausages & forcemeats
e. Brines, cures & marinades

f. Ham, bacon & gammon
g. Galantines & pate

Module II: APPETIZERS & GARNISHES (08 hours)
a. Classification of Appetizers
b. Examples of Appetizers
c. The historic importance of culinary Garnishes
d. Explanation of different Garnishes

Module III: SANDWICHES (08 Hours)
a. Parts of Sandwiches
b. Types of Bread
c. Types of filling – classification
d. Spreads and Garnishes
e. Types of Sandwiches
f. Making of Sandwiches
g. Storing of Sandwiches

Module IV: CAKE (06 Hours)
Introduction, types of bases, flavors, garnishes, tools and equipment & commodities

Module V: ICINGS & TOPPINGS (04 hours)
Varieties of icing, Using of Icings Difference between icings & Toppings

Suggested Readings
1. Le Rol A. Polsom, The Professional Chef (4th Edition), Wiley & Sons, 2011
2. M J Leto & W K h Bode, Larder Chef, Butterworth- Heinemann, 2006
3. Kinton & Cessarani, Theory of Catering, ELBS, 2012
4. Y. Ashok Kumar, Textbook of bakery and confectionary, PHI, 2012
5. W. Gisslen, Professional Baking, John Wiley & Sons, 2009
6. L J Hanneman, Patisserie, Routledge, 2005

Mapping of Cos to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M		M		
CO 3		H			
CO4				H	H
CO5			H		

HAGC303L: GARDE MANGER & CONFECTIONARY PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):
The objective of the course is to learn & demonstrate various preparations of garde manger and confectionaries.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Demonstrate various types of sandwiches, sausages, forcemeats (Understand)
CO 2: Identify & relate different desserts (Knowledge)
CO 3: Analyze, explain and demonstrate the different bakery & confectionary-making procedures with the temperature required. (Analyze)
CO 4: Create various types of appetizers of various cuisines. (Create)

Practical
1. Various preparations of sandwiches
2. Various preparations of sausages
3. Various preparations of forcemeats
4. Various preparations of desserts from world cuisine.
5. Different varieties of Bread
6. Different varieties of Chocolate,
7. Different varieties of Meringues,

8. Different varieties of Frozen Dessert.
9. Various preparations of Appetizers – Indian cuisine
10. Various preparations of Appetizers – French cuisine
11. Various preparations of Appetizers – Italian cuisine
12. Various preparations of Appetizers – Chinese cuisine

SUGGESTED MENU:

Exp 1 (sandwiches) BLT Chicken Club Cheese Potato Grilled Pinwheel sandwich Ribbon sandwich	**Exp 2(Sausages)** Breakfast sausages Cajun Sausages Hot Italian sausages	**Exp 3 (Forcemeats)** Chicken & bellpapper roulade Chicken & Spinach terrine Prawn & garlic Pate'	**Exp 4 (Desserts)** Tiramisu Crepe Allemande Chocolate Mousse Lamingtons
Exp 5 (Breads) Focaccia Lavash Soda Bread Pita	**Exp 6(Chocolates)** Chocolate Sandesh Chocolate Marzipan Choco cashew Pudding	**Exp 7 (Meringues)** Pavlova Meringue cookies Macaroons	**Exp 8 (Frozen desserts)** Strawberry Sorbet Orange Sherbet Mango yoghurt
Exp 9 (Appetizers –Indian) Paneer Potli Mirchi Vada Chicken 65 Dahi Vada	**Exp 10 (Appetizers -French)** Salade Lyonnais Souffle Au Fromage Tapenade canape' Paillassons de courgettes	**Exp 11 (Appetizers - Italian)** Caprese salad Grilled veg Bruchetta Stuffed Dates Whipped ricotta	**Exp 12 (Appetizers - Chinese)** Egg Drop Soup Cong You Bing Baozi Cantonese spring rolls

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M	M	M									
CO 2				M								
CO 3					M	M	M	M				
CO 4									M	M	M	M

HARB304T: REVENUE MANAGEMENT & BUDGETING

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the yield management and the concept of room revenue used in the front desk sectors of hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the Yield Management, its concept, rates, and different booking horizons and Statistical representations. (Understand)

CO 2: Identify the budgeting and forecasting and to analyze room revenue. (Knowledge)

CO 3: Create & describe and implement role plays of guest complaint handling. (Create)

Module I: YIELD/REVENUE MANAGEMENT (09 hours)

a. Yield in hotel industry
b. Methods of measuring hotel performance/yield
c. Elements and benefits of yield management
d. Challenges in Yield management
e. Yield management strategies
f. Measuring Yield

Module II: FORECASTING (07 Hours)

a. Concept of forecasting
b. Benefits of forecasting
c. Data/ records required for forecasting room availability

Module III: BUDGETING (07 hours)

a. Types of budget & budget cycle
b. Making front-office budget

c. Factors affecting budget planning
d. Capital & operations budget for front office
e. Refining budgets, budgetary control
f. Forecasting room revenue

Module IV: GUEST COMPLAINT HANDLING / PROBLEM SOLVING (07 hours)
a. Types of complain
b. Process, thumb rules
c. Common complaints / problems
d. Situation handling

Suggested Readings
1. Colin Dix &Chirs Baird, Front office operations, Pearson, 2006.
2. James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
3. Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011
4. Raymond S Schmidgall, Hospitality Industry Managerial accounting, AHLA, 2006
5. Michael Kasavana and Cahell, Managing computers in hospitality industry, AHLA, 1996

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	L	H	H	
CO 3				H

HARB305L: REVENUE MANAGEMENT & BUDGETING PRACTICAL

(2 credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):
The objective of the course is to learn & demonstrate different SOP's and files and formats regarding memberships, budgets & guest complains required in front desk of hospitality sector.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Explain the techniques of room up selling, enrollment in loyalty membership programs and maintain guest history (Understand)
CO 2: Identify & handle guest complain and different situations in front office. (Knowledge)
CO 3: Analyze & Construct operating budget, calculate staff requirements and allocate duties accordingly. (Analyze)
CO 4: Develop & implement all the SOP's of front office and list about different countries and their capitals, currency, flags chart etc. (Create)

PRACTICAL
1. Up selling of Rooms
2. Enrollment in loyalty membership programs
3. Role play on handling guest complain
4. Handling of inebriated guest, guest with special care, guest involved in inappropriate activity
5. Role of telephone operator in different situation
6. Maintaining guest history
7. Capitals, currencies, airlines and flags chart
8. Preparing operating budget for front office operation
9. Calculating staff requirement
10. Preparing duty rota's
11. Evaluation of SOP's

Mapping of COs to Syllabus

	Exp I	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11
CO 1	H	H									
CO 2			H	H	H	H					
CO 3								H	H	H	
CO 4	L	M	L	L	M		H				H

HAPR306T: TRAINING & DEVELOPMENT: FOOD & BEVERAGE SERVICE

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s):
The objective of the course is to learn the importance and future prospects of industrial exposure training in food & beverage service sector of hospitality.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Discuss the basics of training in Food & Beverage service (Understand)
CO 2: Analyze the skills development through training (knowledge)
CO 3: Develop & identify the future prospectus through training & development in Food & Beverage service (Create)

Module – I: Introduction to Training (10 hours)
a. Importance & objective of training in food & beverage service
b. Benefits, Future prospectus of training in food & beverage service
c. Areas to cover: room dinning, banquets, bar, etc.

Module – II: Types of Trainings (10 hours)
a. Orientation
b. In House
c. Mentorship
d. External training

Module – III: Challenges & Opportunities (10 hours)
a. Challenges: Initial phase of training
b. Opportunities: After the completion of training
c. Case studies of at least 4 renowned successful professionals from Food & Beverage service

Module – IV: Development (10 hours)
a. Initial vs. After training
b. Enhancement of : skills, communication, confidence, motivation
c. Balance between theoretical & practical knowledge
d. Company culture's: knowledge, do's and don't
e. Team work : Importance, efficiency, flexibility
f. Entrepreneurship skills

Module – V: Experience (12 hours)
a. Talent through training
b. Problem solving ability
c. Safety & security
d. Types of clients & behaviour

Suggested Readings
1. Debra F. Cannon, Catherine M. Gustafson, Training & development for the hospitality Industry, Amer Hotel and Motel Association, 2002.
2. Iwan Dietschi, Mastering Hospitality, IWAN DIETSCHI, 2021.

Mapping of CO's with syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2		H			
CO3			H	H	H

HALB307L: TRAINING & DEVELOPMENT: GASTRONOMY

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s):
The objective of the course is to learn the importance and future prospects of industrial exposure training in gastronomy sector of hospitality.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Discuss the basics of training in gastronomy (Understand)

CO 2: Analyze the skills development through training (knowledge)
CO 3: Develop & identify the future prospectus through training & development in gastronomy (Create)

Module – I: Introduction to Training (10 hours)
a. Importance & objective of training in gastronomy
b. Benefits, Future prospectus of training in gastronomy
c. Areas to cover: different sections in the commercial kitchens

Module – II: Types of Trainings (10 hours)
a. Cutting skills
b. Cooking skills
c. Re chauffe cooking
d. Hygiene & Sanitation

Module – III: Challenges & Opportunities (10 hours)
a. Challenges: Initial phase of training in commercial kitchen
b. Opportunities: After the completion of training
c. Case studies of at least 4 renowned successful professionals from gastronomy

Module – IV: Development (10 hours)
a. Initial vs. After training
b. Enhancement of : skills, communication, confidence, motivation, patience
c. Balance between theoretical & practical knowledge of gastronomy
d. Kitchen culture's: knowledge, do's and don't
e. Team work : Importance, efficiency, flexibility
f. Entrepreneurship skills

Module – V: Experience (10 hours)
a. Talent through training
b. Problem solving ability
c. Safety & security
d. Types of clients & behaviour
e. Improvement in Cooking
f. Knowledge of cuisines

Suggested Readings
1. Debra F. Cannon, Catherine M. Gustafson, Training & development for the hospitality Industry, Amer Hotel and Motel Association, 2002.
2. Iwan Dietschi, Mastering Hospitality, IWAN DIETSCHI, 2021.

Mapping of CO's with syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2		H			
CO3			H	H	H

HAIT308L: TRAINING & DEVELOPMENT: ROOM DIVISION

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective(s):
The objective of the course is to learn the importance and future prospects of industrial exposure training in the room divisions sector of hospitality.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Discuss the basics of training in room division (Understand)
CO 2: Analyze the skills development through training (knowledge)
CO 3: Develop & identify the future prospectus through training & development in room divisions (Create)

Module – I: Introduction to Training (05 hours)
a. Importance & objective of training in room divisions
b. Benefits, Future prospectus of training in room divisions
c. Areas to cover: public areas, front desk, cleaning agents, etc.

Module – II: Types of Trainings (08 hours)
a. Orientation
b. In House
c. Mentorship
d. External training

Module – III: Challenges & Opportunities (07 hours)
a. Challenges: Initial phase of training
b. Opportunities: After the completion of training
c. Case studies of at least 4 renowned successful professionals from room division

Module – IV: Development (08 hours)
a. Initial vs. After training
b. Enhancement of : skills, communication, confidence, motivation
c. Balance between theoretical & practical knowledge
d. Organizations culture's: knowledge, do's and don't
e. Team work : Importance, efficiency, flexibility

Module – V: Experience (08 hours)
a. Talent through training
b. Problem solving ability
c. Safety & security
d. Types of clients & behaviour

Suggested Readings
1. Debra F. Cannon, Catherine M. Gustafson, Training & development for the hospitality Industry, Amer Hotel and Motel Association, 2002.
2. Iwan Dietschi, Mastering Hospitality, IWAN DIETSCHI, 2021.

Mapping of CO's with syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2		H			
CO3			H	H	H

HAPR306L: TRAINING REPORT PRESENTATION

(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective(s):
The objective of the course is to prepare the training report which was learned during Industrial exposure training and also completes the log book.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Understand and analysis to the practical experience and actual working environment for developing their skills and capabilities, as well as enhancing their intellectual and emotional persona. (Understand)
CO 2: Identify & integrate classroom theory with workplace practice. (Knowledge)
CO 3: Analyze & gain an understanding of administrative functions and company culture. (Analyze)
CO 4: Develop skills to demonstrate various activities of all the core departments. (Create)

Module I - TRAINING EXPOSURE SUMMERY (50 hours)
The 22 weeks of industrial training would be divided by the hotel for the four key areas of Food Production, Food and Beverage Service, Accommodation Operation, and Front Office Operations and student has to collect information's which will be needed to them during compiling of the training report.

Module 2 - TRAINING REPORT (40 hours)
a. During the training report the students has to complete the training report which will includes the details of the training organization, there USP, facilities of the various department.
b. The outcome and experience they gain from the training .

Module 3 - LOG BOOK (30 hours)
During the training the student has to duly sign the log book from the departmental authorities as a proof of there experience and learning skills from the specific department.

Mapping of Cos to Syllabus

	Module I	Module 2	Module 3
CO 1	H	H	M
CO 2	M	M	H
CO 3	M	L	L
CO4	H	M	M

HAGT400T: MODERN TRENDS IN GASTRONOMY – I

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the modern advancement in the gastronomy sector and the benefits of research & development.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss and describe various global cuisines and modern aspects on gastronomy. (Understand)
CO 2: Identify and learn the benefits of gastronomic tourism (Knowledge)
CO 3: Analyze the concept of production management and its importance (Analyze)
CO 4: Develop skills and illustrate the research & product development in gastronomy and other modern trends (Create)

Module I: Global cuisine (14 hours)

a. Introduction – Italian, French, Mexican, Moroccan, Lebanese, Chinese, Thai, Japanese, Mediterranean.
b. Ingredients used, cooking techniques and specialty
c. International recipe and there description
d. Importance of global cuisine & ingredients – Health & sustainability

Module II: Ancient Grains & Super foods (06 hours)

a. Introduction – Ancient grains
b. Types , description, cooking techniques – Ancient grains
c. Health benefits from ancient grains
d. Introduction – Super foods
e. Types , description, cooking techniques – Super foods
f. Health benefits from Super foods

Module III: Gastronomic Tourism (8 hours)

a. Introduction, history & features
b. Types & categories
c. Benefits of gastronomic tourism
d. Gastronomic tourism – Designing
e. New trends in Gastronomic tourism

Module IV: Production Management (5 hours)

a. Kitchen organization
b. Allocation of Work Job Description, Duty Roasters
c. Production Planning, Production Scheduling
d. Production Quality & Quantity Control
e. Forecasting Budgeting, Yield Management

Module V: Research & Product development (06 hours)

a. Testing new equipment - Commercial and small equipments used in kitchen
b. Developing new recipes – Impact of modern trends, Themes, location, clients etc.
c. Food Trails – based on costing, nutritional value, calorie count, portion sizes

Suggested Readings

1. Jeremy Macveigh, International cuisine, 2008
2. Parvinder Singh Bali, International cuisine and Food production management, 2012
3. Robert D Saik, Food 5.0: How we feed the future, 2019
4. Saurabh kumar Dixit, The routledge handbook of gastronomic tourism, 2021
5. Anne Murcott, Warren Belasco, Peter Jackson, The handbook of food research, 2013
6. Satya J. Rustogi, Global Food Production, 2019

Mapping of Cos to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2			H		
CO 3				H	
CO4			M	M	H

HAGT401L: MODERN TRENDS IN GASTRONOMY – I PRACTICAL

(2 Credits – 60 hours) (L-T-P:0-0-2)

Objective(s):

The objective of the course is to prepare & demonstrate the global cuisines and preparations which are on the basis of innovations and research.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Demonstrate menus from global cuisine (Understand)
CO 2: Identify & demonstrate recipes from ancient grains (Knowledge)
CO 3: Identify & demonstrate recipes from super foods (Analyze)
CO 4: Develop the skills through innovations and research in gastronomy and create recipes (Create)

Practical

Expt. 1: Various preparations from – Italian cuisine
Expt. 2: Various preparation from – French cuisine
Expt. 3: Various preparation from – Mexican cuisine
Expt. 4: Various preparation from – Moroccan cuisine
Expt. 5: Various preparation from – Lebanese cuisine
Expt. 6: Various preparations from – Chinese cuisine
Expt. 7: Various preparations from – Thai cuisine
Expt. 8: Various preparations from – Japanese cuisine
Expt. 9: Various preparations from – Mediterranean cuisine
Expt. 10: Various preparations from – Ancient grains
Expt. 11: Various preparations from – Ancient grains
Expt. 12: various preparations from – Super foods
Expt. 13: Various preparations from – Super foods
Expt. 14: Various preparations based on innovations and research
Expt. 15: Various preparations based on innovations and research
Expt. 16: Various preparations based on innovations and research

SUGGESTED MENU:

Exp 1 (Italian cuisine) Caprese salad Minestrone Milanese Spaghetti Carbonara Mango & coconut Pannacotta	**Exp 2(French cuisine)** French onion soup Coq au vin Ratatouille Baguette	**Exp 3 (Mexican cuisine)** Avocado salad Grilled veg Quesadilla Chilli corn carne Mexican rice	**Exp 4 (Moroccan cuisine)** Harira Makouda Kefta tagine Mint tea
Exp 5 (Lebanese cuisine) Kibbeh Falafel Fattoush Basbousa	**Exp 6 (Chinese cuisine)** Cantonese chicken soup Mushroom Pepper & Salt Mapo Tofu Veg Hakka Noodles	**Exp 7 (Thai cuisine)** Som tom salad Tom Yam soup Chicken Massaman curry Pad thai	**Exp 8 (Japanese cuisine)** Veg Tempura Tamagoyaki Karaage Yakisoba
Exp 9 (Mediterranean cuisine) Greek Salad Shakshuka Moussaka Pita bread	**Exp 10 (Ancient grains)** Crispy millet fritters Wild rice & mushroom soup Mexican amaranth Stew Quinoa & date brownies	**Exp 11 (Ancient grains)** Millet walnut salad Quinoa veg soup Chicken & kamut casserole Wild rice pudding	**Exp 12 (Super foods)** Grilled peach & papaya salad, Couscous meatball soup, Steamed salmon with broccoli, Blueberry banana pancake
Exp 13 (Super foods) Roasted veggies & millet salad Tomato barley soup Grilled salmon with honey	**Exp 14 (Innovations & research)** Menu & Recipes based on innovations and research	**Exp 15 (Innovations & research)** Menu & Recipes based on innovations and research	**Exp 16 (Innovations & research)** Menu & Recipes based on innovations and research

ginger sauce Yogurt Parfait	done by students in gastronomy	done by students in gastronomy	done by students in gastronomy

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M	M	M									
CO 2				M								
CO 3					M	M	M	M				
CO 4									M	M	M	M

OR

HAFO402T: MODERN TRENDS IN FRONT OFFICE – I

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the green practices and modern technologies used for the better services in the modern era of front desk procedures and data's for record keeping

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the quality of service as per their expectation with the help of various modern tools. (Understand)
CO 2: Explain the various technologies which have added to the modern techniques of Front Office functions. (Knowledge)
CO 3: Illustrate and examine the new concepts of vacation and accommodation ownerships. (Analyze)
CO 4: Identify the various implementations of green practices in Front Office (Create)

Module I: QUALITY SERVICE IN FRONT OFFICE (12 hours)

a. Lodging as a guest service business, developing a quality culture
b. Role of Manager in quality, determining guest service expectation,
c. Planning guest service process – recognizing basic concerns
d. Determining and delivering guest service expectations
e. EGQ and NPS
f. Recording Feedback
g. Post Departure Guest Relation

Module II: DIGITALIZATION (06 Hours)

a. Specialized mobile apps
b. AI and Hotel Chat boats
c. Self-check-in Desk Technology

Module III: TIMESHARE & VACATION OWNERSHIP (10 Hours)

a. Definition and types of timeshare options
b. Difficulties faced in marketing timeshare business
c. Advantages & disadvantages of timeshare business
d. Exchange companies -Resort Condominium International, Intervals International
e. How to improve the timeshare / referral/condominium concept in India- Government's role/industry role

Module IV: MODERN ACCOMODATION CONCEPTS (06 Hours)

a. Benefits of Modern accommodation concepts
b. Examples of new conceptual hotels -Smart Hotels, Bunker Hotels, Tree House, Zostel, Under water Hotels, Glass Hotels etc.

Module V: GREEN PRACTICES (06 Hours)

a. Implementation of 3 R's (Reduce, Reuse, Recycle)
b. Eco-Bells
c. Contactless Check-in
d. No paper policy

Suggested Readings

1. Adam harris, Richard Castle, Kristy Espat and more.,More Reservations, happier guest: The ultimate guide for the Modern

hotelier,Cloudbeds, 2022
2. Kelly A. McGuire, Hotel Pricing in a Social World: Driving Value in the Digital Economy, Wiley,2015
3. James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
4. Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011
5. Ashok Aima, Vinay Chauhan, Jaya Bhasin, Contempory Trends in Tourism and Hospitality Managemenr, Primus Books, 2013

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L			
CO 2		H			
CO 3			H	H	
CO 4					H

HAFO403L: MODERN TRENDS IN FRONT OFFICE – I (PRACTICAL)

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the modern procedures of working environment of a digitally equipped front desk area of an hospitality sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Apply techniques of self-check-in & check-out procedures and express check-in & check-out procedure. (Understand)
CO 2: Demonstrate handling of various situations like bomb threats and suicide threats. (Knowledge)
CO 3: Analyze guest feedback and ensuring guest satisfaction with the use of technology.(Analyze)
CO 4: Evaluate post departure procedures and credit limit criteria. (Create)

PRACTICAL

1. Self-Check-in Procedure
2. Express check-in procedure
3. Self-Check-out Procedure
4. Express check-out procedure
5. Role play on handling bomb threat
6. Role play on handling suicide threat
7. Record online guest feedback and utilization of it in future
8. Ensuring Guest Satisfaction with the help of technology
9. Post departure procedure
10. Monitoring guest credit limits

Mapping of COs to Syllabus

	Exp I	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	H	H	H						
CO 2					H	H				
CO 3							H	H	L	L
CO 4	L	L					M	M	H	H

HAFS404T: MODERN TRENDS IN FOOD & BEVERAGE SERVICE –I

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the modern advancements and concepts introduced in the food & beverage service the hospitality sector

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the modern concepts of service area and their implementations (Understand)
CO 2: Identify new concepts of outlets and tourism through beverages in global scenario (Knowledge)
CO 3: Analyze different aspects of digitalization in service sector (Analyze)
CO 4: Develop the skills and illustrate the benefits & modern aspects through sustainability in beverage sector (Create)

Module I: Beverage Pre Mix (6 hours)
a. Definition, classification, Importance
b. Uses and benefits
c. Popular brands – Name, country of origin, description

Module II: Modern theme outlets (8 hours)
a. Types & classifications
b. Utilization of space
c. Lighting effects & design consideration
d. Advantages & utilization of various entertainment facilities

Module III: Beverage Tourism (9 hours)
a. Types & categories
b. Benefits of beverage tourism
c. New trends in beverage tourism

Module IV: Digitalization in Food & Beverage service (9 hours)
a. Impact of digitalization on service Industry
b. E – commerce
c. Latest trends and techniques of digital advancements in service industry

Module V: Sustainability in Food & Beverage services (9 hours)
a. Sustainable packaging & its importance
b. Energy efficient equipments
c. Food waste & recycling
d. Sustainable CSR practices

Suggested Readings
1. Saamia Bukhani Restaurant refined: Exploring trends in the restaurant industry, 2020
2. Sally Everett, Food & drink tourism: Principles and Practice, 2016
3. Mariam Garcia Martinez, Open innovation in the Food & Beverage Industry, 2013
4. Gabriela Ionescu, Sustainable Food & Beverage Industries: Assessments and Methodologies, 2021
5. Mehmet Sarioglan, New trends in Food & Beverage Enterprises & Production management, 2022

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	M	M			
CO 2		H	H		
CO 3				H	
CO 4					H

HAFS405L: MODERN TRENDS IN FOOD & BEVERAGE SERVICE - I PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):
The objective of the course is to demonstrate the newly developed products and concepts which are the USP of modern food & beverage service sector of hospitality.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Demonstrate the beverage pre mix for making cocktails and Mocktails. (Understand)
CO 2: Identify & analyze the layout plan for different modern food outlets for implementation. (Knowledge)
CO 3: Analyze, explain and demonstrate digitalization in beverage sector (Analyze)
CO 4: Develop the skills to familiarize with different concepts of sustainability & digitalization in beverage sector (Create)

Practical
Expt. 1: F&B Staff Organization-Class Room Exercise (Case Study method)
Expt. 2: Developing Organization Structure of various modern Food & Beverage Outlets
Expt. 3: Develop modern concepts for beverage tourism
Expt. 4: Create demo iternary for beverage tourism
Expt. 5: Preparing Job Description & Specification for modern F&B outlets
Expt. 6: Conducting Briefing & Debriefing

Expt. 7: Restaurant, Bar, Banquets & Special Events
Expt. 8: Drafting Standard Operating Systems (SOPs) for various modern F & B Outlets
Expt. 9: Supervising Food & Beverage operations in various modern F&B outlets
Expt. 10: Preparing concepts for digital supports and benefits from social media
Expt. 11: Designing & drafting Standard Operating Systems (SOPs) for sustainable movement in beverage sector
Expt. 12: Preparation & Service of Cocktail & Mixed Drinks based on pre mix.

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1												H
CO 2	H	H			H	M	L	H	M			
CO 3				M		H				M		
CO 4			H	H			M				M	

OR

HAHK406T: MODERN TRENDS IN HOUSEKEEPING – I
(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):
The objective of the course is to learn the new developments and technological advancements in housekeeping sector of hospitality

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Describe the importance of eco friendly products and practices (Knowledge)
CO 2: Identify the modern trends of hospitality housekeeping (Understand)
CO 3: Illustrate software usage in housekeeping (Apply)
CO 4: Advertise the different modern day housekeeping practices (Analyze)

Module I – Eco Practices in Housekeeping (07 hours)
a. Introduction
b. Types of eco friendly practices
c. Importance of eco friendly practices
d. Sustainable cleaning products

Module II – Hygiene & Sanitation (07 hours)
a. Modern theory of hygiene & sanitation in guest rooms and public areas
b. Importance of hygiene & sanitation
c. International standards
d. Modern equipments used for hygiene & sanitation

Module III – Eco friendly amenities & products (08 hours)
a. Energy conservation products
b. Ozone treatment
c. Toiletries
d. Eco friendly chemicals
e. Recyclable amenities

Module IV – Modern Technologies in Housekeeping (07 hours)
a. IT amenities
b. Uses of latest software in housekeeping
c. Forecasting GRA requirement
d. Modified intercom telephone systems
e. Daily housekeeping scheduling

Module V – Case Study (07 hours)
a. Case study 1
b. Case study 2
c. Case study 3

Suggested Readings:

1. Mayola Fernandes, Modern practices Implemented in Housekeeping by 5 – star hotels, 2020
2. Pralay Ganguli, Housekeeping management in hotel & service Industry, 2019
3. Ellen Sandbeck, Green Housekeeping, 2008.

Mapping of CO's to syllabus

	MODULE I	MODULE II	MODULE III	MODULE IV	MODULE V
CO 1	H	M	H		
CO 2	L	L	H	H	
CO 3				H	
CO 4	L		H	M	H

HAHK407L: MODERN TRENDS IN HOUSEKEEPING – I PRACTICAL

(2 Credits: 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the newly developed products and concepts which are the USP of modern housekeeping sector of hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Recognize different modern items and chemicals used in housekeeping (Knowledge)
CO 2: Discuss the effective cleaning and sanitation of guest rooms (Understand)
CO 3: Demonstrate cleaning process of guest rooms (Apply)
CO 4: Classify the uses of software in housekeeping (Analyze)

Practical

1. Familiarising eco friendly items of housekeeping
2. Introduction to eco friendly amenities
3. Introduction to housekeeping software
4. Introduction to hygiene & sanitation agents
5. Handling of chemicals
6. Deep cleaning of model guestrooms using chemicals
7. Surface cleaning
8. Duty roster making
9. Demonstration of room amenity replenishment
10. Identification of health hazards

Mapping of CO's to syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp10
CO 1	H	H		M	L					L
CO 2					L	H	H			
CO 3						H	M			L
CO 4			H					M		

HAGY408T: MODERN TRENDS IN GASTRONOMY –II

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the new offbeat cuisines of India and importance of media and opportunities in Entrepreneurships in modern gastronomic sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the concept and idea of new Indian cuisines and new developments in food industry (Understand)
CO 2: Identify the factors which leads to sustainability (Knowledge)
CO 3: Analyze the importance of media in food industry (Analyze)
CO 4: Develop your skills and illustrate the importance and challenges in food entrepreneurships. (Create)

Module I: Offbeat cuisines of India (10 hours)

a. A detailed study on – Uttarakhandi, Kathiawadi, Parsi , Mappila, Adivasi, Melenadu & Konkani cuisine
b. Traditional preparation methods

c. Utensils and accompaniments

Module II: Modern trends & developments (09 hours)
a. Lab grown meats
b. Plant based dairy products
c. Super foods
d. Micro greens
e. Edible flowers
f. Immune boosting foods
g. Meal kits
h. Seaweed consumption
i. Micro dose

Module III: Sustainability in gastronomy (08 hours)
a. Sustainability – Definition, importance, impacts on environment
b. Sustainable food cycle
c. Sustainable food cultivation & climate change- crops, livestock, marine
d. Role of NGO's, government and non government sector in sustainable food movements

Module IV: Media Importance in Gastronomy (09 hours)
a. Types of media benefits the gastronomy
b. Role of social media in gastronomy
c. Food photography
d. Food advertising
e. Food styling

Module V: Food entrepreneurship (08 hours)
a. Opportunities and challenges in food entrepreneurship
b. Food business opportunities in India
c. Research and development in food business

Suggested Readings
1. RDN Frye, Amanda, Barbara Scheule, Introductory Food, 2019
2. Signe Rousseau, Food and social media, 2012
3. Valentina Marinescu, Food nutririton and media, 2021
4. Paul collinson, Food and sustainability in the twenty –first century, 2019
5. Paola De Barnardi, Danny Azucar, Innovations in food ecosystems: Entrepreneurship for a sustainable future, 2019

Mapping of CO's to syllabus

	MODULE I	MODULE II	MODULE III	MODULE IV	MODULE V
CO 1	H	H			
CO 2			H		
CO 3				H	
CO 4					H

HAGY409L: MODERN TRENDS IN GASTRONOMY – II PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):
The objective of the course is to demonstrate & learn the offbeat cuisines of India and newly developed concepts of gastronomy which supports sustainability and modern trends.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Demonstrate menus from offbeat cuisine of India (Understand)
CO 2: Identify & demonstrate recipes based on modern trends in gastronomy (Knowledge)
CO 3: Identify & demonstrate menu's which supports sustainability in gastronomy (Analyze)
CO 4: Develop the skills through innovations and research in gastronomy and create demo entrepreneurship ideas (Create)

Practical
Expt. 1: Various preparations from – Uttarakhand cuisine
Expt. 2: Various preparation from – Kathiawadi cuisine

Expt. 3: Various preparation from – Parsi cuisine
Expt. 4: Various preparation from – Mappila cuisine
Expt. 5: Various preparation from – Adivasi cuisine
Expt. 6: Various preparations from – Melenadu cuisine
Expt. 7: Various preparations from – Konkani cuisine
Expt. 8: Various preparations from – Micro greens
Expt. 9: Various preparations from – edible flowers
Expt. 10: Various preparations from – Immune boosting foods
Expt. 11: Various preparations from – Seaweeds
Expt. 12: Various preparations from – Plant based dairy
Expt. 13: Various preparations from – sustainable food menu
Expt. 14: Various preparations from – sustainable food menu
Expt. 15: Demo entrepreneurship ideas – Based on gastronomy
Expt. 16: Demo entrepreneurship ideas – Based on gastronomy

SUGGESTED MENU:

Exp 1 (Uttarakhand cuisine) Aloo gutuk Phannu Kumaoni Raita Arsa	**Exp 2(Kathiawadi cuisine)** Ringan no oro Lasaniya bateta Methi thepla Adadiya pak	**Exp 3 (Parsi cuisine)** Chicken farcha Dhansak Patra ni machli Berry pulao	**Exp 4 (Mappila cuisine)** Unnakkaya Fish surkha masala Parottas Thalassary biriyani
Exp 5 (Adivasi cuisine) Dhuska Shukti Jhor Dubki tiyan Bothal bhaat	**Exp 6 (Melenadu cuisine)** Mango Rasam Carrot kosambari Pandi curry Akki roti	**Exp 7 (Konkani cuisine)** Sol kadhi Bombil fry Bharli vangi Caldine veg curry	**Exp 8 (Micro greens)** Spring salad Broccoli micro green soup Micro green pesto sandwich Lemon – garlic pasta with arugula
Exp 9 (Edible flowers) Edible flower Gazpacho Rose jam & strawberry Bruchetta Edible flower canapé Squash blossoms with goat cheese	**Exp 10 (Immune boosting foods)** Chicken & turmeric soup Lentil stuffed sweet potatoes Pumpkin & broccoli curry Coconut rice	**Exp 11 (Seaweeds)** Seaweed salad with sesame dressing Grilled chicken with seaweed butter Tofu & seaweed stir fry Seaweed risotto	**Exp 12 (Plant based dairy)** Strawberry & coconut milk shake Hot garlicky tofu Savory soy milk crepes Almond milk pudding
Exp 13 (Sustainable food menu) Fish head & coconut root soup Leftover lentil croquettes Crispy chicken skin stew Candied lemon peel flavored rice	**Exp 14 (Sustainable food menu)** Cucumber peel pickles Sweet potato & carrot peel Pakora Bottle gourd peel chutney Bitter gourd peel Puri	**Exp 15 (Entrepreneurship ideas)** Students should develop their skills on food entrepreneurship in theory classes and come up with innovative recipes which can be used for revenue generation	**Exp 16 (Entrepreneurship ideas)** Students should develop their skills on food entrepreneurship in theory classes and come up with innovative recipes which can be used for revenue generation

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M	M	M									
CO 2				M								
CO 3					M	M	M	M				
CO 4									M	M	M	M

OR

HAFR410T: MODERN TRENDS IN FRONT OFFICE – II
(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):
The objective of the course is to learn the modern rules, licenses & green certifications of newly developed concepts of front desk and hospitality sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Analyze the concept of home stay and find out about the licenses and rules and regulations to be followed in India. (Understand)

CO 2: Explain the various new technologies in reference to concierge of front office. (Knowledge)

CO 3: Summarize the various certifications which can be obtained for green practices in hotel industry and analyze the SOP's adopted towards safety and security of guest. (Analyze)

CO 4: Discuss various case studies on modern trends in front office and determine its implications and impact on hotel industry. (Create)

Module I: HOMESTAY (06 hours)

a. Concept of Homestay
b. Classification of Homestay
c. Homestay licenses, rules & Regulations in India

Module II: HIGH-TECH CONCIERGE TECHNOLOGY (06 Hours)

a. Virtual Tour
b. AI in Concierge
c. Examples of Hi-tech Concierge Technologies adopted by hotels worldwide

Module III: INTERNATIONAL CERTIFICATION OF GREEN PRACTICES (08 Hours)

a. Eco-leaf rating
b. Green Globe
c. Green Key
d. Nordic Swan rating
e. LEEDS

Module IV: MODERN SAFETY AND SECURITY IN FRONT OFFICE (08 Hours)

a. Modern Equipment used in Front Office
b. Key handling/ Safe Deposit
c. SOP of handling suspicious guest
d. SOP of handling single lady traveler
e. Change of SOP for guest handling post Covid-19

Module V: CASE STUDY (08 Hours)

Case Studies on various examples in relation to Front Office Trends

Suggested Readings

1. Adam harris, Richard Castle, Kristy Espat and more.,More Reservations, happier guest: The ultimate guide for the Modern hotelier,Cloudbeds, 2022
2. Kelly A. McGuire, Hotel Pricing in a Social World: Driving Value in the Digital Economy, Wiley,2015
3. James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
4. Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011
5. Ashok Aima, Vinay Chauhan, Jaya Bhasin, Contempory Trends in Tourism and Hospitality Management, Primus Books, 2013

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H		L		
CO 2		H			
CO 3			H	H	M
CO 4					H

HAFR411L: MODERN TRENDS IN FRONT OFFICE – II (PRACTICAL)

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the modern standard procedures and uses of virtual orientation in the field of front desk area and hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain the concept of virtual orientation of hotel and its facilities as well as orientation of the city. (Understand)
CO 2: Model itinerary of guest. (Knowledge)
CO 3: Apply SOP's of hygiene & sanitation and other standards procedures in front office as per requirements and analyze the applications of modern apps in various procedures. (Analyze)
CO 4: Create unique experience for guest together with construction of forms and formats. (Create)

PRACTICAL

Expt. 1: Virtual Orientation of Hotel
Expt. 2: Virtual Orientation of city in which the hotel is situated
Expt. 3: Digital itinerary creation
Expt. 4: Post Covid-19 hygiene & sanitation in front office
Expt. 5: Application of modern apps and features in front office like voice technology etc
Expt. 6: Flexible check-in and check-out procedure
Expt. 7: Providing unique experience/wow experience
Expt. 8: Dealing with fake currencies
Expt. 9: Updated forms and formats
Expt. 10: Role play

Mapping of COs to Syllabus

	Exp I	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	H								M
CO 2			H							
CO 3				H	H	H		M		M
CO 4				L	L	L	H		H	

HABS412T: MODERN TRENDS IN FOOD & BEVERAGE SERVICE –II

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the modern advancements in beverage outlets and new trending concepts of beverages.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the concepts of modern advancements in beverage outlets and trends (Understand)
CO 2: Identify & analyze the marketing strategies in beverage sector (Knowledge)
CO 3: Analyze and develop skills on modern trends in cocktails and Mocktails (Analyze)
CO 4: Develop the skills and illustrate the entrepreneurship options in beverage sector (Create)

Module I: Innovation's in Beverage sector & outlets (08 hours)

a. Robotics service innovation
b. Companion beverage bars
c. Advance beverage productions
d. Artificial Intelligence

Module II: Modern trends & developments in beverages (07 hours)

a. Herbal & Botanical flavours in beverages
b. Sober trend – Low and non alcoholic drinks
c. Functional drinks
d. Alternative spirits
e. Fermented beverages & teas

Module III: Marketing strategies in Food & Beverage (08 hours)

a. Customer loyalty programs
b. Digital presence in social media
c. Paid media promotions
d. Search engine optimization

Module IV: Modern cocktail & Mocktail trends (08 hours)

a. Canned cocktails & Mocktails
b. Throw back cocktails
c. Two spirit cocktails
d. Modern garnish techniques

Module V: Beverage entrepreneurship (07 hours)
a. Opportunities and challenges in beverage entrepreneurship
b. Beverage business opportunities in India
c. Research and development in beverage business

Suggested Readings
1. Sally Everett, Food & drink tourism: Principles and Practice, 2016
2. Mariam Garcia Martinez, Open innovation in the Food & Beverage Industry, 2013
3. Douglas Raggio, Start a Food & Beverage business, 2022

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			
CO 2			H		
CO 3				H	
CO 4					H

HABS413L: MODERN TRENDS IN FOOD & BEVERAGE SERVICE - II PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):
The objective of the course is to demonstrate the modern advancements in beverage outlets and new trending concepts of beverages.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Demonstrate the beverages based on modern trends. (Understand)
CO 2: Identify & analyze the developments happening in beverage sector and demonstrate. (Knowledge)
CO 3: Analyze & demonstrate modern trends in cocktails & Mocktails (Analyze)
CO 4: Develop the skills to familiarize with different concepts of sustainable garnishes used for Cocktails and Mocktails (Create)

Practical
Expt. 1: Demonstrate herbal & botanical flavored beverages
Expt. 2: Demonstrate zero and non-alcoholic drinks
Expt. 3: Demonstrate functional drinks
Expt. 4: Demonstrate fermented beverages
Expt. 5: Demonstrate various preparations of tea
Expt. 6: Demonstrate throw back cocktails
Expt. 7: Demonstrate two spirit cocktails
Expt. 8: Demonstrate sustainable garnishes
Expt. 9: Demonstrate zero waste Mocktails
Expt. 10: Demonstrate Immune booster Mocktails
Expt. 11: Demonstrate fruit slushies

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11
CO 1	H	M	M	M	M	M	M		M	M	M
CO 2	M	H		H	H						
CO 3			H			H	H		H	H	H
CO 4								H			

OR

COURSE CODE: MODERN TRENDS IN HOUSEKEEPING – II

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):
The objective of the course is to learn the modern advancements in rooms division and new trending concepts of rooms and the management skills.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Describe the importance of employee training (Knowledge)
CO 2: Identify the modern trends of hospitality housekeeping (Understand)
CO 3: Point out software utility in housekeeping (Analyze)
CO 4: Reframe the outsourcing process (Analyze)

Module I – Training & Motivation (08 hours)
a. Training methods
b. Disease and infection control
c. Covid sanitation training
d. Fire safety training and drills

Module II – Modern laundry operations (05 hours)
a. Eco friendly chemicals
b. Optimization of laundry settings
c. Outsourcing laundry practices
d. Water treatment
e. Recycling water

Module III – Safety & Security (08 hours)
a. Modern technologies for security
b. Uses of AI for guest security
c. Usage of IP cameras for face tracking
d. Modern guest security practices
e. International standards

Module IV – Outsourcing Services (08 hours)
a. Importance
b. Different outsourcing services
c. Cost efficiency
d. Outsourced employment

Module V – Case Study (06 hours)
a. Case study 1
b. Case study 2
c. Case study 3

Suggested Readings:
1. Raghubalan. G, Hotel housekeeping Operations & Management 3rd Edition, Oxford University Press, 2015
2. Bhatnagar, S.K., Front Office Management, Frank Bros. & Co. Ltd, 2013
3. Kappa, Margret, Nitschke, Aleta, Managing House Keeping Operation, AHLA, 1997
4. Ganguly, Pralay, Housekeeping Management in Hotel & Service Industry, Dreamtech, 2019

Mapping of CO's to syllabus

	MODULE I	MODULE II	MODULE III	MODULE IV	MODULE V
CO 1	H				
CO 2	L	M	H	M	
CO 3			H		M
CO 4				H	

HAHG415L: MODERN TRENDS IN HOUSEKEEPING – II PRACTICAL
(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):
The objective of the course is to demonstrate the modern advancements in room divisions and new trending concepts of rooms and forms & formats.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:
CO 1: Label training and other activity drills in housekeeping (Knowledge)
CO 2: Demonstrate modern laundry cleaning techniques and processes (Understand)
CO 3: Classify different software used in housekeeping department (Analyze)
CO 4: Construct different forms and formats (Create)

Practical
Expt. 1: Introduction to types of training and motivation process
Expt. 2: Fire safety training drills
Expt. 3: Introduction to modern laundry chemicals and items
Expt. 4: Cleaning of soiled linen using modern laundering techniques
Expt. 5: Removing stains from dirty linen
Expt. 6: Introduction to safety and security in hotels
Expt. 7: Software handling
Expt. 8: Outsourced employees duty roster making
Expt. 9: Forms and formats
Expt. 10: Laundry forms

Mapping of CO's to syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp10
CO 1	H	H		L	M					
CO 2			H	M						L
CO 3						L	H		L	
CO 4								H	H	M

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	HAGH104T	Basics of Gastronomy & Hygiene Practices	2
		HAGH105L	Basics of Gastronomy & Hygiene Practices Practical	2
2	Minor Course 2	HACB106T	Culinary & Baking skills	2
		HACB107L	Culinary & Baking skills Practical	2
3	Minor Course 3	HARS210T	Room reports & surface cleaning	2
		HARS211L	Room reports & surface cleaning Practical	2
4	Minor Course 4	HASB212T	Housekeeping supervision & budgeting	2
		HASB213L	Housekeeping supervision & budgeting Practical	2
5	Minor Course 5	HAHM310T	Advanced housekeeping management	2
		HAHN311L	Advanced housekeeping management Practical	2
6	Minor Course 6	HANE3012T	Eco-Gastronomy: North East Indian regions	2
		HANE3013L	Eco-Gastronomy: North East Indian regions	4
7	Minor Course 7	HABT408T	Basics of Tourism	3
7	Minor Course 8	HARM409T	Research Methodology	2
8	Minor Course 9	HAOB410T	Organizational Behaviour	3

HAGH104T: BASICS OF GASTRONOMY & HYGIENE PRACTICES

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the basic and introductory knowledge of gastronomy sector of hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the hygiene and skills required in workplace**.** (Understand)
CO 2: Identify and analyze basic food commodities and their preparations (Knowledge)
CO 3: Analyze the basic knowledge of baking and breads. (Analyze)
CO 4: Demonstrate the safety procedures in handling kitchen equipment's (Create)
CO 5: Develop the operation flow of the food production department (Create)

Module I: INTRODUCTION TO GASTRONOMY & HIERARCHY (08 hours)

a. Attitudes, behavior & personal hygiene in the kitchen
b. Uniforms & protective clothing
c. Aims and objectives of cooking food
d. Various textures & consistencies
e. Classical & Modern Brigade
f. Duties and responsibilities of various chefs

Module II: METHODS OF COOKING FOOD (05 hours)

a. Methods of Cooking: Roasting, Grilling, Frying, Baking, Broiling, Poaching, Boiling
b. Principles of each of the above
c. Care and precautions to be taken
d. Selection of food for each type of cooking

Module III: Introduction to Bakery (05 hours)

a. Introduction & types of ovens
b. Basic bakery ingredients – uses, importance
c. Different types of breads – Description, country of origin

Module IV: COMMODITIES & TERMS USED IN GASTRONOMY (06 Hours)

a. Cuts & classification of vegetables
b. Classification of fruits
c. Egg cookery
d. Stocks & its uses
e. Thickening & Raising agents
f. List of culinary terms & their explanation

Module V: Food Hygiene (05 Hours)

a. Food & its relation to health
b. Food allergy and precautions
c. General Principles of Food Hygiene
d. Food Hazards & risk
e. Types (Infections and intoxications) & its preventive measures
f. HACCP (Basic Principle and implementation)

Suggested Readings

1. Parvinder S Bali, Food Production Operations. Oxford University Press, 2014
2. Philip E. Thangam, Modern Cookery (Vol- I), Orient Longman, 1946.
3. R. Kinton & V. Cessarani, Foundation Practical Cookery, Hodder Education, 2009.
4. D. Foskett, R. Kinton& V. Cessarani, Theory of Catering. Hodder & Stoughton Educational, 1999
5. K. Arora, Theory of Cookery, Frank Brothers, 1992

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	M	M	L	L	
CO 2					H
CO 3				M	
CO 4				H	
CO 5	M	H	M		

HAGH105L: BASICS OF GASTRONOMY & HYGIENE PRACTICES PRACTICAL

(2 Credits: 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the basic and introductory kitchen tools of commercial kitchen & basic cuts of vegetables.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the usage of kitchen tools (Understand)
CO 2: Identify the safety principles at the food production area (Knowledge)
CO 3: Analyze commonly used raw material (Analyze)
CO 4: Analyze & demonstrate basic cuts of vegetables (Analyze)
CO 5: Develop & demonstrate basic bread preparations (Create)

Practical

Expt. 1: Familiarization and Understanding kitchen equipment and tools
Expt. 2: Understanding Personal Hygiene and Kitchen Hygiene & its importance.
Expt. 3: Understanding kitchen layouts, kitchen knife, and hand tools
Expt. 4: Identification of commonly used raw material
Expt. 5: Basic hygiene practices& Importance of Kitchen Uniform.
Expt. 6: Various Safety practices to be observed in the kitchen
Expt. 7: Basic cuts of vegetables
Expt. 8: Methods of Cooking
Expt. 9: Various classical preparation of Egg.
Expt. 10: Preparation of Stock, Soup & Sauces
Expt. 11: Fire Fighting
Expt. 12: Basic bread preparations

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M		M									
CO 2		M			M	H					M	
CO 3								M	M			
CO 4				H			M			M		
CO5												M

HACB106T: CULINARY & BAKING SKILLS
(2 Credits: 30 hours) (L-T-P: 2-0-0)

Objective(s):
The objective of the course is to learn & develop theoretical skills of various kinds of soup, sauces & stocks and various kinds of meat & fish cookery.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Discuss the basic recipes and outline the different Soups and Sauces preparations (Understand)
CO 2: Identify different food commodities. (Knowledge)
CO 3: Analyze the various processes of cooking methods required for fish & meat cookery (Analyze)
CO 4: Develop & illustrate meat and fish cookery (Create)
CO 5: Identify various types of bakery & confectionary items (Knowledge)

Module I: Soups (05 hours)
a. Definition, Importance, classification – Broth, Bouillon, puree, cream, velouté, chowder, bisque, consommé
b. Cold soups
c. International soups
d. Garnishes and accompaniments

Module II: Sauces (04 hours)
a. Definition, Importance, classification of sauces and mother sauces
b. Derivatives of mother sauces
c. Contemporary & Proprietary sauces
d. Difference between sauce and gravy

Module III: FISH COOKERY (04 hours)
a. Introduction to fish cookery
b. Classification of fish with examples
c. Cuts of fish with menu examples
d. Selection of fish and shellfish
e. Effects of heat on the cooking of fish

Module IV: MEAT COOKERY (06 hours)
a. Introduction to meat cookery
b. Cuts
c. Variety meats
d. Poultry
e. Menu examples of each

Module V: Basic Bakery & confectionary (05 hours)
a. Muffins – Introduction, types
b. Cookies & Doughnuts – Introduction, types
c. Pastries- Types and uses

Module VI: Food commodities (06 hours)
a. Nuts – classification & uses
b. Fruits – classification & uses
c. Herbs – types & uses
d. Pulses & cereals – types and uses.

Suggested Readings
1. K G Dubey, The Indian Cuisine, PHI, 2013
2. P. S. Bali, Quantity Food Production Operations and Indian Cuisine, Oxford University Press, New Delhi, 2012
3. Kinton & Cessarani, Theory of Catering, ELBS, 2012
4. W. Gisslen, Professional Baking, John Wiley & Sons, 2009
5. Philip E. Thangam, Modern Cookery (Vol- I), Orient Longman, 1946.
6. K. Arora, Theory of Cookery, Frank Brothers, 1992.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	H				

CO 2						H
CO 3			M	H		
CO4			H	M		
CO5					H	

HACB107L: CULINARY & BAKING SKILLS PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s)

The objective of the course is to demonstrate the basic kitchen preparation such as soups, sauces and basic recipes of meats, fish & poultry and easy to prepare food items in commercial kitchens.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the uses of different kitchen equipment & commodities. (Understand)
CO 2: Identify, demonstrate and explain cuts of fish and meat (Knowledge)
CO 3: Identify, demonstrate basic preparation of sauces & soups (Knowledge)
CO 4: Analyze & illustrate cuts of poultry (Analyze)
CO 5: Create & demonstrate different preparations of cookies, muffins, doughnut and pastries (Create)

PRACTICAL

Expt. 1: Familiarization and Understanding kitchen equipment and tools
Expt. 2: Cuts of fish with menu examples
Expt. 3: Cuts of Meat with menu examples
Expt. 4: Various preparation of cookies, muffins, doughnut and pastries
Expt. 5: Cuts of Poultry with menu examples
Expt. 6: To illustrate the various uses of kitchen commodities in food preparations.
Expt. 7: To demonstrate various derivatives of sauces and their uses.
Expt. 8: To demonstrate various soups and there garnishes.
Expt. 9: To demonstrate various cuts of fruits and there uses.
Expt. 10: To demonstrate various uses of nuts in gastronomy.
Expt. 11: To demonstrate various uses of pulses & cereals.
Expt. 12: To demonstrate the uses of various herbs and spices.

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M					M			M	M	M	M
CO 2		M	M									
CO 3							H	H				
CO 4					M							
CO5				H					M	M		

SUGGESTED MENU:

Menu 1 Consommé Julienne Cream of Tomato soup Chicken & Corn Broth Pumpkin and Apple soup	**Menu 2** French Onion soup Mulligatawny Gazpacho Minestrone	**Menu 3 (Mother sauce)** Baked potato gratin Grilled lamb leg with Espagnole sauce Meat balls in Tomato sauce	**Menu 4(Mother sauce)** Macedoine Mayonnaise Grilled veg with Hollandaise sauce Poached chicken in Velouté sauce
Menu 5 Fish Fingers with Tartar sauce Grilled fish with lemon butter 8sauce Fish croquettes	**Menu 6** Potato Mustard salad Shepherd's Pie Meat casserole Herb Pilaf	**Menu 7** Chicken Cutlet Pan fried chicken Boiled vegetables Herbed Mashed potatoes	**Menu 8** Fruit & Nut salad Spiced lentil soup Veg Au Gratin Vanilla custard
Menu 9 Waldorf Salad Potato Lyonnais Fish casserole Cinnamon crepes with apple sauce	**Menu 10** Greens with basic vinaigrette Chicken Stew Pilaf rice Caramel custard	**Menu 11** Trio of mushroom Salad Ratatouille Beans ragout Herbed Pancakes	**Menu 12** French Lentil salad Grilled vegetables Chicken in Vinegar sauce Soft Buns

Menu 13	**Menu 14**	**Menu 15**	**Menu 16**
Coconut Cookies	Namak Para	Chocolate doughnuts	Profit roles
Fruit & Nut cookies	Jim Jam Cookies	Bread sticks	Apple Pie
Banana Muffins	Strawberry Muffins	Cinnamon rolls	Chocolate Éclairs
Chocolate Muffins	Swiss rolls		

HARS210T: ROOM REPORTS & SURFACE CLEANING

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s)

The objective of the course is to learn the importance and procedures of cleaning different kinds of surfaces and formats & reports generated by room divisions.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the different room status and the reports & formats used by room division. (Understand)
CO 2: Identify the guest services provided by room division and the procedures followed. (Knowledge)
CO 3: Analyze, recall and describe the entire room reservation system of the hotel (Analyze)
CO 4: Develop & illustrate cleaning procedures for different surfaces (Create)

Module I: ROOM STATUS AND REPORTS USED IN ROOM DIVISION (10 hours)

a. Occupied, Vacant
b. Out Of Order / Out Of Service
c. Occupancy Report
d. d)Arrival Report
e. Managers Flash
f. Discrepancy Report
g. Turn away report
h. Say over list, expected arrival list, Expected departure list
i. other forms and formats

Module II: GUEST SERVICES (05 Hours)

a. Handling Guest Mail
b. Keys and keys Handling
c. Guest Paging
d. Safety Deposit Lockers
e. Wakeup call
f. Room Movement
g. Lost and Found

Module III: ROOM RESERVATION (05 hours)

a. Importance, Functions, Different Channels & sources, and Types of reservation.
b. Cancellations and Amendments
c. Handling Individual & Group reservations
d. Various Forms & Formats

Module IV: CARE AND CLEANING OF DIFFERENT SURFACES (10 Hours)

a. Metals
b. Glass
c. Leather, Leatherettes, Resins
d. Plastic
e. Ceramics
f. Wood
g. Wall finishes
h. Floor finishes

Suggested Readings

1. Manoj Kr. Yadav, A Professional Guide to Rooms Division Operations, John Wiley & Sons,2019
2. Colin Dix &Chirs Baird, Front office operations, Pearson, 2006.
3. James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
4. Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.

5. Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H	M	H	
CO 2		H	L	
CO 3		L	H	
CO 4				H

COURSE CODE: ROOMS REPORTS & SURFACE CLEANING PRACTICAL

(2 Credits- 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate the importance and procedures of cleaning different kinds of surfaces and formats & reports generated by room divisions.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Familiarize with different room status and the reports used in room division (Understand)

CO 2: Analyze & Demonstrate, role play on – room reservation, key handling, wakeup call, telephone handling and lost and found. (Analyze)

CO 3: Create & demonstrate on different surface cleaning – glass, metal and wood (Create)

PRACTICAL

Expt. 1: Identification of room status and outline of various reports generated in room division – room status report, arrival report, discrepancy report, occupancy report

Expt. 2: Handling room reservation

Expt. 3: Role play of key handling and safety deposit locker

Expt. 4: Role play of Room Movement

Expt. 5: Role play of handling guest wakeup call

Expt. 6: Role play of handling guest telephone at control desk

Expt. 7: Role play on lost and found

Expt. 8: Cleaning of different surfaces - Glass cleaning, Metal Cleaning, Wood Cleaning

Expt. 9: Practical involving following activities- Scrubbing, polishing, wiping, washing, rinsing, swabbing, mopping, sweeping, brushing, buffing

Expt. 10: Practical involving following activities- Scrubbing, polishing, wiping, washing, rinsing, swabbing, mopping, sweeping, brushing, buffing

Mapping of COs to Syllabus

	Exp I	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	M								
CO 2		H	H	H	H	H	H			
CO 3								H	H	H

HASB212T: HOUSEKEEPING SUPERVISION & BUDGETING

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the supervision skills and budget control methods used in the housekeeping department of hospitality sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the basic contents of housekeeping and guestrooms (Understand)

CO 2: Analyze the supervision process of housekeeping (Analyze)

CO 3: Develop & reframe the budgetary control methods (Create)

Module – I: Standard Contents of a Guestroom (08 hours)

a. Guestroom furniture

b. Furniture arrangement

c. Guestroom fixture and fittings

d. Beds, mattresses and bedding
e. Soft furnishing
f. Guestroom accessories
g. Placement of guest supplies

Module – II: Supervision in Housekeeping (07 hours)
a. Role of a supervisor
b. Specific functions of supervisors
c. Importance of a supervisor

Module – III: Housekeeping Control Desk (07 hours)
a. Coordination with other departments
b. Handling telephone calls
c. Paging systems and methods
d. Situation handling
e. Room move / Room shift

Module – IV: Budgeting for housekeeping expenses (08 hours)
a. Types of budget
b. Housekeeping expenses
c. Budget planning process
d. Income statement of the rooms division
e. Controlling expenses
f. Inventory control and stock – taking
g. Purchasing

Suggested Readings
1. Andrews, Sudhir, Hotel Housekeeping, Tata McGraw Hill, 2009.
2. Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.
3. Bhatnagar, S.K., Front Office Management, Frank Bros. & Co. Ltd., 2013
4. Branson, C, Lennox Margaret. Hotel, Hostel & Hospital Housekeeping, Hodder Education, 1988.
5. Kappa, Margret, Nitschke, Aleta. Managing House Keeping Operation, AHLA, 1997

Mapping of CO's with syllabus

CO'S	Module I	Module II	Module III	Module IV
CO1	H	L	M	
CO2		H		
CO3				H

HASB213L: HOUSEKEEPING SUPERVISION & BUDGETING PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):
The objective of the course is to learn & demonstrate the skills required to understand the function of chambermaid's trolley and cleaning agents & equipments.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Developing skills for the loading of a chambermaid's trolley (Understand)
CO 2: Identify & explain a guestroom layout (Knowledge)
CO 3: Analyze & understand the usage of cleaning agents and equipment (Analyze)

Practical
1. Familiarising guest room amenities
2. Identification of housekeeping equipment (Manual / Mechanical)
3. Familiarising with chambermaid's trolley
4. Cleaning of different surfaces
5. Practical involving following activities- Scrubbing, polishing, wiping, washing, rinsing, swabbing, mopping, sweeping, brushing, buffing
6. Stain removal

7. Practical activities involving the usage of cloths and their types, abrasives, polishes, chemical agents, and commercially available products

Mapping of COs to the syllabus

CO'S	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
CO 1		L	H				
CO 2	M						
CO 3			L	M	H	H	M

HAHM310T: ADVANCED HOUSEKEEPING MANAGEMENT

(2 Credits: 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn various aspects of decorations required in rooms & focused areas and causes & prevention aspects of safety and security.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the basics of ancillary activities (Understand)
CO 2: Analyze the security systems of a hotel (knowledge)
CO 3: Develop & identify the decorations of the department (Create)

Module – I: Linen and Laundry (05 hours)

a. The linen and laundry room
b. Storage, exchange, par stock, linen control, laundry process
c. Dry cleaning
d. Handling guest laundry
e. Uniforms and sewing room

Module – II: Safety and Security (08 hours)

a. Work environment safety
b. Potential hazards in housekeeping
c. Fire prevention and fire safety
d. First aid
e. Crime prevention
f. Medical emergencies
g. Scanty baggage
h. Lost and found

Module – III: Interior designing (07 hours)

a. Basic types of design
b. Elements and principles of design
c. Design for physically challenged
d. Color and lighting
e. Flooring
f. Carpets and floor maintenance
g. Window and window treatment

Module – IV: Flower Arrangement (04 hours)

a. Flower arrangement basics
b. Designing flower arrangement
c. Japanese / oriental flower arrangement
d. Common flowers and foliages

Suggested Readings

1. Andrews, Sudhir, Hotel Housekeeping, Tata McGraw Hill, 2009.
2. Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.
3. Bhatnagar, S.K., Front Office Management, Frank Bros. & Co. Ltd., 2013
4. Branson, C, Lennox Margaret. Hotel, Hostel & Hospital Housekeeping, Hodder Education, 1988.
5. Kappa, Margret, Nitschke, Aleta. Managing House Keeping Operation, AHLA, 1997

Mapping of CO's with syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2		H		
CO3			H	H

HAHM311L: ADVANCED HOUSEKEEPING MANAGEMENT PRACTICAL

(2 Credits: 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate the concept of interior decorations, bed making & flower arrangements.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Develop skills & construct a model room with various concepts of interior decoration (Understand)
CO 2: Analyze & demonstrate the process of bed-making (Analyze)
CO 3: Create & illustrate various flower arrangement techniques (Create)

Practical

1. Flower arrangement
2. Making floor plans, wall elevations, and templates
3. Creating a model of a guest room / public area with interior decoration themes
4. Cleaning of guestroom
5. Bed making & Turndown service
6. Mini-bar handling

Mapping of CO's to syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6
CO 1	L		H			M
CO 2			L	L	H	
CO 3	H		L			

HANE312T: ECO GASTRONOMY: NORTH EASTERN INDIA

(2 Credits: 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the concept of importance of gastronomy towards the economy and ways to improve the economy through various sustainable gastronomic practices.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss and describe various aspects of eco gastronomy. (Understand)
CO 2: Identify and learn the benefits of eco gastronomic (Knowledge)
CO 3: Analyze the concept of geo gastronomy in North Eastern India (Analyze)
CO 4: Develop skills and illustrate the research & product development in eco gastronomy for North Eastern India (Create)

Module – I: Introduction (05 hours)

a. Definition, Importance, benefits
b. Five dimensions of taste as per eco gastronomy
c. Fundamental categories of eco gastronomy
d. Eco gastronomy vs. Gastronomy

Module – II: Eco Gastronomy in North East (8 hours)

a. Tribal cooking techniques
b. Importance of ethnic cuisine
c. Sustainability in cultivation and farming
d. Ethnic foods in festivals

Module – III: Challenges of Eco Gastronomy in North east (07 hours)

a. Junk & fast foods
b. Urbanization and busy lifestyles
c. Competition among local producers

d. Food habits of teenagers

Module – IV: Future Development of Eco Gastronomy in North East (08 hours)

a. Gastronomic tourism
b. Slow food movements
c. Green Gastronomy
d. Awareness and campaign's

Suggested Readings

1. Ron Pickarski, Eco-Cuisine: An Ecological Approach to Gourmet Vegetarian Cooking, Ten Speed Press, 1995
2. Nicoletta Batini, The economics of sustainable food, Island Press, 2021

Mapping of CO's with syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2		H		
CO3			H	H

HANE313L: ECO GASTRONOMY: NORTH EAST INDIAN REGIONS PRACTICAL

(2 Credits: 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate the concept the eco gastronomy through the various cuisines from North East.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand spices, pulses, sweetening agents of North East and compose different preparations (Understand)
CO 2: Identify & demonstrate the traditional home style cooking and breakfast cooking (Knowledge)
CO 3: Identify & Demonstrate traditional fermentation techniques of North East (Knowledge)
CO 4: Analyze plan and organize a theme menu (Analyze)
CO 5: Create various sweet preparations from North East (Create)

Practical:

Expt. 1: Gravies and their preparations
Expt. 2: Popular breakfast preparations from North East
Expt. 3: Prepare North East sweets and savories
Expt. 4: Prepare varieties of North East pickles & chutney
Expt. 5: Street food of North East
Expt. 6: Introduction to large scale / quantity food production
Expt. 7: Menu1 – Assamese cuisine
Expt. 8: Menu 2- Arunachal Pradesh
Expt. 9: Menu 3 – Mizoram
Expt. 10: Menu 4 – Meghalaya
Expt. 11: Menu 5- Manipur
Expt. 12: Menu 6- Nagaland
Expt. 13: Menu7- Tripura
Expt. 14: Menu 8- Fermented foods from North East
Expt. 15: Menu 9- North East Menu
Expt. 16: Menu 10 – North East Menu

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15	Exp 16
CO 1	M						M	M	M	M	M	M	M	M	M	M
CO 2		M	M													
CO 3				M	M											
CO 4						M	M	M	M	M	M	M	M	M	M	M
CO 5			M													

SUGGESTED MENU:

Menu 1 (Assamese Breakfast) Jolpaan Paani Pitha	**Menu 2 (Arunachal Breakfast)** Khura Zan	**Menu 3 (Mizo Breakfast)** Rice Bai	**Menu 4 (Meghalaya Breakfast)** Putharo Pukhlein
Menu 5 (Manipuri Breakfast) Tan Aloo Kangmet	**Menu 6 (Naga Breakfast)** Egg Sheap Black Tea King chilli chutney	**Menu 7 (Tripura Breakfast)** Sweet Poha Bangui Bhater Bhat	**Menu 8 (Assamese Cuisine)** Xaak aru Bhaji Aloo Pitika Baanhgajor Lagot Kukura Plain rice Goorer Payas
Menu 9 (Arunachal cuisine) Pasa Chura Sabji Pika PIla Rice	**Menu 10 (Meghalaya Cuisine)** Nakham Bitchi Do –o- Kalai Jadoh Rice Pakhlein	**Menu 11 (Mizoram cuisine)** Bai Chhum Han Arsa Beipenek Koat Pitha	**Menu 12 (Manipur cuisine)** Singju Eromba Atoiba Thongba Chakhao
Menu 13 (Naga cuisine) Rosep Aon Naga Fish curry Galho Nap Naang	**Menu 14 (Tripura cuisine)** Mui Borok Wahan Mosdeng Gudok Mosdeng Serma Rice	**Menu 15 (Street Food – North East)** Laksa Kappa Alu Muri	**Menu 16 (Street Food - North East)** Thenthuk Kinalas
Menu 17 (Street Food - North East) Kelli chana Sanipiau Chikhvi	**Menu 18 (Pickles)** Ou Tenga Banana Flowers Bamboo shoots King chili	**Menu 19 (North East Menu)** Curated by students based on home cooking methods	**Menu 20 (North East Menu)** Curated by students based on home cooking methods

HABT408T: BASICS OF TOURISM

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the basic knowledge about the tourism sector in hospitality with its different aspects.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Contextualize tourism within broader cultural, environmental, and economic dimensions of society. (Knowledge)
CO 2: To outline the resources of tourism and different aspects of tour operations. (Understand)
CO 3: Explain the diverse nature of tourism, including culture and place, global/ local perspectives, and experience design and provision. (Understand)
CO 4: Examine the different elements of geography and the relationship with tourism. (Analyze)
CO 5: Illustrate the tour operations (Apply)

Module I: CONCEPT OF TOURISM (06 hours)

a. Origin, objectives, Elements, Scope & Nature of tourism
b. Job opportunities and employment generation in the tourism Industry

Module II: TOURISM PRODUCTS AND RESOURCES (08 hours)

a. Architectural heritage
b. Culture & Fairs and festivals of India
c. Natural and other tourism resources

Module III: TOUR OPERATIONS (08 hours)

a. Meaning & Definition
b. Types of Tourists: Inbound, Outbound & Domestic.
c. Tour Packaging–definition,componentsofatourpackageTypesofPackageTour:IndependentTour,InclusiveTour,
d. Escorted Tour, Business Tour
e. Guides & escorts– The ire-role and function Qualities required to be a guide or escort

Module IV: ITINERARY PLANNING (08 hours)

a. Steps to planning a Tour, Planning Route map
b. Transport booking–reservation,
c. Accommodation–Reservation & Food facilities
d. Tour Costing

Module V: SOCIO-ECONOMIC IMPACT OF TOURISM (07 hours)

a. Impact of tourism on culture
b. People to people contact enhancement
c. Environmental hazards

Suggested Readings

1. Sudhir Andrews, Introduction to Tourism and Hospitality, Tata McGraw Hill, 2010.
2. Charkes R. Goeldner, Tourism principles, practices, philosophies, John Wily Pub, 2007.
3. A.K. Bhatia, International Tourism, Sterling Publications, 2006.
4. P.N. Seth, Introduction to Hospitality, Sterling Publications, 2001.

Mapping of Cos to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M	H		
CO3	M				
CO4				L	M
CO5			H		

HARM409T: RESEARCH METHODOLOGY

(2 Credits: 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the basic knowledge about the research work and different approaches, process and methods of data collection in research work.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the idea of conducting a research (Explain)
CO 2: Analyze the different approaches of a research process (Analyze)
CO 3: Explain the research concepts (Understand)
CO 4: Define the different methods of data collection and different research designs (Knowledge)

Module I – Introduction to Research (06 hours)

a. Define research
b. Objectives of research
c. Types of research
d. Significance of research
e. Research process
f. Criteria's of a good research

Module II – Defining Research Problem (04 hours)

a. Research problem
b. Selecting the problem
c. Necessity of defining the problem
d. Techniques involved in defining a problem

Module III – Research Design (05 hours)

a. Meaning of research design
b. Need for research design
c. Features of a good design
d. Concepts of research design
e. Principles of research design

Module IV – Sampling Design (04 hours)

a. Census and sample survey

b. Steps in sample design
c. Criteria's of selecting a sampling procedure
d. Types of sample design

Module V – Data Collection (05 hours)
a. Collection of primary data
b. Observation method, interview method, questionnaire
c. Methods of data collection
d. Collection of secondary data
e. Primary data vs. Secondary data

Suggested Readings
1. Kothari, Garg, Research Methodology 4th Edition, New Age International, New Delhi
2. Creswell, David Creswell, Research Design, Sage Publication, New Delhi
3. Sarangi, Research Methodology, Taxmann, New Delhi
4. Kothari, Research Methodology 2nd Edition, New Age International, New Delhi

Mapping of CO's to syllabus

	MODULE I	MODULE II	MODULE III	MODULE IV	MODULE V
CO 1	H	M			
CO 2	H	L		M	L
CO 3	H	M	H	L	
CO 4			H	M	H

HAOB410T: ORGANIZATIONAL BEHAVIOUR

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):
The objective of the course is to learn the basic knowledge about the behaviors & approaches of employees and employers towards an organization.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Understand the organizational theory and structure (understand)
CO 2: Identify behavioural and individual perspectives (Knowledge)
CO 3: Analyze focus group behaviour (Analyze)
CO 4: Reframe different cultures and developments in an organization (Evaluate)

Module – I: Organizational theory (10 hours)
a. Introduction to organization
b. Organization theory
c. Organization structure
d. Effectiveness of organizational structure

Module – II: Organizational behaviour and individual perspective – I (08 hours)
a. Overview of organizational behaviour
b. Individual behaviour and learning
c. Perception
d. Attitudes and values

Module – III: Organizational behaviour and individual perspective – II (08 hours)
a. Personality and emotions
b. Stress management
c. Motivation
d. Job design and Job satisfaction

Module – IV: Group behaviour (06 hours)
a. Group formation and structure
b. Communication
c. Conflict management
d. Team building and leadership
e. Power and politics

Module – V: Organizational culture and development (10 hours)

a. Organizational culture and climate
b. Organizational change
c. Organizational development
d. Emerging trends in organizational behaviour

Suggested Readings

1. Robbins. Stephen, Judge. Timothy, Essentials of Organizational Behaviour 14th edition, Pearson, 2017, New York
2. Aswathappa. K, Organizational Behaviour, Himalaya Publishing House, 2018, Pune
3. Luthans. Fred, Organizational Behaviour, McGraw Hill, 2018, New Delhi
4. McShane. L. Steven, Glinoy.Mary Ann, Organizational Behaviour 8th Edition, McGraw Hill, 2017, New York

Mapping of CO's to syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	H	L	
CO 3			L	H	
CO 4	L			M	H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	HAIR108L	Introduction to room division	3
2	S E Course 2	HAFA109L	Functional areas & cleaning agents	3
3	S E Course 3	HAIM214L	Introduction to marketing	3

HAIR108L: INTRODUCTION TO ROOMS DIVISIONS

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the history and classifications of hotel sector of hospitality and the organizational chart along with duties and responsibilities of various levels in room divisions.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the history of the Hospitality Industry and the core areas of rooms division and analyze its co-ordination with other departments. (Understand)

CO 2: Analyze the classification of hotels and the different types of guest rooms and accommodations. (Analyze)

CO 3: Develop the layout of front office/housekeeping, organizational chart, duties & responsibilities and personality traits of room division staff. (Create)

Module I: INTRODUCTION TO HOSPITALITY INDUSTRY & ROOMS DIVISION (06 hours)

a. Hospitality and its origin
b. Hotels, their evolution, and growth
c. A brief introduction to hotel core areas with special reference to Rooms Division
d. Coordination with other departments

Module II: CLASSIFICATION OF HOTELSAND HOTEL ROOMS (12 Hours)

a. Size
b. Star
c. Location & clientele
d. Ownership basis
e. Independent hotels
f. Management contracted hotel
g. Chains
h. Franchise/Affiliated
i. Supplementary accommodation
j. Time shares and condominium
k. Types of Guest Rooms

Module III: LAYOUT AND ORGANIZATIONAL CHART OF ROOM DIVISION (12 hours)

a. Layout of Front Office and Housekeeping department – Small, Medium & Large hotels
b. Organizational Chart of Housekeeping and Front Office – Small, Medium & Large hotels
c. Duties and responsibilities of staff
d. Personality Traits

Suggested Readings

1. Manoj Kr. Yadav, A Professional Guide to Rooms Division Operations, John Wiley & Sons,2019
2. Colin Dix & Chirs Baird, Front office operations, Pearson, 2006.
3. James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
4. Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.
5. Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III
CO 1	H		L
CO 2	L	H	
CO 3	L		H

HAIR108L: INTRODUCTION TO ROOMS DIVISIONS PRACTICAL

Objective(s):

The objective of the course is to learn the identification of various rooms along with hygiene standards and importance of communication and etiquettes.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the importance of hygiene standards and basic manners required for guest services. (Understand)
CO 2: Identify different equipment and furniture used in room division (Knowledge)
CO 3: Analyze & implement communication (verbal & non-verbal) for various guest services. (Analyze)
CO 4: Develop different types of guest rooms and identify the supplies and their positions. (Create)

PRACTICAL

1. Basic Manners, Grooming & Hygiene Standards, its importance,
2. Room Division Communication (verbal/non-verbal) - Body language, Gestures, Facial expression, eye contact, voice
3. Identification of equipment and furniture used in rooms division.
4. Telephone etiquettes, Dialogues
5. Welcoming Guest
6. Escorting, Message handling
7. Familiarization with guest room.
8. Guest Room Supplies and Position
9. Layout of different types of guest room
10. Team Building

Mapping of COs to Syllabus

	Exp I	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	L		M	M	M				
CO 2			H				M	M	M	
CO 3		H		H	H	H		H		H
CO 4			L				H		H	

HAFA109L: FUNCTIONAL AREAS & CLEANING AGENTS

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the basic concepts of rooms divisions which are very necessary for day to day smooth function in room division.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the basic functional areas of room division and outline the layouts of the areas. (Understand)
CO 2: Identify & recall and describe the entire guest cycle. (Knowledge)
CO 3: Analyze & elaborate on the basic concept of tariff decisions, pricing of rooms and meal plans. (Analyze)
CO 4: Develop & analyze the different types of cleaning techniques, cleaning equipments and cleaning agents along with their care and maintenance. (Create)

Module I: FUNCTIONAL AREAS & CLEANING AGENTS (8 hours)

a. Hotel Entrance, Lobby
b. Bell Desk
c. Reception Desk, Cashier
d. d)Concierge
e. Reservation
f. Telephone Operator
g. Housekeeping Control Desk
h. Linen Room, Uniform Room
i. Laundry
j. Florist Room
k. Layout of the areas

Module II: TARIFF (06 Hours)

a. Room tariff, Tariff fixation / calculating room tariff

b. Types of room tariff: Rack rate, discounted rates.
c. Meal Plan and its type
d. Forms & Format/ Tariff Card/Brochure

Module III: GUEST CYCLE (06 hours)
Pre-arrival, Arrival, Stay, Departure & Post Departure

Module IV: CLEANING AND CLEANING AGENTS USED IN HOTELS (10 Hours)
a. Principles of cleaning, hygiene, and safety factors in cleaning
b. Methods of organizing cleaning
c. Frequency of cleaning daily, periodic, special
d. Design features that simplify cleaning
e. Types of cleaning equipment
f. Types of cleaning agents
g. General Criteria for selection
h. Use, Care, and Storage
i. Distribution and Controls

Suggested Readings
1. Manoj Kr. Yadav, A Professional Guide to Rooms Division Operations, John Wiley & Sons, 2019
2. James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
3. Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011
4. Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H			L
CO 2		M	H	
CO 3		H	L	
CO 4				H

HAFA109L: FUNCTIONAL AREAS & CLEANING AGENTS PRACTICAL

Objective(s):
The objective of the course is to learn & demonstrate the use and maintenance of various cleaning agents & equipments and role play on various situations based on room divisions.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Understand the different equipment and cleaning agents used in room division (Understand)
CO 2: Analyze the care and maintenance of cleaning equipment and cleaning agents (Knowledge)
CO 3: Analyze different functional areas of room division. (Analyze)
CO 4: Create & Demonstrate, role play on – bell desk operation, concierge operations, handling telephone & few cleaning procedure along with the forms and formats required to be filled (Create)

PRACTICAL
Expt. 1: Identification of equipment used in functional areas of room division
Expt. 2: Care and maintenance of the equipment
Expt. 3: Familiarization of cleaning agents according to classification
Expt. 4: Layout the various functional areas of room division – laundry, linen room, lobby
Expt. 5: Role play of bell desk operations
Expt. 6: Role play of Paging
Expt. 7: Role play of concierge operations
Expt. 8: Role play of handling telephone
Expt. 9: Room attendant trolley set up
Expt. 10: Fill forms and formats

Mapping of Cos to Syllabus

	Exp I	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	M	H						H	

CO 2		H	M							
CO 3				H	L	L	L	L		
CO 4		L			H	H	H	H	L	H

HAIM214L: INTRODUCTION TO MARKETING

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn & demonstrate the use and maintenance of various cleaning agents & equipments and role play on various situations based on room divisions.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the concept of marketing (Understand)
CO 2: Identify the consumer buying behavior (Knowledge)
CO 3: Analyze the market segmentation process (Analyze)
CO 4: Develop an understanding about marketing components (Create)

Module – I: Introduction to Marketing (07 hours)

a. Introduction
b. Market & Marketing
c. Marketing process
d. Concepts of marketing
e. Functions of marketing
f. Importance of marketing
g. Market orientations

Module – II: The Marketing Process (08 hours)

a. Introduction
b. 4P's of marketing
c. Modern components of marketing mix (3P's)
d. Developing an effective marketing mix
e. Market planning
f. Market implementation and control

Module – III: Consumer Buying Behaviour (06 hours)

a. Introduction
b. Characteristics
c. Types of buying decision behavior, Henry Assael Model, Consumer & buying decision
d. Process
e. Buyer decision process for new products
f. Buying motives & behavior models

Module – IV: Business Buyer Behaviour (07 hours)

a. Introduction
b. Characteristics of business markets
c. Difference between consumer and business buyer behavior
d. Buying situation in industrial / business market
e. Buying roles in industrial marketing
f. Factors that influence business buyers
g. Steps in business buying process

Module – V: Segmentation, Targeting & Positioning (08 hours)

a. Introduction
b. Concepts of market segmentation
c. Benefits of market segmentation
d. Requisites of effective market segmentation
e. Process of market segmentation
f. Bases of segmenting consumer markets
g. Targeting, Market positioning, Advertising and sales promotion
h. Sales force management

Suggested Readings:

1. Kotlar, Phillip, Marketing Management, Prentice Hall, New Delhi
2. Stanton, Etzel, Walker, Fundamentals of Marketing, Tata-McGraw Hill, New Delhi
3. Saxena, Rajan, Marketing Management, Tata-McGraw Hill, New Delhi
4. McCarthy, E.J, Basic Marketing: A managerial approach, Irwin, New Delhi

Mapping of CO's to syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M		L	H
CO 2			H	H	
CO 3					H
CO 4	M	H		L	

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	HABV110I	Basic Vocational Training	4
4	Internship	HASV215I	Specialization Vocational Training	4

VOCATIONAL TRAINING –I **

Note: If the student wants to discontinue the program of "B.sc in Hospitality & Hotel Administration" after 1st year of study, then the student have to undergo a vocational training to get the "certificate" in the same program.

HABV110I: BASIC VOCATIONAL TRAINING

(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective(s):

The objective of the course is to complete the training program of 2 months and prepare the training report which was learned during the training exposure and also completes the log book.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand and analysis to the practical experience and actual working environment for developing their skills and capabilities, as well as enhancing their intellectual and emotional persona. (Understand)
CO 2: Identify & integrate classroom theory with workplace practice. (Knowledge)
CO 3: Analyze & gain an understanding of administrative functions and company culture. (Analyze)
CO 4: Develop skills to demonstrate various activities of all the core departments. (Create)

Module I - TRAINING EXPOSURE SUMMARY (50 hours)

The 08 weeks of vocational training would be from any two key areas of hospitality such as Food Production, Food and Beverage Service, Accommodation Operation, and Front Office Operations and student has to collect information's which will be needed to them during compiling of the training report.

Module 2 - TRAINING REPORT (40 hours)

a. During the training report the students has to complete the training report which will includes the details of the training organization, there USP, facilities of the various department
b. The outcome and experience they gain from the training

Module 3 - LOG BOOK (30 hours)

During the training the student has to duly sign the log book from the departmental authorities as a proof of their experience and learning skills from the specific department.

Mapping of Cos to Syllabus

	Module I	Module 2	Module 3
CO 1	H	H	M
CO 2	M	M	H
CO 3	M	L	L
CO4	H	M	M

VOCATIONAL TRAINING - II**

Note: If the student wants to discontinue the program of "B.sc in Hospitality & Hotel Administration" after 2nd year of study, then the student have to undergo a vocational training to get the "Diploma" in the same program.

HASV215I: SPECIALIZATION VOCATIONAL TRAINING
(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective(s):
The objective of the course is to complete the training program of 2 months and prepare the training report which was learned during the training exposure and also completes the log book.

COURSE / LEARNING OUTCOMES:
At the end of this course student will be able to:
CO 1: Understand and analysis to the practical experience and actual working environment for developing their skills and capabilities, as well as enhancing their intellectual and emotional persona. (Understand)
CO 2: Identify & integrate classroom theory with workplace practice. (Knowledge)
CO 3: Analyze & gain an understanding of administrative functions and company culture. (Analyze)
CO 4: Develop skills to demonstrate various activities of all the core departments. (Create)

Module I - TRAINING EXPOSURE SUMMARY (50 hours)
The 08 weeks of vocational training would be from the hospitality organization for the one key area such as Food Production, Food and Beverage Service, Accommodation Operation, and Front office Operations and student has to collect information's which will be needed to them during compiling of the training report.

Module 2 - TRAINING REPORT (40 hours)
a. During the training report the students has to complete the training report which will includes the details of the training organization, there USP, facilities of the various department
b. The outcome and experience they gain from the training

Module 3 - LOG BOOK (30 hours)
During the training the student has to duly sign the log book from the departmental authorities as a proof of their experience and learning skills from the specific department.

Mapping of Cos to Syllabus

	Module I	Module 2	Module 3
CO 1	H	H	M
CO 2	M	M	H
CO 3	M	L	L
CO4	H	M	M

RESEARCH PROJECT /DISSERTATION

Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	HADI411P	Dissertation I	18
8	Research Project/Dissertation	HADI412P	Dissertation II	20

BSC HHA (Honours) with Research

HADI411P: DISSERTATION PHASE – I
(18 Credits -540 Hours) (L-T-P: 0-0-36)

HADI412P: DISSERTATION PHASE – II
(20 Credits -600 Hours) (L-T-P: 0-0-40)

BACHELOR OF TECHNOLOGY (B TECH) PROGRAMMES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME: BACHELOR OF TECHNOLOGY (BTECH) – ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

*COURSE STRUCTURE (NEP BATCH 2024)

*"Undergraduate Degree Course Structure Based on AICTE Model Curriculum 2024 (Subject to Change)"

Type	Type of Course/ Category	Course Code	Course Title	L-T-P	Credits	Page
SEMESTER I						
Theory	Humanities and Social Science	EGTW107T	English for Technical Writing	2-0-0	2	790
Lab	Humanities and Social Science	EGOP108L	Oral Communication Practice Lab	0-0-2	1	790
Theory	Basic Science	MAMT115T	Mathematics-I	3-1-0	4	797
Theory	Basic Science	PSPH113T	Physics	3-1-0	3	795
Lab	Basic Science	PSPH114L	Physics Lab	0-0-2	1	796
Theory	Basic Science	MAAI116T	Mathematical Concepts for AI	3-1-0	4	798
Theory	Basic Science	CHCY120T	Chemistry II	3-0-0	3	802
Lab	Basic Science	CHCY119L	Chemistry Lab	0-0-2	1	804
Theory	Engineering Science	CSPP102T	Problem Solving and Programming	3-0-0	3	806
Lab	Engineering Science	CSPP103L	Problem Solving and Programming Lab	0-0-2	1	807
Theory	Engineering Science	CSDT104T	Design Thinking	1-0-0	1	807
	Mandatory Course	BTUH0001	Universal Human Values I: Student Induction Program	0-0-0	NC	818
Total Credits					24	
SEMESTER II						
Theory	Basic Science	MAMT117T	Mathematics-II	3-1-0	4	
Theory	Engineering Science	CSOP105T	Object Oriented Programming	3-0-0	3	808
Theory	Engineering Science	CSDS106T	Data Structures	3-0-0	3	809
Theory	Engineering Science	CSDM107T	Discrete Mathematical Structures	3-1-0	4	810
Theory	Engineering Science	CSMC108T	Modern Computer Architecture	3-0-0	3	811
Lab	Engineering Science	CSOP109L	Object Oriented Programming Lab	0-0-2	1	809
Lab	Engineering Science	CSDS110L	Data Structures Lab	0-0-2	1	810
	Humanities and Social Science	BTUH0002	Universal Human Values II	2-1-0	3	818
Total Credits					22	
SEMESTER III						
	Professional Core		Algorithm Analysis and Design	3-0-0	3	
	Professional Core		Database Systems	3-0-0	3	
	Professional Core		Computer Networks	3-0-0	3	
	Professional Core		Introduction to Machine Learning	3-0-0	3	
	Professional Core		Artificial Intelligence	3-1-0	4	
	Professional Elective		Open Elective-I	3-0-0	3	
	Professional Core		Algorithm Analysis and Design Lab	0-0-2	1	
	Professional Core		Database Systems Lab	0-0-2	1	
	Professional Core		Computer Networks Lab	0-0-2	1	
	Professional Core		Introduction to Machine Learning Lab	0-0-2	1	
Total Credits					23	
Any one course from following options can be opted under "Open Elective-I' 1. Internet of Thing (IoT) 2. Robotics						
Semester IV						
	Professional Core		Theory of Computation	3-1-0	4	
	Professional Core		Software Engineering	3-0-0	3	

	Professional Core		Deep Learning	3-0-0	3	
	Professional Core		Operating System	3-0-0	3	
	Professional Core		Theory of computation Ecosystems	3-0-0	3	
	Professional Core		Minor Project	3-0-0	3	
	Basic Science		Environmental Science	3-0-0	0	
	Professional Core		Software Engineering Lab	0-0-2	1	
	Professional Core		Deep Learning Lab	0-0-2	1	
	Professional Core		Operating System Lab	0-0-2	1	
Total Credits				**22**		
Semester V						
	Professional Core		Data and Visual analytics in AI	3-0-0	3	
	Professional Core		Natural Language Processing	3-0-0	3	
	Professional Core		Advanced Machine Learning	3-0-0	3	
	Professional Core		Optimization Techniques in Machine Learning	3-1-0	4	
	Professional Core		Minor Project	--	3	
	Humanities		Indian Constitution	3-0-0		
	Professional Core		Data and Visual analytics in AI lab	0-0-2	1	
	Professional Core		Natural Language Processing lab	0-0-2	1	
	Professional Core		Advanced Machine Learning lab	0-0-2	1	
Total Credits				**19**		
Semester VI						
			Industry / Research Lab Internship		16	
	Internship Option			Alternate option		
	• Within India or Abroad(MITACS/DAAD/Any other aligned with GOI schemes) • To enhance hands-on skills (As per NEP 2020) • Refer Appendix-IV for some suggested Internships			• Alternatively, Courses can also be offered from Open Electives/Professional Electives • Two Course of 3 credits each and one Major project for 10 credits • Students may opt for a virtual internship along with courses		
Total Credits					**16**	
Semester VII						
	Professional Core		Soft Computing	3-0-0	3	
	Professional Elective		Professional Elective-I	3-0-0	3	
	Professional Elective		Professional Elective-II	3-0-0	3	
	Professional Elective		Open Elective-II	3-0-0	3	
	Professional Core		Soft Computing Lab	0-0-2	1	
	Professional Elective		Professional Elective-I Lab	0-0-2	1	
	Professional Elective		Professional Elective-II Lab	0-0-2	1	
	Professional Core		Capstone Project (Part-I)		6	
Total Credits				**21**		
Any one course from following options can be opted under "Open Elective-II' 1. Machine Learning with Python 2. AI for Everyone						
Semester VIII						
	Professional Elective		Professional Elective-III	3-0-0	3	
	Professional Elective		Professional Elective-IV	3-0-0	3	
	Professional Elective		Professional Elective-III Lab	0-0-2	1	
	Professional Elective		Professional Elective-IV Lab	0-0-2	1	
	Professional Core		Capstone Project (Part-II)	-	10	
Total Credits				**18**		
Total Credits				**160**		

- Main emphasis should be on Project Based Learning / Experiential Learning.
- There should be an option to delay internship semester to 7^{th}/ 8^{th} Semester as per institute convenience and availability of internship slots for different group of students.

DEPARTMENT OF CIVIL ENGINEERING

BACHELOR OF TECHNOLOGY (BTECH) – CIVIL ENGINEERING

*COURSE STRUCTURE (NEP BATCH 2024)

*"Undergraduate Degree Course Structure Based on AICTE Model Curriculum 2024 (Subject to Change)"

Semester I (First year)								
Type	**Type of Course/Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Page**
3 WEEKS COMPULSORY UNIVERSAL HUMAN VALUES I (UHV-I): STUDENT INDUCTION PROGRAM (BTUH0001)								
Theory	Basic Science	CHCY118T	Chemistry I	3	1	0	4	801
	Basic Science	MAMT113T	Mathematics I	3	1	0	4	796
	Engineering Science	EEEL100T	Basic Electrical Engineering	2	1	0	3	812
	Basic Science	BOBE113T	Biology for Engineers	3	0	0	3	791
Lab	Basic Science	CHCY119L	Chemistry Lab	0	0	2	1	804
	Engineering Science	EEEL101L	Basic Electrical Engineering Lab	0	0	2	1	814
	Engineering Science	MNWM100L	Workshop/Manufacturing Practices	1	0	2	2	815
	Engineering Science	MNDI101L	Design Thinking and Idea Lab	1	0	2	2	816
TOTAL CREDITS				**13**	**3**	**16**	**20**	

Semester II (First year)								
Type	**Type of Course/Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Page**
Theory	Basic Science	PSEP109T	Engineering Physics	3	1	0	4	792
	Basic Science	MAMT114T	Mathematics II	3	1	0	4	799
	Engineering Science	CSPS100T	Programming for Problem Solving	3	0	0	3	805
	Humanities and social science	EGTW107T	English for Technical Writing	2	0	0	2	790
Lab	Engineering Science	CVGD100T	Engineering Graphics and Design	1	0	4	3	814
	Basic Science	PSEP110L	Engineering Physics Lab	0	0	2	1	793
	Engineering Science	CSPS101L	Programming for Problem Solving Lab	0	0	4	2	805
	Humanities and social science	EGOP108L	Oral Communication Practice Lab	0	0	2	1	790
	Humanities and Social Science	BTUH0002	Universal Human Values (UHV II)	2	1	0	3	824
Theory & Lab	Mandatory -Non-credit Audit Course	BTSY0003	Sports and Yoga or NSS/NCC	1	0	4	0	
TOTAL CREDITS				**15**	**3**	**16**	**23**	

Exit Options for Civil Engineering

Semester I and II - UG certificate (40 credits to be obtained in 1st and 2nd semester)

(Additional Credits required = 6 to 8 Credits)

1. Materials in Civil Engineering (3-0-0 = 3 Credits)
2. Introduction to Construction Techniques & Material Testing (2-0-2=3 Credits)
3. Survey work (1-0-2=2 Credits)

Semester III (Second year)								
Type	**Type of Course/Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Page**
Theory	Engineering Science		Mechanics of Solids	3	0	0	3	
	Basic Science		Mathematics to Civil Engineering	3	1	0	4	
	Engineering Science		Civil Engineering Materials and Concrete Technology	3	0	0	3	
	Professional Core		Fluid Mechanics	3	0	0	3	
	Humanities and Social Science		From Basket (IKS III: Vision of Human Society (Vishva Kalyan thru Vasudhaiva Kutumbkam)	2	0	0	2	

	Mandatory -Non-credit Audit Course		Disability, Accessibility and Universal Design	3	0	0	0	
Lab	Professional Core Course		Building Planning and Computer-aided Civil Engineering drawing-Lab	0	2	2	3	
	Professional Core Course		Civil Engineering Materials and Concrete Technology – Lab	0	0	2	1	
	Professional Core Course		Fluid mechanics Lab	0	0	2	1	
TOTAL CREDITS				**17**	**3**	**8**	**20**	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

Semester IV (Second year)								
Type	**Type of Course/Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Page**
Theory	Professional Core		Transportation Engineering	3	0	0	3	
	Professional Core		Surveying and Geomatics	3	0	0	3	
	Professional Core		Geotechnical Engineering	3	0	0	3	
	Professional Core		Hydraulic Engineering	3	0	0	3	
	Professional Core		Structural Analysis	3	1	0	4	
	Professional Core		Construction Engineering & Management	3	0	0	3	
Lab	Professional Core		Transportation Engineering Lab	0	0	2	1	
	Professional Core		Surveying and Geomatics Lab	0	0	2	1	
	Professional Core		Geotechnical Engineering Lab	0	0	2	1	
	Professional Core		Hydraulic Engineering Lab	0	0	2	1	
	Professional Core		Solid Mechanics and Structural Analysis Lab	0	0	2	1	
Theory	Mandatory –Non-credit Audit Course		Civil Engineering - Societal & Global Impact	3	0	0	0	
TOTAL CREDITS				**21**	**1**	**8**	**24**	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

Exit Options for Civil Engineering
Semseter III and IV - UG Diploma (44 credits to be obtained in 3rd and 4th semester)
(Additional Credits required = 6 to 8 Credits)

1. Fundamentals of Structural Design (2-0-0= 2Credits)
2. Quantity Survey and Estimation (0-1-4 = 3 Credits)
3. Sustainable Construction and Lean Construction (3 – 0 -0 = 3 credits)
4. Environmental Impact Assessment (0-1-2= 2 Credits)
5. Introduction to Building Information Modeling (BIM)(0-1-4 =3 Credits)

Semester V (Third year)								
Type	**Type of Course/Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Page**
Theory	Professional Core		Structural Design –I	3	0	0	3	
	Professional Core		Environmental Engineering	3	0	0	3	
	Professional Core		Engineering Economics, Estimation & Costing	3	2	0	5	
	Professional Core		Hydrology & Water Resources Engineering	3	0	0	3	
	Professional Elective course		1. Plumbing (Water and Sanitation)	3	0	0	3	
			2. Railway & Airport Engineering					
			3. Earth retaining structure					
			4. Open Channel Flow					
	Open Elective course		Multidisciplinary Open Electives Courses -1	3	0	0	3	
			Concrete Materials					

Lab	Professional Core		Structural Design -I Lab	0	0	2	1	
	Professional Core		Environmental Engineering Lab	0	0	2	1	
Theory	Mandatory –Non-credit Audit Course		Professional Practice, Law & Ethics	3	0	0	0	
TOTAL CREDITS				**21**	**2**	**4**	**22**	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

Semester VI (Third year)								
Type	**Type of Course/Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Page**
Theory	Professional Core		Structural Design –II	3	0	0	3	
	Professional Core		Intelligent Transportation Systems	3	0	0	3	
	Professional Core		Sustainable and Green construction	3	1	0	4	
	Professional Elective Course		Program Elective Course -2	3	1	0	4	
			1. Advanced Structural Analysis					
			2. River Engineering					
	Professional Elective Course		Program Elective Course -3	4	0	0	4	
			1. Foundation Engineering					
			2. Surface Hydrology					
	Multidisciplinary Open Electives Courses -2		Multidisciplinary Open Electives Courses -2 - Sustainable construction methods	3	0	0	3	
Lab	Professional Core		Structural Design -II-Lab	0	0	2	1	
Theory	Mandatory –Non- credit Audit Course		Instrumentation & Sensor Technologies for Civil Engineering Applications	2	0	0	0	
TOTAL CREDITS				**20**	**1**	**2**	**22**	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

Exit Options for Civil Engineering

Semseter V and VI – B.E. Vocational (44 credits to be obtained in 5th and 6th semester)

(Additional Credits required = 6 to 8 Credits)

1. Advance Concrete Technology. (2-0-4) = 3 Credits)
2. Air and Noise pollution control engineering (3-0-0 = 3 credits)
3. Introduction and Application of AI, ML and IOT for Civil Engineering (3-0-0 = 3 Credits)
4. Construction Management and Safety (3-0-0) - 3 Credits)

Semester VII (Fourth year)								
Type	**Type of Course/Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Page**
Theory	Professional Core		Robotics and Automation	2	0	0	2	
	Professional Elective course		Program Elective Course – 4	3	0	0	3	
			1. Ground Improvement techniques					
			2. Traffic Engineering & Management					
			3.Structural Dynamics					
	Multidisciplinary Open Electives Courses - 3		Multidisciplinary Open Electives Courses – 3 Repair & Rehabilitation of Structures.	3	0	0	3	
Practical	Internship		Internship	0	0	24	12	
Theory	Mandatory –Non-credit Audit Course		Disaster Preparedness & Planning	3	0	0	0	
TOTAL CREDITS				**11**	**0**	**24**	**20**	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

Semester VIII (Fourth year)								
Type	**Type of Course/Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**Page**
Theory	Program Elective Course -5		Program Elective Course – 5 1. Earth quake Engineering 2. Design of hydraulic Structures 3. Rain water harvesting	3	1	0	4	
	Program Elective Course -6		Program Elective Course – 6 1. Bridge Engineering 2. Urban Transportation Planning 3. Ground water Engineering	3	1	0	4	
	Program Elective Course -7		Program Elective Course -7 1. Elements of Geoinformatics 2.Environmental Geotechnology 3. Pre stressed concrete	3	0	0	3	
	Multidisciplinary Open Electives Courses - 4		Multidisciplinary Open Electives Courses – 4 Introduction to Finite Element Analysis	3	0	0	3	
	Project		Project	0	0	8	4	
	TOTAL CREDITS			**12**	**2**	**8**	**18**	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

TOTAL CREDITS – 167

B.TECH (MINOR / HONOURS / RESEARCH) ADDITIONAL 18 CREDITS

List of Courses for Honours and Minors

Minor courses offered from Civil Engineering Department

Sl. No.	Course Name	Credits	Link
1	Basic Construction Materials	3	https://nptel.ac.in/courses/105/106/105106206/ https://nptel.ac.in/courses/105/102/105102088/
2	Geographic Information System	3	https://nptel.ac.in/courses/105/107/105107155/ https://nptel.ac.in/courses/105/107/105107206/
3	Geomorphology	3	https://nptel.ac.in/courses/105/107/105107200/
4	Maintenance and Repair of Concrete Structures	3	https://nptel.ac.in/courses/105/106/105106202/
5	Remote Sensing-Principles and Applications	3	https://nptel.ac.in/courses/105/101/105101206/ https://nptel.ac.in/courses/105/103/105103193/ https://nptel.ac.in/courses/105/107/105107201/ https://nptel.ac.in/courses/105/108/105108077/ https://nptel.ac.in/courses/105/107/105107160/
6	Strategies for Sustainable Design	3	https://nptel.ac.in/courses/124/106/124106157/
8	Introduction to Civil Engineering Profession	2	https://nptel.ac.in/courses/105/106/105106201/
9	Architectural Conservation and Historic Preservation	2	https://nptel.ac.in/courses/124/105/124105003/
10	Safety in Construction	2	https://nptel.ac.in/courses/105/102/105102206/
11	Natural Hazards	2	Https://nptel.ac.in/courses/105/104/105104183/
12	Mechanics of Solids	3	CVSM0050
13	Introduction to Fluid Mechanics	2	CVFM0049
14	Structural Engineering	3	CVSE0058
15	Surveying & Geomatics	2	CVSG0051
16	Construction Engineering & Management	3	CVCM0063
17	Engineering Economics, Estimation & Costing	4	CVEC0064

List of courses offered for Honours in Civil Engineering

Domain 1: ENVIRONMENTAL ENGINEERING

Sl. No.	Course Name	Credits	Link
1	Plastic Waste Management	2	https://nptel.ac.in/courses/105/105/105105184/
2	Electronic Waste Management	1	https://nptel.ac.in/courses/105/105/105105169/
3	Applied Environmental Microbiology	3	https://nptel.ac.in/courses/105/107/105107173/
4	Water and Wastewater Treatment	3	https://nptel.ac.in/courses/105/105/105105178/
5	Water Supply Engineering	3	https://nptel.ac.in/courses/105/105/105105201/
6	Environmental Remediation	3	https://nptel.ac.in/courses/105/107/105107181/
7	Environmental Chemistry and Microbiology	3	https://nptel.ac.in/courses/102/105/102105087/
8	Applied Environmental Microbiology	3	https://nptel.ac.in/courses/105/107/105107173/
9	Integrated Waste Management for a Smart City	3	https://onlinecourses.nptel.ac.in/noc21_ce46/preview -3rd semester students
10	Wastewater Treatment and Recycling	3	https://onlinecourses.nptel.ac.in/noc21_ce49/preview -5th Sem students

Domain 2: CONSTRUCTION TECHNOLOGY

Sl. No.	Course Name	Credits	Link
1	Land Scape Architecture and Site Planning-Basic Fundamentals	2	https://nptel.ac.in/courses/124/105/124105001/
2	Maintenance and Repair of Concrete Structures	3	https://nptel.ac.in/courses/105/106/105106202/
3	Basic Construction Materials	3	https://onlinecourses.nptel.ac.in/noc21_ce10/preview
4	Safety in Construction	2	https://nptel.ac.in/courses/105/102/105102206/
5	Development and Application of Special Concrete	3	https://nptel.ac.in/courses/105/104/105104206/
6	Principles of Construction Management	2	https://nptel.ac.in/courses/105/104/105104161/
7	Construction Methods and Equipment Management	2	https://nptel.ac.in/courses/105/103/105103206/
8	Concrete Technology	3	https://nptel.ac.in/courses/105/102/105102012/ https://nptel.ac.in/courses/105/104/105104030/ https://nptel.ac.in/courses/105/106/105106176/
9	Project Planning & Control	3	https://onlinecourses.nptel.ac.in/noc21_ce50/preview
10	Hydration, Porosity & Strength of Cementitious Materials - for 3rd semester	3	https://onlinecourses.nptel.ac.in/noc21_ce66/preview
11	Elastic Stability of Structures	3	https://onlinecourses.nptel.ac.in/noc22_ce91/preview
12	Plates and shells	3	https://onlinecourses.nptel.ac.in/noc22_ce80/preview

LIST of VALUE-ADDED COURSES offered by the DEPARTMENT

1. Computer Aided Drafting
2. Building Modeling and Analysis using STAAD-Pro
3. Training on Modeling and Analysis using ABACUS
4. Detailing and Drafting of Concrete Reinforcement
5. Soil modelling with the finite element program PLAXIS 2D (INTRODUCED in AUTUMN 2023)
6. Design of Flexible pavement as per IRC:37-2018

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME: BACHELOR OF TECHNOLOGY (BTECH) - COMPUTER SCIENCE AND ENGINEERING

*COURSE STRUCTURE (NEP BATCH 2024)

*"Undergraduate Degree Course Structure Based on AICTE Model Curriculum 2024 (Subject to Change)"

Type	Type of Course/ Category	Course Code	Course Title	L-T-P	Credits	Page
SEMESTER I						
Theory	BS/IC	PSPT111T	Physics for Technologists	3-1-0	4	794
	BS/IC	MAMT113T	Mathematics I	3-1-0	4	796
	HS/IC	EGTW107T	English for Technical Writing	2-0-0	2	790
	ES/IC	CSPS100T	Programming for Problem Solving	3-0-0	3	805
Lab	BS/IC	PSPT112L	Physics for Technologists Lab	0-0-2	1	795
	ES/IC	CSPS101L	Programming for Problem Solving Lab	0-0-4	2	806
	ES/IC	CVGD100T	Engineering Graphics and Design	1-0-4	3	814
	HS/IC	EGOP108L	Oral Communication Practice Lab	0-0-2	1	790
		MNDI101L	Design Thinking and Idea Lab	1-0-2	2	816
	MC/IC	BTUH0001	Universal Human Values I: Student Induction Program (UHV I)	0-0-0	NC	818
Total Credits					**22**	
SEMESTER II						
Theory	BS/IC	CHCY118T	Chemistry I	3-1-0	4	801
	BS/IC	MAMT114T	Mathematics II	3-1-0	4	799
	ES/IC	EEEL102T	Basic Electrical Engineering	3-1-0	4	813
Lab	ES/IC	CHCY119L	Chemistry Lab	0-0-2	1	804
	ES/IC	EEEL101L	Basic Electrical Engineering Lab	0-0-2	1	814
	ES/IC	MNWM100L	Workshop/Manufacturing Practice	1-0-2	2	815
	MC/IC	BTSY0003	Sports and Yoga or NSS/NCC	2-0-0	0	
	MC/IC	BTUH0002	Universal Human Values II	2-1-0	3	818
Total Credits					**19**	
Skill based internship program for exit policy					MC/IC	
SEMESTER III						
Theory			Analog Electronic Circuits	3-0-0	3	
			Data structure and Algorithms	3-0-0	3	
			Digital Electronics	3-0-0	3	
Lab			Analog Electronic Circuits Lab	0-0-4	2	
			Data structure and Algorithms Lab	0-0-4	2	
			Digital Electronics Lab	0-0-4	2	
			IT Workshop (Sci Lab/MATLAB)	1-0-4	3	
			Mathematics-III (Differential Calculus)	2-0-0	2	
			Humanities-I	3-0-0	3	
Total Credits					**23**	
Semester IV						
Theory			Discrete Mathematics	3-1-0	4	
			Computer Organization & Architecture	3-0-0	3	
			Design & Analysis of Algorithms	3-0-0	3	
			Advanced Programming	3-1-0	4	
Lab			Computer Organization & Architecture Lab	0-0-4	2	

			Design & Analysis of Algorithms Lab	0-0-4	2	
Theory			Management 1 (Organizational Behaviour/Finance & Accounting)	3-0-0	3	
			Environmental Sciences		0	
Total Credit					**21**	
Skill based internship program for exit policy					**6**	
Semester V						
Theory			Signals & Systems	3-0-0	3	
			Introduction to Database Systems	3-0-0	3	
			Machine Learning	3-1-0	4	
			Operating Systems	3-0-0	3	
Lab			Introduction to Database Systems Lab	0-0-2	2	
			Operating Systems Lab	0-0-4	2	
			Humanities II	3-0-0	3	
			Constitution of India/Essence of Indian Knowledge Tradition		0	
Total Credit					**20**	
Semester VI						
Theory			Computer Networks	3-0-0	3	
			Introductory Cyber Security	3-0-0	3	
			Elective-I	3-0-0	3	
			Elective-II	3-0-0	3	
			Theory of Computation	3-1-0	4	
Lab			Computer Networks Lab	0-0-4	2	
			Introductory Cyber Security Lab	0-0-4	2	
			Project-1	0-0-6	3	
Total Credit					**23**	
Skill based internship program for exit policy					**6**	
Semester VII						
Theory			Compiler Design	3-0-0	3	
			Elective-III	3-0-0	3	
			Open Elective-I	3-0-0	3	
Lab			Compiler Design Lab	0-0-4	2	
			Biology	3-0-0	3	
			Project-II	0-0-12	6	
Total Credit					**21**	
Semester VIII						
Theory			Elective-IV	3-0-0	3	
			Open Elective-II	3-0-0	3	
			Open Elective-III	3-0-0	3	
			Project-III	0-0-12	6	
Total Credit					**15**	
Total Credit					**163**	

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BACHELOR OF TECHNOLOGY (BTECH) – ELECTRICAL AND ELECTRONICS ENGINEERING
*COURSE STRUCTURE (NEP BATCH 2024)

*"Undergraduate Degree Course Structure Based on AICTE Model Curriculum 2024 (Subject to Change)"

Type	Type of Course/ Category	Course Code	Course Name	L-T-P	Credits	Page
SEMESTER I						
Theory	BS/IC	PSPT111T	Physics for Technologists	3-1-0	4	794
	BS/IC	MAMT113T	Mathematics I	3-1-0	4	796
	ES/IC	CSPS100T	Programming for Problem Solving	3-0-0	3	804
	ES/IC	CVGD100T	Engineering Graphics and Design	1-0-4	3	814
	ES/IC	MNDI101L	Design Thinking and Idea Lab	1-0-2	2	816
	HS/IC	EGTW107T	English for Technical Writing	2-0-0	2	790
Lab	BS/IC	PSPT112L	Physics for Technologists Lab	0-0-2	1	795
	ES/IC	CSPS101L	Programming for Problem Solving Lab	0-0-4	2	805
	HS/IC	EGOP108L	Oral Communication Practice Lab	0-0-2	1	790
Audit	MC/IC (3 Weeks Compulsory)	BTUH0001	Universal Human Values (UHV I): Student Induction Program	0-0-0	NC	817
Total Credits					22	
SEMESTER II						
Theory	BS/IC	CHCY118T	Chemistry	3-1-0	4	801
	BS/IC	MAMT114T	Mathematics II	3-1-0	4	799
	ES/IC	EEEL102T	Basic Electrical Engineering	3-1-0	4	813
	BS/IC	BOBE113T	Biology for Engineers	3-0-0	3	791
	ES/IC	MNWM100L	Workshop/Manufacturing Practices	1-0-2	2	815
	HS/IC	BTUH0002	Universal Human Values (UHV II)	2-1-0	3	818
Lab	BS/IC	CHCY119L	Chemistry Lab	0-0-2	1	804
	ES/IC	EEEL101L	Basic Electrical Engineering Lab	0-0-2	1	814
Audit	MC/IC	BTSY0003	Sports and Yoga or NSS/NCC	1-0-4	NC	
Total Credits					22	
SEMESTER III						
Theory	PC/DC		Analog Electronics	3-0-0	3	
	PC/DC		Signals and Systems	3-0-0	3	
	PC/DC		Electrical Circuit Analysis	3-1-0	4	
	PC/DC		Electrical Machines-I	3-0-0	3	
	ES/IC		Engineering Mechanics for Electronics and Electricals	3-1-0	4	
Lab	PC/DC		Electrical Machines-I Laboratory	0-0-2	1	
	PC/DC		Electrical Circuit Analysis Laboratory	0-0-2	1	
Internship	PC/DC		Summer Internship I/ Mini Project	0-0-2	1	
Audit	MC/IC		Language Other than Mother Tongue	1-1-0	NC	
	MC/IC		Constitution of India	3-0-0	NC	
Total Credits					20	
SEMESTER IV						
Theory	HS/IC		Effective Technical Communication	3-0-0	3	
	PC/DC		Digital Electronics	3-0-0	3	
	PC/DC		Control Systems	3-0-0	3	
	PC/DC		Power Electronics	3-0-0	3	
	BS/IC		Mathematics III – Complex Variable, Transform Calculus and Probability and Statistics	3-1-0	4	
	PE		Electromagnetic Fields	3-0-0	3	
			Electric Machines – II	3-0-0	3	
Lab	PC/DC		Digital Electronics Laboratory	0-0-2	1	
	PC/DC		Control Systems Laboratory	0-0-2	1	
	PC/DC		Power Electronics Laboratory	0-0-2	1	

Audit	MC/IC		Language Other than Mother Tongue	1-1-0	NC	
	MC/IC		Environmental Science	3-0-0	NC	
Total Credits					25	
SEMESTER V						
Theory	HS/IC		Entrepreneurship and Startups	3-0-0	3	
	PE/DE		Building Cyber Physical Systems	3-0-0	3	
	PC/DC		Power Systems-I	3-0-0	3	
	PE/DE		Renewable Energy	3-0-0	3	
	OE/SE/IE		Computer Architecture	3-1-0	4	
	PE/DE		Analog and Digital Communications	3-0-0	3	
Lab	PC/DC		Building Cyber Physical Systems Laboratory	0-0-2	1	
	PC/DC		Power Systems-I Laboratory	0-0-2	1	
	PC/DC		Renewable Energy Laboratory	0-0-2	1	
	PC/DC		Computer Architecture Laboratory	0-0-2	1	
Internship	PC/DC		Summer Internship II	0-0-2	1	
Total Credits					24	
SEMESTER VI						
Theory	PE/DE		Power Systems –II	3-0-0	4	
			Electrical Safety	3-0-0		
			Electric Vehicles	3-0-0		
	PE/DE		Measurements and Instrumentation	2-0-0	2	
	PE/DE		Introduction to Robotics and Automation	3-0-0	3	
			Microprocessor and Microcontrollers	3-0-0		
	OE/SE/IE		Economics	3-0-0	3	
			Psychology	3-0-0		
			Sociology	3-0-0		
			Industrial Management	3-0-0		
			Introduction to Organisational Behaviour	3-0-0		
			Intellectual Property Rights	3-0-0		
	PE/DE		Digital Signal Processing	3-0-0	3	
			Embedded Systems	3-0-0		
Lab	PC/DC		Measurements and Instrumentation Laboratory	0-0-2	1	
Audit	HS/IC	PYTK0103	Essence of Indian Traditional Knowledge	3-0-0	3	
Total Credits					19	
SEMESTER VII						
Theory	PC/DC		Research Methodology (Swayam/NPTEL)	3-1-0	4	
	PE/DE		Online Course on Power Systems/Control Systems/Embedded Systems/Renewable Energy (Swayam/NPTEL)	3-1-0	4	
	OE/SE/IE		Open Elective Online Course on AI/ML (Swayam/NPTEL)	3-0-0	3	
Internship	PC/DC		Summer Internship	0-0-4	2	
Project	PC/DC		Dissertation Phase-I	0-0-6	3	
Total Credits					16	
SEMESTER VIII						
Theory	PE/DE		Online Course (Swayam/NPTEL)	3-0-0	3	
	PE/DE		Online Course (Swayam/NPTEL)	3-0-0	3	
	OE/SE/IE		Open Elective Online Course (Swayam/NPTEL)	3-0-0	3	
	OE/SE/IE		HSS Open Elective Online Course (Swayam/NPTEL)	3-0-0	3	
Project	PC/DC		Dissertation Phase-II	0-0-24	12	
Total Credits					24	
Total Programme Credits					172	

Bouquet of Departmental Electives 4th Year

Course Code	Course Title	L-T-P	Credits	Page
	Communication Engineering	3-0-0	3	
	Power System Optimization	3-0-0	3	
	Multivariable Control	3-0-0	3	
	DSP Based Control of Drives	3-0-0	3	
	Power Systems Protection	3-0-0	3	
	Advanced Electromechanics	3-0-0	3	
	Operating Systems	3-0-0	3	
	Robotics and Automation	3-0-0	3	
	Power Quality	3-0-0	3	
	Machine Intelligence and Learning	3-0-0	3	
	Multicore Systems	3-0-0	3	
	Renewable Energy System	3-0-0	3	
	Digital Control	3-0-0	3	
	Switch Mode Power Conversion	3-0-0	3	
	Power System Dynamics and Control	3-0-0	3	
	Optimal Control Theory	3-0-0	3	
	Digital Image Processing	3-0-0	3	
	Multirate Signal Processing	3-0-0	3	
	Smart Grid Technology	3-0-0	3	
	I.C. Technology	3-0-0	3	
	Power System Analysis and Stability	3-0-0	3	
	Power System Operation and Control	3-0-0	3	
	Industrial Drives	3-0-0	3	
	Sensors and Actuators	3-0-0	3	
	Speech Processing	3-0-0	3	
	Signal Compression	3-0-0	3	
	Computer Networks	3-0-0	3	
	Microwave Engineering	3-0-0	3	
	Cellular Communication Networks	3-0-0	3	
	Satellite Communications	3-0-0	3	
	Spread Spectrum Communications	3-0-0	3	
	Optical Communication Systems	3-0-0	3	

VALUE ADDED COURSES BY ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

Semester	Course Code	Course Title	L-T-P	Credits	Page
6	EEAR0112	Introduction to Arduino and Raspberry Pi	0-1-2	2	
7	EEAL0113	AutoCAD Electrical	0-1-2	2	
7	EEEL0114	Electrical Wiring	0-1-2	2	
7	EEEV0116	Introduction to Electric Vehicles	0-1-2	2	
8	EEPY0115	Python for Electrical Engineering	0-1-2	2	

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BACHELOR OF TECHNOLOGY (BTECH) - ELECTRONICS AND COMMUNICATION ENGINEERING

*COURSE STRUCTURE (NEP BATCH 2024)

*"Undergraduate Degree Course Structure Based on AICTE Model Curriculum 2024 (Subject to Change)"

Type	Type of Course/Category	Course Code	Course Name	L-T-P	Credits	Page
SEMESTER I						
3 WEEKS COMPULSORY STUDENT INDUCTION PROGRAM (UHV-I) (BTUH0001)						
Theory	BSC/IC	PSPT111T	Physics for Technologists	3-1-0	4	794
	BSC/IC	MAMT113T	Mathematics I	3-1-0	4	796
	ESC/IC	CSPS100T	Programming for Problem Solving	3-0-0	3	804
	HSMC/IC	EGTW107T	English for Technical Writing	2-0-0	2	790
Lab	BSC/IC	PSPT112T	Physics for Technologists Lab	0-0-2	1	795
	ESC/IC	CSPS101L	Programming for Problem Solving Lab	0-0-4	2	805
	ESC/IC	CVGD100T	Engineering Graphics and Design	1-0-4	3	814
	HSMC/IC	EGOP108L	Oral Communication Practice Lab	0-0-2	1	790
	ESC/IC	MNDI101L	Design Thinking and Idea Lab	1-0-2	2	816
Total Credits					**22**	
SEMESTER II						
Theory	BSC/IC	CHCY118T	Chemistry	3-1-0	4	801
	BSC/IC	MAMT114T	Mathematics II	3-1-0	4	799
	ESC/IC	EEEL102T	Basic Electrical Engineering	3-1-0	4	813
	BSC/IC	BOBE113T	Biology for Engineers	3-0-0	3	791
	HSMC/IC	BTUH0002	Universal Human Values (UHV II)	2-1-0	3	818
Lab	BSC/IC	CHCY119L	Chemistry Lab	0-0-2	1	804
	ESC/IC	EEEL101L	Basic Electrical Engineering Lab	0-0-2	1	814
	ESC/IC	MNWM100L	Workshop/ Manufacturing Practices	1-0-2	2	815
	Mandatory Course/IC	BTSY0003	Sports and Yoga or NSS/NCC	1-0-4	0	
Total Credits					**22**	
SEMESTER III						
Theory	EC/DC		Electronic Devices	3-0-0	3	
	EC/DC		Signal and Systems	3-0-0	3	
	EC/DC		Network Theory	3-0-0	3	
	EC/DC		Digital System Design	3-0-0	3	
	BSC/IC		Mathematics III- Transform Calculus, Complex Variable and Probability and Statistics	2-1-0	3	
	HSMC/IC		Economics for Engineers	2-0-0	2	
Lab	EC/DC		Electronic Devices Lab	0-0-2	1	
	EC/DC		Digital System Design Lab	0-0-2	1	
	Internship		Internship Activity		2	
	Mandatory Course/IC		Environmental Science	0-0-0	0	
Total Credit					**21**	
SEMESTER IV						
Theory	EC/DC		Analog Circuits	3-0-0	3	
	EC/DC		Electronic Measurements	3-0-0	3	
	EC/DC		Digital Signal Processing	3-0-0	3	
	EC/DC		Microprocessor and Microcontroller	3-0-0	3	
	HSMC/IC		Introduction to Organisational Behaviour	3-0-0	3	
Lab	EC/DC		Analog Circuits Lab	0-0-2	1	
	EC/DC		Electronic measurements Lab	0-0-2	1	
	EC/DC		Digital Signal Processing Lab	0-0-4	2	
	EC/DC		Microprocessor and Microcontroller Lab	0-0-2	1	
Project 1	EC/DC		Micro Project	0-0-4	2	

	Mandatory Course/IC		Constitution of India	0-0-0	0	
Total Credit					**22**	
SEMESTER V						
Theory	EC/DC		Analog and Digital Communication	3-0-0	3	
	EC/DC		Electromagnetic Waves	2-0-0	2	
	EC/DC		Embedded Systems	3-0-0	3	
	EC/DC		Probability Theory and Stochastic Processes	2-0-0	2	
	EC/DC		Power Electronics	2-0-0	2	
	HSMC/IC		Production and Operation Management	3-0-0	3	
Lab	EC/DC		Analog and Digital Communication Lab	0-0-2	1	
	EC/DC		Electromagnetic Waves Lab	0-0-2	1	
	EC/DC		Embedded Systems Lab	0-0-2	1	
	Internship		Internship Activity		2	
	Mandatory Course/IC		Indian Knowledge System	0-0-0	0	
Total Credit					20	
SEMESTER VI						
Theory	EC/DC		Control Systems	3-0-0	3	
	EC/DC		Computer Networks	3-0-0	3	
	EC/DC		VLSI Design	3-0-0	3	
	EC/DC		Mobile Communication and Networks	3-0-0	3	
	PE/DE		Microwave Theory and Techniques	3-0-0	3	
			Antennas and Propagation			
			Biomedical Electronics			
	OE/IE		Embedded System and Applications	3-0-0	3	
Lab	EC/DC		Computer Networks Lab	0-0-2	1	
	EC/DC		VLSI Design Lab	0-0-2	1	
Project 2	EC/DC		Mini Project	0-0-6	3	
Total Credit					23	
SEMESTER VII						
Theory	PE/DE		Fiber Optic Communication	3-0-0	3	
			Satellite Communication			
			Wireless Sensor Network			
	PE/DE		Information Theory and Coding	3-0-0	3	
			Machine Learning			
			Mixed Signal Design			
	OE/IE		Internet of Things	3-0-0	3	
	OE/IE		Robotics	3-0-0	3	
	HSMC/IC		Financial Management and Accounting	3-0-0	3	
Project 3	EC/DC		Major Project Phase-I	0-0-6	3	
Internship	Internship		Internship Seminar	0-0-4	2	
Total Credit					**20**	
SEMESTER VIII						
Theory	PE/DE		Adaptive Signal Processing	3-0-0	3	
			Digital image Processing			
			Internet of Things			
	OE/IE		Bioinformatics	3-0-0	3	
Project 4	EC/DC		Major Project Phase-II	0-0-28	14	
Total Credit					**20**	
Total Program Credits					**170**	

Value Added Courses					
Type	**Course Code**	**Course Title**	**L-T-P**	**Credit**	**Page**
SPRING					
Theory	ECES6064	Electronic Display System	2-0-0	2	
		Introduction to Bioengineering and	2-0-0	2	

		Bioinformatics			
AUTUMN					
Theory	ECNA6065	Nanotechnology and Applications	2-0-0	2	
		Industry 4.0	2-0-0	2	

PROGRAMME: BTECH (HONOURS) - ELECTRONICS AND COMMUNICATION ENGINEERING

For B.Tech (Honors) in Electronics and Communication Engineering, students will have to earn extra 18 Credits in addition to the regular BTECH courses

There are two domains for BTECH (Honors) in ECE for a student to opt for.

BTECH (HONOURS): (IOT AND SENSOR TECHNOLOGY)						
Type	**Type of Course/ Category**	**Course Code**	**Course Name**	**L-T-P**	**Credits**	**Page**
Theory	Semester IV					
	EC/DC	ECST0114	Sensor Technology	3-1-0	4	
	Semester V					
	EC/DC	ECBA0115	IoT Basics & Architecture	3-1-0	4	
	Semester VI					
	EC/DC	ECWT0116	Web Technology	3-1-0	4	
	Semester VII					
	EC/DC	ECML0117	Machine Learning	3-1-0	4	
	Semester VIII					
	EC/DC	ECET0118	Embedded Systems and IOT	3-1-0	4	
BTECH (HONOURS): (SIGNAL PROCESSING AND VLSI)						
Type	**Type of Course/ Category**	**Course Code**	**Course Name**	**L-T-P**	**Credits**	**Page**
Theory	Semester IV					
	EC/DC	ECVD0096	VLSI Design Technology	3-1-0	4	
	Semester V					
	EC/DC	ECSV0119	Signal Processing for VLSI	3-1-0	4	
	Semester VI					
	EC/DC	EDDS0120	Advance DSP	3-1-0	4	
	Semester VII					
	EC/DC	ECML0117	Machine Learning	3-1-0	4	
	Semester VIII					
	EC/DC	ECCV0121	Fundamentals of Computer Vision	3-1-0	4	

PROGRAMME: BTECH (MINOR) - ELECTRONICS AND COMMUNICATION ENGINEERING

For BTECH Minor in ECE, a student must earn a **minimum of 18 credits** in addition to the regular BTECH courses, by choosing a combination of courses from the list below:

Type	**Type of Course/ Category**	**Course Code**	**Course Name**	**L-T-P**	**Credits**	**Page**
Theory	Semester III					
	EC/DC	ECDC0122	Digital Circuits	3-1-0	4	
	Semester IV					
	EC/DC	ECSC0123	Semiconductor Devices and Circuits	3-1-0	4	
	Semester V					
	EC/DC	ECFC0124	Fundamentals of Analog Electronic Circuit	3-1-0	4	
			Principles of Communication			
	Semester VI					
	EC/DC	ECIM0125	Introduction to Microprocessor and Microcontroller	3-1-0	4	
	Semester VII					
	EC/DC	ECIC0126	Semiconductor IC Technology	3-1-0	4	
		ECMC0127	Microelectronics: Devices to Circuits			

DEPARTMENT OF MECHANICAL ENGINEERING

BACHELOR OF TECHNOLOGY (BTECH) – MECHANICAL ENGINEERING
*COURSE STRUCTURE (NEP BATCH 2024)

*"Undergraduate Degree Course Structure Based on AICTE Model Curriculum 2024 (Subject to Change)"

SEMESTER I						
Type	**Type of Course/ Category**	**Course Code**	**Course Name**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	CHCY118T	Chemistry	3-1-0	4	801
	Basic Science Course/IC	MAMT113T	Mathematics I	3-1-0	4	796
	Engineering Science Course/IC	EEEL100T	Basic Electrical Engineering	2-1-0	3	813
	Basic Science Course/IC	BOBE113T	Biology for Engineers	3-0-0	3	791
Lab	Basic Science Course	CHCY119L	Chemistry Lab	0-0-2	1	804
	Engineering Science Course/IC	EEEL101L	Basic Electrical Engineering Lab	0-0-2	1	814
	Engineering Science Course/IC	MNWM100L	Workshop/Manufacturing Practices	1-0-2	2	815
	Engineering Science Course/IC	MNDI101L	Design Thinking and Idea Lab	1-0-2	2	816
	Mandatory Course/IC	BTUH0001	Universal Human Values-1	0-0-0	NC	817
Total Credits					20	
SEMESTER II						
Theory	Basic Science Course/IC	PSEP109T	Engineering Physics	3-1-0	4	792
	Basic Science Course/IC	MAMT114T	Mathematics II	3-1-0	4	799
	Engineering Science Course/IC	CSPS100T	Programming for Problem Solving	3-0-0	3	804
	Engineering Science Course/IC	CVGD100T	Engineering Graphics and Design	1-0-4	3	814
	Humanities & Social Sciences	EGTW107T	English for Technical Writing	2-0-0	2	790
	Humanities and Social Sciences	BTUH0002	Universal Human Values (UHV II)	3-0-0	3	818
Lab	Basic Science Course/IC	PSEP110L	Engineering Physics Lab	0-0-2	1	793
	Engineering Science Course/IC	CSPS101L	Programming for Problem Solving Lab	0-0-4	2	805
	Humanities & Social Sciences	EGOP108L	Oral Communication Practice Lab	0-0-2	1	790
	Mandatory Course/IC	BTSY0003	Sports and Yoga or NSS/NCC	1-0-4	NC	
Total Credits					**23**	
SEMESTER III						
Theory	Basic Science course/IC		Physics-II	3-1-0	4	
	Basic Science course/IC		Mathematics- III	3-1-0	4	
	Engineering Science Course/IC		Basic Electronics Engineering	3-1-0	4	
	Engineering Science Course/IC		Engineering Mechanics	3-1-0	4	
	Professional core course/DC		Applied Thermodynamics	3-1-0	4	
	Audit Course		Environment Science	2-0-0	NC	
Lab	Basic Science Course/IC		Physics –II Lab	0-0-2	1	

	Engineering Science Course/IC		Basic Electronics Engineering Lab	0-0-2	1	
	Audit course		Machine Drawing Lab	1-0-2	NC	
Total Credits					**22**	
SEMESTER IV						
Theory	Professional core Course/DC		Heat Transfer & Thermal Machines	3-1-0	4	
	Professional core course/DC		Fluid Mechanics & Hydraulic Machines	3-1-0	4	
	Professional core course/DC		Mechanics of Deformable Solids	3-1-0	4	
	Professional core course/DC		Kinematics & Dynamics of Machines	3-1-0	4	
	Professional core course/DC		Engineering Materials & Applications	3-1-0	4	
Lab	Professional core course/DC		Mechanical Engineering Lab-I (Thermal & Fluid)	0-1-2	2	
	Mandatory Course/IC		Constitution of India	0-0-0	NC	
	Value added Course		Introduction to AutoCAD	1-0-2	NC	
Total Credits					**22**	
SEMESTER V						
Theory	Professional core course/DC		Machine Element & System Design	3-1-0	4	
	Professional core course/DC		Mechatronics, Robotics & Control	3-1-0	4	
	Professional core course/DC		Manufacturing Processes	3-1-0	4	
	Professional core course/DC		Measurements & Metrology	3-1-0	4	
	Humanities		Economics for Engineers	3-0-0	3	
Lab	Professional core course/DC		Mechanical Engineering Lab II (Design)	0-1-2	2	
	Mandatory Course/IC		Service Learning		NC	
	Value added Course		Quantitative Aptitude for Competitive Examination	2-0-0	NC	
Total Credits					21	
SEMESTER VI						
Theory	Professional core course/DC		Computer Aided Design & Analysis	3-1-0	4	
	Professional core course/DC		Manufacturing Automation	3-1-0	4	
	Professional core course/DC		Product Innovation & Entrepreneurship	3-1-0	4	
	Professional core course/DC		Production & Operation Management	3-1-0	4	
	Humanities		Operations Research	3-0-0		
	Professional core course/DC		Engineering Project-1(Seminar)	0-0-4	2	
Lab	Professional core course/DC		Mechanical Engineering Lab3: Design	0-0-4	2	
			Royal Enfield Fresher's Course	1-0-2	NC	
Total Credits					23	
SEMESTER VII						
Theory	Professional Elective courses I/DE		Power Plant Engineering/ Renewable Energy Engineering	3-0-0	3	
	Professional Elective courses II/DE		Automobile Engineering/ Agricultural Engineering	3-0-0	3	
	Open Elective courses I/IE		Total Quality Management	3-0-0	3	
	Open Elective courses II/IE		Optimisation Techniques	3-0-0	3	
Project	Professional core course/DC		Engineering Project-2 (Design & Analysis)	0-0-10	5	
	Professional core course/DC		Seminar	0-0-2	1	
	Value added Course		Scilab for Mechanical engineers	1-0-2	NC	
Total Credits					18	

SEMESTER VIII						
	Professional Elective courses III/DE		Additive Manufacturing/Design for Manufacturing & Assembly	3-0-0	3	
	Open Elective courses III/IE		Power Plant Engineering	3-0-0	3	
Project	Professional core course/DC		Engineering Project-3 (Prototype & Testing)	0-0-16	8	
	Mandatory Course/IC		Essence of Indian Traditional Knowledge		NC	
Total Credits					**14**	
Total Programme Credits					**162**	

SCHOOL OF TECHNOLOGY

DETAILED SYLLABUS

EGTW107T: ENGLISH FOR TECHNICAL WRITING
(2 Credits- 30 hours) (L-T-P: 2-0-0)
[B.Tech All Branches]
EEE/ECE/CSE/AI&ML (1st Semester); CVL/MNE (2nd Semester)
Objective: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course/Learning Outcomes:
CO1: Define subject-verb agreement in language **(Remembering)**
CO2: Summarise the different processes of word formation in English **(Understanding)**
CO3: Identify erroneous sentence structures **(Applying)**
CO4: Distinguish between antonyms and synonyms **(Analysing)**
CO5: Explain the importance of proper punctuation in language **(Evaluating)**
CO6: Elaborate the different writing styles in language **(Creating)**

Module I: Vocabulary Building (6 hours)
a) The concept of Word Formation
b) Root words from foreign languages and their use in English
c) Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
d) Synonyms, antonyms, and standard abbreviations.

Module II: Basic Writing Skills (6 hours)
a) Sentence Structures
b) Use of phrases and clauses in sentences
c) Importance of proper punctuation
d) Creating coherence
e) Organizing principles of paragraphs in documents
f) Techniques for writing precisely

Module III: Identifying Common Errors in Writing (5 hours)
Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions,Redundancies, Clichés

Module IV: Nature and Style of sensible Writing (6 hours)
Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion

Module V: Writing Practices (7 hours)
Comprehension, Précis Writing, Essay Writing

Suggested Readings

1. *Practical English Usage*. Michael Swan. OUP. 1995.
2. *Remedial English Grammar*. F.T. Wood. Macmillan.2007
3. *On Writing Well.* William Zinsser. Harper Resource Book. 2001
4. *Study Writing*. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

EGTW108L: ORAL COMMUNICATION PRACTICE LAB
(1 Credit) (L-T-P:0-0-2)
[B.Tech All Branches]
EEE/ECE/CSE/AI&ML (1st Semester); CVL/MNE (2nd Semester)
Objective: The objective of this practical course is to enhance the basic language skills of the learners that would help them communicative effectively and confidently in different situations. This course primarily emphasizes on improving the learner's pronunciation, intonation and accent to enhance overall speech clarity.

COURSE /LEARNING OUTCOMES
After the completion of this lab course the students will be able to:
CO 1: *List* out the different vowel sounds and consonant sounds (Remembering)
CO 2: *Illustrate* the stress and intonation patterns in language. (Understanding)

CO 3: *Identify* the erroneous pronunciations. (Applying)
CO 4: *Compare* the pronunciation of similar sounding words. (Analysing)
CO 5: *Discuss* the tips for facing an interview. (Evaluating)
CO 6: *Determine* the common patterns in everyday conversations and dialogues. (Creating)

The course involves interactive practice sessions in Language Lab and includes topics as mentioned below:
1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations
4. Conversations and Dialogues
5. Communication at Workplace
6. Interviews & Speeches
7. Formal Presentations
8. Expressive language in English
9. Practice descriptive/narrative/persuasive passages in English
10. Practice stress and intonation in connected speech
11. Making a request/ Asking for permission
12. Practice words with similar vowel and consonant sounds

Suggested Readings
1. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
2. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

BOBE113T: BIOLOGY FOR ENGINEERING

3 Credits (2L: 1T: 0P)
(For BTech- MNE, CVE in 1st Semester, CSE, EEE, ECE in 2nd Semester)

Course Outcomes
CO1: Recall the biological observations of 18th Century that lead to major discoveries? (Remembering)
CO2: Compare the two, three, four and five kingdom classifications Highlight the criteria for classification (Understanding)
CO3: Apply thermodynamic principles to biological systems. (Applying)
CO4: Analyse biological processes at the reductionist level. (Analysing)
CO5: Examine DNA as a genetic material in the molecular basis of information transfer (Evaluating)

Module 1: Introduction (4 hours)
Importance of Biology: Fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft; Aspect of biology as an independent scientific discipline. History of Biology: Biological observations of the 18th Century; Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor.

Module 2: Classification (5 hours)
Classification and its criteria: Morphological, Biochemical and Ecological; Hierarchy of Classifications, based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization - Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e)Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life; Organism from different based on classification for the study :1. E.coli, 2. S.cerevisiae, 3. D. Melanogaster, 4.C. elegance, 5. A. Thaliana, 6. M. musculus

Module 3: Genetics and Information Transfer (13 hours)
a) Mendel's laws: Law of segregation and Law of independent assortment, Dominance, Recessiveness; Allele, Gene mapping, Gene interaction, Epistasis ; Meiosis and Mitosis in heredity; Gene – mapping; Genetic disorders in humans; complementation in human genetics.
b) DNA as a genetic material; Structure of DNA- single stranded, double stranded and nucleosomes; Genetic code- Salient features; Gene - complementation and recombination.

Module 4: Biomolecules and Enzymes (14 hours)
a) Biomolecules of life: Micromolecules and Macromolecules- sugars, starch and cellulose; Amino acids and proteins; Nucleotides and DNA/RNA; Two carbon units and lipids. Structure of proteins: Primary, Secondary, tertiary and Quaternary;Proteins as enzymes, transporters, receptors and structural elements.
b) Enzyme classification. Mechanism of enzyme action of any two enzyme. Enzyme kinetics and kinetic parameters; RNA catalysis.

Module 5: Metabolism (5 hours)
Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Key and its relation to standard free energy. Spontaneity. ATP as an energy currency; Glycolysis and Krebs cycle; Photosynthesis; Energy yielding and energy consuming reactions. Energy charge

Module 6: Microbiology (4 hours)
Unicellular organisms; Species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of unicellular organisms. Sterilization and media compositions. Growth kinetics.

Suggested Readings
1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calendar, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

E-Resources
1. https://onlinecourses.nptel.ac.in/noc19_ge31/preview (module-1)
2. a. https://www.youtube.com/playlist?list=PLnxkguKqEzZCF7kCmrzoH54UyNxKDp7-i (module-2)
   b. https://archive.nptel.ac.in/courses/102/103/102103091/ (module-2)
3. a. https://www.youtube.com/watch?v=9N9HvLh8K3w (module-3)
   b. https://onlinecourses.nptel.ac.in/noc22_bt07/preview (module-3)
4. a. https://youtu.be/Btte0Z5an2E?si=Ve4p1gN1Wc9rwTK4 (module-4)
   https://archive.nptel.ac.in/courses/104/103/104103121/ (module-4)
5. **https://youtu.be/iOr6UkAIQRM?si=LvKwJBTyaDLm-Bf5;**
   https://youtu.be/zW0JOcerox4?si=WXwxxIa2uSqhREoB
   https://onlinecourses.nptel.ac.in/noc23_bt05/preview#:~:text=ABOUT%20THE%20COURSE%3A&text=Basics%20understanding%20of%20enzyme%20structure,enzymes%2C%20enzyme%20assay%20and%20kinetics.
6. https://youtu.be/Btte0Z5an2E?si=Ve4p1gN1Wc9rwTK4;
   https://youtube.com/shorts/ixLOPJq9izg?feature=share
   https://youtube.com/shorts/BxZCQyXqBPM?feature=share
   https://youtube.com/shorts/rWlk4DThaxA?feature=share
   https://onlinecourses.nptel.ac.in/noc22_cy03/preview
7. https://onlinecourses.nptel.ac.in/noc22_cy06/preview
8. https://www.youtube.com/playlist?list=PLnxkguKqEzZBjxd-hSgMkBqrfSqPa0IJ0
   https://onlinecourses.nptel.ac.in/noc23_cy61/preview
9. https://www.youtube.com/playlist?list=PLnxkguKqEzZC5m6VmYw9tVxABqLMRitD_
https://onlinecourses.nptel.ac.in/noc23_bt07/preview

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L	L	L	L
CO 2	H	H	L	L	H	L
CO 3	L	L	L	M	H	L
CO 4	L	M	L	L	H	H
CO 5	L	L	H	H	L	L

PSEP109T: ENIGNEERING PHYSICS
(4 Credits – 60 Hours) (L-T-P: 3-1-0)
(For BTECH MNE, CVE)
Objective: To enhance the fundamental knowledge in Physics and its applications pertinent to diverse areas of Engineering and Technology

COURSE OUTCOMES
At the end of this course students will be able to:
CO1: Comprehend the principles of wave optics. (Understanding)
CO2: Able to solve problems for motion under constraints and friction. (Applying)
CO3: Analyse rotating and translating motion of a rigid body. (Analysing)
CO4: Explain the electromagnetic theory and electromagnetic waves. (Remembering)

Module I: Vector Mechanics of Particles (20 Hours)

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Problems including constraints and friction, Potential energy function; F = - Grad V; Conservative and non-conservative forces; Central forces; Conservation of Angular Momentum; Rotating coordinate system: Five-term acceleration formula — Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum; Harmonic oscillator; Damped harmonic motion; Forced oscillations and resonance.

Module II: Planar Rigid Body Mechanics (10 Hours)
Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems, Elasticity, Hooke's law, factors affecting elasticity, Poisson's ratio, Relations in elasticity, twisting couple on a wire.

Module III: Wave Optics (15 Hours)
a) Interference and diffraction: Huygen's principle, superposition of two waves, coherent sources, Young's double slit experiment, intensity distribution; Newton's rings and applications. Fresnel and Fraunhofer diffraction,
b) Photonics: spontaneous and stimulated emission, fundamentals of laser action, ruby Laser, He-Ne laser, applications of lasers. Elements of fibre optics, types of optical fibres

Module IV: Electromagnetic Theory and Semiconductor Physics (15 Hours)
a) Electromagnetism: basic idea of divergence and stokes theorems, Gauss's law and its applications, electrostatic potential, Poisson's and Laplace's equation, work and energy, dielectric polarization bound charges, electric displacement (D); magnetic induction (B), magnetic intensity (H), Biot-Savart's Law, Ampere's circuital law; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Faraday's law of electromagnetic induction, displacement current, Maxwell's equations in differential and integral forms.
b) Intrinsic and extrinsic semiconductors, p-n junction diode, Special purpose diodes: metal- semiconductor junction, Zener Diode, LED, Photovoltaic Effect, Solar cell

Suggested Readings
1. Physics (Introduction to Mechanics) with Lab Manual, Khanna Book Publishing Co., Bhattacharya & Nag
2. Physics (Introduction to Electromagnetic Theory) with Lab Manual, Khanna Book Publishing Company, Bhattacharya & Nag.
3. Physics (Oscillations, Waves & Optics) with Lab Manual, Khanna Book Publishing, Bhattacharya & Nag,
4. Physics for Engineers and Technologists, S. Dey, Eastern Book House.
5. Applied Physics for Engineers –Neeraj Mehta (PHI Learning Pvt. Limited)
6. A text Book of Engineering Physics –Dr. M.N. Avadhanulu and Dr. P.G.Kshirsagar (S. Chand and Company Pvt. Limited).
7. Engineering Mechanics, M. K. Harbola.

Alternative NPTEL/SWAYAM Course

S. No	NPTEL COURSE NAME	INSTRUCTOR	HOST INSTITUTE
1	ENGINEERING MECHANICS	PROF. MANOJ HARBOLA	IIT KANPUR

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1		L	H	
CO 2	H	M		
CO 3		M	H	
CO 4				H

PSEP110L: ENIGNEERING PHYSICS LAB
(1 credit) (L-T-P: 0-0-2)
(For BTECH MNE, CVE)
Course Outcomes
At the end of this course students will be able to:
CO1: Explain the usage of mechanical and optical systems for various measurements (Understanding)
CO2: Apply the analytical techniques and graphical analysis to the experimental data (Applying)
CO3: Evaluate vernier calipers, various rulers, meters, scales and other measuring devices to acquire measurements within the stated precision (Evaluating)

At least 10 experiments to be performed from the following
1. To determine the frequency of an Electrical maintained tuning fork by Melde's experiments

2. Determination of surface tension by capillary rise method.
3. Determination of wavelength of light by Newton's ring method.
4. Determination of grating element of a diffraction grating.
5. Determination of wavelength of laser source by diffraction grating method.
6. Study of photoemission.
7. Determination of Rigidity modulus by static method.
8. Determination of acceleration due to gravity by Bar pendulum.
9. Determination of thermal conductivity by Lee's method
10. Plotting of characteristic curve of a PN junction diode.
11. Determination of Young's modulus by Searle's method.
12. Study of RC circuit.

PSPT111T: PHYSICS FOR TECHNOLOGISTS

(4 Credits – 60 Hours) (L-T-P: 3-1-0)

(For BTECH CSE, ECE, EEE)

Objective: To enhance the fundamental knowledge in Physics and its applications pertinent to diverse areas of Engineering and Technology

COURSE OUTCOMES

At the end of this course students will be able to:

CO1: Comprehend the principles of wave optics. (Understanding)
CO2: Explain the electromagnetic theory and electromagnetic waves. (Remembering)
CO3: Interpret the concepts and principles in quantum mechanics. (Understanding)
CO4: Analyse the physics of semiconductors and their applications. (Analysing)

Module I: Wave Optics (18 Hours)

a) Interference and diffraction: Huygen's principle, superposition of two waves, coherent sources, Young's double slit experiment, intensity distribution; Newton's rings and applications. Fresnel and Fraunhofer diffraction, Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and under-damped oscillators
b) Photonics: spontaneous and stimulated emission, fundamentals of laser action, ruby Laser, He-Ne laser, applications of lasers. Elements of fibre optics, types of optical fibres, numerical aperture. Principles of holography.

Module II: Electromagnetic Theory (14 Hours)

a) Electromagnetism: basic idea of divergence and stokes theorems, Gauss's law and its applications, electrostatic potential, Poisson's and Laplace's equation, work and energy, dielectric polarization bound charges, electric displacement (D); magnetic induction (B), magnetic intensity (H), Biot-Savart's Law, Ampere's circuital law; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Faraday's law of electromagnetic induction, displacement current, Maxwell's equations in differential and integral forms.
b) Electromagnetic waves: Electromagnetic energy densities, Electromagnetic wave equations for E and B, transverse nature and speed of electromagnetic waves.

Module III: Quantum Physics and Applications (14 Hours)

a) Quantum physics: historical overview; particle aspect of radiation – blackbody radiation, photoelectric effect, Compton scattering; wave aspect of particles – de Broglie's hypothesis, matter waves; Heisenberg's uncertainty principle; transition from deterministic to probabilistic states of a system – wave functions, probability density, superposition principle; observables and operators, expectation values. Schrodinger wave equation.
b) Application of quantum mechanics: solutions of one-dimensional problem, infinite deep potential well – energy eigenvalues, eigenfunctions, potential barrier – tunneling.

Module IV: Semiconductor Physics (14 Hours)

a) Free electron theory, density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), energy bands in solids, E-k diagram, direct and indirect bandgaps, types of electronic materials: metals, semiconductors, and insulators, density of states, occupation probability, Fermi level, effective mass, phonons.
b) Intrinsic and extrinsic semiconductors, dependence of Fermi level on carrier- concentration and temperature (equilibrium carrier statistics), carrier generation and recombination, carrier transport: diffusion and drift, p-n junction, Special purpose diodes: metal- semiconductor junction, Zener Diode, LED, Photovoltaic Effect, Solar cell

Suggested Readings

1. Physics for Engineers and Technologists, S. Dey, Eastern Book House.
2. Applied Physics for Engineers –Neeraj Mehta (PHI Learning Pvt. Limited)
3. A text Book of Engineering Physics –Dr. M.N. Avadhanulu and Dr. P.G.Kshirsagar (S. Chand and Company Pvt. Limited).
4. Optics, A. Ghatak, Tata Mcgraw Hill.

5. Introduction to Electrodynamics, D. J. Griffiths, Pearson, Prentice Hall.
6. Concepts of Modern Physics, A. Beiser, McGraw Hill.
7. Quantum Mechanics, L. I. Shiff, McGraw Hills.
8. Quantum Mechanics, E. Merzbacher, Wiley.
9. Quantum Mechanics, G. Aruldas, PHI learning.
10. Classical Mechanics, H. Goldstein, Addison-Wesley.
11. Semiconductor Optoelectronics: Physics and Technology, J. Singh, McGraw Hill.
12. Semiconductor Devices: Physics and Technology, S. M. Sze, Wiley.
13. Semiconductor Optoelectronic Devices, P. Bhattacharya, Prentice Hall of India.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2		H		
CO 3		L	H	
CO 4			L	H

PSPT112L: PHYSICS FOR TECHNOLOGISTS LAB

(1 credits) (L-T-P: 0-0-1)
(For BTECH CSE, ECE, EEE)
COURSE OUTCOMES
At the end of this course students will be able to:
CO1: Explain the usage of mechanical and optical systems for various measurements (Understanding)
CO2: Apply the analytical techniques and graphical analysis to the experimental data (Applying)
CO3: Evaluate vernier calipers, various rulers, meters, scales and other measuring devices to acquire measurements within the stated precision (Evaluating)

At least 10 experiments should be performed from the following
1. To determine the frequency of an Electrical maintained tuning fork by Melde's experiments
2. Determination of surface tension by capillary rise method.
3. Determination of wavelength of light by Newton's ring method.
4. Determination of grating element of a diffraction grating.
5. Determination of wavelength of laser source by diffraction grating method.
6. Study of photoemission.
7. Determination of Rigidity modulus by static method.
8. Determination of acceleration due to gravity by Bar pendulum.
9. Determination of thermal conductivity by Lee's method
10. Plotting of characteristic curve of a PN junction diode.

PSPH113T: PHYSICS

(2 credits-30 Hours)
(For BTECH AIML)
Objective:
This course will help the students to familiarize with Ultrasonics, SHM, Oscillations, Wave motion, diffraction, polarization, laser, fiber optics and holography concepts.

Course outcomes:
After completion of course, students would be able to:
CO 1. Understand latest developments in certain areas of Physics which have important applications for societal needs.
CO 2. Understand lasers and fibre optics which have important applications for societal needs.
CO 3. Understand latest developments in certain areas of Physics which have important applications for societal needs.
CO 4. Develop capability to tackle problems in general and in the various areas covered in the course.

Module I: Ultrasonics & SHM
Production, detection and uses of ultrasonics, reverberation, Sabine's formula (no derivation), Review of basic kinematics (displacement, velocity, acceleration, time period and phase of vibration) and dynamics (restoring force and energetics) of simple harmonic motion, differential equation of SHM, superposition of two SHM in one dimension, charge oscillations in LC circuits

Module II: Oscillations
Damped Oscillations: Concept and cause of damping, differential equation of a damped oscillator and different kinds of

damping, Methods of describing damping of an oscillator - logarithmic decrement, relaxation time, quality factor, band width. Series LCR circuit as a damped oscillator. Forced Oscillations: States of forced oscillations, differential equation of forced oscillator – its displacement, velocity and impedance, behavior of displacement and velocity with driver's frequency, Power, bandwidth, Quality factor and amplification of forced oscillator, resonance in forced oscillators, forced oscillations in series LCR circuit

Module III: Wave Motion and interference
Wave equation and its solution, characteristic impedance of a string, reflection and transmission of waves on a string at a boundary, reflection and transmission of energy, the matching of impedances, Division of wave front and amplitude; Fresnel's biprism, Newton's rings, Michelson interferometerand its applications for determination of λ and dλ.

Module IV: Diffraction & Polarization
Fresnel and Fraunhofer diffraction, qualitative changes in diffraction pattern on moving from singleslit to double slit, plane transmission grating, dispersive power & resolving power of a grating, Methods of polarization, analysis of polarized light, quarter and half wave plates, double refraction.

Module V: Lasers, Fibre Optics and Holography
Elementary idea of LASER production, spontaneous emission, stimulated emission, Einstein's coefficients, Helium-Neon, Ruby and semiconductor lasers, applications of lasers. Basics of optical fibre - its numerical aperture, coherent bundle, step index and graded index fibre, material dispersion, fibre Optics sensors, applications of optical fibre in communication systems, Holography: Basic principle, theory and requirements.

Suggested Readings

1. Engineering Physics by A.B. Bhattacharya, Khanna Publishing House, 2020.
2. Physics for Engineers by N.K. Verma, Prentice Hall India, 2017.
3. Physics of Vibrations and Waves by H.J.Pain, 5th Edition, Wiley, 2006.
4. Optics by Ajoy Ghatak, McGraw Hill Education India, 2017.

PSPH114L: PHYSICS LAB
(1 credit-30 Hours)
(BTECH AIML)

Laboratory/ Practical
1. To find the wavelength of sodium light using Fresnel's biprism.
2. To determine the wavelength of He-Ne laser using transmission grating.
3. To determine the slit width using the diffraction pattern.
4. To determine the wave length of sodium light by Newton's rings method.
5. To determine the wave length of sodium light using a diffraction grating.
6. To find the specific rotation of sugar solution using a Bi-quartz Polarimeter.
7. To design a hollow prism and used it find the refractive index of a given liquid

Alternative NPTEL/SWAYAM Course (if any)

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Classical Physical	Prof. V. Balakrishnan	IIT Madras
2.	Modern Optics	Prof. Partha Roy Chaudhuri	IIT Kharagpur

MAMT113T: MATHEMATICS I
(4 Credits) (3L: 1 T: 0P)
(For BTech CSE, CVE, MNE, EEE, ECE)
Objectives: The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate differentiation and integration. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes
At the end of this course students will be able to:
CO 1: To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions. (Applying)
CO 2: The fallouts of Mean value theorems that is fundamental to application of analysis to Engineering problems. (Analysis)
CO 3: Find the concepts of convergence of sequence and series for real numbers. (Remembering)
CO 4: Classify various functions of several variables that are essential in most branches of engineering. (Understanding)

Module 1: Single-variable Calculus (Differentiation): (10 hours)
Rolle's Theorem, Mean value theorems and applications; Extreme values of functions; Linear approximation; Indeterminate forms and L'Hospital's rule. Curvature, evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Sequences and series: (10 hours)
Limits of sequence of numbers, Calculation of limits, Infinite series; Tests for convergence; Power series, Taylor and Maclaurin series; Taylor theorem, convergence of Taylor series, error estimates.

Module 3: Multivariable Calculus (Differentiation): (10 hours)
Limit, continuity and partial derivatives, directional derivatives, gradient, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 4: Multivariable Calculus (Integration): (10 hours)
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Centre of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Gradient, curl and divergence, Theorems of Green, Gauss and Stokes.

Suggested Readings

1. AICTE's Prescribed Textbook: Mathematics-I (Calculus & Linear Algebra), Reena Garg,
1. Khanna Book Publishing Co., 2023.
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,
5. 2002.
6. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
7. AICTE Model Curriculum for UG Degree Course in Civil Engineering
8. 6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,
9. 2010.
10. 7. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
11. 8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,
12. Reprint, 2008.
13. 9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Alternative NPTEL/SWAYAM Course:

S. No	NPTEL COURSE NAME	INSTRUCTOR	HOST INSTITUTE
1	Engineering Mathematics - I	PROF. JITENDRA KUMAR	IIT Kharagpur

Mapping of COs to Syllabus

	Module 1	**Module 2**	**Module 3**	**Module 4**
CO 1	M		H	M
CO 2	H	M		
CO 3	L	H		
CO 4			H	H

MAMT115T: MATHEMATICS I

(4 Credits) (3L: 1T: 0P)

BTech (AI ML)

Objective:

To make the students well versed with the concepts of linear algebra. The students should also be able to solve calculus and vector calculus-based problems.

COURSE OUTCOMES:

After completion of course, students would be able to:
CO 1: Recall and analyse the idea of basic algebra. (Remembering and analysing)
CO 2: Understand and apply calculus and multivariate calculus. (Understanding and applying)
CO 3: Understand and apply vector calculus. (Understanding and applying)
CO 4: Understand and apply differential equations. (Understanding and applying)

Module 1: Linear Algebra (12 Hours)
Vector spaces, Subspaces, basis and dimension, linear transformations, representation of transformations by Matrices, linear functionals, transpose of linear transformations, canonical forms. Linear functionals and adjoints, Bilinear forms, symmetric bilinear forms, skew symmetric bilinear forms

Module 2: Vector Calculus (8 Hours)
Applications. Integrals of Vector Functions: Line integrals, Green's formula, path independence, Surface integral: definition, evaluation, Stoke's formula, Gauss-Satoransky divergence theorem.

Module 3: Calculus & Multivariate Calculus (12 Hours)
Continuity and differentiability of a function of single variable, statement of Rolle's Theorem, Lagrange's mean value theorem and applications. Double and Triple Integrals: Calculations, Areas, Volumes, change of variables. Integral Calculus: Definite Integrals as a limit of sums, Applications of integration to area, volume, surface area, Improper integrals. Functions of several variables: Continuity and differentiability, mixed partial derivatives, local maxima and minima for function of two variables, Lagrange multipliers.

Module 4: Differential Equations (8 Hours)
Ordinary Differential Equations: First order linear equations, Bernoulli's equations, Exact equations and integrating factor, Second order and Higher order linear differential equations with constant coefficients

Alternative NPTEL/SWAYAM Course (if any):
NPTEL Course Name: Basic calculus for Engineers, Scientists and Economists
Instructor: Prof. Joydeep Dutta; IIT Kanpur

Suggested Readings
1. G. B. Thomas, R. L. Finney. Calculus and Analytic Geometry, Ninth Edition, Pearson Education, 2010
2. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Co., Delhi.
3. B. V. Ramana. Higher Engineering Mathematics, Tata McGraw Hill, 2017
4. E. Kreyszig. Advanced Engineering Mathematics, Wiley, 2015
5. Calculus and Analytic Geometry, G. B. Thomas and R. L. Finney, Pearson Education, 2010

Mapping Cos to the syllabus

COs	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		M	H	M
CO3		H	M	
CO4		M		H

MAAI116T: MATHEMATICAL CONCEPTS FOR AI

(3L: 1T: 0P 4 Credits)
(BTech (AI ML)
Objective:
This course should help the students understand the basic mathematical background of AI. Also, the students should be able to apply statistics and probability to analyse various datasets.

COURSE OUTCOMES
After completion of course, students would be able to:
CO 1: To understand the mathematical background of AI. (Understanding)
CO 2: Understand and apply calculus. (Understanding and applying)
CO 3: Relate the essential tool of matrices and linear algebra in a comprehensive manner. (Analysing)
CO 4: Apply the concept of probability and statistics in real life and apply hypothesis testing on different datasets. (Applying)

Module 1: Equations, Functions and Graphs (8 Hours)
Introduction to linear equations, Intercepts and slopes, System of equations, Exponentials, radicals and logarithms, Polynomials, Polynomial operations, Factorizations, Introduction to quadratic equations, Functions

Module 2: Derivatives and Optimizations (8 Hours)
Rate of change, Introduction to limits, Continuity, finding limits, Differentiability, Derivative rules and operations, using derivatives to analyse functions, Second order derivatives, Optimization functions, Multivariate differentiation

Module 3: Vectors and Matrices (12 Hours)

Introduction to vectors, Vector addition, vector multiplication, Introduction to matrices, matric multiplication, properties of matrices, types of matrices, Matrix division, solving system of equations with matrices, Matrix transformations, Eigen values and eigen vectors, rank of matrix; Echelon form, Normal form, Gauss-Jordan method, Gauss elimination method, Linear Dependence and Independence; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem, rank-nullity theorem.

Module 4: Probability and Statistics (12 Hours)
Basic rules and axioms events, sample space, dependent and independent events, conditional probability, Random variables- continuous and discrete, expectation, variance, distributions- joint and conditional, Bayes' Theorem, Popular distributions- binomial, Bernoulli, Poisson, exponential, Gaussian.
Fundamentals of Data: Collection, Summarization, and Visualization; Sampling and Sampling Distributions, Central Limit Theorem; Methods of Estimation, Unbiased estimators; Confidence Interval Estimation: Z-interval, t-interval; Hypothesis Testing, Types of Errors, Rejection Region Approach and p-value Approach.

Alternative NPTEL/SWAYAM Course (if any):
NPTEL Course Name: Essential Mathematics for Machine Learning
Instructor: Prof. Sanjeev Kumar, Prof. S. K. Gupta, IIT Roorkee

Suggested Readings
1. Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press., 2020
2. Advanced Engineering Mathematics, Reena Garg, Khanna Book Publishing Co., Delhi.
3. Machine Learning, Rajiv Chopra, Khanna Book Publishing Co., Delhi.
4. Introduction to Applied Linear Algebra: Vectors, Matrices, and Least Squares, Stephen Boyd, Lieven Vandenberghe, Cambridge University Press., 2018
5. Probability and statistics for Engineers and Scientists, Walpole, Myers, Myers and Ye, Pearson Education, 2012
6. Advanced Engineering Mathematics, Wylie and Barrett, McGraw Hill, 1995
7. https://www.udemy.com/course/mathematical-foundation-for-machine-learning-and-ai/

Mapping COs to the syllabus

COs	Module 1	Module 2	Module 3	Module 4
CO1	L	M	M	M
CO2	L	H		
CO3			H	
CO4				H

MAMT114T: MATHEMATICS II

(3L: 1 T: 0P 4 Credits)
(For BTech CSE, CVE, MNE, EEE, ECE)
Objective:
The objective of this course is to familiarize the prospective engineers with techniques in matrices, ordinary differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.
Course Outcomes

At the end of this course students will be able to:
CO 1: Determine the essential tool of matrices and linear algebra in a comprehensive manner. (Understanding)
CO 2: Recall the effective mathematical tools for the solutions of differential equations that model physical processes. (Remembering)
CO 3: Use the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems. (Applying)
CO 4: Analysis complex techniques applied to diverse problem-solving situations in engineering and other mathematical contexts. (Analysing)

Module 1: Matrices (12 hours)
Determinant, Inverse of a matrix, Linear Systems of Equations; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Rank of a Matrix; Echelon form, Normal form, Gauss-Jordan method, Gauss elimination method, Linear Dependence and Independence; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem, rank-nullity theorem.

Module 2: First and higher order ordinary differential equations: (12 hours)
Exact linear and Bernoulli's equations. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Second order linear differential equations with variable coefficients: Euler-

Cauchy equations, solution by variation of parameters; Power series solutions: Legendre's equations and Legendre polynomials, Bessel's equation and Bessel's functions of the first kind and their properties.

Module 3: Complex Variable – Differentiation: (8 hours)
Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 4: Complex Variable – Integration: (8 hours)
Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analyticfunctions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof),

Suggested Readings

1. AICTE's Prescribed Textbook: Mathematics II (Calculus, Ordinary Differential Equations and
1. Complex Variable), Reena Garg, Khanna Book Publishing Co, 2023.
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value
7. Problems, 9th Edn., Wiley India, 2009.
8. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
9. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
10. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
11. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
12. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill,
13. 2004.
14. 12. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,
15. Reprint, 2008.
14. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Alternative NPTEL/SWAYAM Course:

S. No	NPTEL COURSE NAME	INSTRUCTOR	HOST INSTITUTE
1	Engineering Mathematics - II	PROF. JITENDRA KUMAR	IIT Kharagpur

Mapping of COs to Syllabus

	Module 1	**Module 2**	**Module 3**	**Module 4**
CO 1	H			
CO 2		H	M	M
CO 3			H	H
CO 4			H	H

MAMT117: MATHEMATICS II

(4 credits-60 Hours)
(BTECH AIML)
Objective:
To make the students understand the behaviour of various series. They should also be able to calculate probabilities and statistics of different datasets.

Course Outcomes
After completion of course, students would be able to:
CO 1. Understand the behavior of series and their applications.
CO 2. Understand number system and its applications.
CO 3. Understand the concept of probability and apply in real life.
CO 4. Understand and apply the concept of statistics.

Module I: Sequences and Series
Limit of a sequence, monotone and Cauchy sequences and properties of convergent sequences, examples. Infinite series, positive series, tests for convergence and divergence, integral test, alternating series, Leibnitz test.

Module II: Functional Series
Pointwise and uniform convergence, basic aspects of Power series, Fourier series

Module III: Math Foundation
Statements, Quantifiers, Operation on sets and functions, Relations, Proofs.

Module IV: Number System
Countability of algebraic numbers, Transcendental numbers and construction of Liouville's number, Equivalence classes, construction of real numbers (using Cauchy sequences), Fermat's little theorem and using it for Miller-Rabin primality test, Wilson's theorem and Primitive root theorem.

Module V: Probability
Sample space and events, definitions of probability, properties of probability, conditional probability. Random variables: distribution functions, discrete and continuous random variables, moments of random variables, conditional expectation, Chebyshev inequality, functions of random variables. Special Distributions: Bernoulli, Binomial, Geometric, Pascal, Poisson, Exponential,Uniform, Normal distributions, Limit Theorems: Law of large numbers

Suggested Readings
1. Probability and statistics for Engineers and Scientists, Walpole, Myers, Myers and Ye,Pearson Education, 2012.
2. Advanced Engineering Mathematics, Reena Garg, Khanna Book Publishing Co., Delhi
3. Advanced Engineering Mathematics, Wylie and Barrett, McGraw Hill, 1995
4. Advanced Engineering Mathematics, M.D. Greenberg, Pearson Education Asia, 2002
5.

Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Engineering Mathematics - I	Prof. Jitendra Kumar	IIT Kharagpur
2.	Probability and Statistics	Prof. Somesh Kumar	IIT Kharagpur

CHCY118T: CHEMISTRY I

4 Credits (3L: 1T: 0P)
(BTech- CSE, CVE, MNE, ECE and EEE)
Objective:
The objective of the Chemistry II is to acquaint the students with the basic phenomenon/concepts of chemistry, the student faces during course of their study in the industry and Engineering field. The student with the knowledge of the basic chemistry will understand and explain scientifically the various chemistry related problems in the industry/engineering field. The student will able to understand the new developments and breakthroughs efficiently in engineering and technology. The introduction of the latest (R&D oriented) topics will make the engineering student upgraded with the new technologies.

Course Outcomes
At the end of this course students will be able to:
CO1: Recall fundamental concepts of 10+2 level of physical, organic and inorganic chemistry.*(Remembering)*
CO2: To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques. *(Understanding)*
CO3: To analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces. *(Analysing)*
CO4: To rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity bulk properties and processes using thermodynamic considerations. *(Applying)*
CO5: To list major chemical reactions that are used in the synthesis of molecules. *(Evaluating)*

Module I: Atomic and Molecular Structure
Schrodinger equation, Particle in a box solutions and their applications for conjugated molecules and nanoparticles, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations, Molecular orbitals of diatomic molecules and plots of the multicentre orbitals, Equations for atomic and molecular orbitals, Energy level diagrams of diatomic, Pi-molecular orbitals of butadiene and benzene and aromaticity, Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures

Module II: Spectroscopic techniques and applications
Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its applications in medicine, Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques, Diffraction and scattering

Module III: Intermolecular forces and potential energy surfaces

Ionic, dipolar and van Der Waals interactions, Equations of state of real gases and critical phenomena, Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

Module IV: Use of free energy in chemical equilibria (6 lectures)
Thermodynamic functions: energy, entropy and free energy, Estimations of entropy and free energies, Free energy and EMF. Cell potentials, the Nernst equation and applications, Acid base, oxidation reduction and solubility equilibria, Water chemistry, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

Module V: Periodic properties
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Module VI: Stereochemistry
Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Module VII: Organic reactions and synthesis of a drug molecule
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings, Synthesis of a commonly used drug molecule.

Suggested Readings

1. AICTE's Prescribed Textbook: Chemistry – I with Lab Manual, Khanna Book Publishing.
2. Engineering Chemistry, by Manisha Agrawal.
3. University chemistry, by B. H. Mahan
4. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
5. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
6. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
7. Physical Chemistry, by P. W. Atkins
8. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
   http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Chemistry - I	Prof. Mangala Sunder Krishnan	IITM

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO 1	L		L	H	H		
CO 2	H	H	M		H	H	H
CO 3			H	M	L	H	
CO 4	M	H		M			H
CO 5	M	H				M	M

CHCY120T: **CHEMISTRY**
3 Credits (3L: 0T: 0P)
(For BTech AIML)
Objective
The objective of the Chemistry II is to acquaint the students with the basic phenomenon/concepts of chemistry, the student faces during course of their study in the industry and Engineering field. The student with the knowledge of the basic chemistry will understand and explain scientifically the various chemistry related problems in the industry/engineering field. The student will able to understand the new developments and breakthroughs efficiently in engineering and technology. The introduction of the latest (R&D oriented) topics will make the engineering student upgraded with the new technologies.

Course Outcomes
At the end of this course students will be able to:
CO1: Recall fundamental concepts of 10+2 level of physical, organic and inorganic chemistry.*(Remembering)*
CO2: To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques. *(Understanding)*
CO3: To analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces. *(Analysing)*
CO4: To rationalise periodic properties such as ionization potential, electronegativity, oxidation states and

electronegativity bulk properties and processes using thermodynamic considerations. *(Applying)*
CO5: To list major chemical reactions that are used in the synthesis of molecules. *(Evaluating)*

Module I: Atomic and Molecular Structure
Schrodinger equation, Particle in a box solutions and their applications for conjugated molecules and nanoparticles, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations, Molecular orbitals of diatomic molecules and plots of the multicentre orbitals, Equations for atomic and molecular orbitals, Energy level diagrams of diatomic, Pi-molecular orbitals of butadiene and benzene and aromaticity, Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures

Module II: Spectroscopic techniques and applications
Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its applications in medicine, Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques, Diffraction and scattering

Module III: Intermolecular forces and potential energy surfaces
Ionic, dipolar and van Der Waals interactions, Equations of state of real gases and critical phenomena, Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

Module IV: Use of free energy in chemical equilibria (6 lectures)
Thermodynamic functions: energy, entropy and free energy, Estimations of entropy and free energies, Free energy and EMF. Cell potentials, the Nernst equation and applications, Acid base, oxidation reduction and solubility equilibria, Water chemistry, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

Module V: Periodic properties
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Module VI: Stereochemistry
Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Module VII: Organic reactions and synthesis of a drug molecule
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings, Synthesis of a commonly used drug molecule.

Suggested Readings
1. AICTE's Prescribed Textbook: Chemistry – I with Lab Manual, Khanna Book Publishing.
2. Engineering Chemistry, by Manisha Agrawal.
3. University chemistry, by B. H. Mahan
4. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
5. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
6. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
7. Physical Chemistry, by P. W. Atkins
8. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
   http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Chemistry - I	Prof. Mangala Sunder Krishnan	IITM

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO 1	L		L	H	H		
CO 2	H	H	M		H	H	H
CO 3			H	M	L	H	
CO 4	M	H		M			H
CO 5	M	H				M	M

CHCY119L: CHEMISTRY LAB
1 Credit
(For BTech All Branches)

Laboratory Outcomes: The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn:
CO1: To estimate rate constants of reactions from concentration of reactants/products as a function oftime.
CO2: To measure molecular/system properties such as surface tension, viscosity, conductance ofsolutions, redox potentials, chloride content of water, etc.
CO3: To synthesize a small drug molecule and analyze a salt sample.

Choice of 10-12 experiments from the following:

1. Determination of surface tension of a given liquid by stalagmometer.
2. Determination of the composition of the given mixture by viscosity method with the help of Ostwald's Viscometer.
3. Thin layer chromatography.
4. Ion exchange column for removal of hardness of water.
5. Determination of chloride content of water.
6. Colligative properties using freezing point depression. 7. Determination of the rate constant of a reaction.
7. Determination of cell constant and conductance of solutions. 9. Potentiometry - determination of redox potentials and emfs.
8. 10. Determination of sodium hydroxide and sodium carbonate in a mixture. 11. Synthesis of a polymer/drug.
9. 12. Saponification/acid value of an oil. 13. Chemical analysis of a salt.
10. Lattice structures and packing of spheres.
11. Determination of free carbon dioxide in given water sample.
12. Models of potential energy surfaces.
13. Chemical oscillations- Iodine clock reaction.
14. Determination of the partition coefficient of a substance between two immiscible liquids.
15. To measure the Adsorption of acetic acid by charcoal.
16. To determine the alkalinity of given water sample.
17. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. No.	Experiment Name	Experiment Link(s)
1.	Determination of surface tensionand viscosity.	http://pcv-au.vlabs.ac.in/physical-chemistry/Determination_of_Viscosity_of_Organic_Solvents/
2.	Ion exchange column for removalof hardness of water.	http://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis_Determination_of_Chemical_Parameters/
3.	Determination of chloride contentof water.	https://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/experiments/determination-of-chloride-nitk/simulation.html
4.	Colligative properties using freezing point depression.	http://pcv-au.vlabs.ac.in/physical-chemistry/Cryoscopy/
5.	Determination of the rate constant of a reaction.	http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
6.	Determination of cell constantand conductance of solutions.	https://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis_Determination_of_Physical_Parameters/
7.	Potentiometry - determination of redox potentials and emfs.	http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
8.	Saponification/acid value of anoil.	https://biotech01.vlabs.ac.in/bio-chemistry/Estimation_of_Saponification_Value_of_Fats_or_Oils/
9.	Lattice structures and packing of spheres.	https://vlab.amrita.edu/?sub=1&brch=282&sim=370&cnt=1

CHCY121T: CHEMISTRY II
3 Credits (3L: 0T: 0P)
(BTech- AIML)
Objective:
The objective of the Chemistry II is to acquaint the students with the basic phenomenon/concepts of chemistry, the student faces during course of their study in the industry and Engineering field. The student with the knowledge of the

basic chemistry will understand and explain scientifically the various chemistry related problems in the industry/engineering field. The student will able to understand the new developments and breakthroughs efficiently in engineering and technology. The introduction of the latest (R&D oriented) topics will make the engineering student upgraded with the new technologies.

Course Outcomes:
At the end of this course students will be able to:
CO1: Recall fundamental concepts of 10+2 level of physical, organic and inorganic chemistry.*(Remembering)*
CO2: To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques. *(Understanding)*
CO3: To analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces. *(Analysing)*
CO4: To rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity bulk properties and processes using thermodynamic considerations. *(Applying)*
CO5: To list major chemical reactions that are used in the synthesis of molecules. *(Evaluating)*

Module I: Atomic and Molecular Structure
Schrodinger equation, Particle in a box solutions and their applications for conjugated molecules and nanoparticles, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations, Molecular orbitals of diatomic molecules and plots of the multicentre orbitals, Equations for atomic and molecular orbitals, Energy level diagrams of diatomic, Pi-molecular orbitals of butadiene and benzene and aromaticity, Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures

Module II: Spectroscopic techniques and applications
Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its applications in medicine, Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques, Diffraction and scattering

Module III: Intermolecular forces and potential energy surfaces
Ionic, dipolar and van Der Waals interactions, Equations of state of real gases and critical phenomena, Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

Module IV: Use of free energy in chemical equilibria (6 lectures)
Thermodynamic functions: energy, entropy and free energy, Estimations of entropy and free energies, Free energy and EMF. Cell potentials, the Nernst equation and applications, Acid base, oxidation reduction and solubility equilibria, Water chemistry, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

Module V: Periodic properties
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Module VI: Stereochemistry
Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Module VII: Organic reactions and synthesis of a drug molecule
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings, Synthesis of a commonly used drug molecule.

Suggested Readings
9. AICTE's Prescribed Textbook: Chemistry – I with Lab Manual, Khanna Book Publishing.
10. Engineering Chemistry, by Manisha Agrawal.
11. University chemistry, by B. H. Mahan
12. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
13. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
14. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
15. Physical Chemistry, by P. W. Atkins
16. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Chemistry - I	Prof. Mangala Sunder Krishnan	IITM

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO 1	L		L	H	H		
CO 2	H	H	M		H	H	H
CO 3			H	M	L	H	
CO 4	M	H		M			H
CO 5	M	H				M	M

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CSPS100T: PROGRAMMING FOR PROBLEM SOLVING
(3 credits-45 Hours)
(For BTech CSE, CVE, ECE, EEE, MNE)

Course Outcomes

1. Define and describe various terms and concepts of C programming language (Remembering)
2. Compare and interpret information based on their understanding of the concepts of C language syntax, data types, control statements, functions, pointers, arrays, structures, files, graphics and hardware programming using C. (Understanding)
3. Solve problems using standard algorithms and translate pseudo-codes into C programs and implement them. (Applying)
4. Analyze their skills for choosing the right data structure, function, data types and develop logic to solve various instancesof problems. (Analyze)
5. Combine the various concepts and ideas learnt in C to plan, propose and develop a product. (Creating)
6. Evaluate various algorithms used for searching, sorting etc., in terms of correctness and computation cost. (Evaluate)

Module I (8 Hours)
Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), and Idea of Algorithm: steps to solve logical and numerical problems. Types of Algorithm: Sequentially executed, Conditional Based, repetitive structure, Representation of Algorithm: Flowchart/Pseudo code with examples, from algorithms to programs; source code, variables (with data types) variables and memory, locations, Syntax and Logical Errors in compilation, object and executable code.

Module II (12 Hours)
Operators, precedence of operators, Arithmetic expressions, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Module III (5 Hours)
Arrays, Arrays (1-D, 2-D), Character arrays and Strings

Module IV (5 Hours)
Basic Algorithm Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module V (8 Hours)
Functions (including built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion.

Module VI (7 Hours)
Structures, Defining structures and Array of Structures, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), File handling.

Suggested Readings

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M				
CO2			H			H
CO3	H	H				
CO4	L				H	H
CO5				H		
CO6	L			H		

CSPS101L: PROGRAMMING FOR PROBLEM SOLVING LAB

(2 credits)

(For BTech CSE, CVE, ECE, EEE, MNE)

Course Outcomes

1. Relate the programming logic (Remembering)
2. Illustrate the theoretical concepts learnt in C programming language. (Understanding)
3. Apply existing algorithms in writing programs using C language and also do graphics programming. (Applying)
4. Analyze their skills for choosing the right data structure, functions, data types and develop logic to write programs in C.(Analyzing)
5. Evaluate the sorting and searching algorithms through implementation in terms of correctness and computation cost.(Evaluating)
6. Combine the various concepts and ideas leant in C to plan, propose and develop a product. (Creating)

Mapping of COs to Syllabus

Course Outcomes	M1	M2	M3	M4	M5	M6
CO1	H				L	
CO2	H	H				
CO3				H	M	
CO4	L				H	H
CO5	M	L		H		
CO6			H		H	M

CSPP102T: PROBLEM SOLVING AND PROGRAMMING

(3 credits-45 Hours)

(For BTech AIML)

Objective:

To develop logical skills and basic technical skills so that students should be able to solve basic computing problems. The students should be able to learn the basic of any computer programming language.

Course outcomes: After completion of course, students would be able to:

CO 1. Understand real world problems and developing computer solutions for those.
CO 2. Understand the basics of Python.
CO 3. Apply python for solving basic programming solutions.
CO 4. Create algorithms using learnt programming skills

Module I: Introduction to Programming

Evolution of languages: Machine languages, Assembly languages, High-level languages. Software requirements for programming: System softwares like operating system, compiler, linker, loader; Application programs like editor. Algorithm, specification of algorithm. Flowcharts.

Module II: Data Types and Operators, Variables, Sequences and Iteration

Different types of Data types, Expressions, Precedence Rules, Operators- Operators: arithmetic operators, relational operators, logical operations, bitwise operators, miscellaneous operators, Local Variables, Global Variables, List, String, Tuples, Sequence Mutations and Accumulation Patterns.

Module III: Conditional Statements, Loops, Arrays and Strings, User Defined Data Types
If-else statement, For loop, While Loop, Nested Iteration, Concept and use of arrays, declaration and usage of arrays, 2-dimensional arrays, different types of user defined data types

Module IV: Dictionaries and Dictionary Accumulation, Functions/Methods
Dictionary Basics, Operations, Methods, Accumulation, Advantage of modularizing program into functions, function definition and function invocation. Positional Parameter Passing, Passing arrays to functions, Recursion, Library functions.

Module V: File Handling and Memory Management
Concepts of files and basic file operations, Writing/ Reading Data to/from a .csv File, Memory Management Operations

Suggested Readings

1. Programming for Problem Solving, R.S. Salaria, Khanna Book Publishing Co., Delhi.
2. Taming Python by Programming, Jeeva Jose, Khanna Book Publishing Co., Delhi.
3. Learning Python, 5th Edition, by Mark Lutz, O'Reilly Media, Inc., ISBN: 9781449355739
4. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.
5. Programming in Python, R.S. Salaria, Khanna Book Publishing Co., Delhi.
6. https://www.coursera.org/learn/python-basics
7. https://www.coursera.org/specializations/python-3-programming

Alternative NPTEL/SWAYAM Course:

S. No.	Course Name	Instructor	Host Institute
1.	Introduction to Problem Solving andProgramming - Video course	Prof. D. Gupta	IIT Kanpur
2.	Problem solving Aspects and PythonProgramming	Dr.S.Malliga, Dr.R.Thangarajan, Dr.S.V.Kogilavani	Kongu Engineering College

CSPP103L: PROBLEM SOLVING AND PROGRAMMING LAB

(1 credit-15 Hours)
(For BTech AIML)

Laboratory/ Practicals:
1. Write a program that asks the user for their name and greets them with their name.
2. Write a program that asks the user for a number n and gives them the possibility to choosebetween computing the sum and computing the product of 1,…,n.
3. Write a function that checks whether an element occurs in a list.
4. Write three functions that compute the sum of the numbers in a list: using a for-loop, awhile-loop and recursion.
5. Given two strings, write a program that efficiently finds the longest common subsequence.

CSDT104T: DESIGN THINKING

(1 credit-15 Hours)
(For BTech AIML)

Objective:
The objective of this Course is to provide the new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products which usefulfor a student in preparing for an engineering career.

Course Outcomes: After completion of course, students would be able to:
CO 1. Compare and classify the various learning styles and memory techniques and Apply themin their engineering education
CO 2. Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products
CO 3. Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products
CO 4. Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development
CO 5. Perceive individual differences and its impact on everyday decisions and further Create a better customer experience

Module I: An Insight to Learning

Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting

Module II: Remembering Memory
Understanding the Memory process, Problems in retention, Memory enhancement techniques

Module III: Emotions: Experience & Expression
Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

Module IV: Basics of Design Thinking
Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) **– Empathize, Define, Ideate, Prototype, Test**

Module V: Being Ingenious & Fixing Problem
Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving

Module VI: Process of Product Design
Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design,Examples of best product designs and functions, Assignment – Engineering Product Design

Module VII: Prototyping & Testing
What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, **SampleExample**, Test Group Marketing

Module VIII: Celebrating the Difference
Understanding Individual differences & Uniqueness, Group Discussion and Activities to encouragethe understanding, acceptance and appreciation of Individual differences

Module IX: Design Thinking & Customer Centricity
Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design

Module X: Feedback, Re-Design & Re-Create
Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – "Solving Practical Engineering Problem through Innovative Product Design & Creative Solution".

Suggested Readings

1. M. Morris Mano, Computer System & Architecture, Prentice Hall of India, 2002.
2. John L. Hennessy and David A Patterson, Computer Architecture-A quantitative approach,Morgan Kaufmann/ Elsevier, 4th Edition, 2007.
3. Hayes. J.P, Computer architecture and organization by McGraw-Hill Companies, 1998
4. Parallel Computer Architecture: A Hardware/Software Approach David Culler and J.P.Singh with Anoop Gupta, Morgan Kaufmann, 1998.
5. https://onlinecourses.nptel.ac.in/noc20_cs41/preview
6. https://www.coursera.org/learn/introduction-high-performance-computing#syllabus

Alternative NPTEL/SWAYAM Course (if any)

S. No.	Course Name	Instructor	Host Institute
1.	Computer Architecture	Prof. Smruti Ranjan Sarangi	IIT Delhi
2.	Advanced Computer Architecture	Prof.John Jose	IIT Guwahati

CSOP105T: OBJECT ORIENTED PROGRAMMING

(3 credits-45 Hours)
(For BTech AIML)

Objective:
The students should be able to understand the concept of object-oriented programming like classes,constructors, Polymorphism, inheritance, and file handling and open source libraries.

Course Outcomes: After completion of course, students would be able to:
CO 1. Understand the basic concepts of OOPs.
CO 2. Apply different Python library to solve programming problems.

CO 3. Understand the advanced concepts of python and apply for accessing databases and web data.
CO 4. Understand APIs and third-party libraries to be used with Python.

Module I: Introduction to Object Oriented Programming Paradigms
Introduction to various programming paradigms, advantages of OOP, comparison of OOP with Procedural Paradigm, Classes and Objects: Prototyping, Referencing the variables in functions, Inline, static and friend functions. Memory allocation for classes and objects. Arrays of objects, Constructors

Module II: Polymorphism & Inheritance
Overriding Methods, type conversions from basic data types to user defined and vice versa, Base classes and Derived classes, types of inheritance, various types of classes, Invocation of Constructors and Destructors in Inheritance, aggregation, composition, classification hierarchies, metaclass/abstract classes, Unit Testing and Exceptions.

Module III: Python libraries:
Basics of open-source libraries for data prepressing, modelling and visualization.

Module IV: Using Python to Access Web Data
Regular Expressions, Extracting Data, Sockets, Using the Developer Console to Explore HTTP, Retrieving Web Page, Parsing Web Pages

Module V: Using Databases with Python
Using Databases, Single Table CRUD, Designing and Representing a Data Model, Inserting Relational Data, Reconstructing Data with JOIN, Many to Many Relationships.

Suggested Readings
1. How to Think Like a Computer Scientist: Learning with Python, by Allen Downey, JeffElkner and Chris Meyers, SoHo Books, 2009.
2. Mastering Object-Oriented Programming, R.S. Salaria, Khanna Book Publishing Co., Delhi
3. Introduction to Computing & Problem Solving with Python, Jeeva Jose, Khanna BookPublishing, 2019.
4. https://www.coursera.org/specializations/python-3-programming#courses
5. Head First Python by Paul Barry, O'Reilly, 2010.

Alternative NPTEL/SWAYAM Course (if any):

S. No.	Course Name	Instructor	Host Institute
1.	Python For Data Science	Prof. RaghunathanRengasamy	IIT Madras
2.	The Joy of Computing Using Python	Prof. Sudarshan Prof.Yayati Gupta Iyengar	IIT Ropar, IIITDharwad

CSOP109L: OBJECT ORIENTED PROGRAMMING LAB
(1 credit-15 Hours)
(For BTech AIML)

Laboratory/ Practicals:
1. Write a NumPy program to compute the cross product of two given vectors
2. Write a NumPy program to calculate the QR decomposition of a given matrix
3. Write a Pandas program to convert a Panda Module Series to Python list and it's type.
4. Write a Pandas program to convert a NumPy array to a Pandas series
5. Create a Python project to get the citation from Google scholar using title and year ofpublication, and volume and pages of journal.
6. Create a Python project to get total Covid-19 cases, total deaths due to Covid-19, totalCovid-19 patients recovered in the world.

CSDS106T: DATA STRUCTURES
(3 credits-45 Hours)
(For BTech AIML)

Objective:
The students should be able to describe and implement various data structures including lists, arrays, stacks, queues, binary search trees, graphs, hash tables, and matrices. The student will be able to analyze and apply various algorithms for shortest path calculation, sorting and searching applications.

Course Outcomes: After completion of course, students would be able to:
CO 1. Understand the different types of data structure to be implemented using any programming language.

CO 2. Choose the data structures that effectively model the information in a problem and
CO 3. Analyzes the efficiency trade-offs (run time and memory usage) among alternative data structure implementations or combinations.
CO 4. Design, implement, test, and debug programs using a variety of data structures including stacks, queues, hash tables, binary and general tree structures, search trees, and graphs.
CO 5. Apply efficient data structure (linked lists, stacks and queues) to solve a particular problem.

Module I: Introduction and Elementary Data Structures

Introduction: Introduction to Data Structures and data types, Efficient use of memory, Recursion, time and space complexity of algorithms, Big O Notation and theta notations.

Elementary Data Structures: Stacks, queues, Infix, Postfix & Prefix conversions, evaluations of expressions, multiple, stacks and queues, priority queues as heaps, double ended queue, implementation of stacks and queues

Module II: Linked Lists

Singly linked lists, linked stacks and queues, polynomial addition, sparse matrices, doubly linked lists and dynamic storage management, circular linked list, Applications of Stacks, Queues and Linked lists, Garbage collection, Josephus Problem

Module III: Trees

Basic terminology, binary trees, binary tree traversal, representations of binary tree, application of trees, decision tree, game trees, Threaded Trees, Binary Search Tree, AVL tree, B-tree

Module IV: Graph Theory

Graph representations, Graph Traversals, Dijkstra's algorithm for shortest path, Prim's and Kruskal's Algorithm for Minimal Spanning tree

Module V: Sorting and Searching

Searching: Linear search, binary search and hash search. Sorting: Insertion sort, selection sort, bubble sort, quick sort, merge sort, heap sort, and Bucket sort

Suggested Readings

1. Data Structures, R.S. Salaria, Khanna Book Publishing, 2019.
2. Data Structures and Program Design in C By Robert L. Kruse,C.L. Tondo, Bruce Leung,Pearson Education, 2007.
3. Expert Data Structures with C/ 3rd Edition, R.B. Patel, Khanna Book Publishing, 2020.
4. Expert Data Structures with C++/ 2nd Edition, R.B. Patel, Khanna Book Publishing, 2020.
5. Data Structures Using C & C++, By Langsam, Augenstein, Tanenbaum, Pearson Education,1989.
6. Fundamentals of Data Structures, By Ellis Horowitz and Sartaj Sahni, Computer SciencePress, 2011.
7. An introduction to data structures with applications, By J.P. Trembley & P.G. Sorensen,TMH, 2004.

Alternative NPTEL/SWAYAM Course (if any)

S. No.	Course Name	Instructor	Host Institute
1.	Data Structures and Algorithms -Video course	Prof. Naveen Garg	IIT Delhi
2.	Data Structures	Dr.S.Sasikala	University of Madras

CSDS110L: DATA STRUCTURES LAB

(1 credit-30 Hours)

(For BTech AIML)

Laboratory/ Practicals:

1. Implement infix to postfix conversion using Stack
2. Write a program for swaping nodes in a linked list without swapping data.
3. Write a program to reverse a Linked List in groups of given size.
4. Write a program for finding the first circular tour that visits all petrol pumps.
5. Implement Inorder tree traversal without recursion.
6. Write a program to Check whether a given graph is Bipartite or not.

CSDM107T: DISCRETE MATHEMATICAL STRUCTURES

(4 credits-60 Hours)

(For BTech AIML)

Objective:

Students should be able to understand Discrete Mathematical Structures (DMS) for the development of theoretical computer science, problem solving in programming language using Discrete Structure and importance of discrete structures towards simulation of a problem in computer science and engineering.

Course Outcomes: After completion of course, students would be able to:

CO 1. Understand the basics of various discrete structures.

CO 2. Apply applications of discrete structures in Computer Science and Engineering.

Module I: Mathematical Reasoning

Mathematical reasoning, Propositions, Negation, disjunction and conjunction, Implication and Equivalence, Truth tables, Predicates, Quantifiers, Natural deduction, Rules of Inference, Methods of proofs, Resolution principle, Application to PROLOG.

Module II: Set Theory

Paradoxes in set theory, Inductive definition of sets and proof by induction, Peano postulates, Relations, Properties of relations, Equivalence Relations and partitions, Partial orderings, Posets, Linear and well-ordered sets.

Module III: Combinatorics and Functions

Elementary Combinatorics, counting techniques, Recurrence relation, Generating functions, Functions; mappings, Injection and Surjections, Composition of functions, Inverse functions, Special functions, Pigeonhole principle, Recursive function theory.

Module IV: Graph Theory

Elements of graph theory, Euler graph, Hamiltonian path, trees, Tree traversals, Spanning trees, Representation of relations by graphs.

Module V: Groups, Rings, Fields, Discrete Probability

Definition and elementary properties of groups, Semigroups, Monoids, Rings, Fields, Vector spaces and lattices, Introduction, Discrete random variables, Applications to Binary Search Tree.

Suggested Readings

1. K. H. Rosen, Discrete Mathematics and applications, 6th Edition, Tata McGraw Hill 2007.
2. S.B. Singh, Discrete Structures/ 3rd Edition, Khanna Book Publishing, 2019.
3. S.B. Singh, Combinatorics and Graph Theory/ 3rd Edition, Khanna Book Publishing, 2018.
4. C. L. Liu, Elements of Discrete Mathematics, 2nd Edn., Tata McGraw-Hill 2000.
5. J .L. Mott, A. Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists andMathematicians, Second edition, Prentice Hall of India 1986.
6. W. K. Grassmann and J. P. Trembnlay, Logic and Discrete Mathematics, A ComputerScience Perspective, Prentice Hall Inc 1996

Alternative NPTEL/SWAYAM Course (if any):

S. No.	Course Name	Instructor	Host Institute
1.	Discrete Mathematical Structures -Video course	Prof. Kamala Krithivasan	IIT Madras
2.	Discrete Mathematics	Prof.Sudarshan Iyengar, Prof. Neeldhara	IIT Roopar,IIT Gandhinagar

CSMC108T: MODERN COMPUTER ARCHITECTURE

(3 credits-45 Hours)

(For BTech AIML)

Objective:

Students should be able to understand basic principles of Computer Systems. They should be able to understand various logic design techniques and their applications. They should be capable of using high performance computing architecture.

Course Outcomes: After completion of course, students would be able to:

CO 1. Understand the organization of the Control unit, Arithmetic and Logical unit, Memory unit andthe I/O unit.

CO 2. Analyse different computer architectures and their applications.

CO 3. Understand modern design structures of Pipelined and Multiprocessors systems.

CO 4. Understand distributed computing architecture and high-performance computing.

Module I: Basics

Designing combinational and sequential logic, computers registers and instructions, timing, and control, instructions cycle, memory reference instruction, I/O interruption, Adder and Subtractor circuits, Booth Multiplication Algorithm, Pipelining Review, control hazards and the motivation forcaches, cache characteristics and basic superscalar architecture basics,

Module II: Multi-core Architecture
Memory technologies, hierarchical memory systems, the locality principle and caching, direct- mapped caches, block size, cache conflicts, associative caches, write strategies, advanced optimisations, performance improvement techniques, DRAM – organisation, access techniques, scheduling algorithms and signal systems. Tiled Chip Multicore Processors (TCMP), Network on Chips (NoC), NoC router – architecture, design, routing algorithms and flow control techniques, Advanced topics in NoC and storage – compression, prefetching, QoS.

Module III: Distributed Computing Systems and Concurrency
Relation to Parallel Multiprocessors/multicomputer Systems, Distributed and Concurrent Programs, Message Passing vs. Shared Memory Systems, Synchronous vs. Asynchronous Executions, Design Issues and Challenges, Distributed Computing Technologies, Clocks and Synchronization, Coordination and Agreement Algorithms, Global State and Distributed Transactions.

Module IV: High Performance Computing (HPC)
HPC Architecture, Parallel Processing, Parallel Memory Models, Data vs. Task Parallelism, High Throughput Computing, Vectorization, Multithreading.

Module V: High Performance Computing with CUDA
CUDA programming model, Basic principles of CUDA programming, Concepts of threads and blocks, GPU and CPU data exchange

Suggested Readings

1. M. Morris Mano, Computer System & Architecture, Prentice Hall of India, 2002.
2. John L. Hennessy and David A Patterson, Computer Architecture-A quantitative approach,Morgan Kaufmann/ Elsevier, 4th Edition, 2007.
3. Hayes. J.P, Computer architecture and organization by McGraw-Hill Companies, 1998
4. Parallel Computer Architecture: A Hardware/Software Approach David Culler and J.P.Singh with Anoop Gupta, Morgan Kaufmann, 1998.
5. https://onlinecourses.nptel.ac.in/noc20_cs41/preview
6. https://www.coursera.org/learn/introduction-high-performance-computing#syllabus

Alternative NPTEL/SWAYAM Course (if any):

S. No.	Course Name	Instructor	Host Institute
1.	Computer Architecture	Prof. Smruti Ranjan Sarangi	IIT Delhi
2.	Advanced Computer Architecture	Prof.John Jose	IIT Guwahati

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

EEEL100T: BASIC ELECTRICAL ENGINEERING
(3 Credits – 45 hours) (L-T-P: 2-1-0)
(For BTech CVE and MNE)
Objectives:
• To understand and Analyse basic electric and magnetic circuits.
• To study the working principles of electrical machines and power converters.
• To introduce the components of low voltage electrical installations.

COURSE OUTCOMES
1. Define basic terminologies related to electrical circuits and machines. (Remembering)
2. Explain the working principle, construction, applications of dc machines and ac machines. (Understanding)
3. Explain basics of converters, domestic wiring and Electrical Installations. (Understanding)
4. Implement network theorems to simplify and solve a complex circuit. (Applying)

Module 1: DC Circuits (10 lectures)
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (15 lectures)
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, R-L, R-C, R-L-C combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Electrical Machines (10 lectures)
DC Machines: Principle of operation of generators and motors, construction of DC machine, EMF and Torque Equations, Classification and applications of DC machines.
Transformer: Construction and principle of operation of a single-phase transformer, EMF equation, introduction of auto-transformer.
Induction Motor: Classification and applications, Construction and principle of operation of single phase and three-phase induction motor

Module 4: Power Converters (5 lectures)
DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 5: Electrical Installations (5 lectures)
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Readings
1. J.B. Gupta, "Basic Electrical Engineering", S.K kataria and Sons.
2. P.V. Prasad,S.Sivanagaraju,K.R. Varmah, Chikku Abraham, "Basic Electrical Engineering, Cengage Learning India.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H		M		M
CO 2		H	H		
CO 3				H	H
CO 4	H				

EEEL102T: BASIC ELECTRICAL ENGINEERING
(4 Credits – 60 hours) (L-T-P: 3-1-0)
(For BTech CSE, EEE and ECE)
Objectives:
- To understand and Analyse basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations.

Course Outcomes
2. Define basic terminologies related to electrical circuits and machines. (Remembering)
3. Explain the working principle, construction, applications of dc machines and ac machines. (Understanding)
4. Explain basics of converters, domestic wiring and Electrical Installations. (Understanding)
5. Implement network theorems to simplify and solve a complex circuit. (Applying)
6. Interrogate basic DC as well as AC circuits. (Analyzing)

Module I (18 lectures)
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module II (16 lectures)
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, R-L, R-C, R-L-C combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module III (14 lectures)
DC Machines: Principle of operation of generators and motors, construction of DC machine, EMF and Torque Equations, Classification and applications of DC machines.
Transformer: Construction and principle of operation of a single-phase transformer, EMF equation, introduction of auto-transformer.
Induction Motor: Classification and applications, Construction and principle of operation of single phase and three-phase induction motor

Module IV (6 lectures)
DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation

Module V (6 lectures)
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Readings
1. J.B. Gupta, "Basic Electrical Engineering", S.K Kataria and Sons.
2. P.V. Prasad, S. Sivanagaraju, K.R. Varmah, Chikku Abraham, "Basic Electrical Engineering, Cengage Learning India.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H		M		M
CO 2		H	H		
CO 3				H	H
CO 4	H				
CO 5	M			M	

EEEL101L: BASIC ELECTRICAL ENGINEERING LABORATORY
(1 Credit- 30 hours) (L-T-P: 0-0-2)
Course Outcomes
1. Find different parameters related to basic electrical circuits. (Remembering)
2. Explain the procedure for performing experiments related to DC and AC circuits. (Understanding)
3. Identify various rotating AC and DC machines. (Applying)
4. Compare the theoretical prediction with experimental results. (Analyzing)
5. Check errors and correction of meters by calibration (Evaluating)
6. Construct a circuit to perform a particular experiment. (Creating)

List of experiments:
1. Calibration of a Voltmeter.
2. Calibration of an Ammeter.
3. Calibration of milliammeter as a voltmeter.
4. Calibration of a millivoltmeter as an ammeter.
5. Verification of Thevenin's theorem.
6. Resonance in series RLC circuit
7. Reversal of direction of rotation of 3-phase induction motor by changing phase sequence.
8. Different types of Connections of the transformer.
9. Demonstration of DC and AC machines.
10. Demonstration of LT switchgear.

Mapping of COs to Syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	M	M	M	M	M
CO 3				L		L	L	L	L	L
CO 4	M	M	M	M	H	H	H	H	H	H
CO 5	H	H	H	H	L	L	L	L	L	L
CO 6	H	H	H	H	H	H	H	H	H	H

DEPARTMENT OF CIVIL ENGINEERING

CVGD100T: ENGINEERING GRAPHICS AND DESIGN
3 Credits- 1 L: 0 T: 4P
OBJECTIVE: *The objective of this course is to teach the basics of engineering drawing and drafting to students by free hand sketching as well as computer aided design.*

COURSE/LEARNING OUTCOMES

After completing the course students will be able to:

CO1: Learn to draw letters, scales and curves (Understanding)

CO2: Learn to draw projection of points, lines, scales and solids(Understanding)

CO3: Learn to draw isometric projection of solids(Applying)

CO4: Learn the functionalities and application of AutoCAD software(Understanding)

Module I: (10 hours)

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales, Conic sections including the Rectangular Hyperbola (General method only), Cycloid, Epicycloid, Hypocycloid and Involute.

Module II:(15 hours)

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes, Projections of Regular Solids: Solids inclined to both the Planes- Auxiliary Views, simple annotation, dimensioning and scale, Sections and Sectional Views of Right Angular Solids: Prism, Cylinder, Pyramid, Cone – Auxiliary Views, development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone, sectional orthographic views of geometrical solids.

Module III: (5 hours)

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions, Isometric Views of lines, Planes, Simple and compound Solids, Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module IV: (15 hours)

Demonstrating knowledge of the theory of CAD software such as the Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids, set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically, producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles, Annotations, layering and other functions to create drawings, create, edit and use customized layers; changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

Suggested-Readings

1. N. D. Bhatt, V. M. Panchal, P. R. Ingle (2014), Engineering Drawing, Charotar Publishing House
2. M. B. Shah and B. C. Rana (2008), Engineering Drawing and Computer Graphics, Pearson-Education
3. B. Agrawal and C. M. Agrawal (2012), Engineering Graphics, TMH Publication
4. K. L. Narayana and P Kannaiah (2008), Text book on Engineering Drawing, SciTech-Publishers
5. Corresponding set of CAD Software Theory and User Manuals

Mapping of COs to syllabus

	CO I	CO II	CO III	CO IV
Module I	**H**			
Module II		**H**		
Module III			**H**	
Module IV				**H**

DEPARTMENT OF MECHANICAL ENGINEERING

MNWM100L: WORKSHOP/MANUFACTURING PRACTICES

0L:0T:4P 2 Credits

Objectives:

1. To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
2. To have a study and hands-on-exercise on plumbing and carpentry components.
3. To have a practice on gas welding, foundry operations and fitting
4. To have a study on measurement of electrical quantities, energy and resistance to earth.
5. To have a practice on soldering.

Laboratory Outcomes:
On completion of this laboratory course, students will be able:
CO 1. To fabricate components with their own hands.
CO 2. To relate practical knowledge of the dimensional accuracies and dimensional tolerances possiblewith different manufacturing processes.
CO 3. To design small devices of their interest by assembling different components.

Module I: Manufacturing Methods- casting, forming, machining, joining, advancedmanufacturing methods.
Module II: CNC machining, Additive manufacturing.
Module III: Fitting operations & power tools.
Module IV: Electrical & Electronics.
Module V: Carpentry.
Module VI: Plastic moulding, glass cutting.
Module VII: Metal casting.
Module VIII: Welding (arc welding & gas welding), brazing.

Practicals:
1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical & Electronics
5. Welding shop (Arc welding + Gas welding)
6. Casting
7. Smithy
8. Plastic moulding & Glass Cutting

Examinations could involve the actual fabrication of simple components, utilizing one or moreof the techniques covered above.

Suggested Readings
1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai**.**
3. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
4. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
5. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
6. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Experiments that may be performed through virtual labs:

S. No.	Experiment Name	Experiment Link(s)
1	Welding shop (Arc welding + Gas welding)	http://mm- coep.vlabs.ac.in/LaserSpotWelding/Theory.html?domain=Mechanical%20Engineering&lab=Welcome%20to%20Micromachining%20laboratory
2	Casting	http://fab- coep.vlabs.ac.in/exp7/Theory.html?domain=Mechanical%20Engineering&lab=Welcome%20to%20FAB%20laboratory

MNDI101L: DESIGN THINKING & IDEA LABORATORY
2 Credits (L-T-P:1-0-2)

Course Objective:
The objective of this Course is to provide the new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student in preparing for an engineering career.

Course Outcomes (CO):
Students will able to
1. Compare and classify the various learning styles and memory techniques and Apply them in their engineering education
2. Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products
3. Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking
process for developing innovative products
4. Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development
5. Perceive individual differences and its impact on everyday decisions and further create a better customer experience

Module 1: An Insight to Learning
Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting

Module 2: Remembering Memory
Understanding the Memory process, Problems in retention, Memory enhancement techniques

Module 3: Emotions: Experience & Expression
Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

Module 4: Basics of Design Thinking
Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test

Module 5: Being Ingenious & Fixing Problem
Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving

Module 6: Process of Product Design
Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design,
Examples of best product designs and functions, Assignment – Engineering Product Design

Module 7: Prototyping & Testing
What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample
Example, Test Group Marketing

Module 8: Celebrating the Difference
Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

Module 9: Design Thinking & Customer Centricity
Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer
Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design

Module 10: Feedback, Re-Design & Re-Create
Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design,
rapid prototyping & testing, final product, Final Presentation – "Solving Practical Engineering

IDEA LAB WORKSHOP

Objectives:
1. To learn the skills associated with the tools and inventory associated with the IDEA Lab.
2. Learn useful mechanical and electronic fabrication processes.
3. Learn necessary skills to create print and electronic documentation for the system/project

Course Contents
1. 3D printing and prototyping technology
2. 3D scanning, point cloud data generation for reverse engineering.
3. User Experience (UX) Design: Design Sprints, Create wireframes using Figma, Create mock-ups in Figma.
4. Electronic component familiarization, Understanding electronic system design flow. Schematic design and PCB layout.
5. Familiarization and use of basic measurement instruments (CRO, FG, Spectrum Analyser)
6. DMM, Signal and Function Generator, Power Supply, Solar Panel, Battery Types and charging.

Suggested Readings

1. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company
2. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual),Veerana D.K., Khanna Book Publishing, 2023.
3. All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
4. Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep
5. Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.
6. 3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
7. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.
8. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978-1681881584.
9. Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978-9352137374

BTUH0001: UNIVERSAL HUMAN VALUES I: STUDENT INDUCTION PROGRAM
(P/NP)

The following list presents the topics covered in the Mandatory Student Induction Program conducted in the Assam Don Bosco University School of Technology:

1. Physical activity – Yoga and sports activity (indoor and outdoor)
2. Creative arts through Extra-curricular clubs e.g., music & singing, dance, drama, debating & quiz, art & craft, photography
3. Universal Human Values – group discussions on the following topics:
    a) Aspirations and family expectations
    b) Gratitude
    c) Competition and cooperation
    d) Competition and excellence
    e) Peer pressure
    f) Self-confidence
    g) Relationships in family
    h) Trust and respect
    i) Anger management
    j) Happiness and prosperity
    k) Dealing language barriers – tests on communication skill for future follow up.
    l) Sexual orientation / courting / sexual harassment
4. Literary exposure through Literary Club
5. Proficiency Modules – Psychological tests and orientation, introduction to Co-curricular clubs and innovations.
6. Lectures by eminent people – in-campus invited Guests and over SKYPE
7. Visit to local areas – visit to industry and institutions of repute
8. Familiarization to departments and common facilities
9. Mentoring system – introduction and assignment of mentors
10. Selection / election of Class Representatives for college association
11. Health check-up for all with documentation for future reference
12. Library Orientation, Introduction to ERP and e-Resources, filling up "Online anti-ragging affidavit" by all.

BTUH0002: UNIVERSAL HUMAN VALUES II: UNDERSTANDING HARMONY
(3 Credits – 45 hours)

Objective*: The objective of the course is four fold:*

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: recognize the nature of themselves, and their surroundings (family, society, nature); (understanding)
CO2: identify their responsibility in life, and handle problems with sustainable solutions, while keeping human relationships and human nature in mind. (understanding)
CO3: demonstrate their critical ability and also become sensitive to their commitment towards what they have

understood (human values, human relationship and human society). (applying)

CO4: execute what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. (applying)

Module I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education (9 hours)

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
7. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module II: Understanding Harmony in the Human Being - Harmony in Myself! (8 hours)

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.
7. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship (9 hours)

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
6. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence (9 hours)

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence.
5. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module V: Implications of the above Holistic Understanding of Harmony on Professional Ethics (10 hours)

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
7. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. Discuss the conduct as an engineer or scientist etc.

Suggested Readings

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English

Mapping of CO to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M	M			
CO 2		H			
CO 3			H		
CO 4				M	H

COMMUNITY ENGAGEMENT COURSES
(SERVICE LEARNING)
THEORY

PROGRAMME: BACHELOR OF COMPUTER APPLICATIONS (BCA) HONOURS/HONOURS WITH RESEARCH

CACE109T: SERVICE LEARNING
(Credit: 2 Hours: 30)

PROGRAMME: BACHELOR OF COMMERCE (BCOM) HONOURS/HONOURS WITH RESEARCH

CMCE111T: SERVICE LEARNING
(Credit: 2 Hours: 30)

PROGRAMME: BACHELOR OF BUSINESS ADMINISTRATION (BBA) HONOURS/HONOURS WITH RESEARCH

MTCE110T: SERVICE LEARNING
(Credit: 2 Hours: 30) (L-T-P: 2-0-0)

Objective*: Service Learning will aim to support the development of basic skills among the students namely, critical and creative thinking, reflection, communication, collaboration, information literacy, and social skills. The emphasis will be on active civic participation. As the students will actively involved in a wide range of experiences, which will benefit both the community at large and the students in particular and in the process the goals of the curriculum shall be achieved*

COURSE/ LEARNING OUTCOMES
After learning this course, the students will be able to:
CO1: define and explain the Service-Learning framework (Remembering)
CO2: explain the nature and types of community engagement work (Understanding)
CO3: identify the need and importance of social responsibility (Applying)

Module I: Concept of Service Learning (8 Hours)
Service Learning – meaning, concept, definition; value based framework of Service Learning; Understanding the core standards of Service Learning such as respect, reciprocity, relevance, and reflection; Elements of Service Learning; Understanding Service Learning – Its philosophy, historical background, purpose, value and theoretical framework; Locating Service Learning within the University context; Principles of Service Learning

Module II: Community Engagement and Community Partnerships (8 Hours)
Community Engagement – concept, meaning, definition and principles; benefits of community engagement, models of community engagement; Civic Engagement, University Community Engagement, Community partnerships – meaning, benefits, Reflection – meaning, definition and implications; Critical inquiry - meaning, definition and implications; Engaged Research - meaning, definition and implications

Module III: Social Responsibility and Communication Basics (8 Hours)
Social Responsibility – meaning, benefits, Socio-economic context – meaning, definition, Social issues – meaning, Understanding of society & social issues; Conflict – meaning, types, Understanding various conflict resolution strategies; Community level partnerships – meaning, significance, types; Social Justice – meaning and implications; Communication – meaning, types, channels of communication, models of communication

Module IV: Identifying the Partners in the Community (6 Hours)
Partners in the community – meaning, types and functions of Community Partners namely, Corporate, Government and PSU Organizations, Panchayats, Community settings, Clinical settings, NGO's, Anganwadi Centres, Self Help Groups, Schools, Business Firms, Community Markets, Weekly Haats

Suggested Readings
1. Kaye Cathryn Berger, The complete Guide to Service Learning: Proven Practical Ways to Engage Students in Civic Responsibility, Academic Curriculum and Social Action, Free Spirit Publishing
2. Barbara Jacoby, Service Learning in Higher Education: Concepts and Practices
3. Patty H. Clayton, Robert G. Bringle and Julie A. Hatcher, Research on Service Learning: Conceptual Frameworks and

Assessment
4. Barbara Jacoby, Service Learning Essentials: Questions, Answers and Lessons Learned
5. Julie A, Hatcher and Robert G. Bringle, Understanding Service Learning and Community Engagement
6. Farbar Katy, Change the World with Service Learning

E Resources
1. https://www.youtube.com/watch?v=bI9RZjF-538
2. https://www.youtube.com/watch?v=MnvWxZhsvKA&list=PLdinyWzDfipOaYB_oPdWBDHqQwFBtyfGk

Mapping of COs with Syllabus

COs	Module 1	Module 2	Module 3	Module 4
CO1	M			
CO3		M		
CO4			H	H

MTCE110T: Community Engagement Practice: SERVICE LEARNING PROJECT
(Credits 2-60 hours) (L-T-P: 0-0-2)
***Objective(s)**: Service Learning will aim to support the development of basic skills among the students namely, critical and creative thinking, reflection, communication, collaboration, information literacy, and social skills. The emphasis will be on active civic participation. As the students will actively involved in a wide range of experiences, which will benefit both the community at large and the students in particular and in the process the goals of the curriculum shall be achieved*

COURSE/LEARNING OUTCOMES
CO1: define the different types of research project. (Remembering)
CO2: explain the various steps of designing research project (Understanding)
CO3: construct the questionnaire and schedules (Applying)
CO4: analyse the data for analysis (Analyzing)
CO5: classify the findings in the report (Evaluating)

Instruction and Guidelines for Students
The students should follow the following instruction and guidelines:
a. The field work should be for a minimum duration of 30 hours which can be extended depending upon the convenience and requirement of the student and the organisation respectively.
b. The students have to undergo the field work during the semester break after 2nd semester or after the semester break after 3rd semester.
c. After the completion of the field work, the students must submit the Report.
d. The assessment will done as follows:
There would be a Presentation (PPT) and Viva-Voce Examination towards the end of the 3rd Semester & 4th semester based on which the students would be evaluated.

Structure of Report
The Service Learning Field Work Report must be in spiral bind and should comprise of the following:
a. Recommendation Letter from the Department.
b. Certificate of Authentication from a competent authority like Village Headman, GP member or any renowned person from the community where the student has worked.
c. Internship Diary as per the prescribed format.
d. The Contents of the Report must include:
i. Introduction.
ii. Need of the study
iii. Objectives of the study
iv. Significance of the study
v. Methodology undertaken for the study
vi. Description of the work done
vii. Learning Outcomes.
viii. Feedback from the target audience / community members
ix. Geo tagged photographs

The Assessment for the internship will have the following components:
a Report: 40 marks
b Seminar Presentation: 30 marks
c Viva-Voce Examination: 30 marks

PROGRAMME: BACHELOR OF SCIENCE CHEMISTRY (BSC) HONOURS/HONOURS WITH RESEARCH

CHCE117T: ELEMENTS OF SERVICE LEARNING IN CHEMISTRY

(Credit: 2 Hours: 30)

COURSE OUTCOMES

CO1: Understanding social responsibility of higher educational institutes. (Understanding)
CO2: Identifying problems in the community and where students originated. (Applying)
CO3: Influence to get involved in the local community to gain insight into local issues. (Evaluating)
CO4: Adopt strong leadership skills which allow students to work well in a team. (Creating)

Module I (10 lectures)

Principles of Service learning; classification of service-learning models; difference between service Learning and other community experiences; historical context of University Community Partnership; service learning for an undergraduate chemistry student.

Module II (5 lectures)

Social responsibility of educational institutes; meaning of community university engagement (CUE), engaged teaching, and engaged research.

Module III (15 lectures)

Conceptualisation of the idea of service learning through practical implementations such as (any two) (i) organizing awareness programmes on scientific temper for nearby communities, (ii) participating in demonstrations of scientific experiments for school children to remove the fear of pursuing higher studies in science, (iii) imparting knowledge and guidance to school students for proper understanding of various topics of their chemistry curriculum.

Suggested Readings

1. Service-Learning Essentials: Questions, Answers, and Lessons Learned, B. Jacoby, Jossey-bass.
2. Where's the Learning in Service-Learning?, J. Eyler and D. E. Giles Jr. Jossey-bass.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3	M		H
CO 4			H

PROGRAMME: BACHELOR OF SCIENCE MATHEMATICS (BSC) HONOURS/HONOURS WITH RESEARCH

MACE110T: COMMUNITY ENGAGEMENT AND SERVICE LEARNING

(Credit: 2 Hours: 30)

COURSE OUTCOMES

1 Develop understanding on Community University Engagement. (Remembering)
2 Acquire knowledge of the measures taken by HEIs towards community engagement. (Understanding)
3 Analyse a problem pertaining to the community by applying methods of participatory research. (Analysing)
4 Apply various tools of CPBR to address real life issues of the communities. (Applying)
5 Decide a suitable tool to connect with a certain community by identifying the major barriers. (Evaluating)

Module I: (Service Learning and Community University Engagement) (10 lectures)

Definition of Service Learning (SL), goals and objectives of SL. Meaning of community university engagement (CUE), Historical overview of Higher Educational Institutes (HEIs) in India, role played by various commissions in CUE, various policies adopted by University Grants Commission (UGC), objectives and structure of schemes adopted by UGC, measures taken by HEIs towards community engagement.

Module II: (Role of HEI fostering social responsibility) (10 lectures)

Understanding social responsibility of higher education institutes, forms of community engagement, notion of engaged teaching, engaged research, engaged service, meaning of an active citizen. Meaning of Community Based Participatory Research (CBPR), methods and tools associated with CBPR. Skills to utilize CPBR fostering social responsibility especially post emergency like pandemic etc.

Module III: Assignments (10 lectures)

a. Visiting nearby villages to collect data on the percentage of students enrolling into schools per year and represent

thesame using various Mathematical models.

b. To conduct fact finding visits in local areas to address a particular problem by helping the community understandingthe situation employing tools like maps and meetings.

Suggested Readings

Where's the learning in service learning, J. Eyler, D.E. Giles Jr.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	M		
CO 3		M	
CO 4		H	M
CO 5			H

PROGRAMME: BACHELOR OF SCIENCE PHYSICS (BSC) HONOURS/HONOURS WITH RESEARCH

PSCE108T: ELEMENTS OF SERVICE LEARNING IN PHYSICS

(Credit: 2 Hours: 30)

COURSE OUTCOMES

1. Explain the meaning of service learning and active learning. (Understanding)
2. Illustrate engaged teaching and engaged research. (Understanding)
3. Organise service learning. (Applying)

Module I: (6 lectures)

Understanding social responsibility of educational institutes; meaning of community university engagement (CUE), engaged teaching, engaged research.

Module II: (9 lectures)

Active learning. Service learning; principles of service learning; classification of service learning models; difference between service Learning and other community experiences; historical context of University Community Partnership; service Learning for an undergraduate physics student

Module III: (15 lectures)

Conceptualisation of the idea of service learning through any two of the following practical implementations: (i) participating in awareness programmes on scientific temper for nearby communities, (ii) taking part in demonstrations of scientific experiments for school children to eradicate the fear of pursuing higher studies in science, (iii) providing guidance to school students for understanding the topics of their physics curriculum, (iv) providing video lectures and/or demonstrations for school students.

Suggested Readings

1. Service-Learning Essentials: Questions, Answers, and Lessons Learned, Barbara Jacoby, Jossey-bass.
2. Where's the Learning in Service-Learning?Janet Eyler and Dwight E. Giles Jr., Jossey-bass.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	M	H	
CO 2	H		
CO 3			H

PROGRAMME: BACHELOR OF ARTS EDUCATION (BA) HONOURS/HONOURS WITH RESEARCH

EDCE106T: SERVICE LEARNING (A COMMUNITY-UNIVERSITY ENGAGEMENT PROGRAMME)

(Credit: 2 Hours: 30)

COURSE OUTCOMES

1. Learn the concept of service learning and community engagement. (Remembering)
2. Understand the importance of service learning and community engagement for developing the skills of addressing real life issues in one's own community. (Understanding)
3. Develop the ethics of civic participation. (Applying)
4. Develop an understanding of the importance of communication skills in interacting with community members.

(Understanding)

5. Be exposed to and empathize with people who are less fortunate than they are,economically, socially, academically, medically etc. (Applying)
6. Organize awareness programmes, rallies, campaigns, social service etc. (Analysing)
7. Develop the skills of problem solving and reflective thinking. (Analysing)
8. Realize one's potentiality to make a difference in the life of their community members.(Evaluating)
9. Understand and experience the system of inequality that exists in the Educationalsystem. (Evaluating)
10. Applying the pedagogical concepts learned in class in the educational institutions of thecommunity. (Creating)

Module I: Service Learning and Community- University Engagement

Concept of service learning and community-university engagement; History of service learning in the context of Indian Universities; Principles for an effective service learning; Principles of a good service learning pedagogy; Models of Service learning: Project Model, Charity Model, Social Justice Model.

1. Programs of Service learning: Community Engagement, Field Education, Volunteerism, Internship.
2. Benefits of Service learning:For Students, Academic enhancement, Personal/ Professional Growth, Understanding Diversity, Civic learning, Critical reflection, For the University, For the community.
3. Service learning: A means to Inclusive Education: Experiential Learning, Expo populations, Challenge to comfort zones, Reflection sure to diverse on Experiences, Personal growth, Professional growth.

Module II: Practices for Service Learning and Community- University Engagement

By collaborating with the Community Members, Village Panchayats, Parents, Educational Institutions (Heads, Teachers and Students), Anganwadis, Balwadis etc. and following the mentioned Models and Programs of Service Learning students can be engaged with the community welfare in the following ways: (**Any….**)

1. Creating awareness among community members regarding Early childhood care andnutrition.
2. Creating awareness among community members about parenting.
3. Self-participatory internship in a school of one's own choice.
4. Creating awareness among school children and community members and providing
5. training in developing one's life skills.
6. Providing teachers training in pedagogy.
7. Providing training to school teachers in the use of ICT for enhancing students' learning.
8. Providing training to teachers in the preparation of teaching aids by using availablecommunity resources.
9. Creating awareness on Mental Health and strategies for its sustenance.
10. Creating awareness on the importance of Physical health and ways of maintaining one's
11. health.
12. Creating awareness on the importance of education and ways of creating a conducive environment for proper learning.
13. Creating awareness on AIDS.
14. Creating awareness on Population explosion- its effects and ways of population control.
15. Creating awareness on life skills and ways to develop one's life skills.

EVALUATION:

INTERNAL	
Attendance	5
Non-Formal	5
Project presentation and Viva	10
EXTERNAL	
Organization of activities and project report	30

Suggested Readings

1. Brown, Erin Marie Burke. (2015). Service-Learning Challenges and Strategies. Service-Learning Institute: Viginia Commonwealth University. Downloaded from http://scholarscompass.vcu.edu/service_institute/servicelearning_2015/background_infoma tion/1
2. Centre for Community Engagement. (n.d.). Faculty Toolkit for Service Learning. Middlesex Community College. Downloaded from https://www.uml.edu/docs/Faculty_Toolkit_MCC_tcm18-52567.pdf.
3. Cress, Christine M., Collier, Peter J., Reitenauer, Viki L. (2005). Learning Through Serving: AStudent Guidebook for Service Across Disciplines. Sterling Virginia.
4. Lavery, S., Chambers, D. and Cain, G. (2018). Service Learning: Enhancing Inclusive Education. Emerald Publishing. United Kingdom.
5. Mittal, Pankaj. Fostering Social Responsibility by Higher Education: COVID-19 and Beyond. https://youtu.be/4Yz1h0DtoBo.
6. Narasimharao, B PanduRanga. (2010). Tertiary Education Institutions for Corporate Education, Need and Relevance of Corporate Education centres. Downloaded from https://www.researchgate.net/publication/216686564.
7. PRIA. (2014). Occasional Paper: Participatory Research in Asia Fostering Social Responsibility in Higher Education in India. New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6	H	H
CO7	H	H
CO 8	H	H
CO 9	H	H
CO 10	H	H

PROGRAMME: BACHELOR OF ARTS ENGLISH (BA) HONOURS/HONOURS WITH RESEARCH

EGCE108T: SERVICE LEARNING- LANGUAGE COMMUNICATION

(Credit: 2 Hours: 30)

Course Outcomes

1. Describe the nature of Service Learning and the principles of Community University Engagement (Remembering)
2. Understand the importance of engagement with nearby communities and develop a mutual partnership in terms of the sharing of knowledge with the local communities (Understanding)
3. Apply the principles of Community University Engagement in the linguistic study of local communities in terms of spoken English and study of speech expressions (Applying)
4. Analyze the linguistic expressions of the communities and the gap of communication in terms of English language. (Analyzing)
5. Evaluate the expressions of the communities and summarize the socio-cultural constructs behind the expressions under Service-learning study. (Evaluating)
6. Design a project report on their understanding of Service learning and involvement with the communities. (Creating)

Module I: Understanding Service Learning (15 lectures)

Introduction to Service Learning; Understanding Community University Engagement; Historical Overview of Community University Engagement in India; Principles of Community University Engagement; Forms of Community University Engagement; Community Based Participatory Research; Social Responsibility of Higher Education Institutions of India

Module II: Interaction with Communities (15 lectures)

Foundations of English grammar; English phonetic symbols (vowels and consonants); Common idioms and phrases in English; Understanding the Key concepts of languages: the socio-cultural context; Exploring differentspeech communities; Learning unique linguistic expressions; Exploring idioms and phrases: the socio-cultural construct that binds them; Basics of translation; Field Visit; Assessment: Assignment writing and Submission

Suggested Readings

1. Abbi, Anvita. *A Manual of Linguistic Fieldwork and Structures of Indian Languages*. Lincom Europa.2001
2. Colina, Sonia. *Fundamentals of Translation*.CUP. 2015
3. Hall Budd. et al. *Strengthening Community University Research Partnerships: Global Perspectives*. University of Victoria,2015
4. Kaye, Berger Catheryn. *A Complete Guide to Service Learning*. Free Spirit Publishing, 2004
5. Rastogi, Pratap. *Art of English Translation*. Ramesh Publishing House,2016

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	
CO 3	H	
CO 4		H
CO 5		H
CO 6		H

PROGRAMME: BACHELOR OF ARTS MASS COMMUNICATION (BA) HONOURS/HONOURS WITH RESEARCH

MCCE110T: COMMUNITY MEDIA

(Credit: 2 Hours: 30)

COURSE OUTCOMES

1. Define and explain service learning and participatory approach to social development (Remembering)
2. Classify the different types of community media (Understand)
3. Utilise community media for social change and development (Applying)
4. Analyse storytelling formats and content about development issues (Analyzing)
5. Identify opportunities for discussing development issues using community media (Evaluating)
6. Produce content for community media (Creating)

Module 1: Introduction to Service-Learning (5 Lectures)

Concept of Service Learning— definition, principles, models of different Higher Education Institution Service Learning; Service Learning as a medium of social change.

Module 2: Understanding Community and Community Participation (5 Lectures)

Understanding Community, Participatory approach to social development; Principles of community participation; Participatory Rural Appraisal.

Module 3: Community Media and Community Engagement (5 Lectures)

Understanding Community Media, Types, Purpose, Relevance and Significance, Skills, tools and Techniques of community media, Practices of Community Media, Participatory communication, socio-cultural media, Communication for Social and Behaviour Change, ethical issues.

Module 4: Community Practicum and Learning Activities (15 Lectures)

Internship, Community Mobilisation, Awareness/Advocacy campaign, folk performances, community meetings, rural reporting, community radio programmings, community video, case studies.

Suggested Readings

1. A to Z in Projects Cycle Management: A Results Based Approach, P. J. Lukose, 2015, Media House Publications, New Delhi
2. Community Media: International Perspectives, Kinda K. Fuller, 2007, Plagrave Macmillan
3. Community Media: People's, Places, and Communication Techniques, Kevin Howley, 2005, Kindle Edition
4. Hand Held Vision: The Impossible Possibilities of Community Media, D. D. Halleck, 2002, Fordham University Press
5. Media, Communication and Development: Three Approaches, Linje Manyozo, 2012, Sage India
6. Methods for community participation: A Complete Guide for Practitioners, S. Kumar, 2002, New Delhi: Vistaar
7. Other Voices: The Struggle for Community Radio in India, Vinod Pavarala and Kanchan K Malik, 2007, Sage Publications
8. Participatory Development Practice: Using Traditional and Contemporary Frameworks, A Kelly and P. Westoby, 2018,London: Practical Action Publishing
9. Rural development: putting the last first, R. Chambers. R, 1983, New Delhi: Routledge
10. Service learning in higher education: concepts and practices, B. Jacoby, 2010, Michigan: Jossey-Bass Publishers
11. Service-learning: History, Theory and Issues, B. W. Speck and S. L Hoppe, 2004, Connecticut: Greenwood Publishing Group

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	M			
CO2		M	M	
CO3			H	H
CO4			H	H
CO5			H	H
CO6			H	H

PROGRAMME: BACHELOR OF ARTS PSYCHOLOGY (BA) HONOURS/HONOURS WITH RESEARCH

PCCE111T: SERVICE LEARNING

(Credit: 2 Hours: 30)

Module 1: introduction to Service Learning (5 hours)

Nature, Objectives, Historical Overview, Models, Qualities, Role of Higher Education Institutions (HEIs), Benefits, Challenges and Opportunities of Service Learning

Module 2: Social Responsibilities of HEIs (5 hours)

Understanding Social Responsibilities of HEIs, Community-University Engagement, Engaged Teaching, Research and Service, Principles for Community Engagement, Forms of Community Engagement, Community Based Participatory Research.

Module 3: Understanding Rural Society (5 hours)
Rural Life Style, Rural Society, Rural Economy and Livelihood, Rural Institutions (Traditional Rural Organisations, Self-Help Groups, Panchayati Raj Institutions), Rural Development Programmes (Sarva Siksha Abhiyan, Beti Bachao Beti Padhao, Swatchh Bharat, Ayushman Bharat, MNREGA etc.).

Module 4: Community Psychology (5 hours)
Definition and Historical Overview of Community Psychology, Principles of Community Psychology, Individual and family wellness, Sense of Community, Respect for Human Diversity, Social Justice and Empowerment, Community Mental Health

PROGRAMME: BACHELOR OF ARTS ECONOMICS (BA) HONOURS/HONOURS WITH RESEARCH

ENCE111T: SERVICE LEARNING

(Credit: 2 Hours: 30)

Objectives:

- *Service-learning is a method of teaching through which students apply their academic skills and knowledge to address real-life needs in their own communities.*
- *Service-learning provides a compelling reason to learn and teaches the skills of civic participation and develops an ethic of service and civic responsibility.*
- *Service-learning increases motivation and retention of academic skills as specific learning goals are tied to community needs.*

COURSE/ LEARNING OUTCOMES

- Students strengthen their ethic of social and civic responsibility.
- Understand problems in a more complex way, including underlying issues.
- Learn how to work more collaboratively with others on real problems.
- Learn about other cultures and respect for cultural differences.
- Observe how decisions are made and how they can impact people's lives.

Module I: Meaning and scope of service learning (15 hours)
Understanding Service Learning - Its philosophy, historical background, purpose, value & theoretical framework; Locating Service Learning within the University context; Principles of Service Learning; Classification of Service Learning Models; Experiential Learning; Reflective Learning; Journaling; Service Learning Pedagogy; Difference between Service Learning and other community experiences ; Historical context of University Community Partnership; Understanding Community & Community Partnership; Ethical understanding of partnership; Understanding the agency of the Community – as co-educators; Community barriers; Understanding of society & social issues.

Module II: Labor Economics (Community research model) (15 hours)
Students work in small groups to produce a report for a career and job resource center. Serving a broad spectrum of labourers in the greater Sonapur area in which they study the effectiveness of vocational training in improving the labor market opportunities for non-college bound youths. Students should also be able to interact with the organization's staff to learn more about the livelihood opportunities and challenges that workers face (specially women) in the labour market. The project includes: field survey, data entry and analysis of field information using appropriate statistical tools.

Suggested Readings

1. Ball, D., McNabb, E. and Whitt, C. (2002) 'Getting Started in Service Learning: Resources for Economists', in McGoldrick, KM. and Ziegert, A. (eds), Putting the Invisible Hand to Work: Concepts and Models of Service Learning in Economics, Ann Arbor: The University of Michigan Press, pp. 93-118.
2. McGoldrick, KM. (1995) 'Service-Learning: An Application for Economics Students', unpublished paper. Presented at the IAFFE Session of the Eastern Economic Association Meetings, New York, March.
3. McGoldrick, KM. (1998) 'Service-Learning in Economics: A Detailed Application', Journal of Economic Education, Vol. 29(4), pp. 365-376.
4. McGoldrick, KM. and Ziegert, A. (eds) (2002) Putting the Invisible Hand to Work: Concepts and Models of Service Learning in Economics, Ann Arbor: The University of Michigan Press.

PROGRAMME: BACHELOR OF ARTS PUBLIC ADMINISTRATION (BA) HONOURS/HONOURS WITH RESEARCH

PACE110T: SERVICE LEARNING

(Credit: 2 Hours: 30)

COURSE OUTCOMES

At the end of this course students are able to:

1. Learn the concept of service learning and community engagement. (Remembering)
2. Understand the importance of service learning and community engagement for developing the skills of addressing

real life issues in one's own community. (Understanding)
3. Develop an understanding of the importance of communication skills in interacting with community members. (Understanding)
4. Be exposed to and empathize with people who are less fortunate than they are, politically, economically, socially, academically etc. (Applying)
5. Organize awareness programmes, rallies, campaigns, social service etc. (Analysing)
6. Develop the skills of problem solving and reflective thinking. (Analysing)
7. Realize one's potentiality to make a difference in the life of their community members. (Evaluating)
8. Understand and experience various political and administrative issues that exist in the Society. (Evaluating)

Module I: Introduction to Service learning (10 hours)
Nature, Objectives, Historical Overview, Models, Qualities, Role of Higher Education Institutions (HEIs), Benefits, Challenges and Opportunities of Service Learning

Module II: Social Responsibilities of HEIs (10 hours)
Understanding Social Responsibilities of HEIs, Community-University Engagement, Engaged Teaching, Research and Service, Principles for Community Engagement, Forms of Community Engagement, Community Based Participatory Research.

Module III: Understanding Rural Society (20 hours)
Rural Life Style, Rural Society, Rural Economy and Livelihood, Rural Institutions (Traditional Rural Organisations, Self-Help Groups, Panchayati Raj Institutions), Rural Development Programmes (Sarva Siksha Abhiyan, Beti Bachao Beti Padhao, Swatchh Bharat, Ayushman Bharat, MNREGA etc.).

Module IV: Practices for Service learning and Community (10 hours)
Internship, Community Mobilization, Awareness/Advocacy campaign, community meetings, rural reporting, case studies

Suggested Readings

1. Berryman, S., and Bailey, T. (1992): The Double &elix of Education and the Economy. New York: The Institute on Education and thd Economy, Teachers College, Columbia University.
2. Blum, R. E. (May 10, 1995): Learning and Teaching: Our Work Together. Draft Concept Paper. Portland, OR: Northwest Regional Educational Laboratory.
3. Carnevale, A.; Gainer, L.; and A. Meltzer. (1990): Workplace Basics: The Essential Skills Employers Want. San Francisco: Jossey-Bass Publishers.
4. Collins, A., Brown, J.S. and S. Newman. "Cognitive Apprenticeship: Teaching the Craft of Reading, Writing and Mathematics", in L.B. Renick (ed.) Knowing Learning and Instruction: Essays in honour of Robert Glaser. Hillsdale, Erlbaum. Druian, G., Owens, J. and S. Owen. "Experiential Education: Search for Common
5. Roots". in R. Kraft and Y. Kielomeier (eds.) Experiential Learning in Schools and Higher EducationJ'. Dubuque, IAI KendalVHunt Publishing Co. (1995), pp. 17-25.
6. Dukehart, L. (1994). Community as Classroom: A Report Based on Presentations at the Work Now and in the Future 11 Conference". 7th Portland, OR Northwest Regional Educational Laboratory.
7. Hamilton, S.F. (1990). Apprenticeship for Adulthoad: Preparing Youth for the Future. New York: Free Press.
8. Zelldin, S. (1995). School to Work and Youth Development: Identifying Common Ground. Boston, M;A. High.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
1				
2				
3				
4				
5				
6				
7				
8				

PROGRAMME: BACHELOR OF SCIENCE BOTANY (BSC) HONOURS/HONOURS WITH RESEARCH

BOCE112T: SERVICE LEARNING ON ETHNOBOTANICAL PRACTICES

(Credit: 2 Hours: 30)

Course Outcomes

At the end of this course students will be able to:

CO1: Ability to think critically and analyze what they have learned in the classroom and how to apply their theoretical knowledge in the real world for the betterment of the society (Applying)

CO2: Development of social accountability and greater participation in community services (Applying)
CO3: Development of communication skill, personality skill, decision making ability and other career related skill (Evaluating)
CO4: Awareness about the cultural diversity and their relationship with traditionalplants (Understanding)
CO5**:** Better understand the basic concepts of ethno-botany and their conservation practices (Understanding)
CO6: Recognize the ethno-botanically important plants species (Remembering)

Module I: Introduction to Service learning (10 Hours)
Definitions; Aims and Objectives of Service Learning; Types of Service Learning; Principles of Service Learning; Important tools of Service Learning; Scopes of Service Learning; Benefits of Service Learning; Community based Service Learning and Volunteering Service Learning.

Module II: Introduction to Ethno-botany (10 Hours)
Concepts of Ethno-botany: Definitions, Interdisciplinary; Aims and Objectives of Ethno-botany; Scope of Ethno-botany: Documentation, Preservation, Conservation; Application of Ethno-botany; Concept on Rare Endangered and Threatened (RET) Taxa; Basic concept on the Conservation and Management of native plants; Basic concept on Intellectual Property Right (IPR).

Module III: Orientation Programme (10 Hours)
Lectures from experts; Discussion on various issues related to health and wellness, environment, waste management, education; Videos on community services

Service Learning on Ethno-botanical practices (200 Hours)
Implement of an interaction programme with the local ethnic group to understand their relationships with the native plants; Awareness programme on the conservation and management of rare and medicinal plants; Awareness campaign on the reconstruction of forest in the local community; Fundraise for cultivation of medicinal plants in the community; Creation of medicinal plant garden for recreation and to earn income for livelihood and to help those who are in need; Combat of invasive plants to restored ecosystems in preserve areas for public use.

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3
CO1	H		L
CO2	H		L
CO3	H		M
CO4		H	
CO5		H	
CO6		H	

PROGRAMME: BACHELOR OF SCIENCE ZOOLOGY (BSC) HONOURS/HONOURS WITH RESEARCH

ZGCE110T: FOUNDATIONS OF SERVICE LEARNING
(Credit: 2 Hours: 30)

COURSE OUTCOMES
1. Develop an understanding about the importance of service to community. (Understanding)
2. Identify the needs of a community. (Applying)
3. Apply skills acquired in Zoology to render service to community. (Creating)
4. Examine what can be learned from the community. (Analyzing)

Module I (5 hours)
Service learning: Definitions; Principles of Service Learning; Awareness of Community; Involvement with Community; Commitment to service

Module II (10 hours)
Waste Management: Principles of waste management; types of waste and their management; eco-friendly waste management;Health and Hygiene: Role and control of vectors of various diseases; Personal hygiene

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	L
CO 2	L	M
CO 3	L	H
CO 4	M	H

PROGRAMME: BACHELOR OF HOSPITALITY AND HOTEL ADMINISTRATION (BSC) HONOURS/HONOURS WITH RESEARCH

HACE110T: INTRODUCTION TO COMMUNITY ENGAGEMENT
(Credit: 2 Hours: 30)

COURSE OUTCOMES
5. Develop an understanding about the importance of service to community. (Understanding)
6. Identify the needs of a community. (Applying)
7. Apply skills acquired in hospitality to render service to community. (Creating)
8. Examine what can be learned from the community. (Analyzing)

Module I (10 hours)
Service learning: Definitions; Principles of Service Learning; Awareness of Community; Involvement with Community; Commitment to service

Module II (20 hours)
Sustainable modules of hospitality: Reduce, Reuse, and Recycle of waste materials generated by hospitality sectors; handling food waste; corporate social responsibilities activities – health & hygiene awareness programs, sustainable waste management programs.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	L
CO 2	L	M
CO 3	L	H
CO 4	M	H

PROGRAMME: BACHELOR OF PHILOSOPHY (BA) HONOURS (MINORS IN ENGLISH AND PSYCHOLOGY)

CBSL100T: SERVICE LEARNING: THEORY
Duration: 30 Hours

Objectives
Service Learning aims to support the development of basic skills among the students namely, critical and creativethinking, reflection, communication, collaboration, information literacy, and social skills. The emphasis will be on active civic participation. As the students will be actively involved in a wide range of experiences, which will benefit both the community at large and the students in particular and in the process the goals of the curriculum shall be achieved.

Course Outcomes
CO 1: Defines and explain the Service-Learning framework (remembering)
CO 2: Explains the nature and types of community engagement work (understanding)
CO 3: Identifies the need and importance of social responsibility (applying)

Module I: Concept of Service Learning (8 hours)
Service Learning – meaning, concept, definition; value-based framework of Service Learning; Understanding the core standards of Service Learning such as respect, reciprocity, relevance, and reflection; Elements of Service Learning; Understanding Service Learning – Its philosophy, historical background, purpose, value and theoretical framework; Locating Service-Learning within the University context; Principles of Service Learning.

Module 2: Community Engagement and Community Partnerships (8 hours)
Community Engagement – concept, meaning, definition and principles; benefits of community engagement, models of community engagement; Civic Engagement, University Community Engagement, Community partnerships – meaning, benefits, Reflection – meaning, definition and implications; Critical inquiry - meaning, definition and implications;

Engaged Research - meaning, definition and implications.

Module 3: Social Responsibility and Communication Basics (8 hours)
Social Responsibility – meaning, benefits, Socio-economic context – meaning, definition, Social issues – meaning, Understanding of society & social issues; Conflict – meaning, types, Understanding various conflict resolution strategies; Community level partnerships – meaning, significance, types; Social Justice – meaning and implications; Communication – meaning, types, channels of communication, models of communication.

Module 4: Identifying the Partners in the Community (6 hours)
Partners in the community – meaning, types and functions of Community Partners namely, Corporate, Government and PSU Organizations, Panchayats, Community settings, Clinical settings, NGOs, Anganwadi Centres, Self Help Groups, Schools, Business Firms, Community Markets, Weekly Haats

Suggested Readings

1. Kaye Cathryn Berger, The Complete Guide to Service Learning: Proven Practical Ways to Engage Students in Civic Responsibility, Academic Curriculum and Social Action, Free Spirit Publishing.
2. Barbara Jacoby, Service Learning in Higher Education: Concepts and Practices.
3. Patty H. Clayton, Robert G. Bringle and Julie A. Hatcher, Research on Service Learning: Conceptual Frameworks and Assessment.
4. Barbara Jacoby, Service Learning Essentials: Questions, Answers and Lessons Learned.
5. Julie A, Hatcher and Robert G. Bringle, Understanding Service Learning and Community Engagement.
6. Farbar Katy, Change the World with Service Learning.

Mapping of COs with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	M			
CO2		M		
CO3			H	H

CBSL101P: SERVICE LEARNING: PRACTICE

Credits: 2 – 60 Hours

Objectives
Service Learning will aim to support the development of basic skills among the students namely, critical and creative thinking, reflection, communication, collaboration, information literacy, and social skills. The emphasis will be on active civic participation. As the students will be actively involved in a wide range of experiences, which will benefit both the community at large and the students in particular and in the process the goals of the curriculum shall be achieved.

Course Outcomes
CO 1: Defines the different types of research projects (remembering)
CO 2: Explains the various steps of designing a research project (understanding)
CO 3: Constructs the questionnaire and schedules (applying)
CO 4: Analyses the data for analysis (analysing)
CO 5: Classifies the findings in the report (evaluating)

Instructions and Guidelines for Students
The students should keep in mind the following instruction and guidelines:
1. The fieldwork should be for a minimum duration of 30 hours which can be extended depending upon the convenience and requirement of the student and the organisation respectively. The rest of the hours are allotted forcompleting the Report. However, the entire duration of the course should not exceed 60 hours.
2. The students have to undergo the fieldwork during the semester break after 2nd semester.
3. After the completion of the fieldwork, the students must submit the Report.
4. The assessment will be done as follows:
5. There would be a Presentation (PPT) and Viva-Voce Examination towards the end of the 3rd Semester based onwhich the students would be evaluated.

Structure of Report

The Service Learning Field Work Report must be in a spiral bind and should comprise the following:
a. Recommendation Letter from the Department.
b. Certificate of Authentication from a competent authority like Village Headman, GP member or any renowned person from the community where the student has worked.
c. The Contents of the Report must include:
    i. Introduction.
    ii. Need of the study
    iii. Objectives of the study
    iv. Significance of the study

v. The methodology which was undertaken for the study
vi. Description of the work done
vii. Learning Outcomes.
viii. Feedback from the target audience/community members
ix. Geo-tagged photographs

The Assessment for the Service Learning Project will have the following Components

a. Report: 40 marks
b. Seminar Presentation: 30 marks
c. Viva-Voce Examination: 30 marks

Mapping of COs to Syllabus

Course Outcomes	
CO1	H
CO2	H
CO3	H
CO4	H
CO5	H

VALUE ADDED COURSES

DEPARTMENT OF COMPUTER APPLICATIONS

CARP6051: ROBOTIC PROCESS AUTOMATION (30 HOURS)

COURSE/ LEARNING OUTCOMES

CO1: Explain the RPA Developer enablement journey and an introduce to the role. (Understanding)

CO2: Explain the three constructs that are fundamental in any software process: variables, arguments and control flow. (Understanding)

CO3: Address what selectors are, the UI Explorer, the Property Explorer, Selector types, where to use them and how to fine-tune Selectors when encountering difficult situations. (Remembering)

CO4: Creating UI input and output actions. (Creating)

CO5: Learn about the many email tasks that can be automated to help you save valuable time. Cover an essential aspect of development, identifying and solving bugs in your projects and learn about how to get automation production-ready: how to anticipate, detect and resolve errors in your workflows. (Applying)

Module I: (8 Hours)

RPA Overview: Overview of Robotic Process Automation (RPA), Benefits of RPA in industries and business processes, Introduction to the RPA Developer Role, Variables, Data Types and Control Flow, Version Control, Data Manipulation, Excel and Data Tables, Selectors.

Module II: (22 Hours)

Bot Building: UI Automation, Introduction to Logging in Studio, IMDB Movie Rating, Contact Details, RPA Challenge.
Amazon Data Scraping, Recording Demo.
Calculate Client Hash, PDF Automation, Error and Exception Handling, Debugging.
Email Automation, Connecting Robot to Orchestrator, Publishing workflow to Orchestrator, Orchestrator Demos.

Suggested Readings

1. The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems by Tom Taulli, Publisher: Apress
2. Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the Leading RPA Tool – UiPath by Alok Mani Tripathi, Publisher: Packt Publishing; 1st edition
3. Robotic Process Automation Projects: Build Real-world RPA Solutions Using UiPath and Automation Anywhere by Arun Kumar Asokan and Nandan Mullakara, Publisher: Packt Publishing Limited

Mapping of COs to Syllabus

	Module I	Module II
CO1	H	
CO2	H	
CO3		H
CO4		H
CO5		H

CABC6052: BLOCKCHAIN (30 HOURS)

COURSE/ LEARNING OUTCOMES

CO1: To understand what Blockchain is and why it is used. (Remembering)

CO2: To be able to explain the different components involved within Blockchain. (Understanding)

CO3: To know when and why you may want to use Blockchain within your environment. (Remembering)

Module I: (7 Hours)

Introduction to Blockchain Technology and its Importance; Evolution of the Blockchain Technology,

Module II: (7 Hours)

Elements of a Blockchain, Basic Crypto Primitives – Cryptographic Hash, Digital Signature

Module III: (16 Hours)

Blockchain Consensus I – Permissionless Models, Blockchain Consensus II – Permissioned Models, Smart Contract Hands On I – Ethereum Smart Contracts (Permissionless Model), Blockchain Applications

Suggested Readings

1. Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020,
2. Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials
3. Ethereum Development Resources - https://ethereum.org/en/developers

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1	H		
CO2	M	H	
CO3		M	H

CAAW6053: ADVANCED WEB APPLICATION DEVELOPMENT TECHNIQUES (30 HOURS)

COURSE/ LEARNING OUTCOMES

CO1: Explain the JavaScript and an introduce to the role in client server architecture.(Understanding)

CO2: Explain the importance of data validation and understand the process of data sanitization. (Understanding)

CO3: Address the threat handling mechanism while development. (Remembering)

CO4: Creating User interface, service design pattern, and remote connection. (Creating)

CO5: Learn about the recent trend in web development architecture based on micro service design pattern. Cover an overview of recent trend in management of load balancing and service scalability. (Applying)

Module I: (18 Hours)

JavaScript Overview: Form events, Client Side Validation (Length check, Numeric field check, Alphanumeric field check, Empty Field, special character, password format, All field entry check), Server Side validation (Data sanitization), SQL Injection, Overview of session management, Cross site scripting, URL validation, Importance of Asynchronous JavaScript and XML (Ajax), loading page content using AJAX, Database connection, Back end data update using AJAX.

Module II: (12 Hours)

Micro Service Applicability: Micro Service design pattern, Overview of Service Oriented Architecture, Principles of Web Service, SOAP / RESTful Web Service, Overview of Containerization: Kubernetes with Docker.

Suggested Readings

1. Beginning JavaScript with DOM Scripting and Ajax – Russ Ferguson and Christian Heilmann, Publisher: Apress ; 2nd edition
2. Ajax programming for the absolute beginner, Jerry Lee Ford, Jr. Publisher: Course Technology, 1st Edition
3. Kubernetes Microservices with Docker by Deepak Vohra, Publisher: Apress, 1st Edition

Mapping of COs to Syllabus

	Module I	Module II
CO1	M	
CO2	M	
CO3		M
CO4		H

CADV6054: DATA VISUALIZATION (30 Hours)

Objective: The objective of this course is to provide students with practical knowledge and skills in data visualization, using various tools and techniques to transform raw data into meaningful visual representations. The course is designed to be fully hands-on, ensuring that participants gain real-world experience in creating and interpreting data visualizations.

COURSE/ LEARNING OUTCOMES

CO1: Apply data cleaning and transformation techniques to prepare data for visualization (Applying)

CO2: Create and customize a variety of basic and advanced charts using data visualization libraries (Creating)

CO3: Design and develop interactive dashboards and reports using standard data visualization tools (Creating)

Module I: Introduction to Data Visualization and Data Preparation (10 Hours)

Overview of Data Visualization, Importance and benefits, Types of data visualizations, Data visualization process, Visual Encoding, Data Visualization Libraries (Matplotlib, Seaborn, Plotly)

Data Cleaning and Transformation, Handling missing values (filling missing values with zero, mean, mode, and median), Smoothing noisy data (Binning), Detecting and Removing outliers (Standard deviation method), Data normalization and standardization

Module II: Basic and Advanced Visualization Techniques (12 Hours)
Creating Basic Charts - Line charts, bar charts, pie charts, donut charts, scatter plots, line plots, and bar plots, area plots, histograms, Customizing charts, Interactive features and customization
Creating Advanced Charts - Box Plots, Bubble Plots, Violin Plots, Heat Map, Dendrogram, Radar Chart, Venn Diagram, 3D Scatter Plots, Geospatial Visualizations, Maps and geographical data, Visualizing networks and connections, Creating time series plots

Module III: Dashboards and Reports (8 Hours)
Introduction to standard Data Visualization tools, connecting to data sources (connecting to databases and APIs), Creating basic visualizations, Calculations and parameters, Building interactive reports and dashboards (Adding filters, parameters, and calculated fields to dashboards)

Suggested Readings
1. Chen, Min, et al., eds. Foundations of data visualization. Cham, Switzerland: Springer International Publishing, 2020.
2. Healy, Kieran. Data visualization: a practical introduction. Princeton University Press, 2018.
3. Wilke, Claus O. Fundamentals of data visualization: a primer on making informative and compelling figures. O'Reilly Media, 2019.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H		
CO2		H	
CO3		L	H

DEPARTMENT OF COMMERCE

CMII6011: IDEATION TO INNOVATION
(0-0-2) (2 credits – 30 hours)

Objective: The objective of the course is to turn an idea into a start-up by giving students a hands-on, real-life experience creating a start-up with like-minded partners from around the world. The course challenges the students to innovate, overcome obstacles, and grow rapidly with the goal of creating a business worth valuing.

Learning Outcomes
After completing the course, the learners will be able to:
CO1: Articulate the skills and know-how to develop their business idea from the conceptual stage to the marketplace (Applying)
CO2: Evaluate and select models for new ventures (Evaluating)
CO3: Apply both quantitative and qualitative customer and market research (Applying)
CO4: Understand the framework of product development (Understanding)
CO5: Design, evaluate, and implement marketing strategies (Creating)
CO6: Design a scalable business model via real-life experiments and tests in a live marketplace with genuine customer feedback (Creating)

Module 1: Team Formation and Ideation (2 Hours)
Ideation activities (problems submission, discussion, down-selection) Team Formation & Ideation, Introduction to Lean Canvas Model

Module 2: Problem – Solution Fit (3 Hours)
How to Find & Assess Ideas - Introduction to Design Thinking Idea validation & online tools, Idea Development

Module 3: Product - Market Fit analysis and development (4 Hours)
Market: Segmentation, Positioning, Market Info Sourcing, Customer Validation Prototyping & Solution Validation

Module 4: Business Model & Marketing Strategy (5 Hours)
Designing & Validating the Business & Revenue Model Marketing Strategy Development & Marketing Tools Business Model Fine Tuning Marketing Campaign Design: Goals, KPIs, Tracking Customer Engagement Campaign & Minimum Viable Product Launch

Module 5: Financial KPIs & Product Sprint (5 Hours)
Financial KPIs: Calculating, Interpreting & Presenting
Start-up Financial Planning & Budgeting Calculating Financial Metrics & Starting Pitch Preparation

Module 6: Start-Up Funding & Pitch Preparation & Product Sprint (4 Hours)
Funding Alternatives for Start-ups, Designing Your Funding Strategy & Start-up Valuation, Investor Presentation Tips & Tricks , Funding Strategy Design & Pitch Deck Preparation , Compulsory exercises: (7 hours), Preparation of the business model, Prototype development, and The Venture Capitalist pitch

Suggested Readings
The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company - Steve Blank and Bob Dorf Running Lean: Iterate from Plan A to a Plan That Works (Lean Series) - Ash Maurya

Mapping of COs with Syllabus

	M1	M 2	M3	M4	M5	M6
CO1	H	H	H	H	H	H
CO2	M	H				
CO3			H	M		
CO4			H	H		
CO5					H	M
CO6						H

CMSS6012: STATISTICAL SOFTWARE PACKAGES FOR DATA ANALYSIS (0-0-2)
(2 credits – 30 hours)

Objective: This course is designed to familiarize students with some omnibus software packages commonly utilized for statistical analysis in science and industry. Statistical programs include both proprietary and open-source packages.

Learning Outcomes
After completing this course, participants will be able to:
CO1: Create and manage data sets in several software programs (Creating)
CO2: Implementing knowledge and skill at using several software programs to run different forms of statistical analysis (Applying).
CO3: Implementing knowledge and skill at using software programs to create tables, graphs, and figures(Applying).
CO4: Assessing practical interpretation of statistical results for developing decisive insights and to inform decision-making and innovation (Evaluating).

Module 1: Data preparation (8 Hours)
Getting familiar with the interface – SPSS, PSPP, MS Excel; Enter, save data - SPSS, PSPP, MS Excel; Import data from Excel to SPSS/PSPP; Carry out different data preparation processes

Module 2: Exploratory Data Analysis (3 Hours)
EDA for one or more variables; Create charts for one variable; Transform data; Transforming scale into categorical variable

Module 3: Inferential Statistics for the mean and the median (6 Hours)
Descriptive statistics for two or more variables; Creating and editing charts for two or more variables Inferential statistics for the mean and the median; One-sample t-test and sign test, T-test ; Paired-difference t-test ; Power Analysis for t-test

Module 4: ANOVA and simple linear regression (4 Hours)
One-way and two-way ANOVA ; Bivariate linear regression; Power Analysis for ANOVA

Module 5: Multiple linear regression (4 Hours)
Multiple linear regression and correlation; Model building and selection; Interpreting regression coefficients and confidence intervals; Power Analysis for linear regression

Module 6: Inferential statistics for the proportion (5 Hours)
Inferential statistics for categorical variables
One-sample Chi-square; Chi-Squared Test of Independence; Power Analysis for the proportion

Suggested Readings
1. Leech, Nancy L.; Karen C. Barrett; and George A. Morgan. 2014. SPSS for Intermediate Statistics: Use and

Interpretation. 5th Edition. Routledge, New York, USA.
2. Maujis, D. Doing Quantitative Research in Education with SPSS. 2nd Edition.SAGE Publications, California, USA.
3. McCormick, K., J. Salcedo, J. Pock, and A. Wheeler. 2017. SPSS Statistics for Data Analysis and Visualization. John Wiley & Sons, Inc. Indianapolis, IN.

Mapping of COs with Syllabus

	Module 1	Module2	Module3	Module 4	Module 5	Module 6
CO1	H					
CO2		H	H	H	H	H
CO3	H		M			
CO4			H	H	H	H

CMAS6013: ACCOUNTING SOFTWARE PACKAGE

Lectures: 10 Hours, Practical Lab: 20 Hours

CO1: Define the basic accounting concept, computerized accounting system and Data Based Management system (Understanding).
CO2: Understand the Preparation of ledgers, Trial balance and other financial statements with SQL (Understanding).
CO3: Application of accounting software (Tally ERP 9) in Voucher entries, preparation of accounts and other financial statements (Application) CO4: Application of Tally ERP 9 software in payroll and voucher entries with GST

Module 1: Basics of Accounting Concept. (5 hours)
Basic accounting concept; journal entries; preparation of books of accounts and ledgers; preparation of trial balance and final accounts of corporate entities; Accounting system; benefits of computerized accounting system and challenges associated with computerized accounting system.

Module 2: Application of SQL (5 hours practical Lab)
Preparation of ledgers; Trial Balance and Report with the help of SQL

Module 3: Tally ERP 9 Fundamentals (2 hours, 7 hours Practical Lab)
Introduction to Tally ERP 9; Features of Tally ERP 9; creating, selecting, altering, deleting and shutting up of company; creating, altering and deleting of group and ledgers, voucher entries; integrating accounts and inventory; Displaying the financial report .

Module 4: Application of Tally ERP 9 in advanced level (3 hours, 8 hours Practical lab)
Activating payroll in Tally; understanding of payroll; pay heads and categories; Attendance entries; salary payment example; pay-sheet and pay-slips. Activating Tally in GST; setting up GST (company level, ledger or inventory level); creating GST masters and generating reports.

Suggested Readings

1. SQL For Beginners: SQL Made Easy; A Step-By-Step Guide to SQL Programming for the Beginner, Intermediate and Advanced User (Including Projects and Exercises) Craig berg
2. Tally.ERP 9 with GST in Simple Steps Paperback; Dreamtech press
3. Learning Tally ERP 9 with GST; Sajee Kurian, Blessing Inc
4. Database Management Systems (DBMS) Rajiv Chopra, S.Chand Publishing
5. Learning SQL ; Alan Beaulieu, O'Reilly Media
6. Ashok K Nadhani, GST Accounting with Tally.ERP9, BPB Publications, New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	L			
CO 2		M		
CO 3			H	
CO 4				H

CMIT6014: INCOME TAX RETURN FILLING

(2 credits: 30 hours) Lectures: 10 Hours, Practical Lab: 20 Hours

After completion of this course, student should learn to:

CO 1: Understand the basics of income tax laws and regulations.
CO 2: Identify different sources of income and applicable tax deductions and exemptions.
CO 3: Prepare and file income tax returns for individuals and businesses.

Module- 1: Introduction to Income Tax Laws and Regulations (4 hours)
Introduction to Income Tax, Brief about Various Sources of Income (with Illustration)

Module- 2: Introduction to Tax Return Filing (2 hours Lecture 4 hours lab)
Introduction of E Filing of Income Tax Returns, Generation of IT Forms like ITR 01(SAHAJ), ITR 02, ITR 03, ITR 04, ITR 4S(SUGAM), ITR 05 and ITR 06.

Module- 3: Tax Return Filing (2 hours Lecture 12 hours lab)
Practical Exposure to www.incometaxindiaefiling.gov.in portal. How to file Return Electronically on portal with or without Digital Signature Certificate. How to Pay Tax online through Net Banking. How to Generate Challans online and Manual.

Module- 4: Tax Deducted at Source (2 hours Lecture 4 hours lab)
Form 16 B, How to view Tax Credit through 26AS, E Filing TDS Salary Return form 24Q and Challan

Assessment:

- Quizzes and assignments throughout the course to assess understanding and retention of key concepts.
- Final project: Prepare and file a mock income tax return for an individual or business, demonstrating proficiency in income tax return filing procedures.

Suggested Readings:
1. Self Preparation and Filing of Income Tax Returns by Individuals Third Edition: May 2019 by Swatantra Sethi.
2. How to File Salary Income Tax, AY 2019-2020 by CA Rahul Gupta.
3. Fast Track Quick Revision Income Tax for AY 2019-2020 by AS K K Agarwal.4. Tax Saving & Investment guide : Income Tax of India by CA Shammi Prabhakar Singh.

	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	L	L
CO 2	H	M		
CO 3		M	H	

CMCR6015: CUSTOMER RELATIONSHIP MANAGEMENT

(2 Credits: 30 hours) (L-T-P: 1-0-1)

COURSE OUTCOME
CO1 To make the students understand the organizational need, benefits and process of creating long term value for individual customers
CO2 To create awareness about formulation and implementation of various CRM
CO2 To make students recognize CRM impact on sales and marketing strategies

Module 1 Introduction to CRM (5hours lecture, 5 Hours Practical)
CRM meaning, About CRM Software, Origin of CRM, objectives, Component of CRM, benefits of CRM, Approaches, Relationship Based Pricing Schemes, Total Care Program, Reasons for loosing Customer

Module 2 Building Custom Relationship (3hours lecture, 7hours practical)
Customer Acquisition, inputs of customer acquisition, process, requisites for effective customer acquisition, Customer Interactive Management, routes of customer interaction management, factors of customer interaction, Customer Retention, C Retention Strategy, determinants

Module 3 Customer Relationship Process (2hours lecture, 8 hours practical)
CRP meaning, objectives, CRM process Model, 4 C's, steps of CRM process, CRM business transformation, IT and Customer Relation, e-CRM, CRM vs e-CRM, , implementation and integration e-CRM Work

Assessment

- Quizzes and assignments throughout the course to assess understanding and retention of key concepts.
- Assisgnment , Group Discussion and preparation of a project report based on the field visit

E-resource
Module1- https://www.eresourceerp.com/blogs/eresource-innovates-business-centric-crm-software/
Module2- https://www.eresourcescheduler.com/
Module3-https://www.indiamart.com/proddetail/customer-relationship-management-software-15994554691.html

Suggested Readings

Customer Relationship Management: Concepts and Technologies
Customer Relationship Management: The Foundation of Contemporary Marketing Strategy
Managing Customer Experience and Relationships: A Strategic Framework

	Module 1	Module 2	Module 3
CO 1	L		
CO 2		H	
CO 3			M

DEPARTMENT OF MANAGEMENT

MTII6011: IDEATION TO INNOVATION
(0-0-2) (2 credits – 30 hours)

Objective: The objective of the course is to turn an idea into a start-up by giving students a hands-on, real-life experience creating a start-up with like-minded partners from around the world. The course challenges the students to innovate, overcome obstacles, and grow rapidly with the goal of creating a business worth valuing.

Learning Outcomes

After completing the course, the learners will be able to:

CO1: Articulate the skills and know-how to develop their business idea from the conceptual stage to the marketplace (Applying)
CO2: Evaluate and select models for new ventures (Evaluating)
CO3: Apply both quantitative and qualitative customer and market research (Applying)
CO4: Understand the framework of product development (Understanding)
CO5: Design, evaluate, and implement marketing strategies (Creating)
CO6: Design a scalable business model via real-life experiments and tests in a live marketplace with genuine customer feedback (Creating)

Module 1: Team Formation and Ideation (2 Hours)
Ideation activities (problems submission, discussion, down-selection) Team Formation & Ideation, Introduction to Lean Canvas Model

Module 2: Problem – Solution Fit (3 Hours)
How to Find & Assess Ideas - Introduction to Design Thinking Idea validation & online tools, Idea Development

Module 3: Product - Market Fit analysis and development (4 Hours)
Market: Segmentation, Positioning, Market Info Sourcing, Customer Validation Prototyping & Solution Validation

Module 4: Business Model & Marketing Strategy (5 Hours)
Designing & Validating the Business & Revenue Model Marketing Strategy Development & Marketing Tools Business Model Fine Tuning Marketing Campaign Design: Goals, KPIs, Tracking Customer Engagement Campaign & Minimum Viable Product Launch

Module 5: Financial KPIs & Product Sprint (5 Hours)
Financial KPIs: Calculating, Interpreting & Presenting
Start-up Financial Planning & Budgeting Calculating Financial Metrics & Starting Pitch Preparation

Module 6: Start-Up Funding & Pitch Preparation & Product Sprint (4 Hours)
Funding Alternatives for Start-ups, Designing Your Funding Strategy & Start-up Valuation, Investor Presentation Tips & Tricks , Funding Strategy Design & Pitch Deck Preparation , Compulsory exercises: (7 hours), Preparation of the business model, Prototype development, and The Venture Capitalist pitch

Suggested Readings

The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company - Steve Blank and Bob Dorf Running Lean: Iterate from Plan A to a Plan That Works (Lean Series) - Ash Maurya

Mapping of COs with Syllabus

	M1	M 2	M3	M4	M5	M6
CO1	H	H	H	H	H	H
CO2	M	H				

CO3			H	M		
CO4			H	H		
CO5					H	M
CO6						H

MTFS6012: FUNDAMENTAL SELLING SKILLS: TECHNIQUES AND APPLICATIONS
2 Credits (30 hours – 4 weeks)

Course Outcomes:
After completion of the course, students will be able to:
CO1: To explain the sales process
CO2: To analyse the relationship between sales and marketing
CO3: To examine the sales force structure and its functioning
CO4: To demonstrate the sales process

Pedagogy:
Students will learn to apply the discussion topics through interactive sessions, assignments, presentations, cases studies and demonstrations throughout the course (4 weeks).

Evaluation:
Weekly Assignments: 4 x10 = 40 marks
Weekly Presentations: 4x5 = 20 marks
Final Assessment (written test) = 40 marks

Module 1: Introduction to Sales Management
Meaning, Evaluation, Importance, Personal selling, Emerging Trends in Sales management, Elementary Study of Sales Organisation, Qualities & Responsibilities Sales Manager, Types of sales Organisations

Module 2: Selling Skills and Selling Strategies
Selling and Business Styles, Sales Funnel and the Sales Model, Selling Process, Sales Pitch and Presentation, Handling Customer Objections and Sales Closing Skills

Module 3: Management of Sales Territory and Sales Quota
Sales Territory Meaning, size, Designing Sales Quota, procedure for dales quota, types of sales quota, recruitment and selection of sales force, training of sales force.

Module 4: Sales Manager and sales person:
Role of sales manager and sales people, functions of sales manager, functions of sales person, types and characteristics of sales manager and sales people, time management for sales manager and sales people.

Module 5: Sales Force Motivation and Compensation
Nature of Motivation, Importance, Process and factors in the motivation, Compensation-meaning, types of compensation plans and evaluation of sales force by performance and appraisal process.

DEPARTMENT OF CHEMISTRY

CHPC6137: PETROLEUM CHEMISTRY
(1-0-1)

Course Outcomes
1. To gain knowledge about the composition of crude petroleum and the refining process. (Remembering)
2. To correlate the quality of fuels with various parameters. (Understanding)
3. Determination of different types of water testing parameters required in thermal power plant. (Applying)
4. Analysing of chemical impurities and their separation techniques. (Analysing)
5. Designing of eco-friendly and sustainable energy source in future. (Evaluating)

Module I: Oil Section (15 Lectures)
Renewable and non-renewable source of energy, Petroleum, Composition of crude petroleum, Hydrocarbon, Distillation (Upper distillation, middle ditillation, Residue distillation), crude distillation unit, Fractional distillation, petroleum refining-applications of various fractions, Cracking, Reforming, Petrol, Diesel, viation turbine fuel, Kerocene, LPG, CNG, LNG, clean fuels, Octane number, Cetane number, Flash point, calorific value, knocking and antiknocking, isomerization, smoke point, Lubricants, viscosity index, cloud point, pore point, Density, Gas chromatography, HPLC.

Module II: Water section (15 Lectures)
Thermal power plant station, concept of zero discharge refinery, Oil content, Effluent treatment plant, boiler, demineralization, uses of cationic and anionic resin during neutralization reaction, requirement of *p*H determination, BOD, COD, TDS, TSS, DO, Microbiological treatment, Scavenger, alkalinity, corrosion monitoring, permanent alkalinity, Total hardness, temporary hardness, silica and phosphate removal process, removal of sulphate, sulphite, ammonia, cyanide, water testing.

Suggested Readings
1. Engineering Chemistry, P. C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.
2. Industrial Chemistry, B. K. Sharma, Goel Publishing House, Meerut
3. Fundamentals of Petroleum and Petrochemical Engineering, U.R. Chaudhuri, CRC Press, Taylor & Francis group.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H
CO 5	H	

CHPA6138: PHARMACEUTICAL CHEMISTRY AND ITS APPLICATIONS
(1-0-1)
Course Outcomes
1. Explanation of the preliminary concept of drug and their classification. (Remembering)
2. To understand the mode of action of different kinds of drugs. (Understanding)
3. Synthesis of simple drug molecules and their purification techniques. (Applying)
4. Extraction of the medicinally active component from a plant source and their characterization techniques. (Analysing)
5. To provide knowledge of computational chemistry in designing drug molecules. (Evaluating)

Module I: Introduction and importance of drug Chemistry (15 Lectures)
Definition of drug, pro-drug, host-receptors interactions in connection to biological response, pharmacokinetics and mechanism of drug action-absorption, distribution, metabolism, and excretion (ADME), Structure activity relationship (SAR and QSAR), drug classification based on mode of action, analgesics and anti-inflammatory drug, COX-2 inhibitors, mode of action of NSAID and SAID, anti-histamine drugs, antidepressant drugs, narcotics, sedative-hypnotics and their mechanism of action, antibiotics, antiviral drugs, anti-bacterial drugs, anti-neoplastic drug, drugs derived from natural origin including plants and bacteria, chemotherapy, nano-drug delivery systems, toxicology, positive and negative aspect of drug chemistry, future scope of drug chemistry.

Module II: Hands on experience on drug chemistry (15 Lectures)
Experimental aspect of drug chemistry: Synthesis of simple drug molecules, various techniques used for purification including crystallization / recrystallization, acid-base purification, column chromatography, quality control / purity determination of drugs using GC-MS, HPLC etc., extraction of active ingredient from various plants in North-eastern region having medicinal importance, procedure for bioactivity test.
Theoretical feature of drug chemistry: Application of computational chemistry in designing of drug molecule, computer simulation to assist in solving chemical problems, drug-DNA interaction study, drug-delivery study.

Suggested Readings
1. An Introduction to Medicinal Chemistry, G. L. Patrick, Oxford University Press.
2. Introduction to Medicinal Chemistry, A. Gringauz, Wiley India Pvt Ltd.
3. Medicinal Chemistry, A. Kar, New Age International Publishers.
4. Medicinal Chemistry: An Introduction, G. Thomas, John Wiley & Sons
5. Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems, D. C. Young, John Wiley & Sons, Inc.
6. Computational Materials Science: An Introduction, J. G. Lee, CRC press, Taylor & Francis Group.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H
CO 5		H

DEPARTMENT OF MATHEMATICS

MAFG0154: FRACTAL GEOMETRY AND APPLICATIONS
(2-0-0)

COUSE OUTCOMES

1. Explain the basic concepts of fractals and their mathematical constructions. (understanding)
2. Develop fractal dimensions and study their applications. (Applying)
3. Categorize Mandelbrot set and Julia sets, and classify their graphical representation and geometric properties. (Analysing)
4. Interpret random fractals, and study their applications to Health science and Stock markets. (Evaluating and Applying)
5. Demonstrate various chaos, renormalization, universality of chaos, and their significance. (Understanding and Creating)
6. Elaborate various applications in different fields of science and technology. (Creating)

Module I: Regular Fractals and Self-similarity (5 lectures)
Self-similarity, Examples of self-similarity, Fractals, Cantor Set, Koch Curve, Sierpinski gasket, Menger Sponge, Initiators and Generators, Geometry of Plane Transformations, Iterated Function Systems(IFS), Inverse problems, Random IFS, Driven IFS, Architecture.

Module II: Natural Fractals and Dimensions (5 lectures)
Ineffective way to measure, Fractal Dimensions and calculation, Hausdorff measure and dimension, Box counting dimension, Similarity dimension, The Moran formula, other dimensions, Area-Perim, Dim Algebra, Natural Fractals, Manufactured Fractals.

Module III: The Mandelbrot Set and Julia Sets (5 lectures)
Complex iteration, Julia sets, Julia sets of quadratic functions, The Mandelbrot set, Combinatorics of the Mandelbrot set, The boundary of the Mandelbrot set, Scaling in the Mandelbrot set, Complex Newton's method, Universality of the Mandelbrot set, Fractal in arts.

Module IV: Random Fractals and the Stock Market (5 lectures)
Self-similar distributions, Random Cantor set, Brownian motion, Fractional Brownian motion , Diffusion Limited aggregation , Levy Stable processes, Percolation , Bacterial Growth, Galaxy distributions, Internet traffic , Random fractal Cartoons, Stock market surrogates.

Module V: Chaos and Fractals (5 lectures)
Doubling, Introduction to Chaos, Test functions, Graphical iterations, Time series, Histograms, Bifurcation diagrams, Return map, Driven IFS, Kelly plot, Fixed points, Cycles, Period doubling bifurcations, Dust in the Tent map, Tent and Logistic bifurcation diagrams, Tangent bifurcations, Intermittency, Discontinuous bifurcations, Scaling, Universality, Renormalization, Control of chaos, Synchronization of chaotic processes.

Module VI: Fractal Applications (5 lectures)
Fractal growth, Singularities of Electrostatic and gravitational potentials, Fractal Antennas, Fractal in Finance, Self-Affine set and dimension, Application to encoding images, Panorama of Fractals and their uses, Animations, application of fractal geometry to Computer science, Telecommunications, and Medicine .

Suggested Readings

1. A Text by Michael Frame and Amelia Urry, Fractal Worlds, Yale University Press.
2. Fractal Geometry; mathematical foundations and Applications, Kenneth Falconer, John Wiley & Sons Ltd, England.
3. Fractal Geometry and Applications, Michel L Lapidus, A Jubilee of Benoit Mandelbrot,
4. The Fractal Geometry of Nature, Benoit Mandelbrot, W.H. Freeman and Co.
5. Fractal Geometry, Mathematical methods, Algorithms, Applications, A K Evans, Woodhead Publishing.
6. Fractals Everywhere, Michael Barnsley, Dover Books on Mathematics.
7. Chaos and Fractals: New Frontiers of Science, Heinz, Otto Peitgen, Springer and Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2		H		M	L	
CO 3			H	H	M	
CO 4			M	H		L
CO 5				M	H	H

CO 6		H				H

MAML0152: ESSENTIAL MATHEMATICS FOR MACHINE LEARNING
(2-0-0)

COURSE OUTCOMES
1. Comprehend the basic and core concepts of vector space, matrices, matrix decompositions. (Understanding)
2. Apply the concepts statistics and linear algebra in Dimension reductions. (Applying)
3. Gain extensive knowledge of probability and statistics for analysis of data. (Analysing)
4. Apply the fundamentals of calculus to evaluate partial derivatives, gradient and other concepts of vector calculus.(Applying)

Module I: (8 lectures)
Vector Spaces: Definitions and examples, Vector Subspaces: Examples and Properties, Basis and Dimensions, Linear Transformations, MATRIX THEORY- Norms and spaces, eigenvalues and eigenvectors, Special Matrices and their properties, least squared and minimum normed solutions.

Module II: (8 lectures)
Matrix Decomposition Algorithms- SVD: Properties and applications, low rank approximations, Gram Schmidt process, polar decomposition, DIMENSIONS REDUCTION ALGORITHMS and JCF- Principal component analysis, linear discriminant analysis, minimal polynomial and Jordan canonical form

Module III: (8 lectures)
Probability – Basic concepts of probability: conditional probability, Bayes' theorem, independence, theorem of total probability, expectation and variance, few discrete and continuous distributions, joint distributions and covariance.

Module IV: (6 lectures)
Calculus – Basic concepts of calculus: partial derivatives, gradient, directional derivatives, Jacobean, hessian, convex sets, convex functions and its properties.

Suggested Readings
1. Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press.
2. Analysis for Applied Mathematics. W. Cheney, New York: Springer Science Business Media.
3. Linear Algebra Done Right, Third Edition, S. Axler, Springer International Publishing.
4. Numerical Optimization. J. Nocedal and S. J. Wright, New York: Springer Science Business Media.
5. A First Look at Rigorous Probability Theory, Second Edition, J. S. Rosenthal, Singapore: World Scientific Publishing.

Mapping COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	L	H		
CO 3		L	H	
CO 4				H

MACS6005: COMPUTATIONAL MATHEMATICS WITH SAGE MATH
(2 Credits- 30 Lectures)

COURSE OUTCOMES
1. Learn and understand the basic Python programming language. (Understanding)
2. Understand how to use Sagemath software and its applications. (Understanding)
3. Solve problems in Calculus, Applied Linear Algebra, Numerical Method and differential equations using Sagemath.(Evaluating)

Module I (10 lectures)
Installation of Python; Getting Started with Python Python as an advanced calculator; For loop in Python; While loop in Python; Use of SciPy and SymPy in Python; Classes in Python - Part 01; Classes in Python - Part 02;

Module II (12 lectures)
Solving Equations in SageMath;2d Plotting with SageMath;3d Plotting with Sage Math; Calculus of one variable with Sagemath, Integration with Sage Math; Improper Integral using SageMath; Application of integration using SageMath; Partial derivative with sage math, limit and continuity of real valued functions; working with vectors in sagemath; Solving

systems of linear equation in sage math, vector space in sage math, Matrix Spaces with SageMath; Linear Transformations with SageMath, eigenvalues and eigenvectors with sage math;

Module III (8 lectures)
Finding Roots of algebraic and transcendental equations in SageMath; Numerical solutions of linear equations and numerical integration with sagemath;Solving 1st and 2nd order ODE with SageMath;Euler's Method to solve 1st order ODE with SageMath.

Suggested Readings
1. Computational Mathematics with SageMath, Paul Zimmermann , Siam
2. Mathematical Computational with Sagemath, Paul Zimmermann Alexandre Casamayou Nathann Cohen Guillaume Connan Thierry Dumont
3. An introduction to Sage Programming: With applications to SAGE Interacts for Numerical methods, Razvan A Mezei, Springer

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2		H	M
CO 3			H

MACM6004: COMPUTATIONAL SKILL DEVELOPMENT: MATHEMATICA
(2 Credits- 30 Lectures)

COURSE OUTCOMES
1. Learn how to use Mathematica, a powerful coding language in science and engineeringcomputing (Remembering).
2. Apply the application-oriented principle to various real-life problems (Applying)
3. Evaluate simple math computations, modeling and simulation problems, data analysis andprocessing, as well as visualization techniques. (Evaluating)

Module I (10 Lectures)
Introduction to Mathematica and to the Wolfram Language (knowledge-based language, built- in support for real-world entities, Wolfram Alpha and the Wolfram Demonstrations Project), Notebook Interfaces, Text-Based Interfaces, Numerical Calculations: Arithmetic, Exact and Approximate Results, Some Mathematical Functions, Arbitrary-Precision Calculations, Complex Numbers, Getting Used to Mathematica, Mathematical Notation in Notebooks, Defining Variables, Making Lists of Objects, Manipulating Elements of Lists, The Four Kinds of Bracketing in Mathematica, Sequences of Operations.

Module II (10 Lectures)
Lists, strings, rules, patterns and pattern matching, different programming paradigms (procedural, functional and rule-based), Graphics and image manipulation (the 30+ members of the plot family, pixelsand voxels, the built-in image editor)

Module III (10 Lectures)
Linear and polynomial algebra. Exact and numerical optimization. Calculus and differential equations (analytic and numerical solutions of ODEs and PDEs). Plane and solid geometry. Probability and statistics(descriptive statistics, built-in support for 100+ distributions)

Suggested Readings
1. The Mathematica Book, S. Wolfram, 5th edition, Wolfram Media, 2003
2. Mathematica Basic Training Course Li Han Long, Sui Ying Deng, National Defense Industry Press,2016
3. Introduction to Mathematica with Applications, M. Muresan, Springer, 2017

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M		
CO 2		M	M
CO 3			H

DEPARTMENT OF PHYSICS

PSCP6120: COMPUTATIONAL PHYSICS USING PYTHON
(2-0-0)

Course Outcomes

1. Outline the fundamental elements of Python computing. (Understanding)
2. Estimate the accuracy and speed of a Python code. (Applying)
3. Develop Python code for solving definite integrals and finding derivatives. (Applying)
4. Solve systems of equations using Python arrays. (Applying)
5. Develop optimized numerical solutions of ordinary differential equations. (Applying)
6. Make use of Monte Carlo methods in random processes for solving physical problems. (Applying)
7. Propose computational solutions to physical problems using Python. (Creating)

Module I: Elements of Python programming (9 lectures)
Data types, basic mathematical operations, variables; lists: indexing, slicing, altering, appending and deleting elements, concatenation; tuples and dictionaries; conditional statements; loops: while and for loops, nested-for loops; Python libraries: installing packages, importing packages; NumPy arrays and matrices, example: eigenvalues and eigenvectors; basics of data handling using Pandas; introduction to SciPy; data visualization using Matplotlib and Seaborn.

Module II: Accuracy and speed (2 lectures)
Variables and data ranges; numerical error; program speed.

Module III: Numerical integrals and derivatives (4 lectures)
Fundamental integral evaluation methods: trapezoidal rule, Simpson's rule; error estimation of integrals; Romberg integration; Gaussian quadrature; numerical differentiation: forward and backward differences, central differences, second derivatives, partial derivatives, differentiation error estimation.

Module IV: Solving linear and non-linear equations (6 lectures)
Linear equations: Gaussian elimination, back-substitution, pivoting, LU decomposition, matrix inverse, tridiagonal and banded matrices; nonlinear equations: binary search, Newton's method, secant method

Module V: Numerical solutions of ordinary differential equations (4 lectures)
First-order differential equations with one variable: Euler's method, Heun's method, 4^{th} order Runge-Kutta method; differential equations with multiple variables; second-order differential equations; boundary value problems: shooting method, relaxation method; eigenvalue problems.

Module VI: Random processes (5 lectures)
Random numbers generators and seeds; non-uniform random numbers, Gaussian random numbers; Monte Carlo integration: mean value method, integrals in many dimensions, importance sampling; importance sampling; Markov chain methods.

Suggested Readings

1. Mark E.J. Newman, Computational Physics, Createspace Independent Pub.
2. Rubin H. Landau, Manuel J. Paez and Cristian C. Bordeianu, Computational Physics: Problem Solving with Python, Wiley.
3. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly Media.
4. David Beazley and Brian K. Jones, Python Cookbook: Recipes for Mastering Python 3, O'Reilly Media.
5. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly Media.
6. Duncan M. McGreggor, Mastering Matplotlib, Packt Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M	M	M	M
CO 3			H			
CO 4				H		
CO 5					H	
CO 6						H
CO 7		M	M	M	H	H

DEPARTMENT OF EDUCATION

EDES6011: EDUCATION FOR SUSTAINABLE DEVELOPMENT (1-0-1)

COURSE OUTCOMES

1. To create awareness about the concept of Sustainable Development. (Remembering)
2. To create skill among the students to find out the sustainability of any economic activity.(Understanding)
3. To create awareness among students about the concept of Education for SustainableDevelopment. (Applying)
4. To create an understanding among the students about the role of Education inSustainable Development. (Analysing)

Module I: Introduction to Sustainable Development (5 Lectures)
Concept of Development**;** Concept of Sustainability**;** Sustainable Development: Its 5 Ps (People, planet, prosperity, peace, and partnership)**;** Sustainable Development Goals- 17

Module II: Curricular Framework for Education for Sustainable DevelopmenT (10 Lectures)
Definition and meaning of Education for Sustainable Development; Principles; Key themes: Climate change, Biodiversity, Sustainable production and consumption, Reduction of poverty; Key Sustainable Competencies to be developed through ESD: Systems thinking Competencies, Anticipatory Competency, normative competency, Strategic competency, Collaboration Competency, Critical thinking competency, Self-awareness Competency and integrated problem Solving Competency; Pedagogical approaches in ESD: Whole- institution approach, Learner centered approach, Action oriented learning, Transformative approach; Teaching techniques for ESD: Simulations, Class discussions, Issue Analysis Techniques, Storytelling.

Module III: Practical Implications of ESD (15 Lectures) (Any two)
Sharing their own stories of struggle/ success with the class
Visiting neighboring areas to collect community related stories/ activities towards the realization of Sustainable Development Goals.
Surveying industries and submitting reports on its sustainability norms. Surveying schools and submitting reports on its sustainability norms.

EVALUATION

	Written test	10
	Attendance	5
	Non- formal	5
	Reports (2)	15+ 15= 30
		50

Suggested Readings

1. UNESCO. (2012). Education for Sustainable Development: Source Book. Retrieved from https://sustainabledevelopment.un.org/content/documents/926unesco9.pdf.
2. Bubaker F. Shareia. (2015). Theories of Development. International Journal of Language and Linguistics.2(1), Pp. 78-90. Retrieved from http://ijllnet.com/journals/Vol_2_No_1_March_2015/9.pdf.
3. UNESCO. (2016). Incheon Declaration and Framework for Action. Retrieved from http://uis.unesco.org/sites/default/files/documents/education-2030-incheon-framework-
4. for-action-implementation-of-sdg4-2016-en_2.pdf.
5. UNESCO. (2017). Education for Sustainable Development Goals: Learning Objectives. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000247444?utm_sq=gj34xbfn94#:~:text=Target% 204.7%20of%20the%20SDGs,peace%20and%20non%2D%20violence%2C%20global.
6. UNESCO. (2018). Issues and trends in Education for Sustainable Development. Retrieved from https://www.ensi.org/global/downloads/Publications/433/Issues%20and%20trends%20in%2 0Education%20for%20Sustainable%20Development.pdf.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H	H	H
CO2	H	H	H
CO3	L	H	H
CO4	L	M	H

EDTT6012: TEACHER AND TEACHING SKILLS (1-0-1)

COURSE OUTCOMES

1. To create awareness among the students about conceptual framework of teaching skills.(Remembering)
2. To make the students well aware of the sources of teaching skills. (Understanding)
3. To create awareness about the approaches concerning teaching skills. (Applying)

Module I: Introduction to Teaching and Teacher
Concept of teaching; Structure of teaching; Levels and phases of teaching.

Module II: Concept of Teaching Skills
Meaning of teaching skill**;** Significance of teaching skills for a teacher**;** Sources and identification of teaching skills**;** Social skills for a teacher.

Module III: Micro teaching as an approach
Concept of Micro teaching; Need of micro teaching; Steps of micro teaching; Preparation of micro teaching lesson plan; Teaching practice for teaching skills through micro teaching lesson plans.

Suggested Readings

1. Abraham, P. P. (1974). Effectiveness of Micro Teaching in the development of questioningskill. M.Ed. Dissertation. M. S. University, Baroda.
2. Aggarwal, J.C (2014): Essentials of Educational Technology, Innovation in Teaching-Learning, Vikas Publishing House Pvt. Ltd. New Delhi
3. Allen, D. W. and Fortune, J. C. (1976): An analysis of micro teaching: A new procedure in teacher education. Stanford University, California.
4. Anupam and Kapoor, K. C. (2012). Micro teaching as an approach in Secondary SchoolTeacher. International journal of Education and Research. 1 (5). ISSN 0975-7481.
5. Jangira, N.K. & Ajit Singh (1983): Core Teaching Skills: The Microteaching Approach, NCERT,New Delhi
6. Kapoor, K.C et. al. (Ed) (2008): Teacher Education in the 21st Century, The AssociatedPublishers, Ambala cantt.
7. Kapoor, K.C. (2020): Teaching of Geography for Secondary School Teachers. DVS Publishers,Guwahati.
8. Mangal, S.K & Mangal, U (2014): Essentials of Educational Technology, PHI Learning Pvt. Ltd,Delhi.
9. Passi, B.K. (1976): Becoming Better Teacher: Microteaching Approach, Ahmedabad: Sahitaya.

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III
CO1	L	H	H
CO2	L	H	L
CO3	L	M	M

EDHW6013: EDUCATION FOR HEALTH AND WELLNESS

Credits: 2
Total Marks: 50 - Internal: 40 % (20 Marks) Total Hours: 30 External: 60% (30 Marks)

Course objectives

After completing the course, students will be able;

1. To acquire the knowledge, about health and physical education
2. To acquire the knowledge about health and safety education
3. To understand the nature of injuries and providing first aid
4. To develop the skills for organising games and sports in educational institution.
5. To acquire the knowledge about yoga

Module-I: concept of Health Education

a. Meaning, Definition, objectives of health education
b. Nutrition, Malnutrition, Personal Hygiene, Health education in schools, Health Services.
c. Food and Nutrition: Meaning, classification, constituents of food, vitamins and their deficiency, Balanced Diets, Diets for obesity and under Weight

Module-II Introduction to Physical & Yoga Education & Wellness Studies

a. Meaning, Definition, Objectives and scope of Physical education
b. Physical fitness: Meaning, definition, components, and benefits
c. Games and sports
d. First Aid: Road Accident, water accident, fire accident
e. Yoga Education: Meaning, Definition and uses of yoga for focussed mind.
f. Selected Asanas and Pranayama: Physical exercises
g. Dimensions of Wellness & Mindfullness.

Practicum:

a. Preparation of first aid kit
b. Health awareness programme
c. Demonstration of Asanas and Pranayama
d. Organizing games
e. Writing about the eminent performers in games and sports

Suggested Readings

1. Nash, T.N. (2006). Health and Physical education. Hyderabad: Nilkamal publishers
2. Prasad, Y.V. (2006). Methods of teaching physical education. New Delhi: Discovering publishing house
3. Chandra, S.S & Krishanan, P. (2005). Health education and physical education. Delhi: Surjeet Publications
4. Mangal, S.K. (2005). Health and physical education. Ludhiana: Tandon Publication

DEPARTMENT OF ENGLISH

EGES0138: EFFECTIVE COMMUNICATION SKILLS (1-0-1) (CREDITS: 02)

Course Outcomes

1. Describe the types of communication. (Remembering)
2. Differentiate from a variety of social functions including greetings, introductions and farewells, making and responding to requests, suggestions, invitations and apologies, conducting simple transactions in shops and offices, asking for and giving directions, etc. (Understanding)
3. Illustrate the daily routines in a series of simple phrases and sentences. (Applying)
4. Categorize the form and function of the basic official correspondences. (Analysing)
5. Evaluate formal and informal writings, preparing reports, letters, memorandum, notices, agenda, minutes etc. (Evaluating)
6. Formulate the rationale of descriptive, narrative, expository and argumentative writing. (Creating)

Module I: Communication and Grammar skills (8 lectures)

Language and communication: Differences between speech and writing, Distinct features of speech, Distinct features of writing, Parts of Speech, Person, Gender, Number, Use of Tense, Aspect and Modals, Degrees of comparison, Sentence types, Negation and Relative Clauses, Narration, Voice change, Proverbs, Vocabulary, Proper use of words, Idioms, Accentuation, Intonation, Understanding Various Englishes.

Module II: Developing Communicative Skills (7 lectures)

Introductory, developmental, transitional and concluding paragraphs: Coherence and cohesion, Descriptive, narrative, expository and argumentative writing, Introduction to soft skills, people and social skills, presentation, interaction and effective communication.

Official letter, Paragraph writing, Note-making, Topic Sentence, Telephonic Conversation, Group Discussion regarding job interview & C. V. Writing, formal and informal writings, reports, handbooks, manuals, letters, memorandum, notices, agenda, minutes.

Module III: Self-Learning (15 lectures)

Practice and drill sessions, online learning via tutorials (link to be provided by the teacher in-charge), self- assessment of progress, submission of assessment reports to the teacher.

Suggested Readings

1. English and Soft Skills. S.P. Dhanavel. Orient BlackSwan 2013
2. Fluency in English - Part II, Oxford University Press, 2006.
3. Business English, Pearson, 2008.
4. Language, Literature and Creativity, Orient Blackswan, 2013.
5. The Cambridge Grammar of the English language. Huddleston and Pullam, CUP,2002.

Mapping of Course Outcomes

Course Outcomes	MODULE 1	MODULE 2	MODULE 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6		H	H

EGML0028: MYTH IN LITERATURE (2-0-0) (CREDITS: 02)

Course Outcomes

1. Remember some of the recurrent classical myths in literature (Remembering)
2. Understand that myths have strong metaphoric function (Understanding)
3. Understand how the application of the myth in the select texts throws more light in understanding the complex ideas therein (Applying)
4. Co-relate the original story in the myth to the story in the corresponding literature (Analyzing)
5. Rate the potentiality of the myth in leveraging literary ideas (Evaluating)
6. Adopt the myth as vehicle of thought in creative writings (Creating)

Module I: Myth Concepts (7 lectures)

Myth, mythology, mytheme, archetype, archetypal, archetypal criticism, mythopoeia, myth critics

Module II: Recurring Myths (15 lectures)

Myth of: Zeus (Jupiter/Jove), Venus (Aphrodite), Cupid (Eros), Adonais, Hercules, Odysseus, Achilles, Oedipus, Electra, Helen, Diana, Hera, Orpheus and Eurydice, Hades, Leda and Swan, Trojan War

Module III: Myth in Literature-significance of select myth (8 lectures)

Geoffrey Chaucer : Myth of Thisbe and Dido in *Legend of Good Women*
P.B.Shelley : Myth of Adonais in "Adonais"
W.B.Yeats : Myth of Leda and Swan in "Lead and the Swan"

T.S.Eliot : Myth of Phiomela, Cleopatra and Tiresias *The Waste Land*

Suggested Readings

1. Frye, Northrop. "Myth, Fiction and Displacement"
2. Graves, Robert (1955). *The Greek Myth*. Penguin, 1992
3. Matyszak ,Philip. *The Greek and Roman Myths – A Guide to the Classical Stories*. Thames and Hudson, 2010.
4. Powell, Barry B. *Classical Myth*. Oxford University Press, 2020
5. Bahun, Sanja. *Myth, Literature, and the Unconscious*. Routledge, 2013.

Mapping of Course Outcomes

Course Outcomes	MODULE 1	MODULE 2	MODULE 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6	H	H	H

DEPARTMENT OF MASS COMMUNICATION

MCCS612: COMMUNICATION SKILLS (1-0-1)

Course Objectives

1. Identify the different styles of communication (Remembering)
2. Understand how to develop effective speaking skills (Understanding)
3. Evaluate various communication needs (Evaluating)
4. Develop professional oral & written communication skills (Applying)

Module 1: Basics of Communication (5 Lectures)

Essentials of effective Communication, Types & techniques of communication: Verbal & Non-Verbal Communication, Communication in organization, Communication Network in an Organization: Personal Communication, Internal Operational Communication, External Operational Communication.

Module 2: Oral Communication (13 Lectures)

Language in Communication, Phonetics, Spelling, Pronunciation, and Accent, Speech Drills, Oral Communication Skills: Seeking and giving information/suggestions/advice, Offering and responding to offers, Requesting and responding to requests, Congratulating people, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving, Giving instructions, Seeking and giving permission, Expressing opinions, Group discussion, Seeking explanations, Expressing sympathy, Reading Skills: Skimming and Scanning, Levels of Reading, Reading Comprehension, Academic Reading Tips, Listening and speaking skills, Contextualised speaking.

Module 3: Written Communication (12 Lectures)

Writing Skills, Elements of Writing: Sentence, Phrases and Clauses, Forms of Written Communication, Formal & Informal Writing, Letter Writing, Notices, Summary, Note-making, Job application, Preparing a CV/Resume and Effective Profiling, Preparation of Cover letters, preparing for and Facing a Job Interview, Preparing a Presentation, Preparing Agenda and Minutes for Meetings, Writing Notices and Memos, Drafting an E-mail, Correspondence with Government Authorities/institutions, Office Orders, Enquiries and Replies, audience analysis.

Suggested Readings

1. Business Communication, Meenakshi Raman and Prakash Singh, 2012, Oxford University Press
2. Oxford English Grammar, Sydney Greenbaum, 1996, Oxford University Press
3. Effective Technical Communication, M. Ashraf Rizvi,2005, Tata McGraw Hill
4. Business Communication, Anjanee Sethi & Bhavana Adhikari, Tata McGraw Hill
5. Working in English, Leo Jones,2001, Cambridge University Press
6. Speaking Personally, Gillian Porter Ladousse,1983, Cambridge University Press
7. Communication Skills. Leena Sen, 2007, PHI Learning
8. English phonetics and phonology paperback with audio CDs (2): A practical course, P. Roach, 2009, Cambridge universitypress.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2		H	

CO3	H		
CO4		H	H

MCCW6123: CREATIVE WRITING (1-0-1)

Course Outcomes

1. Demonstrate understanding on various forms of creative writing (Understanding)
2. Apply the techniques of creative writing for storytelling (Applying)
3. Write contents for various purposes (Creating).

Module 1: Introduction to Creative Writing (10 lectures)

Writing as an Art, Types of writing, Principles of writing, Characteristics of Good Writing, Elements of Writing: Form, Content, Audience, Style & Structure, Meaning of creative writing, Creative process and abilities for writing, Challenges in Creative Writing.

Module 2: Process and Techniques of Creative Writing (10 lectures)

Finding the ideas, sketching the plot, characterization, conflict, climax, resolution, Action Description, Point of View, Dialogue, setting atmosphere, Using technology in process of writing.

Module 3: Writing Exercises (10 Hours)

Content Writing, Reviews writings, Blogging, Feature and Opinion Pieces, Creative Writing, Short Story, Poetry, Fiction, Essay, Adventure Story, Reflective Writing, Persuasive Writing – Commercials, Figurative Writing, Travel Writing.

Suggested Readings

1. Creative Writing – How to Unlock your Imagination, develop your writing skills – and get published, 7th Edition, AdeleRamet, 2007, Howtobooks
2. Creative Writing Course Book, Paul Mills, 2006, Routledge
3. The Cambridge Companion to Creative Writing, South Asian Edition, Morley, 2012, Cambridge University Press
4. The Five Minutes Writer, Margret Geraghty, 2007, HowToBook
5. The Cambridge Introduction to Creative Writing, David Morley, 2007, Cambridge University Press
6. The Psychology of Creative Writing, Scott Barry Kaufman and James C. Kaufman (Ed), 2009, Cambridge University Press
7. Word Power: A guide to creative writing, Julian Birkett, 2016, Bloomsbury Academic India
8. Writing on Both Sides of the Brain: Breakthrough Techniques for People Who Write, Henriette A Klauser, 1987, HarperOne

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	
CO2	H	H	
CO3			H

MCEM6124: EVENT MANAGEMENT (1-0-1)

COURSE OUTCOMES

1. Understand the relevance of event management as a professional skill and career option (Understanding)
2. Demonstrate an in-depth understanding of the intricacies of managing an event (Applying)
3. Examine individual and team orientation in event planning and management (Analysing)
4. Plan and organise an event (Creating)

Module 1: Introduction to Event Management (6 lectures)

Concepts and types of events, Understanding and Introduction to the events landscape, Idea generation, Conceptualisation: Techniques/Methods.

Module 2: Event Planning and Administration (8 lectures)

Developing event vision/mission, objectives and goals, Event proposal, Strategic planning techniques: Action Plans; Event Group Sustainability methodologies, Logistics and operations: Use of work plan structures; time-plans; worksheets; Gantt Charts, Legal frameworks: Licenses and Permissions, Event administration strategies, Resource Mobilisation and techniques, financial management.

Module 3: Event Marketing (8 lectures)

Target Group Segmentations: Concepts and Strategies, Strategic and Integrated Marketing Communications for events, Event Branding, Digital marketing and audience building for events, Marketing plan creation; strategies and implementation, Skills for event managers and planners: negotiation and networking skills; image management; leadership.

Module 4: Post Event Documentation and Evaluation (8 lectures)

Documentation: aims; methods and techniques, Event evaluation methodologies, Audience feedback and review

mechanisms, developing event follow-up strategies and action plans, Developing the Event Planners Journal.

Suggested Readings

1. Event Management and Marketing: Theory, Practical Approaches and Planning, 1st Edition, Anukrati Sharma and ShrutiArora, 2018, Bharti Publications
2. Events Management: An Introduction C. Bladen, J. Kennel, 2012, Routledge
3. Event Marketing: How to Successfully Promote Events, Festivals, Conventions and Expositions, Leonard H. Hoyle, 2002,John Wiley and Sons Inc
4. Event Planning, 2nd Edition, J. Allen, 2009, Wiley
5. Event Planning: The Ultimate Guide, J. Allen, 2000, Wiley and Sons.
6. Planning Special Events, J. S. Armstrong, 2001, Josse Bass Wiley
7. Public Relations Campaigns and Techniques, F.R. Matera & R.J. Artigue, 2000, Allyn & Bacon
8. Special Events: A New Generation and the Next Frontier, 6th Edition, J. Goldblatt, 2010, Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2	H	H	H	H
CO3		H		H
CO4	H	H	H	H

DEPARTMENT OF PSYCHOLOGY

PDSP6117: SCHOOL PSYCHOLOGY
(2 credits- 30 hours)

Course Outcomes

1. Gain knowledge about the concept of School Psychology. (Remembering)
2. Understanding the process of school counseling. (Understanding)
3. Analyze the needs of school children in the new digital world. (Applying)
4. Apply principles and concepts of counseling in school set up. (Analyzing)
5. Evaluate the gaps in the current scenario. (Evaluating)
6. Create a comfortable environment for children in need of intervention. (Creating)

Module 1: Introduction (5 hrs)

Historical background of school psychology, Definition nature and scope of School Psychology, Role of a School Psychologist as a Professional

Module 2: Guidance and Counseling in School setting (15 hrs)

Definitions, Ethics and Legal aspects, Characteristics of an effective counselor, Basic Counseling Skills- Active listening, reflecting, paraphrasing, questioning, confronting, Counseling process- Building, maintaining and terminations counselor's relationships.

Module 3: Tools and Techniques Practice (10 hrs)

Objective tools: Checklist, rating scales, self report inventories and other standardized tools.
Subjective Tools: Observation, anecdotal records, cumulative Records, Interview and case history
Techniques for group intervention: Group tasks, Group discussion, debriefing and interpretation, summary making.
Techniques for individual intervention: role plays, individual assignments, feedback charts
Importance of Record Keeping

Suggested Readings

1. Rao, Ramakrishna & Parnajpe, Anand (2008). Handbook of Indian Psychology. New Delhi: Cambridge University Press India Pvt. Ltd.
2. Thomas, Murray R. (1990) Counseling and Life – Span Development. New Delhi: Sage Publications,
3. Herr, Edwin (1974) Vocational Guidance and Human Development (Ed.). Boston: Houghton Mifflin,
4. Wallace & Lewis (1986). Becoming a Professional Counselor. New Delhi: Sage Publications,
5. Shrivastava, K.K. (2004) Principles of Guidance and Counseling. New Delhi: Kanishka Publishers.
6. Anastasi, A. (1977). Psychological Testing. (5th Ed.) New York: MacMillanPublishing Co. Inc.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	H
CO 2	H	M	H
CO 3	M	M	H
CO 4		H	H
CO 5		H	H
CO 6		H	H

PDCM6118: COMMUNITY MENTAL HEALTH

(2 credits- 30 hours)

Course Outcomes

1. Gain knowledge about the underlying principles of Community Mental Health. (Remembering)
2. Understand current trends of practice and intervention. (Understanding)
3. Apply basic intervention skills in their community projects. (Applying)
4. Analyze gaps in the current functioning of Community Mental Health at regional levels. (Analyzing)
5. Evaluate intervention techniques in multicultural set ups. (Evaluating)
6. Organize awareness programmes for communities. (Creating)

Module 1: Introduction (2 hours)

Basic Principles of Community Mental Health, Counseling Skills, Counseling in Multicultural set up

Module 2: Mental Health Issues (6 hours)

Intellectual disability, Addiction, Developmental disorders, Suicide

Module 3: Identification, Assessment and Intervention (7 hours)

Identification of Mental Health Issues, Assessment of Mental Health Issues, Psycho-education, Evidence Based Practices (Behavior Therapy, Cognitive Behavior Therapy, Rational Emotive Behavior Therapy)

Module 4: Practical (15 hours)

Community Mental Health Projects

Suggested Readings

1. Community Mental Health; Challenges for the 21st century. (2006). Rosenberg, J. & Rosenberg, S. Rotutledge
2. Ethics in Community Mental Health Care. (2002). **Backlar**, Patricia & **Cutler**, David L. (Eds.). Springer US.
3. Community Mental Health and Behavioral-Ecology; A Handbook of Theory, Research, and Practice.(1982). Editors: Jeger, A.M., Slotnick, R.S. (Eds.). Springer US
4. Community Mental Health: Putting Policy Into Practice Globally.(2012).Graham Thornicroft , Atalay Alem, Robert E. Drake, Hiroto Ito, Jair Mari, Peter McGeorge, R. Tara, Maya Semrau (Ed.). Wiley-Blackwell

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	M	H
CO 2	H	H	H	H
CO 3		M	H	H
CO 4			H	H
CO 5			H	H
CO 6			H	H

PCLS6119: LIFE SKILLS EDUCATION

(2 credits-30 hours)

Course Outcomes

1. Choose and gain knowledge about themselves, develop consciousness of self, self-confidence, feelings of mattering, manage personal emotions (Remembering)
2. Able to relate and work with others, practice collaborations, controversy with civility, engage across difference, be committed to ethical action (Understanding)
3. Apply self-knowledge, practice self-worth, congruence, commitment, identify passions and develop common purpose (Applying)
4. Able analyse academic knowledge and integrate into all aspects of living (Analysing)
5. Learn to evaluate and improve upon personal leadership strengths and weaknesses (Evaluating)
6. Create effective change and practice collective efficacy, develop critical thinking/ decision making skills, common purpose and a sense of connectedness within one's communities. (Creating)

Module –I: Introduction (5 hours)

- Definition and Importance of Life Skills
- Livelihood Skills, Survival Skills and Life Skills
- Life Skills Education, Life Skills Approach, Life Skills Based Education
- Life Skills Training - Implementation Models
- Life Skills Education in the Indian Context

Module-II: Social Skills and Negotiation Skills (8 hours)

Introduction

Life Skills: Generic, Problem Specific and Area Specific Skills

• Self-Awareness
  - Definition, Types of Self
  - Self Concept, Body Image, Self Esteem
  - Techniques used for Self Awareness: Johari Window, SWOT Analysis
• Empathy
  - Sympathy, Empathy & Altruism
• Effective Communication
  - Definition, Functions, Models, Barriers
• Interpersonal Relationship
  - Definition, Factors affecting Relationships

Module-III: Coping Skills (5 Hours)

Coping with Emotions

Coping Skills

• Coping & Emotions
  - Definition, Characteristics, Types
  - Classification: Wheel Model, Two-Dimensional Approach
  - Coping Strategies
• Coping with Stress

Definition, Stressors
  - Sources of Stress
  - The General Adaptive Syndrome Model of Stress
  - Coping Strategies

Module-IV: Practical (12 hours)

Life Skills in Specialized Areas

- Peer Education
- Life Skills for Disaster Preparedness
- Life Skills for Corporate Sector
- Life Skills for Special Population
- Life Skills for Geriatric and Palliative Care
- Life Skills in Practice in Educational Settings

Suggested Readings

1. Dahama O.P., Bhatnagar O.P, (2005). *Education and Communication for Development,* (2nd Edn.), Oxford& IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Debra McGregor, (2007).Developing Thinking; Developing Learning - A guide to thinking skills in education, Open University Press, New York, USA
3. Duffy Grover Karen, Atwater Eastwood, (2008). (8th Edn.), *Psychology for Living- Adjustment, Growth and Behaviour Today*, Pearson Education Inc, New Delhi.
4. Hockenbury (2010). Discovering Psychology, Worth Publishers. New York
5. Nair .V. Rajasenan, (2010). *Life Skills, Personality and Leadership*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
6. Nair. A. Radhakrishnan et al., (2010). *Life Skills Assessment Scale*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
7. Stella Cottrell, (2005). Critical Thinking Skills: Developing Effective Analysis and Argument, Palgrave Macmillan Ltd., New York
8. Nair. A. Radhakrishnan, (2010). *Life Skills Training for Positive Behaviour*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu. s
9. RGNIYD. (2008). Facilitators *Manual on Enhancing Life Skills. Tamil Nadu*
10. Family Health International, NACO, USAID (2007), *Life Skills Education tool kit for Orphans and vulnerable children in India*

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module
CO 1	H	M	M	M
CO 2	M	H		H
CO 3	M		H	
CO 4	H			H
CO 5			H	
CO 6	M		H	H

PCFA0120: PSYCHOLOGICAL FIRST AID
(2 Credits-30 Hours) (L-T-P: 2-0-0)

Course Objective: To acquire the basic knowledge about the crisis management strategies and immediate intervention techniques.

Course Outcome:

1. Explain the nature and core competencies required for Psychological First Aid. (Understanding)
2. Apply the basic techniques for relaxation and stress management. (Applying)
3. Examine the need for psychological first aid. (Analysing)
4. Evaluate the need for multidimensional crisis intervention. (Evaluating)

Module-I: **Psychological First Aid (5 Hours)**
Definition and History, Defining Psychological First Aid Development of the PFA Concept, PFA -Core Competencies of PFA, Validation of the Johns Hopkins RAPID PFA Model

Module-II: Intervention and Management (10 Hours)
Intervention Tactics to Stabilize and Mitigate Acute Distress, Explanatory Guidance, Anticipatory Guidance, Cognitive Reframing Stress Management, Instillation of a Future Orientation—Hope, Enlisting the Support of Family and Friends Delay Making Any Life-Altering Decisions/Changes Faith-Based Intervention in PFA, Demonstration of the I in RAPID Model

Module-III: Post Traumatic Stress: (7 Hours)
The Need for a Multidimensional Approach, Patient Suicide: Clinical Assessment, Step-Wise Plan for Interventions & Management

Suggested Readings

1. Everly Jr, G. S., & Lating, J. M. (2022). The Johns Hopkins guide to psychological first aid. JHU Press.
2. Hillman, J. L. (2013). Crisis intervention and trauma: New approaches to evidence-based practice. Springer Science & Business Media.
3. Jacobs, G. A. (2016). Community-based psychological first aid: A practical guide to helping individuals and communities during difficult times. Butterworth-Heinemann.

Mapping of CO's to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	M		
CO-2		H	M	M
CO-3	M		H	H
CO-4	M	H		H

DEPARTMENT OF ECONOMICS

ENOS6002: INTRODUCTION TO STOCK MARKET
(2-0-0)

Objectives: The goal of this course is to provide students with a comprehensive understanding of the workings of the stock market, including the market structure, trading and settlement procedures, processes, and related components, as well as the regulations governing the stock market and the emerging challenges it faces.

Course Outcomes
CO1: Get an idea of the capital market in India, its working and the use of various financial Instruments. (Remembering & Understanding)
CO2: Applying the various terminology of stock market in the process of trading of stocks. (Applying)
CO3: Get an exposure to the working of the stock market with of practical touch and develop the ability to analyze the risk and profitability in investing on stock market. (Analyzing)
CO4: Enable the students to evaluate investment instruments of the money market and compare the different types of Financial Securities. (Evaluating)

Module I: The Stock Market and its Operation (12 Hours)
Role and Structure of Money and Capital Market; Instruments of Capital Market –Share, Debentures, Equity and Bond; The Stock Market and its Operation; Stock Market Index – The BSE Sensex and the NSE Nifty; Role and working SEBI; Impact of SEBI on Capital Market in India; IDRA and its role in Financial Markets

Module II: Terminology of Stock Market (10 Hours)
Strike Price, Call Option, Put Option; Bull and Bear market; Beta, Delta, Bid, Blue chip stock; Board Lot, Odd Lot ; Out of the Money (OTM), Stock split

Module III: Trading of Stock (13 Hours)
Recent development of stock exchange; Stock trading on BSE and NSE; Stock market trading mechanism; Online stock trading(practical demonstration);OTC exchange; Stock indices in India and abroad-commodity exchange, overviews of derivatives in financial market, basic derivatives operation and trading

Module IV: Commodity and Currency Markets (10 Hours)
Commodity exchanges: evolution and history – role in globalizing economy – governing regulations –price –risk management – commodity exposure – hedge accounting – currency futures – managing exchange rate – carbon markets – weather derivatives – ETFs – Purpose, Importance, types, construction

Suggested Readings

1. Bhole, L. M. (1999), Financial Institutions and Markets, Tata McGraw Hill Company Ltd., New Delhi
2. Johnson, H. J. (1993), Financial Institutions and Markets, McGraw Hill, New York.
3. Khan M. Y. (1996), Indian Financial Systems, Tata McGraw Hill, New Delhi
4. Robinson, R.I. and D. Wrightman (1981), Financial Markets, McGraw Hill, London.
5. Fens Termaker, J. V. Readings in Financial Markets &Institutions, Appleton, New York
6. Smith, P. F. (1978), Money and Financial Intermediation: The Theory and Structure of Financial
7. System, Prentice Hall, Englewood-Cilffs, New Jersey

ENDA6005: DATA ANALYSIS WITH SPSS/STATA
(0-0-2)

Course Outcomes
CO1: Identify the importance of SPSS in economic analysis. (Applying)
CO2: Analyse the uses of statistical packages for accurate analysis of data. (Analyzing)
CO3: Explain the importance of presentation of data. (Evaluating)
CO4: Discuss the various key aspects of statistical relations and its applicability. (Creating)

Module I: Introduction to Statistical Packages (15 Hours)
MS-Word, MS-Excel, SPSS; Basic Operations – File, Edit, View, Data, Data Set Creation and Management; Evaluation of Data Quality and Data Cleaning; Statistical Analysis using SPSS – Summary, Tabulation and Comparison of Summary Statistics

Module II: Presentation of Data (15 Hours)
Diagrammatic Presentation; One Dimensional – Single, Subdivided, Multiple Deviation; Two Dimensional –Histogram, Pie Diagram; Three Dimensional – Rectangular, Cube; Pictograms and Cartograms; Scatter; Line and Radar Diagrams; Tabular Presentation – Single, Double, Multiple

Module III: Basic Statistics and Statistical Relations (15 Hours)
Frequency; Summation; Maximum; Minimum; Mean; Median; Mode; Standard Deviation; Skewness; Covariance;

Correlation – Bivariate, Partial, Rank, Correlation Matrix; Simple Linear Regression

Suggested Readings:

1. Field, A. (2013): Discovering Statistics Using IBM SPSS Statistics, Sage Publication
2. Field, A. (2017). Discovering statistics using IBM SPSS Statistics (5th Ed.). Thousand Oaks, CA, USA
3. Gupta S.C, Fundamentals of Statistics, Himalaya Publishing House, 2018

ENRC6008*:* RECENT DEVELOPMENTS IN MONETARY POLICY IN INDIA

(2-0-0)

Objective: This course will examine the influence that monetary policy has on some of the most important aspects of the economy, including interest rates, inflation, and the banking sector, among other topics.

Course Outcome (CO):

CO1: To impart a complete and detailed insight of monetary policy in India. (Remembering & Understanding)
CO2: To educate the students about the contemporary policy reforms taken in to design current monetary policy. (Applying)
CO3: To inform and aware the students about the use of various instruments of monetary policy (Analysing & Evaluating).
CO4: To decipher the knowledge among students about the design, implementation and policy assessment of monetary policy practiced by Reserve Bank of India. (Creating)

Module 1: Overview of Monetary Policy (10 Hours)

Overview: Basic concepts, objectives, advantages and disadvantages, design, instruments and implementation of monetary policy in India; Assessment and Evaluation of monetary policy and the role of monetary policy in economic growth in the context of India economy and problems of monetary policy in India

Module 2: Policy Implication of Monetary policy (10 Hours)

Policy implications of monetary policy: Expansionary and Contractionary monetary policy in the context of India; Working of monetary policy with fiscal policy; Major policy reforms in monetary policy in India after 21st century and their impacts on Indian economy: CRR, SLR, Bank Rate, Base Rate, Repo and Reverse Rate.

Module 3: Monetary policy and Indian Economy (10 Hours)

Impacts on various instruments on monetary policy on Indian economy; other instruments, Liquidity Adjustment Facility (LAF), Marginal Standing Facility (MSF) and Market Stabilisation Scheme (MSS); Assessment and Evaluation of monetary policy and the role of monetary policy in economic growth in the context of India economy and problems of monetary policy in India

Suggested Readings

1. Pathak, B., Indian Financial System Markets: Institutions and Service, Pearson Publication, 3rd Edition, 2010
2. Khan M. Y. (1996), Indian Financial Systems, Tata McGraw Hill, New Delhi
3. David G. Luenberger, Investment Science, Indian Edition, 2012.
4. Basu, Sankarshan, Hull, John C., Options Futures and Other Derivatives, Pearson Education, Inc, 8th Edition, 2013.
5. Ahluwalia, M S (2002): "Economic reforms in India since 1991: has gradualism worked?", Journal of Economic Perspectives, 16, 67-88.
6. Balakrishnan, P (2005): "Macroeconomic policy and economic growth in the 1990s", Economic and Political Weekly, XXXX, 3969-3977.
7. Barman, R B (2002): "Forecasts of economic indicators for monetary policy in India: an assessment", IFC Bulletin, 13, 80-93.
8. Bhattacharya, K and A Das (2003): "Dynamics of market structure and competitiveness of the banking sector in India and its impact on output and prices of banking services", Reserve Bank of India Occasional Papers, 24, 123-159.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1		H	
CO2		M	M
CO3	M		H
CO4		M	

ENCF6009: CONSUMER DECISIONS AND FINANCIAL LITERACY

(2-0-0)

Course Outcome (CO)

CO1: The course will enable the students to understand the financial instruments and how it performs.
CO2: The course is intended to make sure students will be able to understand the consumer decision over financial matters.
CO3: The course is intended to make the students aware about the different financial services and personal financial management.
CO4: The course will enable the students to be aware about various consumer rights and laws.

Course Content
Module I: Instruments of Finance (10 hrs)
Introduction to Indian financial system; Understanding financial instruments; Types of financial instruments - saving accounts, current account, fixed account, cheques, stocks and mutual funds.

Module II: Consumer Rights and Decision Making (10 hrs)
Financial Decision making; Factors affecting financial decisions; Consumer credit, credit law and Rights; Banking ombudsman law; RTI; Negotiable instrument

Module III: Banking and Consumers (10 hrs)
Different types of banks; Types of bank account; Different types of loans; Personal bankruptcy; Insurance; Digital banking

Suggested Readings
1. Pathak, B., Indian Financial System Markets: Institutions and Service, Pearson Publication, 3rd Edition, 2010
2. Khan M. Y. (1996), Indian Financial Systems, Tata McGraw Hill, New Delhi
3. David G. Luenberger, Investment Science, Indian Edition, 2012.
4. Basu, Sankarshan, Hull, John C., Options Futures and Other Derivatives, Pearson Education, Inc, 8th Edition, 2013.
5. Brealey, Richard A., Myers, Stewart, C., Allen, Franklin, & Mohanty Pitabas, Principles of Corporate Finance, Tata McGraw-Hill Education, 10th Edition, 2013.
6. William Sharpe, Gordon Alexander & Jeffery Bailey, Investments, Prentice Hall of India, 6th Edition, 2003.

DEPARTMENT OF PUBLIC ADMINISTRATION

PACS0022: CIVIL SERVICE IN INDIA
Credits: 3 (45 lectures) (45 Hours)

Course Outcomes
At the end of this course students are able to:
1. Understand the Concept, Significance and Evolution of Civil Services (Remembering & Understanding)
2. Understand the Concept of Bureaucracy and its historical evolution (Understanding)
3. Analyze the Changing Nature of Public Services (Analyzing)
4. Evaluate the Civil Services in the context of Globalisation (Applying)

Module I (10 hours)
Civil Services: Concept, Significance and Evolution of Civil Services; Classification of Civil Services (All India Services, Central Services, State Services and Local Services); Union Public Service Commission and Other Service Commissions

Module II (10 hours)
Bureaucracy: Concept of Bureaucracy – Historical Evolution; Civil Service: Neutrality and Commitment; Relationship between Politicians and Civil Servants

Module III (10 hours)
Public Personnel Administration: Recruitment; Methods and Significance; Training of Public Servants in India- Promotion System in India; Disciplinary Procedure for Civil Servants

Module IV (10 hours)
Civil Services-Citizenry Interface: Civil Society and Administration; Technology and Changing Nature of Public Services; Ethics and Accountability

Module V (05 hours)
Indian Civil Services: Major Issues - Generalists and Specialists Controversy, Civil Services in the context of Globalisation, Civil Service Reforms- IInd ARC Recommendation

Suggested Readings
1. P. N. Parashar- History and Problems of Civil Services in India

2. Yogendra Narain- Civil Services: Challenges And Resolutions
3. Abhay Prasad Singh & Krishna Murari - Constitutional Government and Democracy in India
4. S.K. Das - The Civil Services in India
5. Lohit Matani, Vishal - An Introduction to Civil Services
6. S.N. Singh - Politician Civil Servant Relationship and Public Administration in India
7. Sandeep Sharma- Indian Civil Service And Public Administration

Mapping of COs to Syllabus

rse Outcomes	dule 1	dule 2	dule 3	dule 4
1	H	L	L	L
2	L	H	L	L
3	L	L	H	L
4	L	L	L	H

PAIG0023: INNOVATION IN GOVERNANCE

Credits: 3 (45 lectures) (45 Hours)

Course Outcomes

At the end of this course students are able to:

1. Understand the Institutional Framework for Promoting Innovations (Remembering & Understanding)
2. Understand the Methodological Approach for studying best Practices (Understanding)
3. Analyze the Innovations in Public Services (Analyzing)
4. Evaluate the role of citizen's participation in governmental innovations (Applying)

Module – I (10 hours)

Innovations in Governance: Meaning of innovation in governance; Perspectives and Challenges; Characteristics and Patterns of Innovations; Institutional Framework for Promoting Innovations; Public Governance and Innovations: Administrative Reform to Innovation Discourse

Module – II (10 hours)

Understanding Innovations: Innovation for Achieving a Quality of Life, Methodological Approach for studying best Practices, Capacities for Innovation and Best Practices

Module – III (10 hours)

Innovations in Public Services: Recent trends; Innovation Capacity in Organizations; Leadership and Innovation; Innovations in different sectors: General Administration, Urban Administration, Health Administration, Private Sector, Agriculture, etc

Module – IV (10 hours)

Transferability of Best Practices and Innovations: The Ombudsman against Corruption, Technology and Changing Nature of Organizations, Best Practices of Knowledge Management Framework, Diffusion of Innovation in a Development Context

Module – V (05 hours)

Issue Areas: Originality and Replication of Innovations; Innovation with or Without Improvement; Citizen Participation in Government Innovations; Research in Innovative Governance

Suggested Readings

1. Anttiroiko et.al. (Eds.) (2011), Innovations in Public Governance, IOS Press.
2. Bevir, Mark, ed. (2010) The Sage Handbook of Governance. Thousand Oaks, CA: Sage Publications.
3. Borins, S. (2001), The Challenge of Innovating in Government (PricewaterhouseCoopers Endowment for the Business of Government,) Governance Innovators Network, http://www.innovations.harvard.edu/
4. Innovations in Governance and Public Administration: Replicating what works, (2006) Department of Economic and Social Affairs, United Nations, New York
5. Jean Hartley (January 2005), Innovation in Governance and Public Services: Past and Present, Public Money & Management, pp.27-36.
6. Newman, J., Raine, J. and Skelcher, C. (2000), Innovation in Local Government: A Good Practice Guide (DETR, London).
7. Peters, B. Guy (1996) The Future of Governance: Four Emerging Models, pp. 1-20.
8. Pollitt, C. and Bouckaert, G. (2000), Public Management Reform: A Comparative Analysis (Oxford University Press, Oxford).
9. Sandford Borins, ed., (2008), Innovations in Government Research, Recognition, and Replication, Brookings Institution Press.

10. Stephen P. Osborne, Ed.,(2001), The New Public Governance? Emerging Perspectives on the Theory and Practice of Public Governance. London: Routledge
11. Walker, R., Jeanes, E. and Rowlands, R. (2002), Measuring innovation: Applying the literature based innovation output indicator to public services. Public Administration, 80, pp. 201–214.

Mapping of COs to Syllabus

rse Outcomes	Module 1	Module 2	Module 3	Module 4
1	H	L	L	L
2	L	H	L	L
3	L	L	H	L
4	L	L	L	H

DEPARTMENT OF ZOOLOGY

ZGPR6004: PROJECT MANAGEMENT, REPORTING AND DOCUMENTATION (30 HOURS) (P/NP)

Course Outcomes

1. Identify qualities of a successful entrepreneur and develop competencies. (Applying)
2. Construct economically and socially sound business ideas. (Creating)
3. Analyze the potentials of a social catalyst and examine case studies. (Analyzing)
4. Assess plans for effective preparation of Detailed Project Report (DPR) and financials of a DPR. (Analyzing)
5. Develop skills for project implementation and management. (Applying)
6. Define concept of market. (Remembering)
7. Distinguish different methods of Bookkeeping and Accountancy. (Analyzing)
8. Adapt effective plans for preparing accurate project report and practicing positive documentation. (Creating)

Objective	Help the student to understand Entrepreneurship, identification of qualities of a successfulentrepreneur & how to develop it
Module I: Entrepreneurship : Concept and Functions • Who is an entrepreneur? • Entrepreneurial competencies(Initiative, Creativity and Innovation, Risk Taking and Risk Management, Problem Solving,Leadership, Persistence, Quality Performance, • Information Seeking, Systematic Planning, Persuasion and Influencing Others, • Enterprise Launching Competencies, Enterprise Management Competencies) • Functions of an entrepreneur (Promotional functions: Innovation, Risk-taking, • Organisation Building, Discovery of an idea, Detailed Investigation, Assembling the Requirements, Financing the Proposition. Managerial functions: Planning, Organizing, • Staffing, Leadership, Supervision, Communication, Motivation, Controlling. • Commercial Functions : Production, Finance, Marketing, Accounting) • Types of entrepreneur (Innovative Entrepreneur, Imitative Entrepreneur, Fabian • Entrepreneurs, Drone Entrepreneurs) • Entrepreneurship: meaning and definition; types of entrepreneurship; • entrepreneur and entrepreneurship • Difference between entrepreneur and employee	
Objective	Help the students to generate various business ideas and link the best one with them
Module II: Generation of business ideas and linking • EDP: Meaning, Need, Importance of EDP • Necessity of generating ideas • Ways to generate ideas, Area Assessment Survey – Modes (Desk Research, Field • Work, Market Need Based Opportunities, Ideas from Existing Entrepreneurs) • Linking business ideas with the entrepreneur • Methodology of Opportunity Identification & Profiling Business Ideas (Preparation of Personal Profile, Development of OS (decision making) Framework, Snap Investigation of ideas generated, Evaluation in terms of OS (decision making) Framework and Short-listing of Ideas, Pre-feasibility Studies, Errors in Selection, Final Opportunity Selection) • Preparation of business project plan and business project plan execution (Summary of the Project/Project at a Glance, General Information, Details of the Proposed Project, Market Potential, Manufacturing Process, Production Programme/Sales Revenue, Cost of Manufacturing and Profitability Projections)	
Objective	To impart knowledge on social entrepreneurship

Module III: Social entrepreneurship • Who is a social entrepreneur (definition and case study) • Difference between entrepreneurship and social entrepreneurship • Characteristics of social entrepreneur (Social Catalysts, Socially aware, Opportunity- seeking, Innovative, Resourceful, Accountable) • Examples and case study	
Objective	To impart knowledge on preparation of DPR
Module IV: Preparation of Detailed Project Report (DPR) and financials of a DPR • Business plan : key questions • Technical arrangement & Production process (Manufacturing process, Sources of technical know how, plant & machinery, Supplier identification & supplier selection, Raw materials, packaging, land requirement, utilities and manpower, financial viability) and Location selection (Layout, built up area etc). • Product and Market (Product description, Capacity, Market study and market demand, Product mix, Branding, Channels of distribution, Advertising and Promotion etc.) • Project cost and means of finance (Land, site development, building and civil works, plant and machinery cost, other fixed assets, technical knowhow fees, preliminary and preoperative expenses, working capital margin, contingency and escalation) • Income analysis (Capital utilisation and income estimate, Expenditure estimate, Profit estimate, income tax estimate, profitability ratios : TC ratio, cash flow estimate, risk analysis, sensitivity analysis etc.)	
Objective	Impart knowledge on implementing, managing and monitoring the progress of the selected project
Module V: Project implementation and management • Understanding Total Quality Management (Acceptable Quality Level, Benchmarking, Deming Wheel, ISO 9000,Pareto Analysis, Quality Circles, Measures of Central Tendency and Dispersion, Geometric Moving Average, Statistical Process Control etc.) • Goal Oriented Project Planning (Project Planning Matrix and Product Matrix) • Project Activity Planning and Implementation (Gantt Charts, the Programme Evaluation and Review Technique (PERT) andCritical Path Method (CPM) of project scheduling) • Soft skills for launching and managing a project (Creativity and Problem Solving, Interpersonal Communication, Persuasion and Use of Influence Strategy, Negotiation and Networking, Delegation of Authority and Work Effort, Efficiency Orientation As a Trait, Leadership, Concept of risk and risk taking, Legal Requirements, Types of business organisation) • Managing Business Crisis – Starting and Liquidity Crisis	
Objective	To impart the Knowledge of different component of Market
Module VI: Concept of market • Traditional market • Emerging market : E commerce • Analysing the market environment 4 • Researching the market and market survey • Marketing mix • Product mix • Promotion mix • Price mix, method of pricing	
Objective	To impart knowledge on Book Keeping
Module VII: Bookkeeping and Accountancy • Basic concept of Accounting (Management and financial accounting) • Basic books of accounts (Journal, Purchase book, Purchase return book, Sales book, Sales return book, ledger book, Cash book etc.) • Financial statement: Meaning, Importance • Profit and loss account • Balance sheet • Depreciation and adjustment etc. • Interpretation of financial Statement (Liquidity, Current ratio, Profitability ratio, Inventory turnover ratio, Debtors turnover ratio, ROI etc) • Fund flow Analysis	
Objective	To impart knowledge on Documentation and Reporting

Module VIII: Documentation and Reporting
- Why to Document
- What is a Documentation Report
- When and How to prepare the Documentation Report
- Typical format of a Documentation report
- Layout of the Report
- Writing a Report

Mapping COs to syllabus

Course Outcomes	Module1	Module2	Module3	Module4	Module5	Module6	Module7	Module8
CO1	H							
CO2		H						
CO3			H					
CO4				H				
CO5					H			
CO6						L		
CO7							H	
CO8								H

ZGWP6011: INTRODUCTION TO WILDLIFE PHOTOGRAPHY (30 HOURS, L-T-P: 2-0-0) (P/NP)

Course Outcomes
1. Discuss the history of Photography, moving images and Stock photography Creating)
2. Demonstrate a brief understanding of ethics of journalism, photo journalism and sources (Understanding)
3. Assess the importance of digital technology in photography (Evaluating)
4. To define camera basics and different genres of photography (Remembering)

Learning Objective
1. Through theory and practical assignments, this class provides the students with hands on experiences in photography. Lectures, field studies, guest instructors, student presentation and group work will help you develop the analytical basisand insight to reflect upon and assess the impact of photographs on our ideas of the world.
2. By the end of this course, Students will: Be able to start their career in photography. Will be able to create picture story

/ Photo Essays and understand the conventions and challenges of telling stories through images
3. Gain personal leadership through challenging, intercultural assignments

Objective: This module will help to understand the students about photography basics
Module I: Introduction to photography
Camera Basics, Types of Camera, Operating a Camera, Exposure, Aperture & Shutter Speeds Light Meter, Depth of Field, Choosing Lenses, Types of lens, Lighting, Flash Photography, Filters, Steady Shooting, Composition in wildlife Photography.

Objective: *This module will help to understand the students about different types of photography in details*
Module II: Different genres of photography
Mobile Photography, **Microscopic photography**, **Macro photography, Drone photography, Wildlife Photography**

Objective: Post production is an important part of photography student will learn post-production in this module
Module III: Post Processing
Enhancing Photographs, Organizing the Picture, Quality Control, Intermediate/advanced use of post-production software like Adobe Photoshop, Lightroom etc

Objective: How to earn the livelihood from selling your images internationally
Module IV: Stock Photography
Introduction to Stock Photography, How to contribute to various stock photo agencies. Causes of rejections, SubmittingGuidelines, Meta Data

Objective: This module focuses on photojournalism.
Module V: Ethics in Wildlife Photography
How to prepare for a photo tour (Dress code in wildlife photography, permissions, water bottle, notebook and other accessories) How to remain safe during shooting (How close is too close, keeping antivenom & antiallergen; leach guard, safety of gears used) Ethics in wildlife photography (knowing Schedules of animals in Wildlife (Protection) Act, 1972, not using any bait, not taking any animal out of its habitat without permission, non use of flash, not altering the habitat)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	L	H	
CO 2		M			H
CO 3	H	H	H	L	M
CO 4	H	M	H	M	M

ZGTM6010: TEACHING METHODOLOGY AND CLASSROOM MANAGEMENT (30 HOURS: P/NP)

Course Outcome (CO)

1. Define different concepts of teaching skills (Remembering)
2. Create effective teaching instruction (Creating)
3. Evaluate assessments (Evaluate)
4. Make use of ICT(Analyzing)

Module I: Introduction to Core teaching Skills -Micro- teaching

a) Introduction to Methods, Maxims, Devices and techniques of teaching. Practice teaching on Core teaching Skills in Microteaching mode.
b) Approaches and methods of teaching Science - (i) Lecture, demonstration, explanation, Observation. (ii) Ensuring Problemsolving, laboratory, Project, Heuristic, Discussion for teaching science. (iii) Learning by discovery, group work and team teaching. (iv) Collaborative strategies, provision in heterogeneous classroom.

Module II: Planning and designing for effective instruction in science

a) Design of unit and lesson planning approaches to lesson planning, format of lesson plans
b) Teaching aids and laboratories in science, their necessity and importance.
c) Museum, field trips and excursion, their relevance to science. Preparation of simple aids of Science teaching.

Module III: Evaluation of Learners Progress

a) Concept and importance of assessment & evaluation.
b) Techniques of evaluation (Theory & Practical)
c) Construction of Unit test: Design and blueprint, Item construction, Question wise analysis, Construction of Science question paper including marking scheme.

Module IV: Information and Communication Technology (ICT) Integration in Science teaching

a) Introduction to ICT
b) Importance of ICT in Science teaching.
c) Exploring various ICT tools for Science teaching.
d) Open Education Resources (OER) and its uses in Science teaching.
e) ICT Integration in Science teaching.
f) Exploring FOSS in Science teaching

Mapping of COs to Syllabus

Course Outcomes	1	2	3	4
CO1	H	M	M	M
CO2		H		
CO3			H	
CO4				H

ZGSE6024: SOFT SKILL & EMPLOYABILITY SKILL DEVELOPMENT
(30 Hours)
Course Outcomes:

CO1: After this course students will be able to develop their personality which is important for their career. (Applying)
CO2: Students will be able learn the different types of communication skill. (Understanding)
CO3: Students will have the skills for time management, interview skills, presentation and public speaking skills (Applying)

Module I: Personality Development: (6 hours)

a) Definition of Personality, types of personality, identification of different types of personalities.
b) Characteristics of different types of personalities and their behaviour
c) How to develop an attractive personality?
d) Personality test and role plays.

Module II: Communication Skill: (6 hours)

a) Interpersonal Skill: Definition of Interpersonal skill, Importance of interpersonal skill, three principles of interpersonal skill.
b) Body Language & Etiquette: Non-Verbal communication, Features of body language; Different types of Body language; Positive & Negative body language; Mobile etiquette and table manners; Personal grooming and self-care.

Module III: Time management: (6 hours)
a) Preference and prioritize work schedule
b) Preparation of To-Do list
c) Eishenhower's matrix of Time management
d) Ways to reduce time management

Module IV: Presentation & Public speaking Skill: (6 hours)
a) Elements of Public speaking skill
b) How to develop self-confidence to overcome stage fear.
c) Step by step guidance to construct a speech for presentation.
d) Do's and Dont's in public speaking and presentation

Module V: Interview Skill: (6 hours)
a) Right ways to prepare for job interview.
b) Difference between Bio -Data, CV, Resume
c) CV Writing skill, Interview skill and Mock Interview

Mapping of COs to Syllabus

CO	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	M	L	
CO2		H		M	
CO3		L	H		
CO4			L		L

ZGRS6025: FUNDAMENTALS OF GIS AND REMOTE SENSING
(30 HOURS)
Course Overview:
This course aims to provide students with a comprehensive understanding of the fundamental principles and applications of Geographic Information Systems (GIS) and Remote Sensing. Over 30 hours, students will explore key concepts, tools, and techniques used in the geospatial industry, enhancing their skills in spatial data analysis and interpretation.
Course Outcomes:
CO 1: Understanding: Describe the fundamental concepts and components of GIS and Remote Sensing.
CO 2: Analyzing: Evaluate spatial data and imagery to identify patterns and relationships.
CO 3: Applying: Utilize GIS software and Remote Sensing techniques to solve real-world spatial problems.
CO 4: Understanding/Applying: Interpret geospatial data and communicate findings effectively through maps and reports

Module 1: Introduction to GIS (10 Hours)
Basics of Geography, Latitude and Longitude, Map Projections, Map Scale, Spatial Data Types, Geospatial Thinking.
Definition and History of GIS; Applications
Key components and functions of GIS and the interrelationship with maps
Types of spatial data: vector and raster; Data models and structures: points, lines, polygons, and grids.
Coordinate systems and map projections, Basics of spatial analysis and querying

Module 2: Fundamentals of Remote Sensing (10 Hours)
Principles of Remote Sensing: electromagnetic spectrum and energy interactions
Remote Sensing platforms and sensors: satellites, drones, and aerial photography
Types of imagery: multispectral, hyperspectral, and thermal Image acquisition and processing techniques
Interpretation of satellite imagery Applications of Remote Sensing in different domains (Ecology, Agriculture, Urban Planning, Disaster management, etc.)

Module 3: GIS and Remote Sensing Integration and Applications (10 Hours)
Integrating GIS and Remote Sensing data spatial data analysis techniques: overlay, buffer, and spatial statistics
Advanced GIS analysis: network analysis, terrain modelling, and 3D visualization
Image Classification, LULC mapping, Accuracy assessment. Hands-on projects using GIS software (e.g., QGIS, ArcGIS)
Presentation of project findings

HAEM6027: BASICS OF EVENT MANAGEMENT

(2 Credits: 60 hours) (L-T-P: 0-0-2)

Objective(s): The objective of the course is to learn about event management basics which is very beneficial as a value-added course

COURSE/ LEARNING OUTCOMES: At the end of this course student will be able to:

CO 1: Understand the basics of event management, its characteristics and types (Understand)

CO 2: Identify the demand /scopes of events as well as the promotion & creation perspective of events (Knowledge)

CO 3: Analyze and study the competencies /challenges faced by an event manager (Analyze)

CO 4: Develop and create business plan for event company (Create)

Module 1: INTRODUCTION TO EVENT MANAGEMENT (6 hours)

a) Definition of Events
b) Classification/Types of Events
c) Competencies Required: Being an Event Entrepreneur
d) Managing an Event Management Company

Module 2: DESIGNS & DECOR (8 hours)

a) Formation of designs
b) Event Color schemes
c) Types of lighting
d) Flower arrangement – original, artificial & sustainable

Module 3: SELECTION OF EVENT LAYOUTS (4 hours)

a) Function equipment's
b) Table Set – ups

Module 4: PROMOTION & MARKETING (6 Hours)

a) Advertisement tools
b) Marketing campaign
c) Event posters & designs

Module 5: ORGANIZING AN EVENT (6 hours)

a) Venue Site Selection
b) Menu Planning
c) Organizing theme event

Module 6: Assignment: (30 hours)

All the students have to choose one assignment from the given list and have to prepare it in detail under the supervision of the concerned faculty & present it during the end semester lab evaluations:

a) Prepare a list of around 100 events from various social media platforms and categorize them.
b) Plan a theme based destination wedding with all details of color and lighting as per requirement.
c) Construct & design a flower arrangement using artificial and sustainable things.
d) Prepare a written master plan for a special event. The plan should be comprehensive and detailed including at a minimum the following information: title of the event, purpose and goals of the event, description of the target population, plans for marketing and advertising, detailed description of the nature of the event, organizational and staffing arrangements, financial arrangements (expenses and sources of revenue) and a schedule of major tasks and activities to be followed in planning and conducting the event.
e) Construct a menu for wedding/ birthday/theme party as per the number of Pax and do the menu costing to generate profit from the function.
f) Prepare a list of event management companies in your city and interview any one of them. Prepare a list mentioning various decorators, caterers and transporters they are associated with

Suggested Readings

1. Tum, Julia. Management of Event Operations, 1st Editions, Routledge Publishers
2. Sharma, Dr. Anukrati. Event Management & Marketing, 1st edition, Bharti Publishers
3. Sachdeva, Dr. Priya & Mitra, Dr. Archan. Event Management: Emerging technology and practices. IIP Iteractive International Publishers
4. Jones, Meegan. Sustainable Event Management: A practical guide. 3rdedition. Routledge Publisher
5. Das, Dr. Shibu & Chakraborty, Dr. Subhadeep. An introduction to event Management, Kalyani Publishers

Mapping of CO's to syllabus

CO'S	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	L		L	L		M
CO 2	M	M		M	M	
CO 3			M			H
CO 4				H	H	H

FIVE YEAR INTEGRATED PROGRAMMES

CONTENTS

REGULATIONS FOR INTEGRATED MASTERS PROGRAMMES

ASSAM DON BOSCO UNIVERSITY REGULATIONS 2024-2025

INTEGRATED MASTERS PROGRAMMES

(Applicable to Five Year Integrated MBA and Integrated MCA)

Subject to the provisions of *NEP 2020 with Multiple Entry and Multiple Exit*, following are the regulations of Assam Don Bosco University concerning Integrated Masters Programmes leading to the award of the Master's Degree in Five year integrated Degree

1.0 Academic Calendar

1.1 Semester**:** Each academic year is divided into two semesters of approximately 90 working days: An Autumn Semester (July – December) and a Spring Semester (January – June). The Autumn Semester shall ordinarily begin in July for students already on the rolls and the Spring Semester shall ordinarily begin in January. However, the first semester (autumn, for newly admitted students) may begin later depending on the completion of admission formalities.

1.2 Summer Term: A summer term is for eight weeks during summer vacation. Internship/apprenticeship/work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study. Regular courses may also be offered during the summer on a fast-track mode to enable students to do additional courses or complete backlogs in coursework.

1.3 The schedule of academic activities approved by the Academic Council for each semester, inclusive of the schedule of continuous evaluation for the semester, dates for the conduct of end-semester examinations, the schedule of publication of results, etc., shall be laid down in the Academic Calendar for the semester.

2.0 Admission

2.1 All admissions to the Integrated Masters Programmes of the University shall be on the basis of merit. There may, however, be provision for direct admission for a limited number of NRI/FN students.

2.2 **Eligibility Criteria**: To be considered for admission to an Integrated Masters Programme a candidate should have passed the Higher Secondary examination of a recognized Board of Higher Secondary Education or an equivalent examination of any University / Board/ or equivalent stage of education corresponding to Level-4 * (cf. 2.1)

2.2.1 Admission will be on the basis of performance of the candidate at the qualifying examination, entrance test and/or personal interview and/or CUET Score any other entrance tests approved by the competent authority.

2.3 Reservation of seats for the programme shall be as per the guidelines laid out in the Statutes of the University (As approved by the competent authority) .

2.4 Admissions shall ordinarily close after a specified period from the date of commencement of the first semester, through a notification. However, in exceptional cases, admission of a candidate after the last date may be recommended to the University with justification, by the School / Departments concerned. Under such an event, this period shall not exceed four weeks from the date of commencement of the first/third semester.

2.4.1 The attendance of such students shall be computed from the date of admission.

2.4.2 Such students may be offered the opportunity of taking part in in-semester assessment modules which may have already been completed.

2.5 All candidates shall be required to satisfy the norms prescribed by the University for Medical Fitness prior to admission.

2.6 **Anti-Ragging Affidavit:** Students and Parents Undertaking Affidavit In compliance of the UGC Regulations, it is compulsory for each student and every parent to submit an online Anti-Ragging undertaking affidavit every academic year. The Link to fill out the online undertaking affidavit by students and parents is :
www.antiragging.in/affidavit_registration_disclaimer.html
www.c4yindia.org/Home/Undertaking

3.0 Programmes of Study

3.1 The University follows an outcome based learning approach following National Higher Education Qualification Framework (NHEQF)*, explicitly defining the course/programme outcomes and programme specific outcomes, in the curriculum for all the Graduate Degree Programmes. (* available at https://www.ugc.gov.in/pdfnews/2990035_Final-NHEQF.pdf)

3.2 The Undergraduate Programme (UG) is structured with multiple exit options of Certificate, Diploma, basic Bachelor' Degree at the completion of first, second and third years respectively. The students who complete four years Undergraduate Programme, either in one stretch or through multiple exits and re-enter would get a Bachelor's Degree with Honours. If the student completes a rigorous research project in their major area(s) of study during the fourth year

of a Bachelor's Degree will be awarded Honours with research.

3.3 Students who successfully complete the entire Five year Programme will be awarded the Integrated Master's Degree.

4.0 Duration of the Programme

4.1 The duration of the Integrated Programme is 5 years or 10 semesters.

4.2 If a student wants to leave after the completion of the first or second year, the student will be given a UG Certificate or UG Diploma, respectively, provided they secure the prescribed number of credits *(as given in Table 1).*

4.3 Students who exit with a UG certificate or UG diploma are permitted to re-enter within three years and complete the degree programme.

4.4 Students may be permitted to take a break from the study during the period of study but the total duration for completing the programme shall not exceed 9 years.

4.5 Students who successfully complete their Bachelor's Degree with Honours, with suitable grades are eligible to enter the doctoral (Ph. D) Programme in the relevant discipline or enter the "Two-semester" Master's Degree Programme. (Ref 11.5)

5.0 Curriculum Components

5.1 The curriculum consists of major courses, minor courses and courses from other disciplines, language courses, skill courses, and a set of courses on Environmental education, understanding India, Digital and technological solutions, Health & Wellness, Yoga education, and sports & fitness. At the end of the second semester, students can decide either to continue with the chosen major or request a change of major. (Ref 7.3)

5.2 The five year Integrated Master's Programme shall follow 4 + 1 year pattern with 8 semesters of the 4 year undergraduate programme in the first four years and the final 2 semesters in the last one year.

6.0 Credit hours and Course structure

6.1 The medium of instruction, as well as examinations and project reports shall be in English except for Modern Indian language courses.

6.2 The course structure and syllabi of the Integrated Masters Programmes shall be approved by the Academic Council of the University. Departmental Boards of Studies (DBOS) shall discuss and recommend the syllabi of all the courses offered by the department from time to time. The proposals from the departments are forwarded to make recommendations to the Academic Council for consideration and approval.

6.3 The workload for a course is quantified in terms of credit hours, which represent the unit of measurement for coursework. A credit indicates the number of hours of instruction required per week over the duration of a semester. Courses may include:

- lecture and tutorial components
- lecture and practicum components
- lecture, tutorial, and practicum components
- only practicum components

6.3.1 A one-credit Lecture/tutorial in a course is equivalent to 15 hours of engagement.

6.3.2 A one-credit course in practicum or lab work or Seminar or Internship or Studio activities or Field practice/projects or Community engagement and service, and fieldwork is equivalent to 30 hours of engagement.

6.4 **Type of Courses and Credit distribution:**

6.4.1 The Integrated Masters Programmes will consist of the following categories of courses and the minimum credit requirements for 3-year UG, 4-year UG (Honours) or UG (Honours with Research) and 5-year Integrated programmes are given below*:*

Table 1: Course Categorization and Credit Distribution for UG/Bachelor's Programme/Integrated Programme

S.No	Broad Category of Course	Minimum Credit Requirement		
		3-year UG	4-Year UG	5-year Integrated PG
1	Major Courses	60	80	92
2	Minor Courses	24	32	32
3	Multidisciplinary Courses	9	9	9
4	Ability Enhancement Courses (AEC)	8	8	8
5	Skill Enhancement Courses (SEC)	9	9	9
6	Common Value Based Courses for all UG	4	4	4
7	Community Engagement (CE)	4	4	4
8	Summer Internship	2	2	2
9	Research Project / Dissertation	-	12	12

10	Mandatory Courses/Audit Courses	-	-	-
11	Discipline Specific Electives	-	-	8
	Total	120	160	200

Note:

- Exit option with UG Certificate (with the completion of courses across semesters 1, 2 and additional 4 credits in skill based vocational courses offered during summer term or internship equal to a minimum of 44 credits)
- Exit option with UG Diploma (with the completion of courses across semesters 1-4 and additional 4 credits in skill based vocational courses offered during first year or second year summer term equal to a minimum of 84 credits)
- Exit option with 3- year UG Degree (with the completion of courses across semesters 1-6 including 2 credits of Internship offered during second year summer term equal to a minimum of 120 credits)
- Students will be awarded UG Degree (Honours) /UG Degree (Honours) with Research in the relevant Discipline (with the completion of courses equal to a minimum of 160 credits)

6.4.2 **Internship/apprenticeship** can be carried out during the summer break mandatorily for students who exit after two semesters or four semesters of study in addition to the skill based courses.

6.4.3 **Audit Courses:** Students who secure a CGPA of at least 8 at the end of the 4th semester may opt to take one audit course per semester from any Department from the 5th semester onwards, provided the course teacher permits the auditing of the course. This shall be done under the guidance of the Departmental Faculty Advisor/mentor. The student is free to participate in the evaluation process for such courses. However, an attendance of 75% is necessary for obtaining a P grade for such courses. When auditing courses are offered by other departments, it shall be the responsibility of the student to attend such courses without missing courses of one's own department and semester.

6.4.4 **Bridge Courses:** The Departments shall make provision for Bridge Courses to facilitate admission of students from varied backgrounds to a programme of their choice.

6.4.5 **Value-added Courses:** Each department shall offer value-added courses. Value-Added courses are part of the curriculum designed to provide necessary skills to increase the employability quotient and equipping the students with essential skills to succeed in life. Certificates will be awarded to those who successfully complete the course.

6.4.6 In addition to the prescribed credit requirement, a student shall have to complete Institutional mandatory courses with Pass grade, as prescribed by the competent academic authority, from time to time, which shall be recorded in the Grade sheet but not taken into account for computing the SGPA and the CGPA.

6.4.7 In addition, students may also opt for additional courses in consultation with their mentors (Cf. 6.4.8). Courses may also be chosen from SWAYAM/NPTEL. Students are required to participate in the evaluation process of such courses. The grades obtained for such courses shall be recorded in the grade sheet, but not taken into account for computing SGPA and CGPA. (Ref. 6.2)

6.4.8 **Faculty Advisor/Mentor:** A faculty advisor/mentor (and a co-mentor to perform the duties of a mentor during the absence of the mentor) shall be assigned for each student. Generally the faculty advisor/mentor shall be assigned by the concerned department, in consultation with the Director of the School concerned. (Faculty advisors/ mentors shall help their mentees to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them.

6.5 **Academic Bank of Credits (ABC)** a national-level facility for "credit transfer" is created for students to transfer and consolidate the credits earned by them by undergoing courses from any recognized HEIs. The ABC allows for credit redemption through the process of commuting the accrued credits in the Academic Bank Account maintained in the ABC for the purpose of fulfilling the credits requirements for the award of certificate/diploma/degree by the authorized HEIs. Upon collecting a certificate, diploma or degree, all the credits earned till then, in respect of that certificate, diploma or degree, shall stand debited and deleted from the account concerned. The procedure for depositing credits earned, its shelf life, and redemption of credits would be as per UGC (Establishment and Operationalization of ABC scheme in Higher Education) regulations and its amendments, 2021.

7.0 Major and Minor disciplines:

7.1.1 Major discipline is the discipline or subject of main focus and the degree will be awarded in that discipline. Students should secure the prescribed number of credits (about 50% of total credits) through core courses in the major discipline.

7.1.2 Minor discipline helps a student to gain a broader understanding beyond the major discipline. For example, if a student pursuing an Economics major obtains a minimum of 12 credits from a bunch of courses in Statistics, then the student will be awarded B.A. degree in Economics with a Minor in Statistics.

7.2 In order to qualify for an Integrated Master's Degree, a student is required to complete the minimum credit requirements as prescribed by the competent academic authority. (Refer 4.4)

7.3 **Change of Major Discipline:** The University may permit a student to change from one major discipline of study to another after the first two semesters.

7.3.1 Students shall be allowed a change in major discipline provided that the strength of a Programme offering the specific Major discipline should not fall below the existing strength by more than ten percent and should not go above the

sanctioned strength by more than ten percent.

7.3.2 Only those students shall be eligible for consideration of a change of major discipline, who has completed all the credits required in the first two semesters of their studies, in their first attempt. (Ref 6.4.5 for fulfilling any deficient and/or prerequisite courses to be completed)

7.3.3 Applications for a change of major discipline must be made by intending eligible students in the prescribed form. The Office of the Registrar shall call for applications at the beginning of the third semester and the completed forms must be submitted by the last date specified in the notification.

7.3.4 Students may enlist up to two choices of major disciplines, in order of preference, to which they wish to change over. It shall not be permissible to alter the choice after the application has been submitted.

7.3.5 Change of major discipline shall be made strictly in order of merit of the applicants. For this purpose the CGPA obtained at the end of the second semester shall be considered. In case of a tie, the following shall be considered in the given order: the SGPA of the second semester, the SGPA of the first semester, grades obtained by the applicants in the courses of the second semester in an order given in the grade and approved by the Office of the Registrar.

7.3.6 A committee consisting of the Directors and Head of Departments of the concerned School, chaired by the Registrar shall examine the applications and consider them on the basis of the criteria laid out above.

7.3.7 The details of major discipline changes effected shall be notified to the students by the Registrar, within 7 days of the submission of applications.

7.3.8 All changes of major discipline shall be final and binding on the applicants. No student shall be permitted, under any circumstance, to refuse the change of major discipline offered.

7.3.9 All changes of major discipline made in accordance with the above rules shall be effective from the third semester of the applicants concerned. No change of branch shall be permitted after this.

8.0 Transfer of Admission

Transfer of admissions is permissible only for autumn semesters (at the end of second, fourth and sixth semesters for students of other universities and within the University.

8.1 **Evaluation Committee for Multiple entry and Exit:** With the provision of multiple entry and exit, students from other HEIs will be allowed entry to appropriate Level. Evaluation Committee will be set up to see the eligibility of such students who desire to join the University from other HEIs with a lateral entry.

8.1.1 Applications for exit received on or before 31st March after completion of first year/second year/third year, shall be evaluated by the Evaluation Committee.

8.2 The Conditions for transfer admission of students of other Universities

8.2.1 A Candidate migrating from any other University may be permitted to join odd semester of the degree programme provided he/she has passed all the subjects of previous semesters with 4 credits of internship completed. Such candidates must satisfy all other conditions of eligibility stipulated in the regulations of the University.

8.2.2 His/her transfer admission shall be within the intake permitted in the University.

8.2.3 He/she shall fulfill the attendance requirements as per the University Regulation.

8.2.4 The candidate who is migrating from other Universities is eligible for overall SGPA/CGPA or Class and not for ranking. He/ She shall complete the programme as per the regulation governing the maximum duration of completing the programme as per this regulation.

9.0 University Registration

9.1 Candidates who are admitted to a programme shall have to register as bona-fide students with the University as per the University regulations within a period specified by the University, by a formal application routed through the Director of the School concerned.

10.0 Attendance

10.1 To be permitted to appear for the end-semester examination of a particular course, a student is required to have a minimum attendance of 75% for that course.

10.2 Deficiency in attendance up to 10% may be condoned by the Director of the School in the case of leave taken for medical and other grievous reasons, which are supported by valid medical certificates and other requisite documents.

10.3 Some students, due to exceptional situations like their own serious sickness and hospitalization or death of members of the inner family circle (restricted to only father, mother, siblings), may have attendance below 65%. Such students may be given bonus attendance percentage for a particular course based on his/her attendance for that course during the remaining days of the current semester, as given in the following table**:**

Attendance during the remaining days of the current semester	**Bonus percentage available in the current semester**
95% or more	5

90% or more but less than 95%	4
85% or more but less than 90%	3
80% or more but less than 85%	2
75% or more but less than 80%	1

They shall be permitted to appear for the end-semester examination of the course if on the strength of this bonus attendance percentage, they obtain 65% attendance for that course.

10.4 If the sum of the credits of the courses for which a student is unable to appear at the end- semester examinations exceeds 50% of the total credits allotted for the semester, he/she shall not be permitted to appear for the entire end-semester examinations.

10.5 The School may propose to set aside a certain portion of the in-semester assessment marks for attendance. The number of marks and modalities of their allotment shall be made known to the students at the beginning of each semester.

10.6 **Leave**

10.6.1 Any absence from classes should be with prior sanctioned leave. The application for leave shall be submitted to the Office of the Director of the concerned School on prescribed forms, through proper channels, stating fully the reasons for the leave requested along with supporting documents.

10.6.2 In case of emergency such as sickness, bereavement or any other unavoidable reason for which prior application could not be made, the parent or guardian must promptly inform the office of the Director of the concerned School.

10.6.3 If the period of absence is likely to exceed 10 days, a prior application for grant of leave shall have to be submitted through the Director of the concerned School to the Registrar of the University with supporting documents in each case; the decision to grant leave shall be taken by the Registrar on the recommendation of the Director of the concerned School.

10.6.4 The Registrar may, on receipt of an application, also decide whether the student be asked to withdraw from the programme for that particular semester because of long absence.

10.7 It shall be the responsibility of the student to intimate the concerned teachers regarding his/her absence before availing the leave.

11.0 Grading System

11.1 **Three types of courses are offered in the Graduate programmes:**

Graded courses: For the majority of the courses, students shall be assessed and given grades.

Pass/Non-Pass courses: There are some courses for which the students are expected to obtain a P grade to be eligible for the degree.

Audit Courses: A third category of courses are audit courses. These are optional. However, students who opt for these courses must have the required attendance to obtain a P grade in the course.

11.2 Based on the performance of a student, each student is awarded a final letter grade in each graded course at the end of the semester and the letter grade is converted into a grade point. The correspondence between percentage marks, letter grades and grade points is given in the table below:

Marks (x) obtained (%)	**Grade**	**Description**	**Grade Points**
$90 \geq x \leq 100$	O	Outstanding	10
$80 \geq x < 90$	A+	Excellent	9
$70 \geq x < 80$	A	Very Good	8
$60 \geq x < 70$	B+	Good	7
$50 \geq x < 60$	B	Above Average	6
$41 \geq x < 50$	C	Average	5
$x = 40$	P	Pass	4
$x < 40$	F	Fail	0
	AB	Absent	0
	PS	Pass	0
	NP	Not Passed	0
	X	Not Permitted	0

11.2.1 Audit Courses can be graded as 'PS' Pass and 'F' Fail[1] without any credits

11.2.2 In addition, a student may be assigned the grades 'P' and 'F' for pass marks and non- passing marks respectively, for Pass/No-pass courses, or the grade 'X' (not permitted).

11.2.3 A student shall be assigned the letter grade 'X' for a course if he/she is not permitted to appear for the end semester examination of that course due to lack of requisite attendance.

11.2.4 A letter grade 'F' or 'X' in any course implies failure in that course.

11.2.5 A student is considered to have completed a course successfully and earned the credits if she/he secures a letter grade other than 'F', or 'X'.

11.3 At the end of each semester, the following measures of the performance of a student in the semester and in the programme up to that semester shall be computed and made known to the student together with the grades obtained by the student in each course:

11.3.1 The Semester Grade Point Average (SGPA): From the grades obtained by a student in the courses of a semester, the SGPA shall be calculated using the following formula:

$$SGPA = \frac{\sum_{i=1}^{n} GP_i \text{ x } NC_i}{\sum_{i=1}^{n} NC_i}$$

Where, GP_i = Grade points earned in the i^{th} course
NC_i = Number of credits for the i^{th} course
n = the number of courses in the semester

11.3.2 The Cumulative Grade Point Average (CGPA): From the SGPAs obtained by a student in the completed semesters, the CGPA shall be calculated using the following formula:

$$CGPA = \frac{\sum_{i=1}^{n} SGP_i \text{ x } NSC_i}{\sum_{i=1}^{n} NSC_i}$$

Where,
SGP_i = Semester Grade point of the i^{th} semester
NSC_i = Number of credits for the i^{th} semester
n = the number of semesters completed

11.3.3 The CGPA may be converted into a percentage by multiplying CGPA by 10.

11.3.4 Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such. Whenever these CGPA are to be used for official purposes, only the rounded off values shall be used.

11.4 In the case of an audit course, the letters 'P' or 'F' shall be written alongside the course name in the Grade Sheet. Such courses are not taken into account in the calculation of the SGPA or CGPA. However, the award of the degree is subject to obtaining a 'P' grade in all such courses. A student is not required to register again for passing the failed audit courses.

11.5 Only those students who secure CGPA of 7.5 and above in the first six semesters may choose to undertake research in the fourth year

12.0 Assessment of Performance

12.1 A student's performance is evaluated through a continuous system of evaluation comprising tests, quizzes, assignments, seminars, minor projects, major projects and end-semester examinations.

12.2 **Theory Courses**: Theory courses shall have two components of evaluation – in- semester assessment of 40% weightage and an end-semester examination having 60% weightage.

12.2.1 The modalities of the conduct of in-semester assessment and weightages attached to its various components shall be as published by the School at the beginning of each semester.

12.3 **Lab Courses**: Lab courses shall be evaluated on the basis of attendance; assessment of tasks assigned and end semester test/viva voce. The weightage assigned for these components of the evaluation is given in the following table:

Component	Weightage
Attendance	10
Assessment of Tasks Assigned	30
End-semester test / viva voce	60

12.3.1 The modalities of the conduct of evaluation under the heading "Assessment of tasks assigned", its components and the weightages attached to its various components shall be published by the department concerned at the beginning of each semester.

12.3.2 The evaluation of the end-semester test for a lab course may be done on the basis of criteria and weightage to be specified in the question paper, among which are included

- Organisation of the experiment
- Actual conduct of the experiment assigned and accuracy of the result
- Extent of completion
- A comprehensive viva-voce which examines the overall grasp of the subject

12.4 **End Semester examinations**

12.4.1 End-semester examinations for the theory courses, generally of three hours' duration, shall be conducted by the University. The Director of the concerned school and the Examination department shall make the arrangements

necessary for holding the examinations.

12.4.2 In the end-semester examinations, a student shall be examined on the entire syllabus of the courses.

12.4.3 A student shall not obtain a pass grade for a course without appearing for the end- semester examination in that course.

12.5 **Industry Training/Internship Programme**

12.5.1 Departments require students to undergo industry training/internship programmes.

12.5.2 Departments are to notify the students at the beginning of their programmes about the details of industry training/internship.

12.5.3 After the Industry Training/Internship programme, the student shall furnish a certificate from the organisation where he/she underwent the programme as proof of successful completion.

12.5.4 The student shall submit a training/internship report to the department in a format to be laid down by the concerned department. He/she shall also give a seminar to present the learning outcomes of the programme in the presence of the faculty members and students of the department. The student shall be evaluated on the basis of the report, the seminar and interaction during the seminar and grades shall be assigned. These grades shall be given a weightage of two credits in the subsequent semester.

12.6 **Field-based learning/ Minor project/Dissertation:**

12.6.1 Minor project work is conducted during the sixth semester of the programme, and is to be done individually or in groups within the campus/Outside the campus with due permissions.

12.6.2 Each department shall constitute a Departmental Project Evaluation Committee (DPEC) consisting of the Head of the Department, Project Co-ordinator and two senior teachers from the department, with the Project Co-ordinator as the convenor. The DPEC shall co-ordinate the conduct and assessment of the project.

12.6.3 The DPEC shall notify the schedule and modalities for the following stages in the implementation of the project.

- Submission of the topic of the project
- Notification for assignment of project supervisors
- Submission of the synopsis
- Schedule and modality for the submission of weekly activity reports
- Schedule for the seminar presentation of synopsis
- Schedule for Progress Seminars, submission of progress reports and viva voce examination
- Date for the submission of the project report and a brief summary
- Dates for the external evaluation of the project

12.6.4 The DPEC may ask a student to resubmit a synopsis if the same does not get its approval.

12.6.5 The Convener of the DPEC shall submit to the Controller of Examinations a panel of at least three names of external examiners at least three weeks before the external examination. The Controller of Examinations shall appoint the external examiner(s) from this panel. The project supervisor shall be the internal examiner.

12.6.6 Each student shall submit to the DPEC three bound, typed copies of the project report, and prepared according to the prescribed format, after the pre-submission seminar, by the due date. The student shall also submit three copies of a brief summary of the project that shall be forwarded to the concerned examiners.

12.6.7 The DPEC shall make the arrangements necessary to conduct the external evaluation in consultation with the examiner(s) appointed by the University, during the dates notified.

12.6.8 The DPEC shall forward the in-semester assessment marks to the Controller of Examinations by the date specified by the Examination Department.

12.6.9 The end-semester assessment shall have the following components:

- Project implementation: 40 marks
- Seminar presentation: 20 marks
- Viva voce examination: 20 marks
- Project documentation: 20 marks

12.6.10 Those who obtain an 'F' grade for the minor project shall be required to re-enrol for it in the subsequent semesters.

12.7 The evaluation of performance in non-credit courses shall be done by the authorities conducting them and they shall communicate the grades to the Director of the concerned School who shall forward them to the Controller of Examinations.

12.8 The Director of the concerned School shall forward the marks obtained in the in- semester evaluation to the Controller of Examinations within the prescribed time as may be notified.

12.8.1 All evaluated work in a course except the end semester answer scripts shall be returned to the students promptly.

12.9 **Eligibility for appearing in the end-semester examinations:** A student shall be permitted to appear for the end-semester examinations, provided that

12.9.1 A student has not been debarred from appearing in the end semester examinations as disciplinary action for serious breach of conduct.

12.9.2 He/she has satisfactory attendance during the semester according to the norms laid out in the clause 8 of these regulations.

12.9.3 He/she has paid the prescribed fees and any other dues of the university within the date specified.

12.10 **Registration for end-semester Examinations**

12.10.1 The University shall, through a notification, invite applications from students to register for the end-semester examinations.

12.10.2 Students who have registered with the University (vide clause 9) and those who have applied for such registration may apply to appear for the end- semester examinations of the university, in response to the notification issued by the University, provided that they fulfill the eligibility norms as laid down in clause (ref 12.9)

12.10.3 All eligible candidates shall be issued an admit card for the relevant examination and for specified courses. A student who does not have a valid admit card may not be permitted to write the end-semester examinations.

12.10.4 A student who secures an 'F' grade in any course in a semester may register for the end-semester examination for that course in a subsequent semester when that course is offered again, within the maximum period of time allotted for the completion of the programme. The in-semester assessment marks obtained by him/ her in the last semester in which the said course was attended by him/her shall be retained.

12.10.5 Similarly, in case of an 'NP' grade in non-credit courses the student shall have to re-register for it in the appropriate semester of the next academic session.

12.10.6 When a student re-registers for the end semester examination of a course, in accordance with clause 10.10.4 above, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

12.11 **Conduct of Examinations**: The University shall conduct the end-semester examinations in accordance with the applicable regulations on such dates as are set down in the Academic Calendar or as notified.

12.12 **Declaration of Results**: The University shall declare the results of a semester and make available to the students their grade sheets within the time-frame prescribed by the relevant regulations of the university and specified in the academic calendar.

12.13 The University may withhold the results of a student for any or all of the following reasons

- he/she has not paid his/her dues
- there is a disciplinary action pending against him/her
- he/she has not completed the formalities for University Registration according to the requirement of section 5 of these Regulations.

12.13.1 **Re-examining of answer scripts**

12.13.2 If a student feels that the grade awarded to him/her in a course is not correct, he/she may apply to the University for the re-examining of his/her answer script.

12.13.3 Re-examining of scripts may be of two different categories – scrutiny and re- evaluation.

12.13.4 **Scrutiny:** The activities under this category shall ordinarily be confined to checking correctness of the total marks awarded and its conversion into appropriate letter grades whether any part/whole of a question has been left unevaluated inadvertently correctness of transcription of marks on the tabulation sheet and the grade sheet issued in respect of the course under scrutiny.

12.13.5 **Re-evaluation:** Re-evaluation of the answer script by independent experts in the concerned subject(s).

12.13.6 Application for re-examining of answer scripts

- A student may apply for scrutiny or re-evaluation for one or more courses of the just-concluded end-semester examinations within seven calendar days from the date of publication of its results in the application form prescribed for this purpose.
- He/she shall pay the prescribed fee to the University as notified.
- A student applying for scrutiny/re-evaluation shall expressly state on the application form whether the application made is for Scrutiny or for Re- evaluation. In each case, the student may also request to see his/her answer script.
- All applications for scrutiny/re-evaluation must be routed through the Director of the concerned School.

12.13.7 If in the process of re-examining, the grade obtained in a course changes, the better of the two grades shall be assigned to the course. If there is a change, the new grade shall be recorded and a new grade sheet shall be issued to the student.

12.13.8 Without prejudice to any of the clauses of section 10.14, a student who has been found to have used unfair means during an examination shall not be eligible to apply for scrutiny or re-evaluation of answer scripts.

12.14 **Repeat Examination:** The University shall conduct repeat examination for those with F grade at a different time slot, as set down in the Academic Calendar or as notified. Such students should register for these examinations.

12.15 **Improvement Examination**

12.15.1 After the completion of the entire programme of study, a student may be allowed the provision of improvement examinations. These are to be availed of only once each in the Autumn and Spring semesters that immediately follow the completion of the programme, and within the maximum number of years permissible for a programme.

12.15.2 A student who has taken migration from the University shall not be eligible to appear for Improvement Examination.

12.15.3 A student may not choose more than the number of courses specified below for improvement examinations.

Programme	Number of Courses for Improvement Examinations		
	Autumn Semester	Spring Semester	Total
BCA	4	4	8
BCA	4	4	8

12.15.4 After the improvement examination, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

12.15.5 If the student improves his/her grades through the improvement examination, new grade sheets and comprehensive transcripts shall be issued to the student.

12.16 **Special Examination**

12.16.1 The University shall conduct Special Examinations to benefit the following categories of students:

12.16.1.1 Students who, on the completion of the final semester, have some 'F' graded courses in the two final semesters, but no 'F' graded courses in any of the previous semesters

12.16.1.2 Students who have only one 'F' graded course in a semester other than the two final semesters and do not have 'F' graded courses in the two final semesters.

12.16.2 The Special Examinations shall ordinarily be conducted each year within a month of the declaration of the results of the Spring Semester.

12.16.3 Students who fail to secure 50% of the credits offered in the final semester shall not be eligible to appear for the special examinations. Such students will be governed by the provisions of clause 10.5 of these regulations. However, this restriction shall not apply in the case of students who are unable to appear in the end semester examinations due to exceptional situations like their own serious illness and hospitalisation or death of members of the inner family circle (restricted to only father, mother, siblings).

12.16.4 Students who have 'X' graded courses only in the last two semesters may be offered the opportunity for participating in a Tutorial Programme which may be conducted during the semester break immediately following the end-semester examinations of the final semester and students who earn 85% attendance for the programme shall be permitted to appear for the Special Examinations. Separate fees shall be charged for the Tutorial Programme.

12.16.5 Students who do not obtain pass grades in any course at the special examinations shall have to apply in the prescribed format and appear for the end-semester examination of these courses when they are scheduled by the University during subsequent relevant end-semester examinations.

13.0 Enrolment (for semesters other than the first)

13.1 Every student is required to enroll for the relevant courses before the commencement of each semester within the dates fixed for such enrolment and notified by the Registrar.

13.2 Students who do not enroll within the dates announced for the purpose may be permitted late enrolment up to the notified date on payment of a late fee.

13.3 Only those students shall be permitted to enroll who have

- Cleared all University, Departmental, Hostel and Library dues and fines (if any) of the previous semester,
- Paid all required University, Departmental and Hostel fees for the current semester, and
- Not been debarred from enrolling on any specific ground.

13.4 No student may enroll for a semester if he/she has not appeared, for whatever reason, in the end semester examinations of the previous semester.

13.5 Students who due to lack of due attendance have been debarred from exams in any semester (including first and second) will have to re-enroll for the same.

14.0 Eligibility for the Award of the Integrated Master's Degree

14.1 A student shall be declared to be eligible for the award of the five –year Integrated Master's Degree for which he/she has enrolled if he/she has

14.1.1 completed all the credit requirements for the degree with grade 'C' or higher grade in each of the mandatory graded courses and grade 'PS' in all mandatory non-graded courses;

14.1.2 satisfactorily completed all the non-credit requirements for the degree viz., Extra Academic Activities, Industry Training, Field Work, Internship Programme, etc. (if any);

14.1.3 Obtained a CGPA of 5.00 or more at the end of the semester in which he/she completes all the requirements for the degree;

14.1.4 Owes no dues to the University, School, Department, Hostels; and

14.1.5 Has no disciplinary action pending against him/her.

14.2 The award of the Graduate Degree must be recommended by the Academic Council and approved by the Board of Management of the University.

14.2.1 Degree will be awarded, to student completes least fifty per cent of the credits from the University awarding the degree or diploma or certificate (https://www.ugc.gov.in/pdfnews/9327451_Academic-Bank-of-Credicts-in-Higher-Education.pdf)

15.0 Termination from the Programme

15.1 If more than the number of years permitted for the completion of a programme have elapsed since the student was admitted, and the student has not become eligible for the award of Degree, the student shall be removed from the programme.

15.2 A student may also be required to leave the Programme on disciplinary grounds on the recommendations of the Students' Disciplinary Committee of the concerned School.

SCHEME OF IN-SEMESTER ASSESSMENT
INTEGRATED MASTER'S DEGREE PROGRAMMES

EVALUATION OF THEORY COURSES

For theory courses, in-semester assessment carries 40% weightage. Different components along with the weightage of each are given in the table below:

Component	Weightage	Remarks
Class Test (Two Class tests of one and a half hour duration)	20	Average of the two marks shall be considered
Assignment (Individual and Group)	10	Group assignments for two courses and individual assignments for the remaining courses
Non-formal evaluation	5	Based on response and interaction in class, quizzes, open book tests, etc.
Attendance	5	For norms regarding attendance cfr. clause 10 of the Regulations for Undergraduate Programmes

There shall be no re-test for In-semester assessment under any circumstance. The original marks of all the In-semester assessment components shall be retained for all further repeat examinations.

ATTENDANCE

Marks for attendance will be given according to the following scheme:

	Marks Allotted	
Attendance Percent (x)	Theory	Lab
75 <= x < 80	2	4
80 <= x < 90	3	6
90 <= x < 95	4	8
95 <= x 100	5	10

EVALUATION OF LABORATORY COURSES/ SKILL ENHANCEMENT COURSES/INTERNSHIPS

All Laboratory courses, Skill enhancement course, internships are evaluated on the basis of attendance; performance of tasks assigned and end semester test/viva voce examination. The distribution of marks within these components will be specified by individual departments along the lines of the break-up given below:

Component	Weightage
Attendance	10
assessment of tasks assigned	30
End Semester Test and/or Viva-Voce Examination	60
Total	100

EVALUATION OF PROJECTS

The guidelines for the conduct and evaluation of Minor and Mini Projects shall be laid down by the Department. The

components of evaluation and allotment of marks may be as follows:

In Semester Evaluation (weightage 60)	**Marks**	**End Semester Evaluation (weightage 40)**	**Marks**
Synopsis	10	Project Implementation	16
Seminar presentation of synopsis (Analysis and Design)	15	Seminar Presentation	8
Progress Seminar (Implementation)	15	Viva Voce Examination	16
Project Documentation	10		
Attendance	10		
Total	60		40

RULES, PROCEDURES AND BEHAVIOURAL GUIDELINES

1. Dress Code and Identity Card

1.1 The dress code of the University consists of shirt / top (of the prescribed colour and material), trousers (of the prescribed colour and material), shoes (black) and socks (dark grey), a belt (black/dark brown, if required) and a tie (blue, with diagonal stripes). Students are required to come to the University following this dress code. The tie will be required to be worn only on formal occasions. An apron (of the prescribed colour) is to be worn in the Chemistry Lab and during Workshop Practice. During winter, students may wear only a blazer and/or a sweater (full sleeve or sleeveless) of the prescribed colour and material.

1.2 The Student Identity Card is to be brought to the University every day and is to be produced whenever asked for. Entry to the University campus shall be only on production of the Identity Card. The Identity Card is also the Library Card.

1.3 All students should wear the ID card around the neck from entry in the morning to exit in the evening.

2. Morning Assembly

2.1 The morning assembly is a daily programme in the university on all class days during which all members, i.e., students, faculty, staff and management meet together. The assembly starts at the prescribed time. During the assembly, important announcements are made and a thought or insight is shared. The assembly is concluded with an invocation to God to bless the activities of the day. Note that any announcement made at the morning assembly is considered as being equivalent to notifying the same in the notice boards. All students should reach the assembly venue before prescribed time. Immediately after assembly all should proceed to the classroom to start class. Any change in procedures will be notified by the concerned School at the beginning of the Semester.

2.2 One of the following prayers may be used to conclude the Morning Assembly:

The Our Father

Our Father, who art in heaven,
Hallowed be thy name, Thy kingdom come, Thy will be done on earth as it is in heaven.
Give us this day, our daily bread
And forgive us our trespasses
As we forgive those who trespass against us. And lead us not into temptation,
But deliver us from all evil, Amen.

Or

Prayer for Peace

Lord, make me an instrument of your peace,
where there is hatred, let me sow love;
where there is injury, pardon;
where there is doubt, faith;
where there is despair, hope;
where there is darkness, light;
where there is sadness, joy;
O Divine Master, grant that I may not so much seek to be consoled as to console;

to be understood as to understand;
to be loved as to love.
For it is in giving that we receive;
it is in pardoning that we are pardoned;
and it is in dying that we are born to eternal life. Amen

3. Punctuality in Attending Classes

3.1 All are expected to be at their respective assembly venues five minutes before assembly time.

3.2 Normally no student shall leave the University before all the classes are over. In case of an emergency, a student may leave with proper written permission from the HOD of the concerned department.

3.3 While all students are encouraged to have their lunch in the University Canteens, students are permitted to take lunch outside the University.

4. Make-up Classes, Leave of Absence and Earned Attendance

4.1 If any student misses any laboratory class due to illness or other grievous problems, he/she is required to meet the concerned teacher for completing the experiments as soon as possible. Such make-up attendance will be taken into consideration at the end of the semester if attendance is less than 75%. At most two make-up attendances may thus be earned by any student.

4.2 Any student who is required to be engaged in a University activity or a pre-planned training and placement activity during class hours, may apply for the grant of an 'earned attendance' from the concerned HODs in the prescribed form available at the Reception. Such applications must be forwarded by the Activity In-Charge. For club related activities, Faculty Advisor of the concerned club will be the Activity In- Charge. In all other cases, Faculty In-Charge or Assistant Faculty In-Charge of Student Affairs will be the Activity In-Charge. Filled up forms shall be submitted preferably before or in case of emergency, immediately after the activity for which earned attendance is to granted.

4.3 Any student going to participate in any activity or competition outside the University must apply to the Faculty In-Charge of student Affairs using the prescribed form which must be forwarded by the Assistant Faculty In-Charge of Student Affairs in consultation with respective Club Advisers. On return, these students must report back to the Assistant Faculty In-Charge of Student Affairs for recording the outcome.

4.4 Any student who is not able to attend classes due to medical or other grievous reasons are required to apply for leave in the prescribed form along with valid medical certificates and other requisite documents, to the Faculty In-charge, students' affairs within seven days of joining back. Such applications must be signed by a parent of the student and forwarded by the mentor of the concerned student and the HOD of the concerned department. Only these students will be considered for condonement of deficiency in attendance.

5. Discipline

5.1 Personal, academic and professional integrity, honesty and discipline, a sense of responsibility and a high degree of maturity is expected of all students inside and outside the campus. Integrity calls for being honest in examinations and assignments, avoiding plagiarism and misrepresentation of facts.

5.2 Indulging in acts of violence, riotous or disorderly behaviour directed towards fellow students, faculty members or other employees of the institution/hostel in the campus or outside is considered to be a serious breach of discipline and will attract penalty.

5.3 Respect for Common Facilities: Care and respect for common facilities and utilities are an essential component of social responsibility. Any willful damage to University property must be made good by the persons concerned. Further, maintaining cleanliness of the classrooms and the entire campus is everyone's responsibility.

5.4 Substance Abuse: Chewing of tobacco, betel nut and the likes, smoking and the use of other addictive substances and alcoholic drinks are strictly prohibited. These should not be brought into or used within the campus of the University. Violation of this norm will lead to stern action.

5.5 Use of Cell Phones: Cell phones may be used in the University lawns, canteens andother open areas. However, the use of cell phones in classrooms and labs are strictly prohibited except when used for teaching/learning purposes with the explicit permission of the teacher concerned. The cell phone of anyone found violating this rule shall be confiscated and his/ her SIM card shall be taken away and retained in the University office for 7 days. If a person violates the norm for a second time, his/her mobile will be confiscated and retained in the University office till the end of the semester.

5.6 Use of Internet: The entire campus is wi-fi enabled and the students may use the Internet freely for educational purposes. Students may also use the Computing Centre for browsing the Net. However, the use of Internet to access unauthorized and objectionable websites is strictly prohibited.

5.7 All cases of indiscipline will be brought before the Students' Disciplinary Committee and the decisions made by the Committee for dealing with such cases shall be final.

6. Class Tests and Examinations

6.1 The conduct of examinations will be governed by the norms of the University.

6.2 The Student Identity Card shall be the Admit Card for the class tests

6.3 During class tests, all students are expected to enter the venue of the class test 15 minutes before the scheduled time of commencement. However, no one will be permitted into the examination hall after 15 minutes of the commencement of the class test and No one will be allowed to leave the examination hall until an hour has elapsed from the commencement of the class test.

6.4 No one is to leave the hall during examination for any purpose, except in case of an emergency.

6.5 Malpractices during class tests and examinations will not be tolerated and will attract stern action.

7. Ragging

Ragging and eve-teasing are activities which violate the dignity of a person and they will be met with zero tolerance. Anti-ragging norms have been given to each student at the time of admission and all students and parents have signed the anti-ragging affidavit. Any case of ragging and eve-teasing must be reported to the anti-ragging squad. All cases of violation of anti-ragging norms will be taken up by the anti-ragging Committee and punished according to the norms.

8. Grievance Redressal

The University has constituted a Grievance Redressal Cell to redress any genuine grievance students may have. Any student having a genuine grievance may make a representation to the Grievance Redressal Cell through his/her mentor. The representation should be accompanied by all relevant documents in support of the genuineness of the grievance.

9. School Association

9.1 The School Association is an association of the representatives of the various stake holders of the School – students, staff, faculty and management. It is the responsibility of the School Association to take charge of organizing most of the co-curricular activities such as the annual festivals, quizzes, debates, competitions and social events.

9.2 A male and a female student are elected by the students of each class as "class representatives" to represent them in the School Association. Class representatives are expected to be outstanding students who are academically competent and having qualities of leadership.

10. Participation in University Activities

10.1 In order to provide opportunities for the holistic development of the human person, a large number of co-curricular and extra-curricular activities are designed and implemented under the banner of the University Association and student clubs. Some of the most important activities are D'VERVE & BOSCOSIADE (intra- University sports and cultural festival during University Week), PRAJYUKTTAM (the inter-University technical festival). All students are expected to take part actively in such activities to showcase their talents, to develop leadership qualities and to gain the experience of working in groups.

10.2 **Training and Placement Activities:** The training and Placement Cell of DBCET has been incorporated with the objective of minimizing the gap between industry and academia and giving the students training and exposure so that they can capitalize on every opportunity for placement. It is the prime responsibility of the cell to look after all matters concerning 'Training to enhance employability' and 'guiding students for placement'. In the first two semesters, students are trained for communication skills development under the department of Humanities and Social Sciences, and personal development programmes under the department of campus ministry. From the third semester onwards, in every semester, students are given systematic training in aptitude tests, communication skills, group discussion, etc. They are also made to undergo mock HR and Technical Interviews. These activities of the training and placement cell find a place in the curriculum as Extra Academic Programmes (EAP) and all students are required to get a P grade for these activities by taking an active part in these activities regularly.

Other departments of the University offer customised services in training and placement of their students.

11. Free Time

Some hours without class may be available for some students during the day. Students are expected to use such 'free time' for visiting the library, meeting teachers and mentors, self- study, carrying out lab or project related activities, etc.

12. Faculty Performance Feedback

In order to improve the teaching and learning process in the University, students will be required to give feedback about the performance of their teachers from time-to-time. All students are expected to participate in the online feedback sessions concerning their teachers with sincerity and responsibility.

13. Mentoring

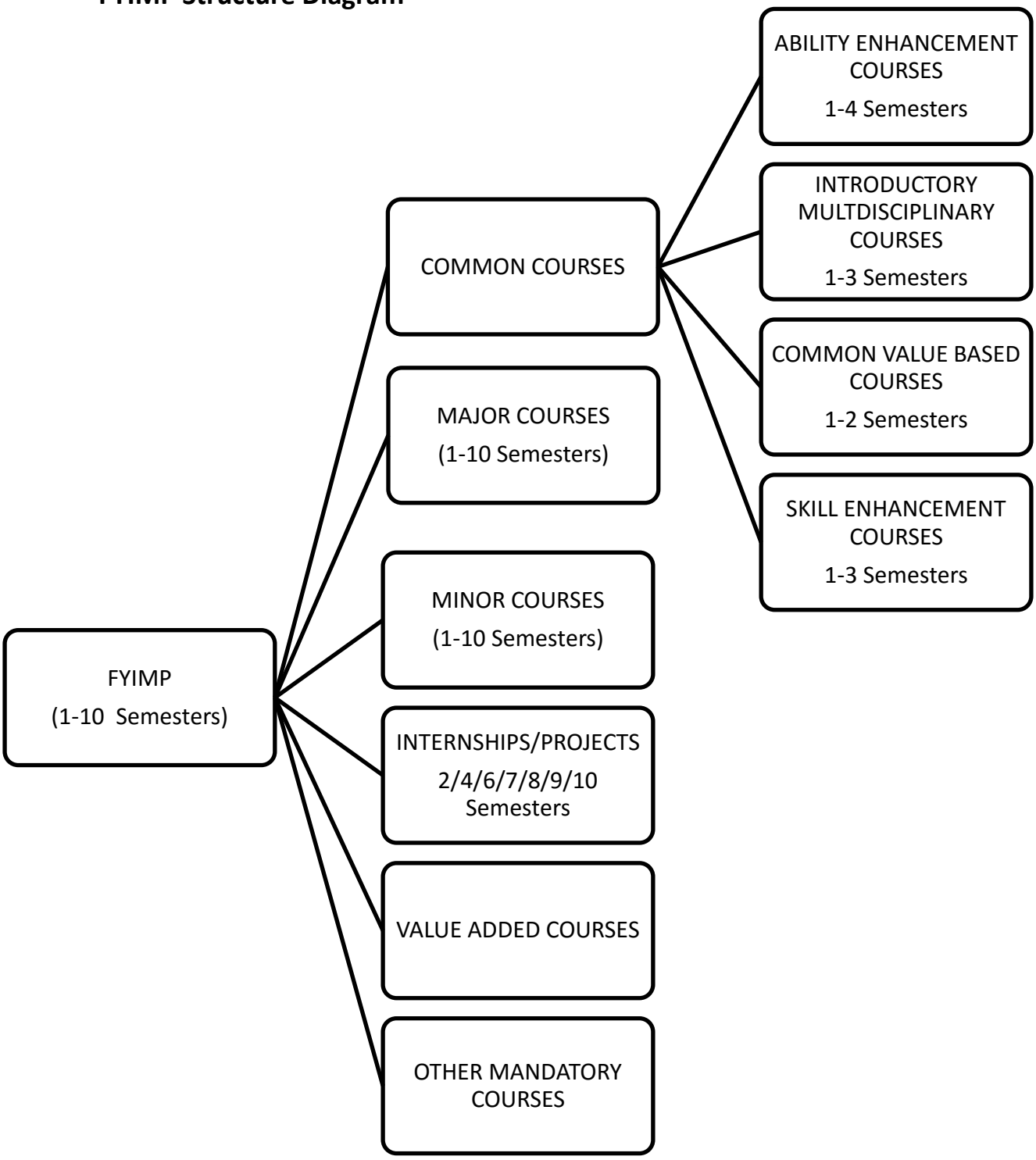
All students are assigned mentors from among the faculty members for their guidance. Directors of Schools in collaboration with the Heads of Departments will take care of assigning mentors. Mentors shall help the students to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them. Although students should meet their

mentors on a regular basis to get timely help, specific days have been set aside in the calendar for meeting mentors to ensure proper documentation of achievements, activities, shortcomings and problems faced by the students. Every student must meet the mentor during these days.

14. Interaction Meet with Parents

The University organises interaction meetings with parents once a year in which the parents are invited to interact with teachers and management to appraise themselves about the performance of their ward and also to offer their suggestions for the betterment of the institution. It is the responsibility of the students too to invite their parents to come and participate in the event and make the event meaningful.

FYIMP Structure Diagram



INTEGRATED MASTER OF COMPUTER APPLICATIONS (iMCA)

DEPARTMENT OF COMPUTER APPLICATIONS

PROGRAMME: FIVE-YEAR BCA-MCA INTEGRATED PROGRAMME

DEGREE: INTEGRATED MASTER OF COMPUTER APPLICATIONS (iMCA)

VISION:

Imparting advanced knowledge in Computer Applications to develop industry-ready IT professionals, innovative researchers, and visionary entrepreneurs who are adaptive, skilled, and dedicated to societal advancement.

MISSION:

- To prepare students for successful careers in both industry and academia by providing a robust teaching, learning, and advanced research environment.
- To foster the development of highly skilled individuals and entrepreneurs through intensive academia-industry collaboration and exposure to cutting-edge technologies.
- To instil a sense of innovation, ethical responsibility, and commitment to societal development through the application of advanced technologies.

PROGRAM OUTCOMES (POs)

PO1 - Advanced Critical Thinking: Apply advanced critical thinking and problem-solving skills to address complex technical challenges in a dynamic IT landscape.
PO2 - Proficient Communication: Communicate effectively in professional and academic settings, with a focus on articulating complex ideas clearly in both technical and non-technical contexts.
PO3 - Collaborative Innovation: Lead and contribute to collaborative projects that require interdisciplinary skills and innovative thinking to achieve solutions in real-world scenarios.
PO4 - Global Citizenship: Demonstrate global awareness and ethical responsibility, contributing to sustainable development and societal progress through informed decision-making and civic participation.
PO5 - Professional Ethics: Apply ethical principles in professional practices, understanding the broader implications of technology on society and the environment.
PO6 - Environmental Stewardship: Integrate principles of sustainability into the design and development of technology solutions that minimize environmental impact.
PO7 - Life-long Learning and Adaptability: Cultivate a proactive approach to life-long learning and adaptability, essential for thriving in the ever-evolving tech industry.
PO8 - Innovation and Entrepreneurship: Drive innovation and entrepreneurship by identifying opportunities, leveraging emerging technologies, and creating value for the industry and society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 – Knowledge of Computing Expertise: Gain a comprehensive understanding of modern computing systems, including both foundational and emerging technologies, to effectively design and implement complex software solutions.
PSO2 - Innovative Research and Development Skills: Cultivate advanced research skills and the ability to innovate by leveraging state-of-the-art tools and methodologies, contributing to cutting-edge developments in computer applications.
PSO3 - Industry Integration and Professional Competence: Achieve industry readiness through hands-on experience, collaboration with industry experts, and practical exposure to current trends and technologies, ensuring a seamless transition from academia to the professional environment.
PSO4 - Leadership and Entrepreneurial Skills: Develop leadership and entrepreneurial abilities, enabling the creation and management of technology-driven ventures and fostering a culture of innovation and strategic thinking in the industry.

COURSE STRUCTURE

Year	Semester	Category	Course Code	Name of the Course	Credit	Page No
I	1	Major Course 1	CACL100T	Computer Programming in C Language (Theory)	2	890
			CACL101L	Computer Programming in C Language (Lab)	2	891
		Minor Course 1	CACF110T	Cybersecurity Fundamentals	4	918
		Skill Enhancement Course	CAMG111L	Multimedia and Graphics	3	929
		Multi-disciplinary Course	Course to be chosen from stream not studied in Class 12		3	
		Ability Enhancement Compulsory Course	AECE100T/ AECH100T/ AECA100T AEFR100T/ AEGR100T	Communicative English -I / Communicative Hindi-I / Communicative Assamese-I/ French Beginner Level I/ Introduction to German Language – I	2	67 69 71 73 75
		Common Value Based Course-I	CBES101T	Environmental Studies	1	106
		Common Value Based Course-II	CBHY102T	Health and Wellness, Yoga Education, and Sports and Fitness	1	107
		Community Engagement Course	CACE109T	Service-Learning	2	
		TOTAL CREDITS			20	
	2	Major Course 2	CADS102T	Data Structures Using C (Theory)	3	892
			CADS103L	Data Structures Using C (Lab)	1	893
		Minor Course 2	CAET105T	E-commerce Technologies	4	920
		Skill Enhancement Course	CAIT112L	Introduction to Internet of Things	3	930
		Multi-disciplinary Course	Course to be chosen from stream not studied in Class 12		3	
		Ability Enhancement Compulsory Course	AECE101T/ AECH101T/ AECA101T/ AEFR101T/ AEGR101T	Communicative English -II / Communicative Hindi-II / Communicative Assamese-II/ French Beginner Level-II/ Introduction to German Language–II	2	68 70 72 73 75
		Common Value Based Course-III	CBDT103T	Digital and Technological Solutions	1	107
		Common Value Based Course-IV	CBUI104T	Understanding India	1	108
		Community Engagement Course	CESL102P	Service-Learning Practice	2	
		TOTAL CREDITS			20	
BCA Certificate						
II	3	Major Course 3	CAIJT200T	Introduction to Java Programming (Theory)	3	893
			CAIJ201L	Introduction to Java Programming (Lab)	1	894
		Major Course 4	CALD202T	Digital Logic Design (Theory)	3	895
			CALD203L	Digital Logic Design (Lab)	1	896
		Minor Course 3	CAER210T	Enterprise Resource Planning	4	921
		Skill Enhancement Course	CACV215L	Computer Vision Fundamentals	3	931
		Multi-disciplinary Course	Course to be chosen from stream not studied in Class 12		3	
		Ability Enhancement Compulsory Course	AECE200T/ AECH200T/ AECA200T	Communicative English -I / Communicative Hindi-I / Communicative Assamese-I/	2	67 69 71

			AEFR200T/ AEGR200T	French Beginner Level I/ Introduction to German Language – I		73 75
		TOTAL CREDITS			20	
	4	Major Course 5	CAOS204T	Operating System (Theory)	3	896
			CAOS205L	Operating System (Lab)	2	897
		Major Course 6	CACA206T	Computer Organization and Architecture (Theory)	3	898
			CACA207L	Computer Organization and Architecture (Lab)	2	899
		Major Course 7	CARD208T	Relational Database Management Systems (Theory)	3	899
			CARD209L	Relational Database Management Systems (Lab)	1	900
		Minor Course 4	CAWD211T	Basics of Web Designing (Theory)	3	922
			CAWR212L	Basics of Web Designing (Lab)	1	923
		Ability Enhancement Compulsory Course	AECE201T/ AECH201T/ AECA201T/ AEFR201T/ AEGR201T	Communicative English -II / Communicative Hindi-II / Communicative Assamese-II/ French Beginner Level-II/ Introduction to German Language–II	2	68 70 72 73 75
		TOTAL CREDITS			20	
BCA Diploma						
III	5	Major Course 8	CACN300T	Computer Network Fundamentals (Theory)	3	901
			CACN301L	Computer Network Fundamentals (Lab)	2	902
		Major Course 9	CAFW315T	Full Stack Web Development (Theory)	3	909
			CAFW316L	Full Stack Web Development (Lab)	2	910
		Major Course 10	CASE304T	Software Engineering (Theory)	3	904
			CASE305L	Software Engineering (Lab)	1	905
		Minor Course 5	CAPT310T	Basics of Python (Theory)	2	924
			CAPT311L	Basics of Python (Lab)	2	925
		Internship	CAIN314I	Internship	2	932
		TOTAL CREDITS			20	
	6	Major Course 11	CACC306T	Cloud Computing	4	905
		Major Course 12	CAMD317T	Mobile Application Development (Theory)	2	910
			CAMD318L	Mobile Application Development (Lab)	2	911
		Major Course 13	CANS308T	Network Security	4	907
		Minor Course 6	CABS312T	Business Statistics	4	925
		Major Course 14	CAPW309P	Minor Project	4	908
		TOTAL CREDITS			20	
BCA						
IV	7	Major Course 15	CAPM400T	Python and Machine Learning (Theory)	3	912
			CAPM401L	Python and Machine Learning (Lab)	2	913
		Major Course 16	CADA402T	Design and Analysis of Algorithm (Theory)	3	914
			CADA403L	Design and Analysis of Algorithm (Lab)	2	915
		Minor Course 7	CAAI407T	Introduction to Artificial Intelligence	3	926
		Minor Course 8	CARM408T	Research Methodology	2	927
		Research Project / Dissertation	CADI410P	Dissertation Phase – I	6	933
		TOTAL CREDITS			21	
	8	Major Course 17	CADS404T	Data Science (Theory)	3	915
			CADS405L	Data Science (Lab)	2	916

		Major Course 18	CAOR406T	Operation Research	5	917
		Minor Course 9	CADV409T	Data Visualization	3	928
		Research Project / Dissertation	CADI411P	Dissertation Phase – II	6	934
		TOTAL CREDITS			19	
BCA (Honours)						
IV	7	Minor Course 7	CARM408T	Research Methodology	2	927
		Research Project / Dissertation	CADI410P	Dissertation Phase – I	18	933
		TOTAL CREDITS			20	
	8	Research Project / Dissertation	CADI411P	Dissertation Phase – II	20	934
		TOTAL CREDITS			20	
BCA (Honours) with Research						
V	9	Major Course 19		Mathematical Foundation for Computer Science	4	
		Major Course 20		Theory of Computation	4	
		Minor Course 8/9		Blockchain Fundamentals	4	
		Specialization I: (Research-Based)				
		Discipline Specific Elective-I		Deep Learning / NPTEL Course of 8 - 12 Weeks	2+2	
		Discipline Specific Elective-II		Soft Computing	2+2	
		Specialization II: (Application-Based)				
		Discipline Specific Elective-III		Development and Operation Tools / NPTEL Course of 8 - 12 Weeks	2+2	
		Discipline Specific Elective-IV		IoT and Smart City Technologies	2+2	
		TOTAL CREDITS			20	
	10	Project		Major Project (Research-Based/ Application-based)	20	
		MOOCS		NPTEL/SWAYAM Course (8 – 12 Weeks)	NC	
				List of Courses to be provided by the Department		
		TOTAL CREDITS			20	
Integrated MCA						

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	CACL100T	Computer Programming in C Language (Theory)	2
		CACL101L	Computer Programming in C Language (Lab)	2
2	Major Course 2	CADS102T	Data Structures Using C (Theory)	3
		CADS103L	Data Structures Using C (Lab)	1
3	Major Course 3	CAIJT200T	Introduction to Java Programming (Theory)	3
		CAIJ201L	Introduction to Java Programming (Lab)	1
3	Major Course 4	CALD202T	Digital Logic Design (Theory)	3
		CALD203L	Digital Logic Design (Lab)	1
4	Major Course 5	CAOS204T	Operating System (Theory)	3
		CAOS205L	Operating System (Lab)	2
4	Major Course 6	CACA206T	Computer Organization and Architecture (Theory)	3
		CACA207L	Computer Organization and Architecture (Lab)	2
4	Major Course 7	CARD208T	Relational Database Management Systems (Theory)	3
		CARD209L	Relational Database Management Systems (Lab)	1
5	Major Course 8	CACN300T	Computer Network Fundamentals (Theory)	3
		CACN301L	Computer Network Fundamentals (Lab)	2
5	Major Course 9	CAFW315T	Full Stack Web Development (Theory)	3
		CAFW316L	Full Stack Web Development (Lab)	2
5	Major Course 10	CASE304T	Software Engineering (Theory)	3
		CASE305L	Software Engineering (Lab)	1
6	Major Course 11	CACC306T	Cloud Computing	4
6	Major Course 12	CAMD317T	Mobile Application Development (Theory)	2
		CAMD318L	Mobile Application Development (Lab)	2
6	Major Course 13	CANS308T	Network Security	4
6	Major Course 14	CAPW309P	Minor Project	4
7	Major Course 15	CAPM400T	Python and Machine Learning (Theory)	3
		CAPM401L	Python and Machine Learning (Lab)	2
7	Major Course 16	CADA402T	Design and Analysis of Algorithm (Theory)	3
		CADA403L	Design and Analysis of Algorithm (Lab)	2
8	Major Course 17	CADS404T	Data Science (Theory)	3
		CADS405L	Data Science (Lab)	2
8	Major Course 18	CAOR406T	Operation Research	5

CACL100T: COMPUTER PROGRAMMING IN C LANGUAGE
(2 credits – 30 hours) (L-T-P: 2-0-0)

Objective:
The objective of the course is to learn the concept of C programming language and to solve the problem statement using the C language.

COURSE / LEARNING OUTCOMES
At the end of this course, students will be able to:
CO 1: Define information based on the understanding of the concepts of C language's syntax, data types, control statements, functions, pointers, arrays, structures and pointers in C. (Understanding)
CO 2: Solve problems using standard algorithms, translate pseudo-codes into C programs, and implement them. (Applying)
CO 3: Evaluate the data structure, function, data types, and algorithms used for searching, sorting, solving problem instances, etc. in terms of correctness and computation cost. (Evaluating)
CO 4: Combine the various concepts and ideas learned in C to plan, propose, and develop a product. (Creating)

Module I: Introduction to Algorithms and Programming Languages (8 hours)
Introduction to structured programming and problem-solving methods: algorithms, key features of algorithms, flowcharts,

pseudocode, generation of programming languages, structured programming languages.
Overview of C: introduction to C, basic structure of a C program, compiling and executing C programs, comments, characteristics of a good program, character set, identifiers, keywords, data types, constants, and variables, I/O statements, operators, and expressions, precedence and associativity of operators, type conversion, and typecasting.

Module II: Decision Control Statements, Loops and Functions (8 hours)
Decision Control Statements and Loops: Introduction to Decision Control Statements, Conditional Branching statements, while loop, do-while loop, for loops, Nested Loops, Break and Continue Statements
C Functions: Need for functions, function declaration and definition, user defined and library functions, passing parameters to function, return statement, scope of variables, storage classes, recursive functions.

Module III: Arrays, Strings and Pointers (8 hours)
Arrays and Strings: One-dimensional arrays, passing array to function, multidimensional arrays and their applications, character arrays and string operations.
Pointers: Introduction to pointers, pointer expressions, dynamic memory allocation.

Module IV: Structures and Unions (6 hours)
Structures and Unions: Declaration of structures and simple implementation of structures, unions, enumerated data types.

Suggested Readings
1. Thareja, R., Computer Fundamentals and Programming in C, Oxford University Press, New Delhi.
2. Gottfried, Byron S., Programming with C (Schaum's Outlines Series), Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Kernighan, B.W., and Ritchie, Dennis M., The C Programming Language, Prentice Hall Pvt. Ltd, New Jersey.

E Resources
1. NPTEL SWAYAM Course on- Introduction To Programming In C- By Prof. Satyadev Nandakumar, IIT Kanpur
2. NPTEL SWAYAM Course on- Problem-Solving Through Programming In C, By Prof. Anupam Basu, IIT Kharagpur
3.
4. C Programming - Learn Computer Programming With C Language, Udemy

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	L	H	H	M
CO 3	H	H	M	M
CO 4		M	H	H

CACL101L: COMPUTER PROGRAMMING IN C LANGUAGE LAB

(2 credits – 30 hours) (L-T-P: 0-0-2)

Objective
The objective of the course is to learn how to solve problems using c programming language.

COURSE / LEARNING OUTCOMES
At the end of the Lab experiments students will be able to:
CO 1: Interpret information based on their understanding of the concepts of C language's syntax, data types, control statements, functions, pointers, arrays, structures and pointers in C. (Understanding)
CO 2: Solve problems using standard algorithms and translate pseudo-codes into C programs and implement them. (Applying)
CO 3: Apply their analytical skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. (Analysing)

List of experiments:
1. Introduction to OS: Linux/Unix, Vi editor, file handling, directory structures, creating and editing simple C programs.
2. C programming using variables, assignment and simple arithmetic expressions
3. If else
4. Switch-case statements
5. Break, continue
6. Loops
7. Single and multidimensional arrays
8. Functions and recursion
9. Pointers, address operator, declaring pointers and operations on pointers

Suggested Readings

1. Balagurusamy, E., Computer Fundamentals and C Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Kanetkar, Y., Let us C, BPB Publication, New Delhi

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX
CO 1	L	M	L	L	L	H	H	H	H
CO 2			L	L	L	H	M	H	H
CO 3	L	M	M	M	H	H	H	H	H

CADS102T: DATA STRUCTURES USING C

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of the course is to learn how to create data structures to represent a collection of similar data and solve problems using C language.

COURSE / LEARNING OUTCOMES

At the end of this course, students will be able to:

CO 1: Recall the basic C constructs and familiarize with basic C syntax, also define and outline the relationship between data and operations on these data using different data structures like arrays, linked list, stacks and queues, graphs and trees. (Remembering)

CO 2: Define C constructs for explaining and generalizing these data structures and choosing appropriate algorithms for efficient program design using C syntax. (Understanding)

CO 3: Compute and demonstrate these data structures and algorithms in different real world problem domain (Applying)

CO 4: Review the choice of data structure and algorithms based on the problem domain. (Evaluating).

Module I: Arrays and Lists (13 Hours)

Data Type, Abstract Data Type, Data Structure, Fundamental and Derived Data Types, Array as a data structure, Representation of arrays: single and multidimensional, Address calculation using column and row major ordering; insertion and deletion in arrays; use of arrays for matrix representation and manipulation (addition, multiplication).

Linked List as a data structure; operations on lists; singly linked list (with one or two external pointers), doubly linked list, circular list; use of linked lists for polynomial representation and manipulation (addition and multiplication), and sparse matrix representation and manipulation (inputting, adding, and displaying in matrix form).

Module II: Stacks and Queues (12 Hours)

Stacks and Queues as data structures; implementation of stacks and queues using arrays and linked lists; Circular Queue, Priority Queue; Application of stacks: Conversion of infix (containing arithmetic operators including exponential operator, and parenthesis) to postfix and prefix expressions; evaluation of postfix expression.

Module III: Trees and Graphs (10 Hours)

Binary Trees and General Trees, Representation of trees using linked lists, Binary tree traversal methods, recursive and non-recursive algorithms for traversal methods, Binary search trees (creation, insertion and deletion of a node), Height balanced (AVL) binary trees (construct and traverse an AVL tree), B-tree (construction and traversal of a B-tree of given order)

Introducing Graphs; Graph representation: Adjacency matrix, adjacency lists, incidence matrix; Traversal schemes: Depth first search, Breadth first search

Module IV: Searching and Sorting (10 Hours)

Linear and binary search, Indexed search; Hashing, Hash Functions (division method, mid square method, folding), Basic Sorting algorithms.

Suggested Readings

1. Lipschutz, S., Theory and Problems of Data Structures (International Edition), Schaum's Outline Series, New Delhi: Tata McGraw-Hill.
2. Kanetkar, Y. P., Data Structures Through C Language, New Delhi: BPB Publications.
3. Chattopadhyay, S.; D. G. Dastidar; M. Chattopdhyay, Data Structures Through C Language, New Delhi: BPB Publications.

E Resources

1. NPTEL SWAYAM Course on- Data Structure using C Programming, By Dr. Dipti Verma and Mr. Aditya Tiwari, Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

2. Data Structures and Algorithms In C (DSA) by Udemy

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		
CO 3			H	M
CO 4		M	M	H

CADS103L: DATA STRUCTURES USING C Lab

(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Recall the basic C constructs and familiarize with basic C syntax, also define and outline the relationship between data and operations on these data using different data structures like arrays, linked list, stacks and queues, graphs and trees. (Remembering)

CO 2: Define C constructs for explaining and generalizing these data structures and choosing appropriate algorithms for efficient program design using C syntax. (Understanding)

CO 3: Compute and demonstrate these data structures and algorithms in different real world problem domain (Applying)

CO 4: Review the choice of data structure and algorithms based on the problem domain. (Evaluating).

Solution of problems on-

1. Arrays
2. Stacks and Stack Application, Queues
3. Linked Lists, Circular and Doubly Linked Lists
4. Binary Trees
5. Searching and data modification: Linear search, Binary search, Hashing
6. Sorting Techniques: Selection, Insertion, Bubble Sort.

Suggested Readings

1. Lipschutz, S., Theory and Problems of Data Structures (International Edition), Schaum's Outline Series, New Delhi: Tata McGraw-Hill.
2. Kanetkar, Y. P., Data Structures Through C Language, New Delhi: BPB Publications.
3. Chattopadhyay, S.; D. G. Dastidar; M. Chattopdhyay, Data Structures Through C Language, New Delhi: BPB Publications.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M			M	M
CO 2	M	H			H	H
CO 3	M		H	M		
CO 4		M	M	H	M	M

CAIJ200T: INTRODUCTION TO JAVA PROGRAMMING

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The course is designed to impart the knowledge and skill required to solve real-world problems using an object-oriented approach utilizing Java language constructs. This course covers the two main parts of Java i.e. Java Language and Java Library (JDK 5).

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Recall the knowledge of the structure and model of the Java programming language, (Remembering)

CO 2: Explain the use of Java programming language for various programming technologies (Understanding)

CO 3: Develop software in the Java programming language. (Applying)

CO 4: Analyse user requirements for software functionality required to decide whether the Java programming language can meet user requirements. (Analysing)

CO 5: Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (Evaluating)

CO 6: Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (Creating)

Module I: Java Fundamentals (16 hours)
Genesis, Java Philosophy, Java & Internet, Object-Oriented Programming features, Java Applet and Application, Java Environment and Java Development Kit (JDK) and Java Standard Library (JSL), Tokens, Expressions, Using Data Types, Declarations, Control Flow

Module II: Java Classes, Packages and Interfaces, Java Streams (14 hours)
a) Introduction, Classes, Working with Objects, Packages, Inheritance, Interfaces
b) Data Flow with Java Streams, Input Streams, Output Streams

Module III: Exception Handling in Java and Java threads (10 hours)
a) Introduction, Exception Methods, java.lang Exceptions
b) Introduction, Creating Threads, the Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads

Module IV: Java Applets (10 hours)
Introduction, Applet Examples, The java.applet.Applet Class, The Five Stages of an Applet's Life Cycle, Methods for Adding UI Components, Methods for Drawing and Event Handling

Module V: Java AWT (10 hours)
Introduction, Swing Component and Container classes, Layout managers (Flow Layout, Grid Layout, Border Layout), Handling events, Adapter classes, Anonymous inner classes, Swing GUI components :JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollBar, JScrollPane, JToolTip, JPanel, JFrame, introduction to database connectivity with JDBC.

Suggested Readings
1. Deitel, H. M.; P. J. Deitel, Java: How to Program, New Delhi: Prentice Hall India
2. Schildt, H., The Complete Reference Java 2, New Delhi: Tata McGrawHill
3. Moss, K., Java Servlets, New Delhi Tata McGraw-Hill
4. Russell, Java Programming for the absolute Beginner, New Delhi: Prentice-Hall India
5. Hanagan D., Java Examples in a Nutshell, New Delhi: O' Reilly

E Resources
1. Coursera course on Introduction to Java
2. Udemy Course on Java Programming for Complete Beginners

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	H	M			
CO 3		M	M	M	M
CO 4		M	M	M	M
CO 5		M	M	M	M
CO 6		M	M	M	M

CAIJ201L: Introduction to Java Programming Lab

(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES
At the end of the Lab experiments students will be able to:
CO 1: Identify classes, objects, members of a class and relationships among them needed for a specific problem.(Remembering/Evaluating)
CO 2: Write Java application programs using OOP principles and proper Program structuring. (Applying/Understanding)
CO 3: Demonstrate the concepts of polymorphism and inheritance .(Applying)
CO 4: Write Java programs to implement error handling techniques using exception handling.(Applying)
CO 5: Analyse the real world problems and solve using Java programming .(Analysing/ Applying)

List of Experiments
1. Java Fundamentals using Data Types, Declarations, Control Flow
2. Java Classes and Java Packages
3. Java Interfaces and Java Streams

4. Java Exception Handling
5. Java Threads
6. Java Applets
7. Java AWT

E-resource for learning

1. Java, www.spoken-tutorial.org

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H	H					
CO 2	M	M	M	M			
CO 3			M				
CO 4				H			
CO 5					M	M	M

CALD202T: DIGITAL LOGIC DESIGN

(3 credits–45 hours) (L-T-P) (2-1-0)

Objectives

This course covers the basic concepts of digital logic. The course includes the fundamental concepts of Boolean algebra and its application for circuit analysis, multilevel gates networks, flip-lops, counters logic devices and synchronous and asynchronous sequential logic and digital integrated circuits.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: To solve conversion among different number systems (Applying)

CO 2: Apply the knowledge of Boolean algebra, Karnaugh-map or tabulation method to minimise Boolean expressions. (Applying)

CO 3: Design and analyse a given combinational/ sequential circuit and determine the corresponding truth table/ state table. (Analysing)

Module I: Number Systems (6 Hours)

Binary, Octal, & Hexadecimal Number Systems and Their Conversions, Representation of Signed Numbers-Floating Point Number, Binary Arithmetic, Representation-of BCD-ASCII-Excess 3 -Gray Code —Error Detecting and Correcting Codes.

Module II: Boolean Algebra, Simplification of Boolean Functions (13 Hours)

Boolean Algebra: Various Boolean operations; Postulates, Theorems, Duality, Boolean functions, Canonical forms, Representation of Boolean expressions using truth tables, logic gates. Boolean expressions minimization using Karnaugh map, Realization of canonical forms from Karnaugh map, Don't Care Conditions - problems using Don't care conditions, benefit of using Don't care conditions. Tabulation method/Quine- Mc Kluskey method, prime implicants.

Module III: Combinational Logic and Sequential Logic (26 Hours)

Digital devices: Logic gates, wired-logic, 8 non-degenerate forms of NOR and NAND, multilevel NAND and NOR gats, buffer, 3-state buffer, high impedance state, Realization of other logic functions using NAND/NOR gates. Drawing logic diagrams for different types of Boolean expression derived from truth tables; A brief introduction to Combinational and sequential circuits. Difference between Combinational and sequential circuits; Arithmetic circuits: Half-adder, Full-adder, Binary Adder, Binary Parallel Adder, BCD Adder, Binary Adder-Subtractor, Half-subtractor, Binary Incrementer, carry propagation, look ahead carry, carry generator, magnitude comparator; Encoders, Decoders, Multiplexers, Demultiplexers

Flip-flops: Different types of flip-flops, Flip-flop excitation tables, characteristic equations, truth tables, Triggering of Flip-flops.

Registers: Registers (Register with Parallel Load), Shift registers

Counters: Asynchronous counters, Synchronous counters; Binary Counter with Par-allel Load, binary Ripple Counter, BCD ripple counter, synchronous binary counter, binary count-up-down counter, BCD synchronous counter.

Suggested Readings

1. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd., New Delhi, 1994
2. Thomas L. Floyd, Digital Fundamentals, Fifth Edition, Pearson Education, 2002
3. V. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996

E Resources

1. SWAYAM course on Digital System Design By Prof. Neeraj Goel, IIT Ropar
2. SWAYAM Course on Digital Circuits by Prof. Santanu Chattopadhyay, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	M
CO 3			H

CALD203L: DIGITAL LOGIC DESIGN LAB

(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES

At the end of the experiments students will be able to:

CO 1: Explain the working of the various logic gates. (Understanding)
CO 2: Experiment with different logic gates to solve any given problem. (Applying)
CO 3: Analyse a given logic circuit and point out errors in it. (Analysing)
CO 4: Evaluate the output of a logic circuit for given inputs. (Evaluating)

List of experiments-

1. *Study of the Truth tables of logic gates*
2. *Realization of half/full adder and half/full adder subtractor*
3. *Verify truth table of multiplexer and demultiplexer*
4. *Verify truth table of one bit and four bit comparators*
5. *Verify truth table of flip-flops*
6. *Simulation with VDHL*
7. *Adders*
8. *Subtractors*
9. *Logic gates*
10. *MUX and DEMUX*

Suggested Readings:

1. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd., New Delhi, 1994
2. Thomas L. Floyd, Digital Fundamentals, Fifth Edition, Pearson Education, 2002
3. V. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996

E Resources

1. SWAYAM course on Digital Logic and Circuits Simulations by Prof. Awadhesh Kumar, Banaras Hindu University

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M	M		
CO 3			M	M	H	H
CO 4			M	M	M	H

CAOS204T: OPERATING SYSTEMS

(3 Credits – 45 hours) (L-T-P: 2-1-0)

Objective

To provide the basic functionalities and services provided by an operating system. This subject provides an overview of process management, memory management, deadlock, file system, input-output systems and protection and security. It gives knowledge on existing common operating systems like UNIX, Linux and Windows.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Define the basic concepts of operating systems and terminology related to operating systems such as processes, threads, files, semaphores, IPC abstractions, shared memory regions. (Remembering)
CO 2: Analyze important algorithms such as Process scheduling and memory management algorithms. (Analysing)
CO 3: Categorize the operating system's resource management techniques, deadlock management techniques, memory management techniques. (Analysing)
CO 4: Discuss and examine the importance of File and I/O system management in operating systems. (Evaluating)

Module I: Introduction to Operating systems (5 Hours)
Definition of Operating Systems, Functions of Operating Systems, Types of Operating Systems: Batch, Multiprogrammed, Time sharing, Multi-Processor, Real-time and Distributed Operating Systems, Operating System Structures, Components and Services, System calls.

Module II: Process Management (10 Hours)
Process Concept-Definition, Process States, Process Control Block, Process Schedulers- Short term, Medium term and Long term schedulers, Scheduling Algorithms - Preemptive and Non-Preemptive, Co-operating process, Threads, Inter-process communication.

Module III: Process Synchronization and Deadlock (12 Hours)
Process Synchronization-the Critical Section Problem, Classical Problems of Synchronization, Semaphores. Deadlocks - Definition of a Deadlock, System model, Characterization, Deadlock Handling-Prevention, Avoidance, Detection and Recovery (Banker's Algorithms and Resource Request Algorithm

Module IV: Memory Management (10 Hours)
Memory Management- Logical and Physical Address Space, Address Mapping, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging. Virtual memory- Demand paging and its performance, Page replacement algorithms-FIFO and LRU, Thrashing.

Module V: File and I/O System Management (8 Hours)
File management (Systems, Secondary Storage Structure)-File Concepts, Access methods, Directory Structure, Protection and consistency, Recovery.
I/O System Management- Overview of I/O Systems, I/O Interface, Secondary Storage Structure-Disk Structure and Scheduling methods, Disk management, Swap – Space management.

Suggested Readings
1. Abraham Silberschatz and Peter Baer Galvin, "Operating System Concepts", 7th Edition, Pearson Education, 2002.
2. Tannenbaum," Modern Operating Systems", PHI
3. William Stallings, "Operating Systems", 6th Edition, Pearson Education, 2010.
4. Harvey M. Deitel, Operating Systems, Second Edition, Pearson Education Pvt. Ltd.
5. Mandik and Donovan, Operating Systems, Mcgraw Hill.

E Resources
1. NPTEL SWAYAM Course on- Introduction to Operating Systems, By Prof. Chester Rebeiro, IIT Madras
2. NPTEL SWAYAM Course on- Operating System Fundamentals, By Prof. Santanu Chattopadhyay, IIT Kharagpur
3. Operating System, Udemy

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	M
CO 2		H		H	
CO 3			H	H	
CO 4					H

CAOS205L: OPERATING SYSTEMS LAB
(2 CREDIT-30 Hours) (L-T-P) (0-0-2)

COURSE / LEARNING OUTCOMES
At the end of Introduction to Operating Systems Lab students will be able to:
CO 1: Experiment with *fork()* system call to create a new process.
CO 2: Infer the concepts related to shell programming and their significance. (Understanding)
CO 3: Experiment with various scheduling algorithms (FCFS, SJF and Round Robin). (Applying)
CO 4: Examine the results obtained from page replacement algorithms-(FIFO, LRU), and understand the underlying principles and working of space management concepts. (Analysing)

List of experiments
1. Programs using fork system calls.
2. Shell programming.
3. Programs to simulate process scheduling- FCFS, SJF and Round Robin.

4. Programs to simulate page replacement algorithms-FIFO, LRU.
5. Programs to simulate free space management.

E-resource

Linux-Ubuntu, www.spoken-tutorial.org

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	H

CACA206T: COMPUTER ORGANIZATION AND ARCHITECTURE

(3 Credits – 45 hours) (L-T-P: 3-1-0)

Objective

This course aims to provide the student with the concepts and basic knowledge necessary to understand the organisation and architecture of computing systems.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Recognize and define the basic components and design of a computer, including CPU, memories, and input/output units. (Remembering)

CO 2: Identify and classify the major components of a CPU and discuss, review the operations intrinsic to it. (Understanding)

CO 3: Discover the parameters of performance improvement and use them in predicting the issues in instruction cycle. (Applying)

CO 4: Analyse the mapping techniques of different memory units; instruction sets interpret the different performance trade-offs between them. (Analysing)

CO 5: Summarize the concepts adhered to the principles and architectures of a digital computer system to design and develop new improvised systems. (Create)

Module I: Control Unit (10 Hours)

a. Major Components of a CPU; General Register Organization; Stack Organization (Register Stack, Memory Stack, Reverse Polish Notation); Characteristics of Complex Instruction Set Computer (CISC) and Reduced Instruction Set Computer(RISC)
b. Micro operations, Control Function, Role of Three-State Bus Buffers in Memory Transfers; Arithmetic Microoperations, Logic Microoperations, Shift Microoperations; Microprogrammed Control and Hardwired Control; Control Memory, Control Word, Microinstruction, Microprogram, Mapping of Instructions; Instruction Formats(Three- Address Instructions, Two-Address Instructions and Zero-Address Instructions); Addressing modes.

Module II: Parallel Processing and Multiprocessors (12 Hours)

a. Parallel Processing: Flynn's Classification of computers; Pipelining, Data Dependency,Handling of Branch Instructions, Delayed Load, Delayed Branch; Vector Processing, Supercomputers; Array Processors.
b. Multiprocessors: Tightly Coupled, Loosely Coupled;

Module III: Memory Organization (10 Hours)

Hardware Organization for Associative Memory; Mapping methods for Cache Memory (Associative Mapping, Direct Mapping, Set-Associative Mapping), Write Through, Write Back, Cache Initialization, Cache Coherence; Virtual Memory, Memory management hardware.

Module IV: Input-Output Organization (13 Hours)

Input Output Interface, I/O Bus, Memory Bus, Isolated I/O, Memory-Mapped I/O; Asynchronous Data Transfer, Strobe Control, Handshaking; Modes of Transfer- viz. Direct Memory Access, Programmed I/O, and Interrupt-Initiated I/O; Priority Interrupt (Daisy-Chain Priority, Parallel Priority Interrupt, Priority Encoder); Input-Output Processor; Serial Communication(Character-Oriented Protocol and Bit-Oriented Protocol).

Suggested Readings

1. M. Morris Mano, Computer System Architecture, Third Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
2. V. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996
3. William Stallings, Computer Organization and Architecture, Sixth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2002

E Resources

1. SWAYAM course on Computer Architecture and Organization by Prof. Indranil Sengupta, Prof. Kamalika Datta, IIT Kharagpur
2. SWAYAM course on Computer Architecture by Prof. Smruti Ranjan Sarangi, IIT Delhi

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	M		
CO 3		M	H	L	
CO 4			H	L	
CO 5					H
CO 6			H	H	L

CACA207L: COMPUTER ORGANISATION AND ARCHITECTURE LAB

(2 credits – 30 hours) (L-T-P: 0-0-2)

Objective

This course aims to provide the student with the concepts and basic knowledge necessary to develop the organization and architecture of computing systems.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO 1: Recall different OPcodes and syntax used in 8086 (Remembering).

CO 2: Illustrate the syntax of 8086 assembly language (Understanding).

CO 3: Choose the appropriate method to Categorize different types of OPcodes and write an 8086 assembly program (Evaluating).

Module I:

Dismantling and assembling a PC along with study of connections, ports, chipsets, SMPS etc.

Module II:

Assembly language programming using IA32(gcc), Introduction of gcc assembly programming, Verification of Instruction Set, Arithmetic operations

Module III:

Addition, Subtraction, Multiplication and Division of two 8-bit numbers.

Multi byte Addition and Subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.

Module IV:

Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.

By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.

DOS/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

Suggested Readings

1. V. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996
2. William Stallings, Computer Organization and Architecture, Sixth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2002

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	H	H	M
CO 2	M	M	L	L
CO 3		H	H	H

CARD208T: RELATIONAL DATABASE MANAGEMENT SYSTEMS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objectives of this course are to give students an in-depth understanding of the relational model for establishing fundamental skills with SQL and the operation of an RDBMS. The course also provides concepts of data modeling, design, and management for solving real problems.

COURSE / LEARNING OUTCOMES:

At the end of this course, students will be able to:

CO 1: Define the terminologies and features related to database systems and also describe the main functions and benefits of each of the database systems. (Remembering)

CO 2: Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database. (Understanding)

CO 3: Master sound design principles for the logical design of databases, including the E-R model, EER model, and schema diagrams. (Evaluating)

CO 4: Transform an information model into a relational database schema and use the various types of query languages to implement and use the schema using a DBMS. (Applying)

CO 5: Analyze the concepts used for transaction processing and also the issues and techniques related to concurrency and recovery management. (Analyzing)

Module I (10 hours)

a. Database System – Database, Database System, DBMS, Advantages of using the database system, Functionalities of the database, Data Independence, Data Abstraction

b. Data models - Entity Relationship (ER), Enhanced Entity Relationship (EER), Mapping ER Model to Relational data model, Hierarchical and Network data models, Object Oriented and Object-Relational Data Models

Module II (15 hours)

a. SQL Queries - Relation Query Languages, SQL data types, Data Definition Language (DDL) commands, Data Manipulation Language (DML) commands, Data Retrieval commands, Single-row and Group functions, Multi-table querying (Joins and Subqueries)

b. Query Languages - Relational Algebra, Tuple and Domain Relational Calculus, Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.

Module III (8 hours)

a. Normalization: Concepts of Normalization and Denormalization, First Normal Form, Second Normal Form, Third Normal Form, Fourth Normal Form, and Fifth Normal Form

b. Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Query Optimization Algorithms

Module IV (12 hours)

a. Storage Strategies: Indices, B-Trees, Hashing, Transaction processing: Recovery and Concurrency Control, Locking and Timestamp based Schedulers

b. Advanced topics: Web Databases, Distributed Databases, Data Warehouse, and Data Mining.

Suggested Readings

1. Ramez Elmasri and Shamkant B Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education
2. Abraham Silberschatz, Henry F Korth and S Sudarshan, Database System Concepts, 5th Edition, Mc-Graw Hill.
3. C.J. Date, Introduction to Database Systems, 8th ed., Pearson Education.
4. Bipin Desai, An Introduction to Database System, Galgotia Publication.

E Resources

1. SWAYAM Course on Database Management System by Prof. Partha Pratim Das, IIT Kharagpur
2. SWAYAM Course on Database Management Systems by Dr. K. Arul Deepa, Assistant Professor, Dr.K.Arul Deepa & Dr.P.Velvizhy, Asst. Professor Dept. of IST, Anna University, CEG, Chennai, Anna University, Chennai, Anna University

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2	L	M	H	
CO 3		M		H
CO 4			M	H
CO 5			H	M

CARD209L: RELATIONAL DATABASE MANAGEMENT SYSTEMS LAB

(1 credit – 15 hours) (L-T-P:0-0-1)

Objective

The objectives for this course are to give students an in-depth understanding of the relational model for establishing

fundamental skills with SQL and the operation of an RDBMS. The course also provides concepts of data modelling, design and management for solving realistic problems.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Infer database language commands to create simple database
CO 2: Analyze the database using queries to retrieve records
CO 3: Applying PL/SQL for processing database

Module I: SQL Queries (10 hours)

SQL Queries: Data Definition Language (DDL) commands – CREATE, DROP, ALTER and RENAME; Data Manipulation Language (DML) commands – INSERT, UPDATE, and DELETE; Data Retrieval command – SELECT, Single-row Functions – String functions, Numeric Functions, Date-Time Functions, General Functions, Data Type Conversion Functions; Group functions -SUM, AVG, MIN, MAX, COUNT, Multi-table querying (Joins and Subqueries)

Module II: PL/SQL Programming (5 hours)

PL/SQL Programming: PL/SQL Block Structure – DECLARE, BEGIN, END, EXCEPTION, SQL Within PL/SQL, Loops and Decision making statements, Cursor Types – Implicit and Explicit cursors

Suggested Readings

1. Ramez Elmasri and Shamkant B Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education
2. Abraham Silberschatz, Henry F Korth and S Sudarshan, Database System Concepts, 5th Edition, Mc-Graw Hill.
3. C.J. Date, Introduction to Database Systems, 8th ed.,Pearson Education.
4. Bipin Desai, An introduction to Database System, Galgotia Publication.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	L
CO 3		H

CACN300T: COMPUTER NETWORK FUNDAMENTALS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to make the students understand basic terminologies of computer networks along with their types, mode of communication, models, transmission media, connecting devices. It also emphasizes to make the students aware about network security and basic conception of the World Wide Web.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Define the basic concepts of Computer Networks, its goals and network related terminologies. (Remembering)
CO 2: Explain the concepts of Analog and Digital signals, Electromagnetic spectrum and related concepts on various architecture used in computer networks. (Understanding)
CO 3: Experiment with various Networks concepts such as Types of networks, Topologies, Transmission media. (Applying)
CO 4: Comprehend Network Security Devices, Digital Signature and Internet Basics for designing the network with a suitable topology and network types. (Creating)

Module I: (15 Hours)

Computer Network: Definition, Goals, Applications, Structure, Components, Topology, Types of Topology, Types of Networks (LAN, MAN, WAN, Internet), Broadcast and Point-To-Point Networks, Communications Types (Synchronous, Asynchronous), Modes of Communication, Topology, Client/Server architecture, Network Models, Design issues of the layer, Protocol Hierarchy, ISO-OSI Reference Model (Functions of each layer),Terminology, SAP, Connection Oriented and connectionless services, Peer Entities, TCP/IP model, Layers, Ports, Protocol Stack, Comparison of ISO-OSI and TCP/IP Model

Module II: (15 Hours)

Transmission Media, Classes of Transmission Media, Guided Media: Coaxial Cable, Twisted Pair, Fiber Optics Cable, Connectors, Unguided Media (Wireless), Electromagnetic Spectrum for Wireless Communication, Propagation Methods (Ground, Sky, Lineof-Sight), Wireless Transmission, Radio Waves, Infrared, Microwave, Wireless LANs Architecture, MAC Sublayer, Frame Format,Frame Types, Bluetooth Architecture.

Module III: (15 Hours)

Analog and Digital Signals, Data Encoding, Parallel and Serial Transmission, Network Connectivity Devices, Categories of

Connectivity Devices, Passive and Active Hubs, Repeaters, Bridges, Switches (2-Layer Switch, 3-Layer Switch (Router)), Gateways, Network Interface Cards (NIC), Internetworking Principles, Network Security : Definition, Network Security Requirements and Attacks, Network Security Devices (firewalls, Proxy Server), Encryption and Digital Signatures, Internet Basics, Concept of Intranet and Extranet, Web Server, World Wide Web (WWW) Architecture, Web Documents, Search Engines, Internet Service Providers (ISP).

Suggested Readings

1. Andrew S. Tannenbaum, "Computer Networks", Tata McGraw-Hill Publishing Company Limited New Delhi.
2. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill Publishing Company Limited New Delhi.
3. William Stallings, "Data and Computer Communications", Pearson Education Asia.

E Resources

1. Udemy Course on Computer Network Fundamentals
2. Coursera course on Networking Fundamentals

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	L	M	M
CO 2		M	M
CO 3	L	L	L
CO 4	H		H

CACN301L: COMPUTER NETWORK FUNDAMENTALS LAB

(2 credits – 30 hours) (L-T-P: 0-0-2)

COURSE / LEARNING OUTCOMES

At the end of this course, students will be able to:

CO 1: Implement various commands and evaluate the significance of socket programming used in networking. (Understanding)
CO 2: Make client-server communication with optimum algorithm and topology. (Creating)
CO 3: Make a distinctive comparison of various routing algorithms to select the optimum network path for data transfer.(Analysing)

List of Experiments

1. Basic Networking Commands and troubleshooting.
2. Introduction and implementation of LAN Trainer for various topologies and protocols simulation.
3. Programs using TCP Sockets (like date and time server and client, echo server and client, file transfer, etc.)
4. Programs using UDP Sockets (like simple DNS, file transfer, etc.)
5. Program to implement Remote Command Execution.
6. Create HTTP socket for web page upload and download.
7. Perform a case study on the following routing algorithms to select the optimum network path for data transfer.
   a. Shortest path routing
   b. Flooding
   c. Distance vector

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	L	H	L	L	M	M	L
CO 2	L	H	M	M	H	M	L
CO 3			M	M			H

CAWT302T: WEB TECHNOLOGIES

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies.

COURSE / LEARNING OUTCOMES

On successful completion of the course students will be able to:

CO 1: Recall the various Internet related terminologies and examine the history and growth of Internet. (Remembering)
CO 2: Identify and differentiate the various services provided by the internet. (Understanding)
CO 3: Experiment with various mark-up languages and style sheets to design a static website. (Applying)
CO 4: Experiment with various scripting languages to design a dynamic website. (Applying)
CO 5: Develop and create a website using standard tools and technologies. (Creating)

Module I: Basic Internet-related Terms and Static Web Development (13 Hours)

Basics of Internet – History of Internet and WWW, W3C Recommendations, Internet Connectivity (Dial-up, Leased Line, DSL, WiFi, and VSAT); Requirements for Internet Connectivity; Search Engines, Various Internet Services; Web Portal; Different types of browsers (IE, Firefox, Chrome); URLs, Domain names

Static Web Development: Introduction to XHTML; HTML vs. XHTML, XHTML comments; Basic Tags-XHTML, HEAD, TITLE, BODY; Paragraph Tag, Horizontal Rule Tag, Headings Tags, Blockquote Tag, Lists, Linking, Images, Tables, FONT Tag, PRE, DIV and SPAN tags; other different formatting tags; Forms; Frames

Module II: CSS and XML (12 Hours)

Cascading Style Sheets: Types of Style Sheets-Inline, Embedded, and External; CSS Background properties, text and font properties, Use of CSS for positioning elements, Background, and Text flow, CSS Box Model, CSS Borders and Outlines, Style class and Pseudo-class

XML: Introduction to XML; Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Parser; Document Object Model; Extensible Stylesheet Language (XSL)

Module III: Website Design Considerations and JavaScript (12 Hours)

Website Design Considerations: Planning to design a website, sitemaps, top-down vs. bottom-up approach, Creating a Compatible website for different color depths, resolutions, and browser considerations)

DHTML: Introduction to DHTML and JavaScript, Data types, operators, variables, input and output statements, Built-in functions, Arrays, If statement, Switch statement, Looping statements, JavaScript Form Validation, Events in JavaScript.

Module IV: Web Servers and PHP (8 Hours)

1. Web servers: Need of a web server; System Architecture of a Web server; HTTP Request Types; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Various web servers- Microsoft IIS, Apache, NGINX, LAMP, WAMP
2. PHP: Introduction to PHP; PHP Data Types; Control Structures; Functions; Strings; Arrays

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

E Resources

1. Spoken Tutorial on HTML by Praveen S, IIT Bombay
2. Spoken Tutorial on CSS by Neha Solanki, IIT Bombay
3. Spoken Tutorial on JavaScript by Jayesh K Ramalingaiah
4. Spoken Tutorial on PHP by Kavita Kharad

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			L
CO 2	H			
CO 3	H	H		
CO 4			H	H
CO 5		L	L	H

CAWT303L: WEB TECHNOLOGIES LAB

(2 CREDIT - 30 HOURS)

Objective

The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this

course, students should be able to design and implement a website on their own by including client-side and server-side technologies.

COURSE/LEARNING OUTCOMES

At the end of the experiments, students will be able to

CO 1: Experiment with various mark-up languages and style sheets to design a static web site (Applying)
CO 2: Develop and create a dynamic website using scripting languages. (Creating)
CO 3: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (Evaluating)

Module I: Static Web Designing (10 Hours)

Web Designing: Creating static websites involving various XHTML elements
Cascading Style Sheets: Designing web pages that use CSS for standard formatting

Module II: Dynamic Web Designing (5 Hours)

JavaScript: Designing websites that use JavaScript for creating interactive web pages
PHP: Designing websites that use PHP as server-side scripting language to connect and access the web server

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3	H	H

CASE304T: SOFTWARE ENGINEERING

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

To provide the ability to analyse a scenario and produce a problem statement. The learners will be able to produce a conceptual solution which includes sample prototypes, domain models, and user stories. The learners will be able to describe the attributes and activities involved in software development process models and testing.

COURSE/LEARNING OUTCOMES

At the end of this course, students will be able to:

CO 1: Relate and examine the life cycle models of software. (Remembering)
CO 2: Interpret and differentiate various software life cycle models(Understanding)
CO 3: Experiment with different software architectures and identify the best feasible one (Applying)
CO 4: Analyse and design the software requirement specification and formulate an effort estimation plan (Analysing)
CO 5: Develop and create various design diagrams and find solutions to problems. (Creating)

Module I (15 Hours)

Problems and solutions: Why software is developed. Problem and vision statements. Goals and objectives. Definitions and paradigms, A generic view of software engineering. Software development life cycle, Role of quality, metrics and measurement, The feasibility study, Software Requirement Analysis and Specifications, work breakdown structure (WBS), Problem Analysis, Creating software requirement specification document (SRS).

Module II (15 Hours)

Process Models: How software is built. The fundamental design concept for data, architectural and procedural designs, Conceptual solutions, Agile concept and User stories. Domain modeling with UML diagrams-Class diagram, Use cases etc, Object oriented design paradigm; Creation of technical design document, The relationship between design and implementation, Coding the procedural design, Good coding style and review of correctness and readability.

Module III (15 Hours)

Strategies of software testing. Types of testing, functional testing, validation and verifications, Test Case Design, Maintenance as part of software evaluation, techniques and procedures for maintenance, Introduction to configuration Management, The concept of CASE, green engineering.

Suggested Readings

1. Sommerville, "Software Engineering", Addison Wesley.
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

E Resources

4. Udemy course on Complete Software Engineering Course : Build Better Software
5. NPTEL course on Software Engineering By Prof. Rajib Mall, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	L
CO 2		H	L
CO 3	H	M	L
CO 4		H	H
CO 5			H

CASE305L: SOFTWARE ENGINEERING LAB

(1 Credit – 15 hours) (L-T-P: 0-0-1)

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO 1: Implement the software engineering process to develop any software project and formulate an effort estimation plan. (Understanding)
CO 2: Apply software design patterns. (Applying)
CO 3: Maintain the software project by using maintenance plan. (Creating)

Module I (5 Hours)

Identifying the requirements from problem statements.
Estimation of project metrics. Modelling Data Flow Diagrams

Module II (3 Hours)

Development of User stories.
Identifying domain classes from the problem statements

Module III (7 Hours)

Modeling UML use case diagram & capturing use case scenarios
Class diagram, Activity diagram etc.
Designing test suite and testing.

Suggested Readings

1. Lab using IBM RSA tools
2. Virtual lab Weblink: http://vlabs.iitkgp.ernet.in/se/

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	L	H
CO 2	L	H	H
CO 3	H	L	H

CACC306T: CLOUD COMPUTING

(4 credits-60Hours) (L-T-P: 4-0-0)

Objective

This course is designed to enable students

- *To get acquaint with the latest computational model, i.e. cloud computing*
- *To understand the basic foundational elements of cloud computing*
- *To study details of Data storage in cloud, big data file handling and parallel computing basics*

- *To get familiarized with popular cloud platforms and applications*

COURSE / LEARNING OUTCOMES

On successful completion of the course students will be able to:

CO 1: Recall and identify the various cloud service models. (Remembering)
CO 2: Understand the basic concepts of Big Data and interpret using Hadoop. (Understanding).
CO 3: Identify and relate security issues with respect to cloud environment. (Applying)
CO 4: Analyse the Quality of Service rendered by various cloud service providers. (Analysis)

Module I: Introduction and Cloud Service Models (15 Hours)

Introduction to Cloud Computing, the Evolution of Cloud Computing, Hardware Evolution, Internet Software Evolution, Server Virtualization, Web Services Deliver from the Cloud, Communication-as-a-Service, Infrastructure-as-a-Service, Monitoring-as-a-Service, Platform-as-a-Service, Software-as-a-Service, Building Cloud Network on amazon web service as VPC.

Module II: Cloud data handling (18 Hours)

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, The Map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Map-reduce.

Module III: Security Issues (15 Hours)

Putting security on the spot with questions: Understanding Security Risks, Reducing Cloud Security Breaches, Vulnerability assessment tools, Cloud computing security architecture, Architectural considerations, general issues, Trusted cloud computing, Cloud computing security challenges, Virtualization security management, VM Security recommendations, Secure execution environments and communications in cloud.

Module IV: Quality of Service (QoS) in Cloud (12 Hours)

Issues in cloud computing, implementing real-time application over cloud platform, Issues in Inter cloud environments, Dependability, Dita migration, streaming in cloud, Quality of Service (QoS) monitoring in cloud computing environment, taking virtualization into cloud, develop an application on cloud platform and deploy.

Suggested Readings:

1. John W. Rittinghouse , "*Cloud Computing: Implementation, Management, and Security*", CRC Press
2. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "*Cloud Computing for Dummies*",Wiley India Edition
3. Gautam Shroff, "*Enterprise Cloud Computing*", Cambridge
4. Ronald Krutz and Russell Dean Vines, "*Cloud Security*", Wiley-India
5. Jeffrey Dean, Sanjay Ghemawat, "*MapReduce: Simplified Data Processing on Large Clusters*", OSDI'04: Sixth Symposium on Operating System Design and Implementation,San Francisco, CA, December, 2004.
6. Tim Malhar, S.Kumaraswammy, S.Latif,"*Cloud Security & Privacy*",SPD,O'REILLY
7. Antohy T Velte, et.al,"*Cloud Computing : A Practical Approach*", McGraw Hill,

E Resources

1. http://aws.amazon.com/
2. SWAYAM course on Cloud computing by Prof. Soumya Kanti Ghosh, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3			H	L
CO 4			M	H

CAAD307T: ANDROID APPLICATION DEVELOPMENT FUNDAMENTALS

(4 credits-60Hours) (L-T-P: 4-0-0)

Objective

This course is designed to enable students to get a complete understanding of the development of android applications. On completion of this course, students will be able to design, develop, debug and deploy various real-time applications.

COURSE / LEARNING OUTCOMES

CO 1: Interpret the android architecture and configure the development environment (Understanding)

CO 2: Design and build user defined app with different types of menus and views (Applying)
CO 3: Make use of AsyncTask for accomplishing different background task (Applying)
CO 4: Create SQlite database and use views to interact with the database and publishing of application.(Creating)

Module I: Get started (10 Hours)
Get started: Build your first app, Introduction to Android, Create Your First Android App, Layouts, Views and Resources, Text and Scrolling Views.Activities: Understanding Activities and Intents, the Activity Lifecycle and Managing State,Activities and Implicit Intents. Testing, debugging, and using support libraries: The Android Studio Debugger, Testing your App, The Android Support Library

Module II: User experience (13 Hours)
User interaction: User Input Controls, Menus, Screen Navigation, RecyclerView, Delightful user experience: Drawables, Styles, and Themes, Material Design, Providing Resources for Adaptive Layouts Testing your UI: Testing the User Interface

Module III: Working in the background (15 Hours)
Background Tasks: AsyncTask and AsyncTaskLoader, Connect to the Internet, Broadcast Receivers, Services, Triggering, scheduling and optimizing background tasks: Notifications, Scheduling Alarms, Transferring Data Efficiently

Module IV: All about data (22 Hours)
Preferences and Settings: Storing Data, Shared Preferences, App Settings b) Storing data using SQLite: SQLite Primer, SQLite Database, Sharing data with content providers: Share Data Through Content Providers d) Loading data using loaders: Loaders. Permissions, Performance and Security, Firebase and AdMob, Publish

Suggested Readings
1. Android Developer Fundamentals Course – E-book by the Google Developer Training team.
2. The practical workbook: Android Developer Fundamentals Course—Practical's E-book.
3. Slide decks & Videos of lectures for reference provided by Google.

E Resources
4. Udemy Course on Learn Android Application Development: A beginner course on Android Application development
5. Coursera Course on Introduction to Android Mobile Application Development

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3		H	H	
CO 4			M	H

CANS308T: NETWORK SECURITY

(4 credits – 60 hours) (L-T-P:4-0-0)

Objective

The objective of the course is to learn the network security attacks, system vulnerabilities and strategies that can be deployed to increase the efficiency of the network service.

COURSE / LEARNING OUTCOMES

CO 1: Recall and identify the different security attacks, requirements, mechanisms and services in the practical field. (Remembering)
CO 2: Recognize and summarize the core principles of cryptography and cryptanalysis available today, including symmetric and asymmetric encryption, hashing, and digital signatures. (Understanding)
CO 3: Identify and relate themselves with the different vulnerabilities, a system in a network can have. (Applying)
CO 4: Inference and predict the issues of securing computer and information systems. (Analyzing)
CO 5: Construct how malicious code functions, relate the vulnerabilities that make proliferation possible and rewrite methods and practices available for alleviation. (Creating)

Module I: (18 hours)
Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

Module II: (18 hours)

Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC, Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

Module III: (12 hours)
Email privacy: Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Module IV: (12 hours)
Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats. Firewall Design principles, Trusted Systems, Intrusion Detection Systems, Ransomware and different types of Ransomware, Methodology of execution of Ransomware.

Suggested Readings

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech.
3. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.
4. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
5. Cryptography and network Security, Third edition, Stallings, PHI/Pearson
6. Principles of Information Security, Whitman, Cengage Learning.
7. Cryptography and Network Security, S.Bose , Pearson

E Resources

1. SWAYAM: Introduction to Cyber Security (IGNOU)o https://onlinecourses.swayam2.ac.in/nou24_cs13/preview
2. Cybrary - Free and paid courses on various aspects of network security. Cybrary Network Security
3. SANS Institute - Cybersecurity training and certification programs. SANS Institute
4. Kali Linux Documentation - Resources for using Kali Linux in network security. Kali Linux Documentation
5. OWASP - Resources and tools for improving web application security. OWASP
6. Coursera Network Security Courses - Various courses on network security fundamentals and advanced topics. Coursera Network Security
7. E-Book: Introduction to Cyber Security https://uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H	M	
CO 3	L	H	M	L
CO 4	L	M	H	M
CO 5		M	H	L

CAPW309P: MINOR PROJECT

(4 credits – 60 hours) (L-T-P: 0-0-4)

Objective

This course aims to provide the student with various practical knowledge on different problem specific system deployment techniques and analysis.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO 1: Recall different processes involved in software development life cycle (Remembering).
CO 2: Understanding the problem statement and related literature study (Understanding).
CO 3: Analyse end user requirements for identifying system functionality metrics and decide whether developed system can meet end user requirements. (Analysing)
CO 4: Choose an engineering approach to solving problems, starting from the acquired knowledge to visual interpretation. (Evaluating)
CO 5: Propose the use of certain technologies by implementing them in different programming languages to solve the problem statement (Creating).

Module I:
Feasibility study of the problem statement and solution, evaluation of existing system, finding the limitation of existing system

Module II:
Literature study, identification of software and hardware requirement, schedule feasibility, economic and operational feasibility, identification software development metrics

Module III:
Evaluate Design diagrams for solving the problem statement. Identify deployment strategy.

Module IV:
Develop algorithms and implement those using programming languages. Resolve and implement the problem statement through proposed software model and system architecture.

Module V:
Prepare a report to highlight the problem statement, design diagram, technologies deployed, and references used to resolve end user's requirement.

Suggested Readings:
1. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
2. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	L	L	
CO 2	H	H			
CO 3	L	L	H	H	M
CO 4		L	H	H	L
CO 5			M	H	H

CAFW315T: FULL STACK WEB DEVELOPMENT

2 Credits - 30 Hours (L-T-P: 2-0-0)

***Objective**: To introduce various aspects of full stack web development for deployment of real world application. It also aims to make knowledgeable about the modern web development technologies including front-end, middleware, back-end architectures and systems.*

COURSE OUTCOMES

CO1: Explain the definition and usage of different components under Full Stack web Development for getting familiar with the latest web developer technologies and ecosystems (Understanding)
CO2: Apply the knowledge and skills acquired during the course to address the day-to-day real-world applications. (Applying)
CO3: Know what type of Full Stack Web Development components to adopt for efficient communication and what services through offline and online to be used for problem solving. (Analyzing)

Module I: (10 Hours)
Introduction to DevOps methodologies, HTML5 Semantic, Cascading Style Sheets: syntax, attributes, Introduction to Bootstrap: basic properties, Introduction to JavaScript, Events, functions, RegExp, Objects, AJAX.

Module II: (8 Hours)
Introduction to PHP Laravel framework, Accessing Form Variables, functions, Object - Oriented Concepts & Creating Classes, Attributes, Operations in PHP Laravel framework, Implementing Inheritance in PHP, MVC Concept

Module III: (12 Hours)
Introduction to MongoDB, Collections, Documents in MongoDB, Difference between Mysql and NoSql, queries, aggregation in Mongodb Database, Embedded Document in MongoDb, Django, MEAN / MERN Stack properties, Introduction to ReactJS, Components, Component inter communication, Routing, Hooks, States, Using Routing to create single page app, Introduction to Java Web Development, JDBC, Servlet, JSP, Java Framework, Web Services, Microservices design pattern, Docker, Automation Testing Tools

Suggested Readings
1. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, 1st ed. Edition, Kindle Edition, by Chris Northwood

2. Full Stack Web Development For Beginners: Learn Ecommerce Web Development Using HTML5, CSS3, Bootstrap, JavaScript, MySQL, and PHP, By Riaz Ahmed
3. Python API Development Fundamentals: Develop a full-stack web application with Python and Flask, By Jack Chan, Ray Chung, Jack Huang
4. Road to React: Your Journey to Master React.js in JavaScript, By Robin Wieruch

Mapping of CO to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H	M	M
CO2	L	H	H
CO3	M	M	H

CAFW316L: FULL STACK WEB DEVELOPMENT LAB

2 Credits - 30 Hours (L-T-P: 0-0-2)

***Objective**: To present different facets of full stack web development in preparation for the implementation of practical applications. Additionally, it seeks to educate students on current web development technologies, such as front-end and back-end architectures.*

COURSE/LEARNING OUTCOMES

CO1: Explain the definition and usage of different components under Full Stack web Development for getting familiar with the latest web developer technologies and ecosystems (Understanding)

CO2: Apply the knowledge and skills acquired during the course to address the day-to-day real-world applications. (Applying)

Module I: (10 Hours)

Form validation using RegExp, Bootstrap JS, AJAX, create a PHP Laravel prototype application, MySQL' Privilege System, Creating Databases and Users, Tables, Inserting, Retrieving, Altering and Updating Data, Setting Up a connection & Querying the Database, Integrate with Framework

Module II: (8 Hours)

Mongodb and Components, ReactJS Application for data processing, ReactJS Mongodb connection, user interface development, report generation

Module III: (8 Hours)

Advanced Java Framework, Spring Boot Applications, integrating database operations, Webservice and Microservice, Docker Configuration.

Suggested Readings

1. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, 1st ed. Edition, Kindle Edition, by Chris Northwood
2. Full Stack Web Development For Beginners: Learn Ecommerce Web Development Using HTML5, CSS3, Bootstrap, JavaScript, MySQL, and PHP, By Riaz Ahmed
3. Python API Development Fundamentals: Develop a full-stack web application with Python and Flask, By Jack Chan, Ray Chung, Jack Huang
4. Road to React: Your Journey to Master React.js in JavaScript, By Robin Wieruch
5. Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker (First Edition), By Frank Zammetti

Mapping of CO to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H	M	M
CO2	H	H	H

CAMD317T: MOBILE APPLICATION DEVELOPMENT

2 Credits - 30 Hours (L-T-P: 2-0-0)

***Objective:** To equip students with the knowledge and skills to design, develop, and deploy Android applications using modern development tools and best practices.*

COURSE OUTCOMES:

At the end of this course students will be able to:

CO1: Understand and explain the fundamentals of Kotlin programming and Android development environments. (Understanding)

CO2: Apply core Android components, including activities, fragments, and UI elements, to build functional mobile applications. (Applying)

CO3: Analyze and troubleshoot Android application lifecycles and app architecture to optimize performance and maintainability. (Analyzing)

CO4: Create and deploy a fully functional Android app to the Google Play Store, adhering to best practices in UI/UX design and coding standards. (Creating)

Module I: Introduction to Mobile Application Development (8 Hours)

Introduction to Mobile Computing: Overview of Mobile Computing, Mobile Platforms and Architectures, Introduction to Android OS and Ecosystem, Android Development Environment: Setting Up Android Studio, Android SDK and Tools Overview, Understanding the Android Project Structure, Emulator vs. Real Device Testing, Basic UI Design: Understanding Android Components: Activities, Views, and Layouts, Designing User Interfaces using XML, Introduction to Material Design Principles, Handling User Input: Buttons, Text Fields, and Events

Module II: Introduction to Kotlin and Core Android Concepts and Components (12 Hours)

Kotlin basics: data types, operators, variables, control structures, and nullable versus non-nullable variables. Functions: functions in Kotlin, including default values for parameters, filters, lambdas, and compact functions. Classes and Objects: classes, objects, and inheritance in Kotlin

Android Activities and Intents: Activity Lifecycle and States, Navigating Between Activities, Implicit and Explicit Intents, Passing Data Between Activities, Fragmentation and Adapters: Introduction to Fragments and Fragment Lifecycle, Using Adapters and RecyclerView for Dynamic Lists, Handling Orientation Changes and Fragment Transactions, Data Persistence: Saving Data using SharedPreferences, Introduction to SQLite in Android, File Handling in Android, Using Content Providers for Data Sharing

Module III: Advanced Android Features and Best Practices (10 Hours)

Networking and Web Services: Introduction to Networking in Android, Making HTTP Requests and Parsing JSON/XML, Integrating RESTful APIs using Retrofit/Volley, Best Practices for Network operations and Security, Notifications and Background Services: Implementing Notifications in Android, Understanding Services and Background Tasks, Using WorkManager for Background Processing, Broadcast Receivers and System Services, Publishing and Maintenance: Preparing an App for Deployment, App Signing and Versioning, Publishing on Google Play Store, Maintaining and Updating Apps

Suggested Readings

1. Bill Phillips, Chris Stewart, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch Guides, 2017.
2. Dawn Griffiths and David Griffiths. Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin, Third Edition, O'Reilly, 2021.
3. Barry Burd and John Paul Mueller, Android Application Development All-In-One for Dummies, Third Edition, Wiley, 2021.

E Resources

1. Android Developer Documentation (developer.android.com)
2. Complete Study Material provide by Google: https://docs.google.com/presentation/d/1EXRoxyZxMdy4UEJ7YvWgZLEHwOGDE_QmbXkQ543JwnA/edit#slide=id.g8ef83c870c_0_70

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4
Module I	M	H		
Module II	H	H	M	M
Module III			M	H

CAMD318L: MOBILE APPLICATION DEVELOPMENT LAB

2 Credits - 30 Hours (L-T-P: 0-0-2)

Objective: *This course is designed to enable students to get a complete understanding of the android applications development. On completion of this course, students will be able to design, develop, debug and deploy various real-time android apps.*

COURSE OUTCOMES:

At the end of this course students will be able to:

CO1: Apply basic Android development tools and environments to create simple mobile applications. (Applying)

CO2: Demonstrate proficiency in designing and implementing user interfaces using XML and Material Design principles. (Applying)

CO3: Analyze and debug Android applications, focusing on event handling, database management, and API integration. (Analyzing)

CO4: Create and deploy a functional Android application, following best practices for UI/UX design, data management, and app deployment. (Creating)

List of Experiments:

1. Create a "Hello World" app to verify the setup.
2. Design a simple user interface with TextViews, Buttons, and EditTexts.
3. Implement event listeners for buttons to perform actions like showing a toast message or changing text.
4. Design the UI and implement logic to calculate and display the tip based on user input.
5. Create a list of items (e.g., a list of contacts) that users can scroll through.
6. Implement Fragment lifecycles, and demonstrate how to handle complex lifecycle situations, and use logging to help debug and track the state of the app.
7. Implement an app with multiple activities and fragments, including navigation between them.
8. Create a simple app to add, update, delete, and display records in a local database.
9. Build an app that retrieves JSON data from a web service and displays it in the UI.
10. Integrate elements like FloatingActionButton, CardView, and Snackbar into an app.
11. Build an app that allows users to register, log in, and log out using Firebase Authentication.
12. Configure Firebase Cloud Messaging (FCM) to send notifications and create a sample app that receives and displays push notifications.
13. Package, sign, and publish a simple app to the Google Play Store (hypothetical or actual).

Suggested Readings

1. Bill Phillips, Chris Stewart, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch Guides, 2017.
2. Dawn Griffiths and David Griffiths. Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin, Third Edition, O'Reilly, 2021.
3. Barry Burd, John Paul Mueller, Android Application Development All-In-One for Dummies, Third Edition, Wiley, 2021.

E Resources

1. Android Developer Documentation (developer.android.com)
2. Complete Study Material provide by Google: https://docs.google.com/presentation/d/1EXRoxyZxMdy4UEJ7YvWgZLEHwOGDE_QmbXkQ543JwnA/edit#slide=id.g8ef83c870c_0_70

Mapping of COs to Experiments

Experiment/Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	13
1	H	M	M	H	M		H						
2	L	H	M	H	H	M		H		H			
3	L	M	H	M	M		H	H	H		H	H	M
4	L		L	M	M	H			H	M	M	M	H

CAPM400T: PYTHON AND MACHINE LEARNING

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The course is intended to give the students an insight into python programming language and its application extended to machine learning techniques in different problems of applications.

COURSE/LEARNING OUTCOMES

At the end of the Python and Machine Learning Lab students will be able to:

1. Understand python basics, data types, flow controls, sequences and functions. (Remembering).
2. Understand the file operations, function programming, data handling using Python and its libraries. (Understanding).
3. Build machine learning programs for designing self-learning solutions to different problems in the real world. (Applying)

4. Experiment with different learning techniques & parameters and conclude the pros and cons of each with respect to different problem domains. (Analysing)

Module I: (15 hours)
Introduction to python, Python basics: Data types and variables, data type conversions, command line argument, data input, Flow control: if, if_elif_else statement, while loop, for loop, break & continue, Python sequences: Range, String, List, Tuple, Dictionary, Set, Shallow and deep copy, Functions and modules: Function, Pass arguments, Arguments with default values and arbitrary arguments, local and global variables, returning single and multiple values from functions, python modules, import statement for importing modules.

Module II: (15 hours)
File operations handling: Reading, writing, manipulations, Exception handling: try, except, finally, raise exception, user defined exception, Python class & objects: Constructors, creating objects, Destructors, Inheritance, Overriding, Overloading, Data hiding, Functional programming: Iterators, Generators, lambda construct, Comprehensions, Map reduce and filter. NumPy: selecting data using slicing, numerical processing with multidimensional array, 2D plotting with matplotlib Pandas: Loading from CSV and other structured formats, 1D and 2D data structures-Series and DataFrame, Normalizing data, dealing with missing data.

Module III: (15 hours)
Introduction to Machine learning: Basic definition, types of learning, linear regression, Decision trees, Probability and Bayes learning, Instance Based Learning: K-Nearest Neighbours Algorithm, K-Means Algorithm, Artificial Neural Network (ANN).

Suggested Readings
1. Python Cookbook-by Alex Martelli, Anna Martelli Ravenscroft, and David Ascher
2. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
3. Introduction to Machine Learning Edition 2, by Ethem Alpaydin.

E Resources
1. Coursera course on IBM Machine Learning with Python.
2. Harvard University course on Machine Learning and AI with Python
3. W3Schools course on Machine Learning
4. Suggested web links: To be provided as and when required for a particular module/topic

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	
CO 2	M	H	
CO 3			H
CO 4			M

CAPM401L: PYTHON AND MACHINE LEARNING LAB

(2 Credits – 30 hours) (L-T-P: 0-0-2)

Objective

The course is intended to give students hands-on experience on Python and building machine learning systems using Python.

COURSE/LEARNING OUTCOMES

At the end of the Python and Machine Learning Lab students will be able to:
1. Understand Python basics, data types, flow controls, sequences and functions. (Remembering).
2. Understand the file operations, function programming, data handling using Python and its libraries. (Understanding).
3. Build machine learning programs for designing self-learning solutions to different problems in the real world. (Applying)
4. Experiment with different learning techniques & parameters and conclude the pros and cons of each with respect to different problem domains. (Analysing)

List of Experiments
1. Installation of PyCharm and Jupyter. Making the Machine learning environment ready.
2. Practice of loops, iterators, string operations, file handling and classes in Python.
3. Use of Numpy and Pandas for data reading and preprocessing - standard dataset as an example.
4. Writing program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
5. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

6. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using the standard Heart Disease Data Set. You can use Java/Python ML library classes/API
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

Suggested Readings

1. Python Cookbook-by Alex Martelli, Anna Martelli Ravenscroft, and David Ascher
2. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
3. Introduction to Machine Learning Edition 2, by Ethem Alpaydin.
4. Suggested web links: To be provided as and when required for a particular module/topic.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1	H	H	H					
CO 2	M	H	H					
CO 3				H	H	H	H	H
CO 4					H		H	

CADA402T: DESIGN AND ANALYSIS OF ALGORITHM

(3 Credits – 45 hours) (L-T-P: 2-1-0)

Objective

To create analytical skills, to enable the students to design algorithms for various applications and to Analyse the algorithms with the objective to introduce mathematical aspects, design and analysis of algorithms.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Define algorithms, importance of analysis of an algorithm and their asymptotic bounds and relate the different types of problem and their solutions. (Remembering)
2. Explain different design strategies such as brute force, divide and conquer, dynamic programming, greedy and backtracking used for the design of algorithms. (Understanding)
3. Compare and analyse different design strategies of algorithms. (Analysing)
4. Assess various algorithms in terms of correctness, computation cost and memory space used. (Evaluating)

Module I: (11 hours)

1. Basic Concepts of Algorithms: Introduction, Notion of Algorithm, Fundamentals of Algorithmic Solving, Important Problem types, Fundamentals of the Analysis Framework – Asymptotic Notations and Basic Efficiency Classes.
2. Mathematical Aspects and Analysis of Algorithms: Mathematical Analysis of Non- recursive Algorithm, Mathematical Analysis of Recursive Algorithm.

Module II: (12 hours)

Analysis of Sorting and Searching Algorithms: Brute Force – Selection Sort and Bubble Sort – Sequential Search and Brute-force string matching – Divide and conquer – Merge sort – Quick Sort – Binary Search – Binary tree- Traversal and Related Properties – Decrease and Conquer – Insertion Sort.

Module III: (12 hours)

Algorithmic Techniques: Transform and conquer – Presorting – Heaps and Heap sort – Dynamic Programming – Strassen's Algorithm, Warshall's and Floyd's Algorithm – Optimal Binary Search trees – Greedy Techniques – Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman trees.

Module IV: (10 hours)

NP-Complete Problems: The classes P and NP, Languages and problems, NP-completeness of the satisfiability problem. Algorithm Design Methods: Backtracking – n-Queen's Problem – Hamiltonian Circuit problem – Knapsack problem – Traveling salesman problem.

Suggested Readings

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI.
2. A.V.Aho, J.E. Hopcroft and J.D.Ullman, The Design and Analysis Of Computer Algorithms, Pearson Education.
3. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Education.
4. Sara Baase and Allen Van Gelder, Computer Algorithms - Introduction to Design and Analysis, Pearson Education.

E Resources

1. NPTEL Swayam Course on: Design and analysis of algorithms, By Prof. Madhavan Mukund, Chennai Mathematical Institute
2. Design and Analysis of Algorithms, Udemy

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		
CO 3		M	H	H
CO 4			M	M

CADA403L: DESIGN AND ANALYSIS OF ALGORITHMS LAB

(2 Credits – 30 hours) (L-T-P: 0-0-2)

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Define algorithms, importance of analysis of an algorithm and their asymptotic bounds and relate the different types of problem and their solutions. (Remembering)
2. Explain different design strategies such as brute force, divide and conquer, dynamic programming, greedy and backtracking used for the design of algorithms. (Understanding)
3. Compare and analyse different design strategies. (Analysing)
4. Assess various algorithms in terms of correctness, computation cost and memory space used. (Evaluating)

List of experiments-

1. Prove that Bubble sort algorithm has time complexity (n2) by showing the graph notation.
2. Implement the Dynamic programming technique and Analyse the algorithm showing the graph notation.
3. Implement the Greedy programming technique and Analyse the algorithm showing the graph notation.
4. Implement the Divide and Conquer technique and Analyse the algorithm showing the graph notation.
5. Design a small file compressor and decompressor by using Huffman coding technique

Suggested Readings

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI.
2. A.V.Aho, J.E. Hopcroft and J.D.Ullman, The Design and Analysis Of Computer Algorithms, Pearson Education.
3. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson Education.
4. Sara Baase and Allen Van Gelder, Computer Algorithms - Introduction to Design and Analysis, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M	H			
CO 3		M	H	H	M
CO 4	M		M	M	H

CADS404T: DATA SCIENCE

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to introduce to the students the fundamental concepts, tools and techniques needed for dealing with various facets of Data Science practice. Being a data scientist mainly requires an integrated skill set such as mathematics, statistics, machine learning, databases, deep learning, along with other branches of computer science. This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset.

COURSE / LEARNING OUTCOMES

At the end of this course, students will demonstrate the ability to

1. Understand the basic concepts and technologies related to Data Science. (Understanding)
2. Interpret data findings effectively to any audience, orally, visually, and in written formats. (Understanding)
3. Obtain, clean/process, and transform data and analyze the transformed data using an ethically responsible approach (Applying and Analyzing)
4. Apply statistical analysis, machine learning and/or deep learning tools and methodologies to solve data science tasks. (Remembering)
5. Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges (Creating)

Module I: Introduction to Data Science, Preprocessing, and Data Visualization (12 Hours)

Introduction to Data Science and Data Preprocessing: Why Learn Data Science, Data Analytics Life Cycle, Types of Data Analysis, Introduction to Data Preprocessing, Data Types and Forms, Possible Data Error Types, Various Data Preprocessing Operations.

Data Plotting and Visualization: Introduction to Data Visualization, Basic Data Visualization Tools - Histograms, Bar Charts, Scatter Plots, Line Charts, Pie Charts, Box Plots, Bubble Plots, Heat Map; Advanced Data Visualization Tools - Wordclouds, Waffle Charts, Choropleth Map

Module II: Machine Learning and Deep Learning (20 Hours)

Machine Learning for Data Science: Overview of Machine Learning, Types of Machine Learning, Regression Methods (linear and logistic), KNN Classification, K-means Clustering

Deep Learning for Data Science: Introduction to TensorFlow, Pytorch, Deep Learning Primitives, Activation Functions, Artificial Neural Network, Convolutional Neural Network

Module III: Statistical Data Analysis and Business Analytics (13 Hours)

Statistical Data Analysis: Role of Statistics in Data Science, Kinds of Statistics, Descriptive Statistics (Measures of Frequency, Central Tendency, Dispersion, and Position), z-Test, Probability Theory

Business Analytics: An Overview of Business Analytics, The Business Analytics Life Cycle, Basic Tools Used in Business Analytics, Customer Analytics, and Employee Analytics

Suggested Readings

1. G. Nandi, R. K. Sharma, ***Data Science Fundamentals and Practical Approaches,*** BPB, 1st Edition, 2020.
2. Silberschatz, H. F. Korth, S Sudarshan, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, *1st Edition, Dreamtech, 2016*
3. C. Neil, R. Schutt, ***Doing Data Science: Straight Talk from the Frontline,*** O'Reilly, 1st Edition, 2019

E Resources

1. NPTEL Swayam Course on Python for Data Science, by Prof. Ragunathan Rengasamy, IIT Madras
2. NPTEL Swayam Course on Data Science for Engineers, Prof. Shankar Narasimhan and Prof. Ragunathan Rengasamy, IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	H	L	L
CO 3	H	L	L
CO 4		H	H
CO 5			H

CADS405L: DATA SCIENCE LAB

(2 credits – 30 hours) (L-T-P: 0-0-2)

Objective

The objective of this course is to make the students learn to extract valuable information for use in strategic decision making, product development, trend analysis, and forecasting. Through the practical approaches, quantitative modeling and data analysis techniques can be applied to find the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques. This course will thoroughly introduce students to the rapidly growing field of Data Science and equip them with some of its basic principles and tools for data analysis and decision making.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Apply data visualisation for presenting the output after an in-depth analysis of the given problem
2. Utilise data preprocessing techniques to prepare data for further analysis.
3. Apply standard machine learning and deep learning algorithms to solve real-life problems

Module I: Introduction to Data Preprocessing, and Data Visualization (15 Hours)

Data Preprocessing Operations using Python - Data Cleaning, Data Integration, Data Transformation, Data Reduction, and Data Discretization

Data Plotting and Visualization – Plotting Basic Data Visualization Tools - Histograms, Bar Charts, Scatter Plots, Line Charts, Pie Charts, Box Plots, Bubble Plots, Heat Map; Advanced Data Visualization Tools - Wordclouds, Waffle Charts, Choropleth Map

Module II: Statistical Data Analysis, Machine Learning and Deep Learning (25 Hours)

Statistical Data Analysis using Python: Applying Descriptive Statistics (Measures of Frequency, Central Tendency, Dispersion, and Position), z-Test, Bayesian Probability

Machine Learning and Deep Learning using Python: Applying linear and logistic regression, KNN Classification, K-means Clustering, Artificial Neural Network, Convolutional Neural Network

Suggested Readings

1. G. Nandi, R. K. Sharma, Data Science Fundamentals and Practical Approaches, BPB, 1st Edition, 2020.
2. Silberschatz, H. F. Korth, S Sudarshan, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, 1st Edition, Dreamtech, 2016
3. C. Neil, R. Schutt, Doing Data Science: Straight Talk from the Frontline, O'Reilly, 1st Edition, 2019.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	L
CO 2	H	
CO 3		H

CAOR406T: OPERATIONS RESEARCH

(5 credits - 75 hours) (L-T-P: 5-0-0)

Objective

Operations Research can be described as a scientific approach to the solution of problems in the management of complex systems. In a rapidly changing environment, an understanding is sought which will facilitate the choice and the implementation of more effective solutions which, typically, may involve complex interactions among people, materials and money.

Module I: Introduction to Linear Programming (20 hours)

Introduction to linear programming - formulation, graphical method, Simplex method and its applications, initial feasible solution, optimality test, Big M method and Two-Phase method.

Module II: Special topics in Linear Programming (19 hours)

Duality in linear programming, the dual simplex method, the revised simplex method, sensitivity analysis of linear programming, Goal programming, and Integer programming.

Module III: The Transportation Model and The Assignment Model (18 hours)

a. Formulation and solution of Transportation Model, North-west Corner method, Vogel's approximation method, stepping stone method, modified distribution method, degeneracy in Transportation problem, least me transportation problems,
b. Mathematical representation and solution of assignment model, Hungarian method.

Module IV: Sequencing Problem, Replacement Analysis and Queueing Model (18 hours)

Assumptions in sequencing problem, processing of n jobs through one machine, two machines and three machines, processing of two jobs through m machines. Replacement of items whose maintenance and repair cost increase with me, i) ignoring changes in the value of money, ii) value of money changes with me; replacement of items that fail suddenly. Introduction to Queueing Model.

Suggested Readings

1. C. Mohan, "Optimization Techniques" New Age
2. D. S. Hira and P.K. Gupta, "Operations Research" S. Chand
3. J.K. Sarma"Operations Research "Macmillan
4. Taha " Operation Research an introduction" Pearson
5. Billey Gillet "Operations Research" PHI
6. N.G Nair "Operations Research" Dhanpat Rai Publication
7. Pablo Pedvegal "Introduction to Optimisation" New Age.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	L	H	H	M
CO 3	H	H	M	M

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	CACF110T	Cybersecurity Fundamentals	4
2	Minor Course 2	CAET105T	E-Commerce Technology	4
3	Minor Course 3	CAER210T	Enterprise Resource Planning	4
4	Minor Course 4	CAWD211T	Basics of Web Designing	4
5	Minor Course 5	CAPT310T	Basics of Python	2
		CAPT311L	Basics of Python Lab	4
6	Minor Course 6	CABS312T	Business Statistics	4
7	Minor Course 7	CAAI407T	Introduction to Artificial Intelligence	3
7	Minor Course 8	CARM408T	Research Methodology	2
8	Minor Course 9	CADV409T	Data Visualization	3
9	Minor Course 10	-	Blockchain Fundamentals	

CACF110T: CYBERSECURITY FUNDAMENTALS

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objective: *The rapid growth of ICT has raised various complex questions which need to be addressed. A need has been felt to address cyber security broadly, as also in sufficient depth so that even students from non-technical streams will develop a more complete picture of the cyber security issues. The aim is to create more aware, responsive and responsible digital citizens, thereby contributing effectively to an overall healthy cyber security posture and ecosystem.*

COURSE OUTCOMES/LEARNING OUTCOMES

CO1: Students would be able to understand the concept of Cyber security and issues and challenges associated with it. **(Understanding)**

CO2: Students, should be able to understand the cyber-crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures. **(Understanding)**

CO3: Students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms. **(Analyzing)**

CO4: Students would be able to understand the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds. **(Understanding)**

CO5: Students will be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices. **(Applying)**

Module-I: Introduction to Cyber security (10 Hours)

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

Module-II: Cyber-crime and Cyber law (15 Hours)

Classification of cyber-crimes, Common cyber-crimes, cyber-crime targeting computers and mobiles, cyber-crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cyber-crimes, Remedial and mitigation measures, Legal perspective of cyber-crime, IT Act 2000 and its amendments, Cyber-crime and offences, Organisations dealing with Cyber-crime and Cyber security in India, Case studies.

Module-III: Social Media Overview and Security (10 Hours)

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

Module IV: E - Commerce and Digital Payments (15 Hours)
Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payament Settlement Act,2007.

Module V: Digital Devices Security, Tools and Technologies for Cyber Security (10 Hours)
End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Anti-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.

Suggested Readings

1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
7. Fundamentals of Network Security by E. Maiwald, McGraw Hill

Mapping of COs to Syllabus

	Module-I	Module-II	Module-III	Module-IV	Module-V
CO1	**H**				
CO2		**H**			
CO3			**H**		
CO4				**H**	
CO5					**H**

CALE104T: CYBER LAW AND ETHICS

(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective
The course aims to learn about the different cyber threats, law and ethics that are associated with cyberspace.

COURSE/LEARNING OUTCOMES:
At the end of the course, students will be able to:
CO 1: Identify knowledge related to the constitution and its legal issues in cyberspace. (Remembering)
CO 2: Explain the different cybercrimes, and the related cyber laws. (Understanding)
CO 3: Demonstrate the different perspectives of professional ethics and responsibilities of engineers. (Understand)
CO 4: Illustrate the concepts behind Cyber Torts, Intellectual Property Rights and describe the concepts in connection to dispute resolution in cyberspace. (Analyzing)

Module I: (14 Hours)
Constitutional & Human Rights Issues in Cyberspace Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet, Right to Privacy, Right to Data Protection, Cyber Crimes & Legal Framework Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud Cyber terrorism, Cyber Defamation.

Module II: (18 Hours)
Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies, Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering

Module III: (14 Hours)
Cyber Torts Cyber Defamation, Different Types of Civil Wrongs under the IT Act 2000, Intellectual Property Issues in Cyber Space Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

Module IV: (14 Hours)
Dispute Resolution in Cyberspace, Concept of Jurisdiction, Indian Context of Jurisdiction, and IT Act, 2000. International Law and Jurisdictional Issues in Cyberspace, Dispute Resolutions.

Suggested Readings
1. Engineering Ethics M. Govindarajan, S. Natarajan, V. S. Senthilkumar Prentice –Hall, 2004
2. Constitution of India, Professional Ethics and Human Rights Shubham Singles, Charles E. Haries, and et al Cengage Learning India 2018
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi.
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute.
5. Jonthan Rosenoer, Cyber Law, Springer, New York.
6. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York.

E Resources
1. SWAYAM Course on Cyber Laws by Vishal Goyal Punjabi University - Patiala

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	M	M	M
CO 2	L	H	H	M
CO 3	L	H	M	M
CO 4		M	H	M

CAET105T: E-COMMERCE TECHNOLOGY

(4 Credits- 60 Hours) (L-T-P: 4-0-0)

Objectives
To enable the student to become familiar with the mechanism for conducting business transactions through electronic means, buildup knowledge on electronic business, online marketing and make the students to devise marketing strategies for concerns engaged in ecommerce and understand the current status of e-business.

COURSE/LEARNING OUTCOMES:
After learning this course, the students will be able to:
CO 1: Interpret the basic concepts and technologies used in the field of E-Commerce. (Remembering)
CO 2: Explain the different regulatory provisions relating to E-Commerce. (Understanding)
CO 3: Develop processes of developing and implementing information systems. (Applying)
CO 4: Define the ethical, social, and security issues of information systems. (Analysing)
CO 5: Evaluate the various online business transactions (Evaluating)

Module I: Introduction (12 Hours)
E – Commerce: Meaning, definition, features, functions of E-Commerce, Scope, Benefits and limitations of E-Commerce – The Internet and India – E-commerce opportunities and challenges for IndustriesTechnology used in E-commerce: The dynamics of world wide web and internet (meaning, evolution and features); Designing, building and launching e-commerce website (A systematic approach involving decisions regarding selection of hardware, software, outsourcing vs. in-house development of a website)

Module II: Electronic Data Interchange (12 Hours)
Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI, EDI Agreements, EDI Security, Business Model, E-business Models Based on the Relationship of Transaction Parties: Business-to-Consumer (B2C), Business to-Business (B2B), Consumer-to-Consumer (C2C), Consumer-to-Business (C2B), E-business Models Based on the Relationship of Transaction Types: Brokerage Model, Aggregator Model, Implementation, Legal Framework for E-Commerce: E-Commerce Legal Framework, Rights and Obligations in the World of E-commerce , Copyrights , Defamation, Privacy, Contracts, Taxation, Signing a contract Electronically ,Domain name and Registration.

Module III: E-payment System (12 Hours)
E-payment Systems: Digital payment Requirements, Digital Token-based E-payment systems, Benefits to Buyers , Benefits to Sellers, Credit card as E-payment system, Mobile payments, smart card cash payment system, Micropayment system, E- Cash,

Risk and e-Payment Systems, Designing e-Payment Systems, E-Retailing, E services.
E-Finance: Areas of Financing, E-Banking, Traditional Banking Vs. E-Banking, Operations in E-Banking, E-Trading, Stock Market trading, Importance and advantages of E-Trading.

Module IV: Security and Encryption: (12 Hours)
E-commerce security environment: dimension, definition and scope of e- security, security threats in the E-commerce environment, technology solutions, business procedures, and public laws , Threats in Computer Systems: Virus, Cyber Crime, Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server.

Module V: IT Act 2000 and Cyber Crimes (12 Hours)
IT Act 2000: Definitions, Digital signature, Electronic governance, Attribution, acknowledgement and dispatch of electronic records, Regulation of certifying authorities, Digital signatures certificates, Duties of subscribers, Penalties and adjudication, Appellate Tribunal, Offences and Cyber-crimes

Suggested Readings
1. Joseph P. T., E - Commerce – An Indian Perspective
2. Kenneth C. Laudon and Carlo GuercioTraver, E-Commerce,Pearson Education.
3. David Whiteley, E-commerce:Strategy,TechnologyandApplications,McGrawHill Education
4. Bharat Bhaskar, Electronic Commerce: Framework, Technology and Application, 4thEd., McGraw Hill Education
5. Joseph P T, E-Commerce: An Indian Perspective, PHILearning
6. Bajaj K K and Debjani Nag, E-commerce, McGraw HillEducation
7. Chhabra T N, E-Commerce, Dhanpat Rai Co.
8. Madan Sushila, E-Commerce, Taxmann

E Resources
1. Udemy Course on Mastering E-commerce: The Ultimate Course
2. Swayam course on E-Business By Prof. Mamata Jenamani, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			M
CO2	M	H			
CO3		M	H		M
CO4			M	H	
CO5			H	M	M

CAER210T: ENTERPRISE RESOURCE PLANNING
(4 CREDITS – 60 HOURS) (L-T-P: 4-0-0)

Objective
To help the student understand the conceptual elements of ERP and its theory and implementation. This is especially poignant in view of large number of organizations implementing ERP applications in recent years. The student will appreciate the impact that ERP brings into the daily operations of firms with respect to their productivity, integration, communication, etc.

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:
CO 1: Recall the conceptual elements of ERP. (Remembering)
CO 2: Demonstrate the Influence of ERP in Large Organizations. (Understanding)
CO 3: Identify the impact of ERP into the daily operations of firms with respect to their productivity, integration, communication etc. (Applying)
CO 4: Analyse the practical side of ERP implementation with different vendors. (Analysing)
CO 5: Discuss and evaluate the best practices of ERP with various case studies and real time examples. (Creating, Evaluating)

Module I: ERP Basics (15 hours)
Evolution and structure of ERP, ERP concepts, growth of the ERP market, conceptual model of ERP, 2-tier and 3-tier architecture, elements in ERP architecture, advantages/benefits of ERP, overview of an enterprise, integrated management information, business modelling, integrated data model ERP and related technologies: Business Process Reengineering (BPR), Management Information Systems (MIS), Decision Support Systems (DSS), Data Warehousing, Data Mining, Online Analytical Processing (OLAP), Supply Chain Management.

Module II: ERP Modules (10 hours)
Item types in ERP, Manufacturing, distribution and Financial requirements, item control module in ERP, Finance module, Manufacturing and Production Planning module, Sales and Distribution module, Plant Maintenance module, Quality Management module, Materials Management module, Capital Requirement Planning module, Purchase Control module, Human Resources modules; concept of Bill of materials, concept of formula management.

Module III: Profiling ERP Vendors (10 hours)
SAP AG: R/3 –, overview of R/3 system, R/3 modules, R/3 and the internet BAAN: Baan ERP modules, Baan ERP Tools
Oracle: Oracle modules – Financials, Human Resources, Projects, Manufacturing, Supply chain.
PeopleSoft: Accounting and control, Treasury Management, Performance Management, Sales and Logistics, Procurement.

Module IV: ERP Implementation Lifecycle (10 hours)
Elements of implementation methodology, Pre-evaluation Screening, Package evaluation, project planning phase, Gap Analysis, Business Process Re-engineering, configuration, Implementation team training, testing, product migration and support, Problems in ERP implementation, cost of ERP.

Module V: Best Practices in ERP (15hours)
Concept of Best Practices, concept of Customer Order Decoupling Point(CODP), Demand Management – Sales and Operations Planning, ERP scenario in India, future directions in ERP. Case studies should also be introduced to highlight situations where ERP projects are implemented, and the success stories/benefits/difficulties of these implementations.

Suggested Readings
1. O'Leary, Daniel E, Enterprise Resource Planning Systems: systems, life cycle, electronic commerce and risk, Cambridge University Press.
2. Alexis Leon, Enterprise Resource Planning, 14th reprint, Tata McGraw Hill, New Delhi 2005
3. Rahul V Altekar, Enterprise Resource Planning (Theory and Practice), Prentice Hall India, New Delhi 2004
4. Alexis Leon, ERP Demystified, Tata McGraw Hill Pub. Co. Ltd, 2000
5. Kent Sandoe, Enterprise Integration, John Wiley and Sons
6. Garg and Venkitakrishnan, Enterprise Resource Planning: Concepts and Practice, 2nd edition, Prentice Hall India
7. Garg and Venkitakrishnan, ERPWARE: ERP Implementation Framework, Prentice Hall India

E Resources
1. Oracle course on Oracle Fusion Cloud Enterprise Resource Planning Training and Certification
2. Udemy course on SAP ERP Fundamentals

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			M
CO 2		H	M		
CO 3		M	H		M
CO 4			M	H	
CO 5				M	H

CAWD211T: BASICS OF WEB DESIGNING

(3 Credit – 45 Hours) (L-T-P: 3-0-0)

Objective
The objective of the course is to familiarize the students with a discussion on Internet and its growth. It also provides the students a study on the basic services provided by the Internet. A familiarization on the markup languages and scripting language are also being discussed to make the student competent to design websites.

COURSE/LEARNING OUTCOMES
On successful completion of the course students will be able to:
CO 1: Recall the various Internet related terminologies and examine the history and growth of Internet. (Remembering)
CO 2: Identify and differentiate the various services provided by the internet. (Understanding)
CO 3: Experiment with various mark-up languages and style sheets to design a static website. (Applying)
CO 4: Experiment with various scripting languages to design a dynamic website. (Applying)
CO 5: Develop and create a website using standard tools and technologies. (Creating)

Module I: Basics of Internet and XHTML (15 Hours)
Basics of Internet: History of the Internet and the World Wide Web; W3C; Levels of Internet Connectivity; Requirements for Internet Connectivity; Search Engines, Various Internet Services, Web Portal; Different types of browsers; URLs, Domain names,

HTTP and URL
XHTML: Basic HTML Tags – html, head, title, body, paragraph, headings, horizontal, break, image, table, lists, links, and forms. Introduction to XHTML; HTML vs. XHTML, XHTML comments;

Module II: Cascading Style Sheets and JavaScript (18 Hours)
Cascading Style Sheets: Types of Style Sheets - Inline, Embedded, and External; CSS Text properties, font properties, and Background properties; CSS Borders and Outlines, CSS Box Model, Style class and Pseudo-class
JavaScript: Client-side scripting, Introduction to JavaScript, Simple JavaScript code, JavaScript variables, functions, conditions and loops

Module III: Website Design Considerations and Web Servers (12 Hours)
Website Design Considerations: Planning to design a website, use of sitemaps, Creating a compatible website for different color depths, resolutions, and browser considerations, validating a website
Web servers: Need of a web server; System Architecture of a Web server; HTTP Request Types; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Various web servers- Microsoft IIS, Apache, NGINX, LAMP, WAMP, MAMP, XAMPP

Suggested Readings
1. Steven Holzner,"HTML Black Book", Dremtech Press
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications: Concepts and Real-World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson
5. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

E Resources
1. Spoken Tutorial on HTML by Praveen S, IIT Bombay
2. Spoken Tutorial on CSS by Neha Solanki, IIT Bombay
3. Spoken Tutorial on JavaScript by Jayesh K Ramalingaiah

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
1	H		
2	H		
3	H	H	
4		H	
5	M	L	H

CAWR212L: BASICS OF WEB DESIGNING LAB
(1 Credit - 15 Hours) (L-T-P: 0-0-1)

Objective
The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies.

COURSE/LEARNING OUTCOMES
At the end of the experiments, students will be able to
CO 1: Experiment with various mark-up languages and style sheets to design a static web site (Applying)
CO 2: Develop and create a dynamic website using scripting language. (Creating)
CO 3: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (Evaluating)

Module I: Static Web Designing (10 Hours)
Web Designing: Creating static websites involving various XHTML elements.
Using Style Sheets: Designing web pages that use CSS for standard formatting

Module II: Dynamic Web Designing (5 Hours)
JavaScript: Designing websites that use JavaScript for creating interactive web pages

Suggested Readings
1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.

2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
1	H	
2		H
3	H	M

CAPT310T: BASICS OF PYTHON

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective:

The objective of the course is to provide learners with a solid foundation in the fundamentals of the Python programming language. The course aims to equip students with the knowledge and skills necessary to write simple Python programs and understand the core concepts and principles of Python programming.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Learn the syntax, semantics and OOP concepts of Python Programming Language.
CO 2: Comprehend the flow control logic in Python
CO 3: Use Python functions to facilitate code reuse and manipulate strings.
CO 4: Illustrate the process of exception handling, structuring the data using lists, tuples and dictionaries.

Module I: Introduction to Python (8 hours)

What is Python? and history of Python, Unique features of Python, Install Python and Environment Setup, Python Identifiers, Keywords and Indentation, Comments and document interlude in Python, Command line arguments, Getting User Input, Python Data Types, variables

Module II: Control Statements (8 hours)

if-else, if-elif-else, while loop, for loop, break, continue, assert, pass, return
List, Ranges & Tuples in Python
Lists in Python, Understanding Iterators, Generators, Comprehensions and Lambda Expressions, Generators and Yield, Next and Ranges, Understanding and using Ranges, Ordered Sets with tuples
Python Dictionaries and Sets
Introduction to the section, Python Dictionaries, More on Dictionaries, Sets, Python Sets Examples

Module III: Input and Output in Python (8 hours)

Reading and writing text files, writing Text Files, appending to Files and Challenge, Writing Binary Files Manually, Using Pickle to Write Binary Files
Python built in function, Python user defined functions, Python packages functions, Defining and calling Function, The anonymous Functions, Loops and statement in Python, Python Modules & Packages

Module IV: OOP concept in Python (6 hours)

Overview of OOP, The self-variable, Constructor, Namespaces, Creating Classes and Objects, Inheritance, Types of Methods, Instance Methods, Static Methods, Class Methods, Accessing attributes, Built-In Class Attributes, Destroying Objects, Abstract classes and Interfaces, Abstract Methods and Abstract class, Interface in Python, Abstract classes and Interfaces

Suggested Readings

1. Reema Thareja, "Python Programming using problem solving approach", Oxford University press, 2017. ISBN-13: 978-0199480173
2. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.

E Resources

1. Coursera course on Introduction to Python Fundamentals

2. Udemy course on Extensive Python Fundamentals in 4 Weeks

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
1	L	H	H	H
2		H	H	H
3	L	M	M	H
4	H		H	H

CAPT311L: BASICS OF PYTHON LAB

(2 Credits- 30 Hours) (L-T-P: 0-0-2)

Objective

The objective of the course is to provide learners with a solid foundation in the practical knowledge of Python programming language. The course aims to equip students with the knowledge and skills necessary to write simple Python programs and understand the core concepts and principles of Python programming.

COURSE / LEARNING OUTCOMES

At the end of the lab experiments, students will be able to learn

CO 1: Writing programs in python, Understanding the basic structure of Python programming.
CO 2: Understanding the built – in libraries
CO 3: Implementing the concepts of OOPs in Python

Lists of experiments:

1. if-else, if-elif-else, while loop, for loop, break, continue, assert, pass, return
2. List, Ranges & Tuples in Python
3. Python Dictionaries and Sets
4. Reading and writing text files, writing Text Files, appending to Files and Challenge, Writing Binary Files Manually, Using Pickle to Write Binary Files
5. Constructor, Namespaces, Creating Classes and Objects

Suggested Readings

1. Reema Thareja, “Python Programming using problem solving approach”, Oxford University press, 2017. ISBN-13: 978-0199480173
2. Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1st Edition, Shroff Publishers, 2017. ISBN: 978-9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
4. Wesley J Chun, “Core Python Applications Programming”, 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO2		L	H	H	M
CO 3	M	M	M	H	H

CABS312T: BUSINESS STATISTICS

(4 Credit – 60 Hours) (L-T-P: 2-0-0)

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Recall the key terminology, concepts tools and techniques used in business statistical analysis (Remembering)
CO 2: Understand the use of Graph Theory, Probability and Time-series analysis for management decisions. (Understanding)
CO 3: Apply differential and inferential statistics to solve problems related to statistical analysis (Applying)
CO 4: Apply coorelation and regression analysis to solve problems related to statistical analysis (Applying)

Objective: *The objective of this course is to familiarize the students with basic concepts of Statistics in Business and an in-depth learning of the various statistical techniques. The aim of this course is to impart knowledge to students to improve their logical reasoning ability and interpretation of various business results. The course makes an effort to acquaint the students with the emerging issues in business, trade, and commerce regarding analyzing business facts.*

Module I: Introduction to Statistics, Frequency Distribution, and Graphs (12 Hours)
Introduction to Statistics: Statistics as a Subject of Study, Information and Data, Census data vs. Sample data, Methods of statistical data collection, Statistical Variables: Qualitative and Quantitative
Frequency Distribution and Graphs: Frequency, Stem and Leaf Display, Frequency Distributions, Data Grouping - Discrete and Continuous, Introduction to Graphs, Graph for Qualitative variables, Graph for Quantitative variables, Various types of graphs and diagrams: pictographs, bar diagram, scatter diagram, histogram, pie chart, frequency curve and frequency polygon

Module II: Descriptive and Inferential Statistics (18 Hours)
Descriptive Statistics: Measures of Central Tendency (Median, Mode, Arithmetic Mean, Geometric Mean, Harmonic Mean), Measures of Dispersion, Range, Co-efficient of Range, Quartiles, Inter-Quartile Range and Quartile Deviation, Standard Deviation, Skewness and Kurtosis; Co-efficient of Skewness: Karl Pearson's Coefficient
Inferential Statistics: Hypothesis Testing, Parametric vs. Non-Parametric tests, Parametric Tests (z-test, t-test, Chi-Square test, and F-test)

Module III: Correlation and Regression Analysis (15 Hours)
Correlation Analysis: Introduction to Correlation, Karl Pearson's product moment Co-efficient of Correlation, Positive, negative and zero correlation, Correlation through Scatter diagrams, Interpretation of Correlation Co-efficient, Simple and Multiple Correlation;
Regression Analysis: Regression and the criterion for the Line of Best Fit, Linear Regression, Logistic Regression, Polynomial Regression

Module IV: Probability and Probability Distributions (15 Hours)
Probability and Probability Distributions: Sample space and Events, Simple and Compound Events, Probability and Probability distributions: Normal Distribution, Binomial and Poisson Distribution
Time-Series Analysis: Definition, Overview of Time-Series Analysis, Components of Time-Series, Time-Series Forecasting Models using Stochastic Models (AR, MA, ARMA and ARIMA)

Suggested Readings
1. Sharma, Japuji K. *Business statistics*. Pearson Education India, 2012.
2. Bajpai, Naval. *Business statistics*. Pearson Education India, 2009.
3. Siegel, Andrew F. *Practical business statistics*. Academic Press, 2016.

E Resources
1. NPTEL course on Business Statistics
2. Study.com course on Business 212: Business Statistics

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
1	H	L		
2	H			H
3		H		
4			H	

CAAI407T: INTRODUCTION TO ARTIFICIAL INTELLIGENCE (L-T-P: 3-0-0)

(3 credits- 45 hours) (L-T-P: 3-0-0)
Objective
The course aims to familiarise the students with concepts of Artificial Intelligence, search techniques and knowledge representation issues. This course also aims to equip the students with knowledge of fuzzy logic and its uses for artificial intelligence, game playing and natural language processing.

COURSE / LEARNING OUTCOMES
At the end of the lab experiments, students will be able to learn
CO 1: Define artificial intelligence and the different techniques of artificial intelligence. (Remembering)
CO 2: Understand the components of AI agents and different problem-solving techniques, various applications of AI techniques in intelligent agents, expert systems, and artificial neural networks. (Understanding)
CO 3: Apply basic principles of AI in solutions that require problem-solving, inference, perception, knowledge representation, and learning. (Applying)
CO 4: Analyze and examine the different approaches to Knowledge Representation, reasoning, problem-solving etc. (Analyzing)

Module I (15 Hours)

What is AI (Artificial Intelligence)? : The foundation of AI problems, the history of AI, the underlying Assumption, and AI techniques Intelligent Agents: Agents and Environments, nature of environments, the structure of Agents Problem-solving Agents, State Space Search & Heuristic Search Techniques, Local Search and Optimization, Adversarial Search, Constrained Satisfaction Problem.

Module II: (12 Hours)
Knowledge Representation and Reasoning Issues: Representations and Mappings, Approaches to Knowledge Representation. Using Predicate Logic: Representation of Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning. Symbolic Reasoning Under Uncertainty: Statistical Reasoning: Probability and Bayes' Theorem.

Module III: (10 Hours)
Learning in AI: Supervised, Unsupervised, Linear regression and classification, Decision Trees, Ensemble Learning.

Module IV: (8 Hours)
Recent Advances in AI: Neural Network, Fuzzy Sets and Theory, Expert Systems. Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse And Pragmatic Processing.

Suggested Readings
1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

E Resources
1. Harvard University course on Machine Learning and AI with Python
2. Simplilearn course on Professional Certificate Program In Generative AI And Machine Learning

Mapping of COs to Modules

	Module I	**Module II**	**Module III**	**Module IV**
CO1	H	M	L	L
CO2	L	H	M	M
CO3		M	H	L
CO4		M	H	H

CARM408T: RESEARCH METHODOLOGY

(2 credits- 30 hours) (L-T-P: 2-0-0)

Objective
This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights into solving a relevant problem.

COURSE/LEARNING OUTCOMES
At the end of the course students will be able to:
CO 1: Define and tell why research and its methodology are important. (Remembering)
CO 2: Explain the use of methodology in understanding the process of research. (Understanding)
CO 3: Identify the sources of data and apply various data collecting and sampling techniques. (Applying)
CO 4: Justify the use of data preprocessing techniques before analysing data. (Evaluating)
CO 5: Apply statistical analysis to classify, analyse and draw inferences from data. (Analysing/Applying)

Module I: Introduction to Research (15 Hours)
Concept and nature, objectives, criteria of a good research, types of research; features of a good research design; research problem: definition, Components, selection and formulation of research problem; preparation and presentation of research proposal; types of data, methods of data collection; sampling process; methods of sampling; determination of sample size; Report Writing: Essentials of report writing, report format

Module II: Processing and Analysis of Data (15 Hours)
Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression,

Skewness, Time series Analysis, Index Number Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

Suggested Readings

1. Kothari C.R , Research Methodology: Methods and Techniques, New Age International,
2. Srivastava, S. C. : Foundation of Social Research and Economics Techniques, Himalaya Publishing House, 1990.
3. Sharma H.D. and Mukherji S. P: Research Methods in Economics and Business, New York: The Macmillan Company, 1992.
4. Saunders M , Philip Lewis and Adrian Thornhill, Research Methodology for business students, Pearson Education
5. Michael V.P, Research Methodology in Management, Himalaya Publishing House

E Resources

1. NPTEL Swayam Course on Research Methodology by Prof. E. Prasad, IIT Madras
2. NPTEL Swayam Course on Research Methodology by Prof. Soumitro Banerjee, IISER Kolkata

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	
CO2	H	
CO3	H	L
CO4		H
CO5	L	H

CADV409T: DATA VISUALIZATION

(3 Credits – 45 hours) (L-T-P: 3-1-0)

Objectives:

- Develop skills to both design and visualizations.
- Understand visualization for correlation analysis, distribution analysis and multivariate analysis.
- Understand the components involved in visualization design.
- Understand the type of data impacts the type of visualization.

COURSE/LEARNING OUTCOMES

On successful completion of the course students will be able to:

CO 1: Develop familiarity with the design process to develop visualization methods and visualization systems. (Remembering)
CO 2: Understand the fundamental design principles and different types of data visualization. (Understanding)
CO 3: Apply existing visualization tools and techniques to analyze basic datasets. (Applying)
CO 4: Design and develop various data visualization methods for a given problem. (Creating)

Module I: (10 hours)

Visual Perception and Cognition, visual representation of data, Coordinate Systems and Axes, Gestalt principles, information overloads, Tufte's Principles, Data visualization: Introduction, Types of data visualization, Data for visualization, Aesthetics and Types of data, Applications of Data Science technologies for visualization.

Module II: (10 hours)

Basic Plotting - Line plot, Bar plot, Pie Chart, Scatter Plot, Histogram, Stacked Bar Charts, Sub Plots, Matplotlib, Searborn, Plotly, Seaborn Styles. Applied Visualizations - Box plot, Density Plot, Area Chart, Heat map, Tree map, Graph Networks. Interactive Visualizations and Animation - Dynamic charts, Dynamic maps, Animation types- 2D, 3D, Motion Animation, Animation Principles, Altair Package, Statistical Visualizations.

Module III: (13 hours)

Distribution analysis, describing distributions, distribution patterns, distribution displays, distribution analysis best practices, correlation analysis, describing correlations, correlation patterns, correlation displays, correlation analysis techniques and best practices, multivariate analysis, multivariate patterns, multivariate displays, multivariate analysis techniques and best practices.

Module IV :(12 hours)

Information dashboard, Introduction, Types of Dashboard, dashboard designing, Design Issues and assessment of needs – Considerations for designing dashboard-visual perception, Best practices in Dashboard design. Case Study: Creating a dashboard using Excel.

Time Series Data Visualization - Individual time series data, multiple time series data. Visualizing Trends – Smoothing, Showing Trends with a defined functional form, detrending and time series data decomposition.

Suggested Readings

1. Cole Nussbaumer Knaflic, Storytelling with Data: A Data Visualization Guide for Business Professionals, Wiley, 2015

2. Claus O. Wilke, Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, O'Reilly, 2019
3. Edward R. Tufte, The Visual Display of Quantitative Information, Graphics Press, 2001.
4. D. Kusleika, Data Visualization with Excel Dashboards, Wiley 2021.

E Resources

1. Udemy Course on Mastering Data Visualization: Theory and Foundations
2. Coursera Course on Data Visualization with Python

Mapping of COs to Modules

	Module I	Module II	Module III	Module IV
CO 1	H	M		M
CO 2	M	H		
CO 3		M	H	
CO 4		H	M	H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	CAMG111L	Multimedia and Graphics	3
2	S E Course 2	CAIT112L	Introduction to Internet of Things	3
3	S E Course 3	CACV215L	Computer Vision Fundamentals	3

CAMG111L: MULTIMEDIA AND GRAPHICS

(3 Credits – 45 Hours) (L-T-P: 0-0-3)

Objective: This course aims to equip students with hands-on experience in multimedia and graphics through the comprehensive use of open-source tools. The course is designed to develop students' proficiency in image editing, photo manipulation, and digital art creation using GIMP. By exploring advanced techniques in compositing, retouching, and creative design, students will enhance their technical skills and creativity, enabling them to conceptualize and produce visually compelling multimedia projects that effectively address various design challenges and real-world scenarios.

COURSE/LEARNING OUTCOMES

CO 1: Apply advanced image editing techniques to enhance, retouch, and manipulate digital images using GIMP. *(Applying)*
CO 2: Analyze different layers, masks, and blending modes to effectively combine and composite multiple images. *(Analyzing)*
CO 3: Evaluate the effectiveness of various filters, effects, and retouching tools in improving the quality of digital images. *(Evaluating)*
CO 4: Design and create a comprehensive multimedia project, integrating advanced techniques in image editing, compositing, and digital art using GIMP. *(Creating)*

Module I: Introduction to GIMP (15 hours)

GIMP interface: Toolbox, Layers, Brushes, and Navigation; Understanding image file formats and resolutions, Basic tools: Selection tools (Rectangular, Elliptical, Lasso), Move, Crop, and Rotate; Opening resizing, cropping, and rotating an image; Layer operations: Adding, deleting, and merging layers; Adjusting brightness, contrast, and color balance; Using the Levels and Curves tools for image enhancement

Module II: Advanced Image Editing and Photo Manipulation (15 hours)

Introduction to GIMP's built-in filters and effects; Applying blur, sharpen, and noise reduction filters; Creative effects: Drop shadows, glows, and artistic filters; Using Clone tool, Heal tool, and Perspective Clone tool; Adding and formatting text in GIMP; Using the Paths tool for complex selections and text effects.

Module III: Compositing and Advanced Techniques (15 hours)

Combining multiple images into a single composition; Using brushes, patterns, and gradients for digital painting; Customizing brushes and creating textures; Photo manipulation, digital painting, or a poster design.

Suggested Readings

1. Lecarme, Olivier, and Karine Delvare. *The book of GIMP: A complete guide to nearly everything*. No Starch Press, 2013.
2. Peck, Akkana. *Beginning GIMP: from novice to professional*. Apress, 2006.
3. Web Link: https://www.gimp.org/tutorials/

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	L	
CO 2	H	M	
CO 3	H	H	H
CO 4	H	H	H

CAIT112L: INTRODUCTION TO INTERNET OF THINGS

3 credits: 45 hours (L-T-P: 0-0-3)

Objective: *This course aims to provide students with practical skills in IoT, focusing on programming with Arduino and networking with ESP8266. Students will learn to interface sensors, control actuators, and configure wireless communication, enabling them to develop and implement IoT projects for real-world applications.*

Course Outcomes:

At the end of the course students will be able to:

CO1: Apply programming on Arduino to interface sensors, control actuators, and manage serial communication, demonstrated through practical exercises such as LED control, sensor data acquisition, and actuator operation. (Applying)

CO2: Examine and configure ESP8266 for wireless communication, analyse network configurations, and assess data transmission using protocols such as TCP/IP, HTTP, and MQTT. (Analysing)

CO3: Plan, design, and implement IoT projects, integrating various components and systems to develop functional prototypes for applications in fields such as healthcare, agriculture, and smart cities. (Creating)

CO4: Critically assess various IoT architectures, components, and communication technologies, and evaluate their suitability for different IoT applications and platforms, considering real-time examples and challenges in the field. (Evaluating)

Module I: Introduction to IoT (8 Hours)

Definitions & Characteristics, IoT Architectures (Physical & Logical Design), Overview of IoT components and IoT Communication Technologies, Various Platforms for IoT, Real time Examples of IoT, Challenges in IOT.

Module II: Arduino Programming and Basics (12 Hours)

Microcontroller fundamental-(architecture, I/O, timers) Arduino IDE: Architecture, Setting up the IDE & Arduino Libraries, basic programming- Data types, variables, operators, Control flow statements, functions, Basics of sensors and actuators, sensor interfacing (analog and digital sensors, data acquisition), Actuator control (relays, motors, servos, PWM), Serial communication (UART), Practical exercises (LED blinking, button control, sensor reading, actuator control)

Module III: Networking with ESP8266 (12 Hours)

Wireless network basics (Wi-Fi, network topologies), Introduction to ESP8266 (hardware, AT commands, firmware modes), Network Configuration- SSID, password, Static IP setup, Web Server Configuration, Sending basic data over Wi-Fi, TCP/IP networking (sockets, client-server model), Communication Protocols in IoT ((TCP/IP, HTTP, MQTT, CoAP), Cloud integration (basic concepts, data upload), practical exercises (web server, data logging)

Module IV: IOT Projects and Application (13 Hours)

IoT project planning and development process, Hands-on projects (like home automation, IoT in health care, agriculture, smart parking etc),project planning, implementation and testing, Troubleshooting and debugging techniques.

Suggested Readings

1. Khan, Jamil Y., and Mehmet R. Yuce, eds. Internet of Things (IoT): systems and applications. CRC Press, 2019.
2. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley, 2013.
3. Qusay F. Hassan, Internet of Things A to Z: Technologies and Applications, Wiley-Blackwell, 2018.
4. Peter Waher, Mastering Internet of Things: Design and Create Your Own IoT Applications Using Raspberry Pi 3, Packt Publishing, 2018.

Mapping of COs with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4

CO 1		H	M	M
CO 2	L		H	M
CO 3	L	M	M	H
CO 4	H		H	

CACV215L: COMPUTER VISION FUNDAMENTALS

(3 Credits – 45 Hours) (L-T-P:0-0-3)

Objective: *The objective of this course is to equip students with a comprehensive understanding of the core principles, techniques, and applications of computer vision. This course aims to introduce students to the fundamental concepts of image processing, feature extraction, object detection, and recognition.*

COURSE OUTCOMES:

By the end of this course, students will be able to:

CO1: Understand the basic principles and techniques used in computer vision. (Understanding)

CO2: Apply image processing methods to extract meaningful features from visual data. (Applying)

CO3: Implement algorithms for object detection, recognition, and tracking. (Analysing)

CO4: Develop computer vision applications using relevant programming tools. (Creating)

Module I: **Introduction to Computer Vision** (**10 Hours)**

Overview of Computer Vision, Image Formation and Camera Models, Image Representation (2D and 3D), Image Acquisition and Pre-processing

Module II: **Image Processing and Feature Extraction** (**10 Hours)**

Basic Image Processing Techniques (Filtering, Edge Detection, Thresholding), Color Spaces and Transformations, Feature Detection (SIFT, SURF, ORB), Feature Matching and Tracking

Module III: **Object Detection and Recognition** (**14 Hours)**

Object Detection Techniques (Haar Cascades, HOG, YOLO), Face Detection and Recognition, Introduction to Deep Learning for Computer Vision (CNNs), Implementing Object Recognition Algorithms

Module IV: Applications and Case Studies (**9 Hours)**

Real-world Applications of Computer Vision (Medical Imaging, Surveillance, Robotics), Case Studies on Successful Computer Vision Projects, Ethical Considerations in Computer Vision, Future Trends in Computer Vision

List of Practical Work:

1. Image Acquisition and Pre-processing: Capture images using a camera or smartphone and apply basic pre-processing techniques like resizing, cropping, and rotation.
2. Image Filtering and Enhancement: Apply various image filtering techniques such as Gaussian blur, median filtering, and sharpening to enhance image quality.
3. Edge Detection: Implement edge detection algorithms like Canny and Sobel to detect edges in images.
4. Color Space Conversion: Convert images between different color spaces (e.g., RGB to Grayscale, RGB to HSV) and analyze the impact on image interpretation.
5. Feature Detection and Matching: Task: Use algorithms like SIFT, SURF, or ORB to detect and match key features between two images.
6. Face Detection: Implement face detection using Haar cascades or other pre-trained models.
7. Object Detection using YOLO: Implement object detection on a video stream using the YOLO (You Only Look Once) algorithm.
8. Building a Simple Image Classifier: Build a basic image classifier using a Convolutional Neural Network (CNN) with a small dataset (e.g., MNIST or CIFAR-10).
9. Image Segmentation: Task: Implement image segmentation techniques such as thresholding, region growing, or using pre-trained models like U-Net.
10. Tracking Moving Objects: Implement object tracking in a video using algorithms like Mean Shift or Kalman Filter.
11. Case Study Implementation: Choose a real-world application of computer vision (e.g., medical imaging, autonomous driving) and implement a simplified version of the solution.

Suggested Readings and E Resources

1. "Fundamentals of Computer Vision" by Shanmuganathan Raman, ISBN: 978-9811519780, Publisher: Springer

2. "Image Processing and Pattern Recognition: Fundamentals and Techniques" by Frank Y. Shih, ISBN: 978-1119211665, Publisher: Wiley India
3. "Introduction to Pattern Recognition and Machine Learning" by M Narasimha Murty and V Susheela Devi, ISBN: 978-9811307981, Publisher: Springer
4. "Computer Vision and Image Processing: Fundamentals and Applications" by S. Nagabhushan, ISBN: 978-8120337249, Publisher: New Age International Publishers
5. "Digital Image Processing" by S. Jayaraman, S. Esakkirajan, and T. Veerakumar, ISBN: 978-0070144798, Publisher: McGraw Hill Education
6. "Computer Vision: Algorithms and Applications" by Richard Szeliski ISBN: 978-1848829343
7. "Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods ISBN: 978-0132345637
8. "Learning OpenCV 4: Computer Vision with Python" by Adrian Kaehler and Gary Bradski ISBN: 978-1491937990
9. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani ISBN: 978-1788295628
10. "Multiple View Geometry in Computer Vision" by Richard Hartley and Andrew Zisserman ISBN: 978-0521540513
11. OpenCV Documentation: URL: https://docs.opencv.org/
12. Coursera - "Computer Vision Basics" URL: https://www.coursera.org/learn/computer-vision-basics
13. PyImageSearch URL: https://www.pyimagesearch.com/
14. Khan Academy - "Introduction to Image Processing" URL: https://www.khanacademy.org/computing/computer-science/algorithms/image-processing
15. DeepAI - "Computer Vision" URL: https://deepai.org/machine-learning-glossary-and-terms/computer-vision

Mapping of COs with Syllabus

Module	CO1	CO2	CO3	CO4
M 1	H	L	-	-
M 2	M	H	M	-
M 3	L	M	H	M
M 4	-	L	M	H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	CAIN107I	Internship	4
4	Internship	CAIN213I	Internship	4
5	Internship	CAIN314I	Internship	2

CAIN107I/ CAIN108I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 hours)

CAIN314I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours)

Objectives

The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in classroom courses to real-life industry work situations. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills.

COURSE/ LEARNING OUTCOMES

At the end of the internship, students will be able to:

CO 1: Relate theory and practical with real life examples. (Remembering)
CO 2: Explain the technical processes involved in the industry. (Understanding)
CO 3: Identify the importance of learning the computer technology. (Applying)
CO 4: Analyse application of computer technology into the practical field. (Analysing)
CO 5: Discuss the actual technological advancements in the industry. (Creating)

GUIDELINES:

The students should follow the following instruction and guidelines during the course of the internship:

- The internship should be for a minimum duration of 80 hours which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.
- The students have to undergo the internship during the Summer/Winter Break.
- The students can undergo an internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to computer technology.
- After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department.
- There would be a Seminar Presentation (PPT) and Viva-Voce Examination based on which the students would be evaluated for the internship. The Internship report would also be a part of the evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise the following:

a. Recommendation Letter from the Department.
b. Completion Certificate from the Organisation where the student has worked as an intern.
c. Internship Diary as per the prescribed format.
d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.

The Contents of the Report must include:

a. Introduction.
b. Objectives of the Internship.
c. About the Organisation (Sector, Activities, Operations).
d. Description of the work.
e. Learning Outcomes.

The Assessment for the internship must have the following components:

- Internship Report: 20 Marks
- Internship Diary: 20 Marks
- Seminar Presentation: 30 Marks
- Viva-Voce Examination: 30 Mark

RESEARCH PROJECT/DISSERTATION

BCA (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	CADI410P	Dissertation Phase I	6
8	Research Project/Dissertation	CADI411P	Dissertation Phase II	6
BCA (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	CADI412P	Dissertation Phase I	18
8	Research Project/Dissertation	CADI413P	Dissertation Phase II	20

BCA (Honours)

CADI410P: DISSERTATION-I

(6 credits – 180 hours) (L-T-P: 0-0-6)

Objective

This course aims to provide the student with various practical and research based knowledge on different problem specific statement, system deployment techniques and analysis.

COURSE / LEARNING OUTCOMES

At the end of the research project students will be able to:

1. Recall different process involved in software development life cycle (Remembering).
2. Understanding the research problem statement and related literature study (Understanding).
3. Analyse end user requirements for identifying system functionality metrics and decide whether developed system can solve the research problem. (Analysing)
4. Choose an engineering approach to solving problems, starting from the acquired knowledge to visual interpretation. (Evaluating)

5. Propose the use of certain technologies by implementing them in different programming languages to solve the research problem statement (Creating).

Module I: (12 hours)
Research methodology and types, Identification of research problem statement, finding the limitation of existing system

Module II: (12 hours)
Literature study, Identification of software and hardware requirement, schedule feasibility, economic and operational feasibility, identification software development metrics, Identification of development platform, planning for experimental arrangement

Module III: (8 hours)
Prepare Design diagrams/flowchart etc. (as applicable), Identify deployment strategy, identify probable outcome and observation.

Module IV: (15 hours)
Resolve and Implement the problem statement through proposed software model and system architecture.
Write a paper based on overall evaluation and findings during case studies / research project activities.

Module V: (13 hours)
Prepare a report to highlight the problem statement, design diagram, technologies deployed and references used to resolve end users requirement.
Submit a research paper for participation in national/international conferences for a peer review by external editorial committee.

Suggested Readings:
1. Kothari, C. and Garg, G., *Research methodology Methods and Techniques*., NEW AGE International Publishers
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	**H**	**H**	**L**	**L**	
CO 2	**H**	**H**			
CO 3	**L**	**L**	**H**	**H**	**M**
CO 4		**L**	**H**	**H**	**L**
CO 5			**M**	**H**	**H**

CADI411P: DISSERTATION-II

(6 credits – 180 hours) (L-T-P: 0-0-6)

Objective
This course aims to provide the student with various practical and research-based knowledge on different problem-specific statements, system deployment techniques, and analysis.

COURSE / LEARNING OUTCOMES
At the end of the research project, students will be able to:
1. Understanding the research problem statement and related literature study (Understanding).
2. Analyse end-user requirements for identifying system functionality metrics and decide whether the developed system can solve the research problem. (Analysing)
3. Choose an engineering approach to solving problems, starting from the acquired knowledge to visual interpretation. (Evaluating)
4. Solve problems using standard algorithms along with the presentation of probable findings and recommendations (Applying)
5. Propose the use of certain technologies by implementing them in different programming languages to solve the research problem statement (Creating).

Module I: (12 hours)
Research methodology and types, Identification of problem statement, literature study for a solution, evaluation of the existing system, finding the limitation of the existing system

Module II: (12 hours)
Comparative Literature review on recent trends for research problem solving, identification of software and hardware

requirement, schedule feasibility, economic and operational feasibility, identification of software development metrics, Identification of development platform, and planning for experimental arrangement

Module III: (8 hours)
Prepare Design diagrams/flowcharts etc. (as applicable), design test cases, develop a test bed for solving the problem statement, Identify deployment strategy, and identify probable outcomes and observation.

Module IV: (15 hours)
Develop algorithms and implement using programming languages.
Resolve and Implement the problem statement through proposed software model and system architecture.
Write a paper based on overall evaluation and findings during case studies / research project activities.

Module V: (13 hours)
Prepare a report to highlight the problem statement, design diagram, technologies deployed and references used to resolve end users requirement.
Submit a research paper for participation in conference/books/letter/journal for a peer review by external editorial committee.

Suggested Readings
1. Kothari, C. and Garg, G., *Research methodology Methods and Techniques*., NEW AGE International Publishers
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			
CO 2	L	L	H	H	M
CO 3		L	H	H	L
CO 4			H	H	M
CO 5			M	H	H

BCA (Honours) with Research

CADI412P: DISSERTATION- I
(18 Credits -540 Hours) (L-T-P: 0-0-18)

Objective
During this phase, the student will start a research project applying the knowledge acquired during the first two semesters and incorporating the recent trends in the chosen area. It should include phases of analyses and design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department during the semester.

COURSE / LEARNING OUTCOMES:
At the end of the research work, students will be able to-
1. Plan and engage in, an independent and sustained critical investigation and evaluation of a chosen research topic relevant to environment and society. (Applying)
2. Systematically identify relevant theory and concepts, relate these to appropriate methodologies and evidence, apply appropriate techniques and draw appropriate conclusions. (Applying and understanding)
3. Systematically analyse and critically evaluate the relevant information sources. (Analysing and evaluating)
4. Formulate a methodology for the problem statement. (Creation).

Module I: Introduction (30 Hours)
Formulation of the problem statement, research question.

Module II: Literature Review(60 Hours)
Literature review, study of the existing systems and their limitations, and comparative study.

Module III: Requirement Analysis and Feasibility Study (60 Hours)
Requirement analysis: Identification of software and hardware requirement, Feasibility study: schedule feasibility, economic and operational feasibility, identification software development metrics, Identification of the development platform, planning for experimental arrangements

Module IV: Design, Dataset Preparation and Methodology Design (60 hours)

Data collection: Dataset collection, dataset description, dataset preprocessing
Prepare Design diagrams/flowchart etc. (as applicable), Identify the deployment strategy, the probable outcome, and the observation. Design a methodology for the given problem statement.

Module V: Documentation (60)
Project report, presentation
Submit a research paper for participation in national/international conferences or journals (peer reviewed) for peer review by an external editorial committee.

Suggested Readings:
1. Kothari, C. and Garg, G., *Research methodology Methods and Techniques*., NEW AGE International Publishers
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			H
CO 2		H	H		M
CO 3				H	M
CO 4				H	M

CADI413P: DISSERTATION- II

(20 Credits -600 Hours) (L-T-P: 0-0-20)

Objective
During this phase, the student will carry forward and complete the work that they started in Phase I. It is expected that the student will publish at least one research paper in a well-known journal to augment their work during this phase. Published papers will carry extra weight during evaluation. The mode and components of evaluation and the weights attached to them shall be published by the Department at the beginning of the semester.

COURSE / LEARNING OUTCOMES:
At the end of the research work, students will be able to-
1. Apply the algorithm formulated in Phase I for model implementation(Application).
2. Compare the results with the existing system to identify its accuracy (Analysis)
3. Evaluate and summarize the outcome which is expected from the research (Evaluating).
4. Create an outcome based on the methodology implemented (Creation)

Module I: Implementation (80 hours)
Implement the proposed methodology using a suitable platform and tools.

Module II: Comparative Analysis (80 hours)
Detailed analysis of the standard techniques applied for decision making.

Module III: Training, Testing and Performance evaluation (60 hours)
Train and test the designed model with the prepared dataset.
Apply evaluation metrics to analyze performance and the accuracy of results.

Module IV: Documentation (80 hours)
Project report, presentation
Submit a research paper for participation in national/international conferences for peer review by external editorial committee.

Suggested Readings:
1. Kothari, C. and Garg, G., *Research methodology Methods and Techniques*., NEW AGE International Publishers
2. Roger S. Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		H	H	
CO 3			H	H
CO 4				H

INTEGRATED MASTER OF BUSINESS ADMINISTRATION (iMBA)

DEPARTMENT OF MANAGEMENT

PROGRAMME: FIVE-YEAR BCA-MCA INTEGRATED PROGRAMME

DEGREE: INTEGRATED MASTER OF BUSINESS ADMINISTRATION (iMBA)

Vision:
The five year BBA-MBA Integrated curriculum strives to grow into a significant position in Management education to create graduates in the field of business and management to become future business leaders, entrepreneurs who are socially responsible professionals capable of adapting into the dynamic corporate world having a globally acceptable vision.

Mission:
To focus on imparting the highest quality education at par with international standards with a strong foundation of management concepts and its applications, for students to excel and enhance their skills in order to make them accepted worldwide as managers.
To develop a strong industry-academia interface for project based learning, internships and placements
The pedagogy designed focus on practical learning through case studies, flipped classrooms, experiential projects, presentations, group discussions, etc enabling students to apply their knowledge in real world scenarios. This hands-on approach prepares the students to understand and interpret the challenges of the business world and enhances their critical thinking, analytical and communication skills.

Programme Outcomes (PO)
On successfully completing the program the student will be able to:
PO 1. Critical Thinking, Business Analysis and Problem Solving:
Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO 2. Effective Communication:
Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
PO 3. Social Responsiveness and Interaction:
Developing responsiveness to contextual social issues / problems and exploring solutions. Elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO 4. Ethical and responsible citizen:
Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them. : Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO 5. Environment and Sustainability:
Understand the issues of environmental contexts and sustainable development.
PO 6. Leadership and Team work,
Understanding leadership roles at various levels of the organization and leading teams. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes (PSO)
On the successful completion of B.B.A., the students will be able to:
PSO 1: Acquisition of Knowledge, skills and experiential learning in functional areas of management:
Comprehend the various concepts, processes and significance; to develop an insight and analytical abilities and also to develop the ability to provide solutions for effective decision making in practical business problems
PSO 2: Development of managerial skills:
Ability to visualize managerial problems and identify various alternatives to solve them To provide an opportunity for gaining practical understanding of the workplace and develop various leadership and interpersonal skills through internship training and also to make the students industry ready and to enhance critical thinking skills in understanding business challenges related to global business.
PSO 3: Entrepreneurship development skills:
To promote entrepreneurial skills by understanding the fundamentals of new business ventures. Ability to apply contemporary tools and techniques

COURSE STRUCTURE

Year	Semester	Category	Course Code	Name of the Course	Credit	Page No
I	1	Major Course 1	MTMP100T	Management Process, Principles and Practices	4	942
		Minor Course 1	MTBO102T	Business Organisation	4	961
		Skill Enhancement Course	MTED104L	Entrepreneurship Development	3	975
		Multi-disciplinary Course	Course to be chosen from stream not studied in Class 12		3	
		Ability Enhancement Compulsory Course	AECE100T/ AECH100T/ AECA100T AEFR100T/ AEGR100T	Communicative English -I / Communicative Hindi-I / Communicative Assamese-I/ French Beginner Level I/ Introduction to German Language – I	2	67 69 71 73 75
		Common Value Based Course-I	CBES101T	Environmental Studies	1	106
		Common Value Based Course-II	CBHY102T	Health and Wellness, Yoga Education, and Sports and Fitness	1	107
		Community Engagement Course		Service-Learning Theory	2	
				Total Credits	20	
	2	Major Course 2	MTMF107T	Accounting for Managers and Financial Management	4	943
		Minor Course 2	MTMF103T	Management Fundamentals	4	962
		Skill Enhancement Course	MTOM105L	Office Organization and Management	3	976
		Multi-disciplinary Course	Course to be chosen from stream not studied in Class 12		3	
		Ability Enhancement Compulsory Course	AECE101T/ AECH101T/ AECA101T/ AEFR101T/ AEGR101T	Communicative English -II / Communicative Hindi-II / Communicative Assamese-II/ French Beginner Level-II/ Introduction to German Language–II	2	68 70 72 73 75
		Common Value Based Course-III	CBDT103T	Digital and Technological Solutions	1	107
		Common Value Based Course-IV	CBUI104T	Understanding India	1	108
		Community Engagement Course		Service-Learning Practice	2	
				Total Credits	20	
BBA Certificate						
II	3	Major Course 3	MTMM200T	Marketing Management	4	944
		Major Course 4	MTOV201T	Organizational Behaviour	4	945
		Minor Course 3	MTBI205T	Banking and Insurance	4	963
		Skill Enhancement Course	MTRM210L	Retail Management	3	977
		Multi-disciplinary Course	Course to be chosen from stream not studied in Class 12		3	
		Ability Enhancement Compulsory Course	AECE200T/ AECH200T/ AECA200T AEFR200T/ AEGR200T	Communicative English -I / Communicative Hindi-I / Communicative Assamese-I/ French Beginner Level I/ Introduction to German Language – I	2	67 69 71 73 75
				Total Credits	20	
	4	Major Course 5	CMHR202T	Human Resource Management	5	946
		Major Course 6	MTCB203T	Consumer Behaviour	5	
		Major Course 7	MTMD204T	Business Mathematics and Statistics for Decision Making	4	947
		Minor Course 4	MTFT206T/ MTCM207T/-- -	Fundamentals of Investment / Compensation Management / Customer Relationship Management	4	964 965 965
		Ability Enhancement Compulsory Course	AECE201T/ AECH201T/ AECA201T/	Communicative English -II / Communicative Hindi-II / Communicative Assamese-II/	2	68 70 72

			AEFR201T/ AEGR201T	French Beginner Level-II/ Introduction to German Language–II		73 75
				Total Credits	20	
BBA Diploma						
III	5	Major Course 8	MTME300T	Managerial Economics	5	949
		Major Course 9	MTEG301T	Business Ethics and Corporate Governance	5	950
		Major Course 10	MTPO302T	Production and Operations Management	4	951
		Minor Course 5	MTSH307T/ MTPF308T/ MTMR309T	Strategic HRM/ Personal Financial Planning/ Marketing Research	4	966 967 968
		Internship	MTIN315I	Internship	2	979
				Total Credits	20	
	6	Major Course 11	MTPM303T	Business Policy and Strategic Management	4	952
		Major Course 12	MTFI304T	Financial Markets and Institutions	4	952
		Major Course 13	MTCL305T	Corporate and Business Law	4	953
		Minor Course 6	MTIR311T/ MTIP312T/ MTDM313T	Management of Industrial Relations/ Investment Analysis and Portfolio Management / Digital Marketing	4	969 970 971
		Major Course 14		Minor project	4	
				Total Credits	20	
BBA						
IV	7	Major Course 15	MTCF400T	Corporate Finance	5	956
		Major Course 16	MTSC401T	Supply Chain Management	5	957
		Minor Course 7		Analysis of Business Environment: Indian and Global	3	972
		Minor Course 8	MTRM406T	Research Methodology	2	973
		Major Project 1	MTDI408P	Research Project/Dissertation - I	5	981
		TOTAL CREDITS			20	
	8	Major Course 17	MTSM402T	Services Marketing	5	958
		Major Course 18	MTCR403T	Corporate Restructuring	5	959
		Minor Course 9	MTIB407T	International Business	3	974
		Skill Enhancement Course		Virality in Digital Media	2	978
		Major Project 2	MTDI409P	Research Project / Dissertation - II	6	
				Total Credits	20	
BBA (Honours)/ BBA (Honours) with Research						
V	9	Major Course 19		Strategic Management	4	
		Minor Course 10		Quantitative Techniques for Business	4	
		Skill Enhancement Course		Business Case Design and Presentation	3	
		Specialization I: **Finance Specialisation**				
		Discipline Specific Elective-I		Corporate Financial Decision	3	
		Discipline Specific Elective-II		Financial Reporting	3	
		Discipline Specific Elective-III		International Finance	3	
		Specialization II: **Marketing Specialisation**				
		Discipline Specific Elective-I		International Marketing	3	
		Discipline Specific Elective-II		Integrated Marketing Communications	3	
		Discipline Specific Elective-III		Hospitality & Tourism Marketing	3	
		Specialization III: **Marketing Specialisation**				
		Discipline Specific Elective-I		Cross Cultural Management	3	
		Discipline Specific Elective-II		Training & Management Development	3	
		Discipline Specific Elective-III		Strategic HRM	3	
		TOTAL CREDITS			20	
	10	Major Course 20		Dissertation III	4	
		Minor Course 11		Data Analytics and AI in Business	4	

		Skill Enhancement Course		Business Case Design and Presentation	3	
		Finance Specialisation				
		Discipline Specific Elective-I		Project Appraisal & Finance	3	
		Discipline Specific Elective-II		Management of Financial Institutions	3	
		Discipline Specific Elective-III		Personal Finance & Planning	3	
		Marketing Specialisation				
		Discipline Specific Elective-I		Service Marketing	3	
		Discipline Specific Elective-II		Sales and Distribution Management	3	
		Discipline Specific Elective-III		Product & Brand Management	3	
		HR Specialisation				
		Discipline Specific Elective-I		HR Analytics	3	
		Discipline Specific Elective-II		Team Dynamic and Leadership	3	
		Discipline Specific Elective-III		Organisational Development & Change Management	3	
				Total Credits	20	
Integrated MBA						

DETAILED SYLLABUS
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	MTMP100T	Management Process, Principles and Practices	4
2	Major Course 2	MTHB101T	Fundamentals of Human Resources Management & Organisation Behaviour	4
3	Major Course 3	MTMM200T	Marketing Management	4
3	Major Course 4	MTAI201T	Introduction to Aviation Industry	4
4	Major Course 5	MTFM202T	Fundamentals of Financial Management	5
4	Major Course 6	MTCB203T	Consumer Behaviour	5
4	Major Course 7	MTMD204T	Business Mathematics and Statistics for Decision Making	4
5	Major Course 8	MTME300T	Managerial Economics	5
5	Major Course 9	MTEG301T	Business Ethics and Corporate Governance	5
5	Major Course 10	MTPO302T	Production and Operations Management	4
6	Major Course 11	MTPM303T	Business Policy and Strategic Management	4
6	Major Course 12	MTFI304T	Financial Markets and Institutions	4
6	Major Course 13	MTCL305T	Corporate and Business Law	4
6	Major Course 14	MTMP306P	Minor Project – 1	4
7	Major Course 15	MTCF400T	Corporate Finance	5
7	Major Course 16	MTSC401T	Supply Chain Management	5
8	Major Course 17	MTSM402T	Services Marketing	5
8	Major Course 18	MTCR403T	Corporate Restructuring	5

MTMP100T: MANAGEMENT PROCESS, PRINCIPLES AND PRACTICES

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s)*: The objective of this course is to develop an understanding of the Principles and processes of management covering the basic management functions and challenges in the emerging perspective.*

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: define the meaning of MPP. (Remembering)
CO2: explain the theory of planning and control. (Understanding)
CO3: determine the organisational process. (Applying)

Module I: Introduction to MPP (15 Hours)

Introduction: Concept, Nature, Process and Significance of Management; Managerial Roles (Mintzberg); Development of Management Thought- Classical, Neo -classical, Behavioural and Management Science Approach, System and Contingency Approaches.

Module II: Planning & Control (15 Hours)

Planning and Control: Concept, Process and Types; Planning Tools- Forecasting and Scheduling; Decision -making concept and process; Bounded rationality; Management by objectives; Corporate Planning- Environment analysis and Diagnosis

Module III: Organising (15 Hours)

Organising: Concept, nature, process and significance; Authority and Responsibility relationships Delegation, Decentralisation; Departmentation basis and formats (Project and Matrix); Formal and Informal Organisation; Changing patterns in Organisation structures in the Knowledge economy. Directing- Motivating and Leading People at work.

Module IV: Communication and Decision Making (15 Hours)

Role of communication; Communication media and technology, communication networks - formal vs. informal; barriers to effective communication; communication skills; persuasion in communication; active listening; participative decision making techniques; group vs. the individual; the decision making process

Suggested Readings

1. Joseph L. Massie :Essentials of Management .PHI, New Delhi; 2015
2. James F.Stoner :Management. Pearsons Education, Delhi ; 2020
3. Harold Koontz, Heinz Weihrich: Management. Tata McGraw Hill Pub. Co., Delhi; 2015
4. Amitai Etzioni :Modern Organizations. PHI, New Delhi; 2021
5. Jones, Gareth R. and Jennifer M. George: Contemporary Management. Tata McGraw Hill
6. Charles Hill, W.L. and Steven L.McShane: Principles of Management. Tata McGraw Hill

E Resources

a) https://www.youtube.com/watch?v=q6LMjurECZM
b) https://www.youtube.com/watch?v=GZ2dmbDmB5I

Mapping of COs with Syllabus

Cos	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M

MTMF107T: ACCOUNTING FOR MANAGERS AND FINANCIAL MANAGEMENT
(Credits: 4- 60 hours) (L-T-P: 4-0-0)

Objective(s)*:* To equip students with a comprehensive understanding of accounting and financial management principles, enabling them to apply financial analysis and decision-making tools for effective managerial control and strategic planning.

Course/Learning Outcomes

After learning this course, the students will be able to:
CO1: define the Fundamental accounting principles and financial management concepts. (Understanding)
CO2: identify the financial statements and interpret financial information for decision-making (Applying)
CO3: analyse the budgeting and financial control systems for effective resource management. (Analyzing)
CO4: evaluate the financial performance of a business and recommend strategies for improvement (Evaluating)

Module I: Financial Accounting

Introduction to accounting: Basic concepts, accounting principles, and the accounting cycle. Financial statements: Balance sheet, income statement, cash flow statement, and their analysis. Ratio analysis: Liquidity, profitability, solvency, and activity ratios. Inventory valuation and management: Inventory systems, valuation methods, and inventory control.

Module II: Cost Accounting

Introduction to cost accounting: Cost concepts, classification, and behavior. Cost-volume-profit analysis: Break-even point, margin of safety, and contribution margin. Job order costing and process costing: Costing systems and procedures. Activity-based costing: Concept, benefits, and implementation.

Module III: Financial Management

Financial management concepts: Goals, scope, and functions. Time value of money: Concepts, calculations, and applications. Capital budgeting: Techniques for evaluating investment proposals. Working capital management: Cash, receivables, and inventory management.

Module IV: Financial Markets and Institutions

Financial markets: Types, functions, and participants. Financial institutions: Commercial banks, investment banks, and financial intermediaries. Risk management: Types of risk, risk assessment, and risk mitigation. Financial instruments: Shares, debentures, and derivatives.

Module V: Budgeting and Financial Control

Budgeting process: Types of budgets, budgeting techniques, and zero-based budgeting. Performance evaluation: Responsibility accounting, variance analysis, and performance measurement. Financial forecasting and planning: Techniques and tools. Cash flow management: Cash budgeting and cash forecasting.

Suggested Readings

1. Horngren, C. T., Datar, S., & Rajan, M. V. (2012). Cost accounting: A managerial emphasis. Pearson.
2. Ross, S. A., Westerfield, R. W., & Jordan, B. D. (2019). Fundamentals of corporate finance. McGraw-Hill Education.

3. Weygandt, J. J., Kimmel, P. D., & Kieso, D. E. (2019). Financial accounting. Wiley.
4. Gitman, L. J., & Joehnk, M. D. (2018). Principles of managerial finance. Pearson.

Mapping of COs with Syllabus

Cos	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M
CO4				M	
CO5					M

MTMM200T: MARKETING MANAGEMENT

(Credits: 4 - 60 hours) (L-T-P: 4-0-0)

Objective(s)*: The Objective of the course is to introduce the students to the domain of marketing and to its practical applications.*

Course/Learning Outcomes

At the end of the course students will be able to:
CO1: enumerate the fundamentals of marketing management. (Understanding)
CO2: assess the marketing environment. (Analyse)
CO3: analysing market segmentation. (Analysis)
CO4: examine pricing strategy and distribution channels. (Analysis)
CO5: importance of communication in marketing (Creating)

Module I: Fundamentals of Marketing (8 Hours)

Conceptual Framework of Marketing, Core Concepts of Marketing, Marketing Philosophies, Marketing Myopia, Marketing Practices developed over 21st Century; Different Contexts of Marketing Applications.

Module II: Marketing Environment (10 Hours)

Analysis of marketing environment: Macro and Micro components and their impact on marketing decisions, Macro & Micro environment of Marketing – Industry & Competitor analysis, Developing strategies.

Module III: Market Segmentation and Product Overview (13 Hours)

Consumer buying Model, Market segmentation, Targeting and Positioning, Market and Marketing research and Marketing Information System, Marketing Mix, Product mix strategies, : Product and service concept, Product Lines- Length, Breadth & depth, Product life cycle, New product Development, Brand concept, Brand Equity.

Module IV: Pricing and Distribution Strategies (14 Hours)

Pricing strategies, Price setting, Price determination. Channels of distribution: Types, Designing Distribution Channels, Managing Conflicts and Controls in Channels, Retailing, and Wholesaling, E-Retailing.

Module V: Marketing Communication Mix (15 Hours)

Marketing Communication, Integrated Marketing Communication, Promotional Mix Components- Advertising Vs Promotion, Advertising Vs Publicity, Sales Promotion, Public Relations, Personal Selling and Direct Marketing, Digital Marketing. Emerging issues in marketing, Ethical issues, Green marketing, Consumerism, CSR in marketing, Payment related issues in the cashless era.

Suggested Readings

1. Kotler, P., Keller, K., Koshy, L., & Jha, M: Marketing Management: A South Asian Perspective. Pearson Education, New Delhi; 2019.
2. Saxena, R: Marketing Management. Tata McGraw Hill, New Delhi; 2015.
3. Stanton: Fundamentals of Marketing, McGraw Hill; 2020.
4. S. Jayachandran: Marketing Management, Tata McGraw Hill; 2015.
5. Ramaswamy, V. S., & Namakumari, S: Marketing Management: Global Perspective Indian Context. Laxmi Narayan Publication, New Delhi; 2014.

Mapping of COs to syllabus

Cos	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3			H		
CO4				H	
CO5					M

MTOV201T: ORGANISATIONAL BEHAVIOUR
(4 credits-60 Hours) (L-T-P: 4-0-0)
Objective(s)*: The Objective of the course is to equip students with a comprehensive understanding of individual, group, and organizational behavior, enabling them to analyze organizational dynamics, develop effective interpersonal and leadership skills, and contribute to organizational success.*

Course/Learning Outcomes
At the end of the course students will be able to:
CO1: demonstration of fundamental concepts and theories of organizational behavior. (Understanding)
CO2: assessing the individual and group behavior within organizational contexts (Evaluating)
CO3: assessing the organizational behavior concepts to address real-world organizational challenges (Evaluating)
CO4: categorise the effective interpersonal and leadership skills. (Analysis)
CO5: evaluating the impact of organizational behavior on organizational performance (Evaluating)

Module I: Introduction (10 Hours)
Airline Industry – Scope, Types. Scheduled and Non-Scheduled Flights; Air Cargo Transport – Economic and Social impact; Regulatory Bodies; Key Performance indicators.

Module II: Fundamentals of Aviation Industry (12 Hours)
Airline Profitability, Main Industry, Characteristics of Passenger airlines, Service Industry – Characteristics.

Module III: Organisational Structure (12 Hours)
Airline Alliances, Development of commercial airlines, Deregulation – Impact of Deregulated Airline industry, Organizational Structure, Types of Airline Personnel, Flight crew and Cabin Crew Training, Organizational Culture**.**

Module IV: Airport and services (12 Hours)
Airports – Personnel, Processing Passengers and Freight, Airport Security, Air Navigation Services, Air Traffic Control, Airplanes – Manufacturers – Types of Aircraft.

Module V: Safety and Security (14 Hours)
Air Safety and Security, Role of Regulatory Agencies, Airside Safety, Culture of Safety, Issues in Air safety, Accident and Incident Investigation, Future of Airline Industry

Suggested Readings
1. Andreas Wald, Sven Grossand Hanns Christian Wirtz, Introduction to Aviation Management, published by Routledge
2. Dr Richard Shevell, Fundamentals of Aviation and Aerospace, published by CRC Press in 2018
3. National Research Council, Aviation and the Role of Government, published by National Acaemies Press in 1998
4. Bijan Vasign, Ken Flemming and Thomas Tacker, Introduction to Airport EconmicsL From Theory to Applications, published by Routledge in 2015

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L	M		L	
CO 2	L	L			
CO 3			M	M	M
CO 4			H		
CO 5					H

Major 5: HUMAN RESOURCES MANAGEMENT

(5 credits- 75 hours) (L-T-P: 5-0-0)

Objective(s): *The objective of this paper is to provide the students with a comprehensive understanding of human resource management principles and practices, enabling them to effectively manage human capital, contribute to organizational success, and foster a positive work environment.*

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: define the nature and strategic role of human resource management in organizations (Remembering)
CO2: describe the human resource issues and challenges faced by organizations (Understanding)
CO3: explain the human resource management concepts and practices to solve organizational problems (Applying)
CO4: analyse the effective human resource policies and strategies (Analyzing)
CO5: evaluate the impact of human resource management on organizational performance. (Evaluating)

Module I: Human Resource Management: An Overview

Evolution of human resource management. Strategic human resource management. Human resource planning and job analysis. Recruitment and selection processes. Legal framework of human resource management

Module II: Human Resource Development

Training and development needs assessment. Training methods and techniques. Performance management and appraisal. Career planning and development. Employee compensation and benefits

Module III: Organizational Behavior

Individual behavior in organizations: Personality, perception, attitudes, and motivation. Group dynamics and team building. Leadership and organizational culture. Organizational change and development. Conflict management and negotiation

Module IV: Employee Relations

Employee communication and engagement. Employee welfare and safety. Industrial relations and collective bargaining. Labor laws and regulations. Grievance handling and disciplinary actions

Module V: Contemporary Issues in HRM

Global human resource management. Diversity and inclusion. Work-life balance. Organizational ethics and social responsibility. Human resource information systems (HRIS).

Suggested Readings

1. Dessler, G. (2017). Human resource management. Pearson.
2. Noe, R. A., Hollenbeck, J. R., Gerhart, B., & Wright, P. M. (2017). Human resource management: Gaining a competitive advantage. McGraw-Hill Education.
3. Robbins, S. P., & Judge, T. A. (2017). Organizational behavior. Pearson.
4. Mondy, R. W., Premeaux, S. R., & Noe, R. A. (2016). Human resource management. Wiley.

Mapping of COs with Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M
CO4				M	
CO5					M

MTCB203T: CONSUMER BEHAVIOUR

(5 credits- 75 hours) (L-T-P: 4-0-0)

Objective(s): The objective of the course is to make the *students understand the different concepts of consumer behavior, role of social and cultural settings on consumer behavior and consumer buying process.*

Course/ Learning Outcomes:

At the end of this course students will be able to:

CO1: define the consumer behaviour. (Remembering)
CO2: explain the models of consumer decision process. (Understanding)
CO3: apply the factors influencing consumer behavior in developing marketing strategies, identify purchase decision and post

purchase behaviour in varied marketing situations (Applying)
CO4: analyse market segmentation and segmentation of consumer markets, (Analysing)
CO5: assess the positioning strategies on buying behaviour. (Evaluating)

Module I: Contemporary Dimensions of Consumer Behaviour (15 Hours)
Consumer Behaviour, Consumer Decision-Making, Models of Consumer Decision –Making, Types of Consumer Buying Behaviour, Factors influencing Consumer Behaviour, Market Segmentation, Segmentation of Consumer markets, Positioning, Differentiation and Marketing Mix, Marketing Research; Consumer Research Process, Types of Research Methods.

Module II: Implications Social and Cultural Settings on Consumer Behaviour (15 Hours)
Influence of culture and Subculture on Consumer Behaviour, Influence of Social Class on Consumer Behaviour, Social Stratification and Marketing Strategy, Group Influence on Consumer Behaviour, Household and Family Influence on Consumer Behaviour, Socialisation of family Members, Family Purchasing Decision-Making and Consumption Related Roles, family Life Cycle.

Module III: Consumer Buying Process (15 Hours)
Stages of Consumer Buying Process, Purchase Decision and Post Purchase Behaviour, Traditional and Contemporary Models of Consumer Behaviour; Case study

Module IV: Advertising as a communication process (20 Hours)
a) Advertising as a tool of communication; Meaning, nature and importance of advertising; Types of advertising; Advertising objectives. Audience analysis; Setting of advertising budget: Determinants and major methods.
b) Major media types-their characteristics, internet as an advertising media, merits and demerits; Factors influencing media choice; media selection, media scheduling, Advertising through the Internet-media devices

Module V: Evaluating communication and sales effects (10 Hours)
Evaluating communication and sales effects; Pre- and Post-testing techniques

Suggested Readings
1. Blackwell, Roger D, Paul W Miniard and James F Engel, Consumer Behaviour, Thomson Learning Inc.,2002.
2. Duhan S.N., GarimaSahni N.K. , Consumer Behaviour, 1st edition, 2016, Kalyani Publishers
3. Loudon, David l., and Albert J. Della Bitta, Consumer Behaviour, Tata McGraw Hill, New Delhi
4. Schiffman, Leon G., and Leslie kanuk, Consumer Behaviour, Prentice Hall, New Delhi
5. Schiffman, Kanuk L L., S Ramesh Kumar, Consumer Behaviour, 10th edition, Pearson
6. Dheeraj Sinha, Consumer India Inside the Indian Mind and Wallet, 2011, Jain Book Depot

Mapping of COs to Syllabus

Cos	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H		M	L	
CO 2		M			
CO 3			L	H	
CO 4		H			M

MTMD204T: BUSINESS MATHEMATICS & STATISTICS FOR DECISION MAKING

(4 Credits – 60 Hours) (L-T-P: 3-0-0)

Objective(s): *The objective of this course is to familiarize students with the applications of mathematics and statistical techniques in business decision-making*

Course/Learning Outcomes
At the end of this course students will be able to:
CO1: apply matrices in business and economic models (Applying)
CO2: illustrate the use of differentiation in business and economic models. (Applying)
CO3: identify the methods of calculating interest rates (Applying)
CO4: summarize data sets using descriptive statistics (Understanding)
CO5: analyse the relationship between two variables (Analysing)
CO6: determine the trend and seasonality in time series data (Evaluating)

Part – A: Business Mathematics

Module I: Matrices (7 Hours)
Definition of a matrix. Types of matrices; Algebra of matrices. Calculation of values of determinants up to third order; Adjoint of a matrix; Finding inverse of a matrix through ad joint; Applications of matrices to solution of simple business and economic problems

Module II: Differential Calculus (13 Hours)
Mathematical functions and their types – linear, quadratic, polynomial; Concepts of limit and continuity of a function; Concept of differentiation; Rules of differentiation – simple standard forms. Applications of differentiation – elasticity of demand and supply; Maxima and Minima of functions (involving second or third order derivatives) relating to cost, revenue and profit.

Module III: Basic Mathematics of Finance (5 Hours)
Simple and compound interest Rates of interest – nominal, effective and continuous – their interrelationships; Compounding and discounting of a sum using different types of rates

Part – B: Business Statistics
Module IV: Uni-variate Analysis (15 Hours)
Measures of Central Tendency including arithmetic mean, geometric mean and harmonic mean: properties and applications; mode and median. Partition values - quartiles, deciles, and percentiles. Measures of Variation: absolute and relative. Range, quartile deviation and mean deviation; Variance and Standard deviation: calculation and properties.

Module V: Bi-variate Analysis (10 Hours)
Simple Linear Correlation Analysis: Meaning, and measurement. Karl Pearson's co-efficient and Spearman's rank correlation Simple Linear Regression Analysis: Regression equations and estimation. Relationship between
correlation and regression coefficients

Module VI: Time-based Data: Index Numbers and Time-Series Analysis (10 Hours)
Meaning and uses of index numbers; Construction of index numbers: Aggregative and average of relatives – simple and weighted, Tests of adequacy of index numbers, Construction of consumer price indices. Components of time series; additive and multiplicative models; Trend analysis: Finding trend by moving average method and Fitting of linear trend line using principle of least squares.

Suggested Readings
1. Mizrahi and John Sullivan. Mathematics for Business and Social Sciences. Wiley and Sons.
2. Budnick, P. Applied Mathematics. McGraw Hill Publishing Co.
3. N. D. Vohra, Business Mathematics and Statistics, McGraw Hill Education (India) Pvt Ltd
4. J.K. Thukral, Mathematics for Business Studies, Mayur Publications
5. J. K. Singh, Business Mathematics, Himalaya Publishing House.
6. J. K. Sharma, Business Statistics, Pearson Education.
7. S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.
8. S.P. Gupta and Archana Gupta, Elementary Statistics, Sultan Chand and Sons, New Delhi.
9. Richard Levin and David S. Rubin, Statistics for Management, Prentice Hall of India, New Delhi.
10. M.R. Spiegel, Theory and Problems of Statistics, Schaum's Outlines Series, McGraw Hill Publishing Co.

Mapping of COs to Syllabus

Cos	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H				
CO 3			H			
CO 4				H		
CO 5					H	
CO 6						H

Major 8: MANAGERIAL ECONOMICS : (5 credits-75 Hours) (L-T-P: 5-0-0)

Objective(s): *The purpose of this course is to apply micro economic concepts and techniques in evaluating business decisions taken by firms. The emphasis is on explaining how tools of standard price theory can be employed to formulate a decision*

problem, evaluate alternative courses of action and finally choose among alternatives. Simple geometry and basic concepts of mathematics will be used in the course of teaching.

Course/Learning Outcome

At the end of this course students will be able to:

CO1: explain the mechanics of supply and demand in allocating goods and services and resources (Remembering)
CO2: illustrate how changes in demand and supply affect markets (Understanding)
CO3: apply the choices made by a rational consumer (Applying)
CO4: interpret the relationships between production and costs (Evaluating)
CO5: discuss key characteristics and consequences of different forms of markets (Creating)

Module I: (20 Hours)

Demand, Supply and Market equilibrium: individual demand, market demand, individual supply, market supply, market equilibrium; Elasticity of demand and supply : Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, elasticity of supply;

Theory of consumer behavior : cardinal utility theory, ordinal utility theory(indifference curves, budget line, consumer choice, price effect, substitution effect, income effect for normal, inferior and giffen goods), revealed preference theory.

Module II: (15 Hours)

Producer and optimal production choice: optimizing behavior in short run(geometry of product curves, law of diminishing marginal productivity, three stages of production), optimizing behavior in long run (isoquants, iso-cost line, optimal combination of resources) Costs and scale : traditional theory of cost (short run and long run, geometry of cost curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.

Module III: (20 Hours)

Theory of firm and market organization : perfect competition (basic features, short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of changes in demand, cost and imposition of taxes) ; monopoly (basic features, short run equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination; monopolistic competition (basic features, demand and cost, short run equilibrium, long run equilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma

Module IV :(20 Hours)

Factor Market: demand for a factor by a firm under marginal productivity theory (perfect competition in the product market, monopoly in the product market), market demand for a factor, supply of labour, market supply of labour, factor market equilibrium.

Suggested Readings

1. Dominick Salvatore (2009). Principles of Microeconomics (5th ed.) Oxford University Press
2. Lipsey and Chrystal. (2008). Economics. (11th ed.) Oxford University Press
3. Koutosyannis (1979). Modern Micro Economics. Palgrave Macmillan
4. Pindyck, Rubinfeld and Mehta. (2009). Micro Economics. (7th ed.). Pearson.

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		H		
CO 3			H	
CO 4				H
CO 5	H			M

MTEG301T: BUSINESS ETHICS AND CORPORATE GOVERNANCE

(Credits: 5-75 hours) (L-T-P: 5-0-0)

Objective(s): *The objective of this paper is to make the students aware about the importance of ethics in the business, practices of good governance to encourage moral imagination and heightening sensitivity towards the ethical dimension of managerial problems.*

Course/Learning Outcomes

At the end of this course the students will be able to:

CO1: define Business Ethics and best practices of business ethics (Remembering)
CO2: explain the various Corporate Social Responsibilities (Understanding)
CO3: plan the need and importance of corporate and professional responsibility (Applying)
CO4: analyse the corporate governance frameworks (Analyzing)

Module I: (15 Hours)

Business ethics: Introduction, Meaning of ethics, Types of business, ethical issues, why ethical problems occur in business, Ethical dilemmas and principles in business,
Case Study: Personal companies like Tata related to Ethics in Business in Indian context

Module II: (20 Hours)

Corporate governance: concept, need to improve corporate governance standards, Features of good governance, Corporate governance abuses, Role played by regulators to improve corporate governance. Different Approaches to Corporate Governance, Leadership and Corporate Governance, Rights and Privileges of shareholders; Investor's Problem and protection; Board of Directors; Role, Duties and Responsibilities of Auditors, Bank and Corporate Governance.

Case Study: International experience- UK scenario (Cadbury committee; US scenario(Tread way commission, Blue ribbon committee); Indian experience- imperatives, CII code of best practices, Kumar Mangalam Birla, Narayan Murthy committee report.

Module III: (20 Hours)

Moral issues in business: Importance of moral issues and reasoning, Principles of moral reasoning, Quality of work life, implications of moral issues in different functional areas of business like finance, HR and marketing.

Whistle blowing: Kinds of Whistle blowing, Marketing truth and advertising: Marketing, Advertising, Truth and advertising, Allocation of moral responsibility in advertising Trade secrets, corporate disclosure, insider trading: Trade secrets, corporate disclosure, insider trading Accounting, finance Affirmative action, Ethics and Environment

Module IV :(20 Hours)

Corporate Social Responsibility: Meaning, Evolution of Corporate Social Responsibility, Limits of Corporate Social Responsibility, Voluntary Responsibility Vs. Legal requirements, Profit maximization vs. social Responsibility, Socially Responsive Management: Strategies of response, formulating socially responsive strategies, Implementing social responsiveness, Financial incentives for social responsibility, Role of self regulation in discharge of social responsibility.

Case studies on Indian companies like Tata, Godrej etc related to Corporate Social Responsibility

Suggested Readings

1. Crane. A., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Taxmann Publishing House.
2. Manuel G Velasquez. Business Ethics: Concept and Cases
3. William H. Shaw, Business Ethics: A Textbook with Cases
4. Tom L. Beauchamp and Norman E. Bowie, Ethical Theory and Business
5. Jill Solomon, Corporate Governance and Accountability
6. R. I. Tricker, Corporate Governance: Principles, Policies, and Practices

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H		M	L
CO 2		M		H
CO 3		M	L	H
CO 4		H		L

MTPO302T: PRODUCTION AND OPERATIONS MANAGEMENT

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective(s): This course aims at acquainting the students with the functions of production and operations management and basic issues and tools of managing production and operation functions of an organization. The course also intends to provide the students a system theoretic view on project management and helps develop an understanding on why today's organizations are cultivating a formal project management process to gain competitive advantage.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define a production system. (Remembering)
CO2: explain the tools and techniques to measure work study, motion study. (Understanding)
CO3: demonstrate the procedure for product development and design. (Applying)
CO4: compute project completion time and Analyse and evaluate project risk management techniques. (Evaluating)

Module I: Introduction and Work Study (15 Hours)

Introduction to Production and operations management- Meaning and scope, subdivisions of work study Method/Motion study and Work Measurement

Module II: Plant Location and layout (15 Hours)

a) Objectives, Locational factors, Economics of plant location
b) Meaning, objectives and types of plant layout and their relevance to mass, batch and job- order production systems.
c) Systematic Layout Planning (SLP) procedure

Module III: Product design and Development and PPC (15 Hours)

a) Meaning of product, Product life cycle (PLC) and Product mix
b) Decisions to be taken during product development and design
c) Procedure for product development and design
d) Value of a product – its meaning, Value Analysis (VA) – its objectives, procedure and example, Simplification and Standardization.
e) Meaning and Objectives of PPC, Effects of types of production

Module IV: Project Management (15 Hours)

a) Project management framework, Project management processes, Cost and Time management, Project integration management, Project risk management, Project Quality management, Project communication management.

Suggested Readings

1. Adam, Ebert, Production and Operations Management, PHI.
2. R. Panneerselvam, Production and Operations Management, PHI.
3. K. Aswathappa & K. Shridhara Bhat, Production and Operations Management, Himalaya Publishing

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV
CO 1	H		M	L
CO 2		M		H
CO 3		M	L	H
CO 4		H		L

MTPM303T: BUSINESS POLICY & STRATEGIC MANAGEMENT

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Objective(s): *This course is designed to enhance knowledge on business policy and strategy adopted for managing the business. It will help a student to get broad exposure to understand the business policy and strategic management adopted by different business for their smooth running and facing the competition.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: develop an understanding of underlying concepts, tools, frameworks, issues and challenges involved in the area of Business Policy & Strategic Management for Under-graduates.

CO2: achieve development of an understanding of the increasing competition as well as not for profit business policies, strategies and the practice in organizations

CO3**:** explain the different circumstances & situations arising from ever changing strategic situation.

Module I: Introduction to Business Strategy and Formulation (15 Hours)

Introduction & Concept of Strategy, Corporate Policy as a field of study, Nature. Importance, purpose and objective of business policy, Chief Executive job, roles and responsibilities of board of Directors, An overview of strategic management, its nature and process, Formulation of strategy, Environment, environment scanning, environment appraisal, Identifying corporate competence & resource.

Module II: Introduction to Strategic Management (15 Hours)

Corporate Strategy, Persona1 and Ethical Values, Business ethics, Industry structure, Reconciling divergent values, Modification of values, moral components of corporate strategy, community considerations and corporate social responsibility (CSR) .

Module III: Strategic Management Process (15 Hours)

Corporate portfolio analysis, competitor & SWOT analysis, strategic audit & choice, strategic plan, routes to sustainable competitive advantage (SCA)

Module IV: Strategic Planning and Implementation (15 Hours)

Strategy Implementation, Structural implementation, organisational design and change, behavioural implementation, leadership, corporate culture. corporate politics and use of power, functional implementation - financial, marketing. Operation personnel (HR) policies and their integration, strategic evaluation and control

Suggested Readings

1. Wheelen, Thomas L , Hunger, J David & Rangarajan, Krish (2001) Concepts in Strategic Management & Business Policy, Pearson Education.
2. David, Fred R (2005), Strategic Management Concepts & Cases, PHI.
3. Kazmi, A. (2000); Business Policy, McGraw Hill.
4. Pearce, John A , Robinson, Richard B , Mital, Amita (2005) , 10th Edition., Strategic Management – Formulation, Implementation & Control, McGraw Hill.

Mapping of COs with Modules

Cos	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2		H		
CO 3			H	H

MTFI304T: FINANCIAL MARKETS AND INSTITUTIONS

(4 credits – 60 Hours) (L-T-P: 4-0-0)

Objective(s): *The objective of this paper is to introduce students to the different aspects and components of financial Institutions and financial markets and also to introduce them with the emerging application of technologies in the system. The study of the course will enable them to take rational decisions in the growing financial environment.*

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: describe the Indian banking system (Understanding)

CO2: explain the role of regulatory bodies in regulating the system (Understanding)

CO3: analyze the operative system of financial markets in India (Analyzing)

CO4: evaluate the types of debt instruments and their characteristics. (Evaluating)

CO5: elaborate the links between the theories of financial markets (Creating)

Module I: Structure of Indian Financial System (12 Hours)

An overview of the Indian financial system, financial sector reforms: context, need and objectives; major reforms in the last decade; competition; deregulation; capital requirements; issues in financial reforms and restructuring; future agenda of

reforms; Regulation of Banks, NBFCs &FIs, Salient provisions of banking regulation act and RBI Act; Role of RBI as a central banker; Products offered by Banks and FIs: Retail banking and corporate banking products. Universal Banking: need, importance, trends and RBI guidelines.

Module II: Emerging Technologies in Indian Financial System (12 Hours)
Core banking solution (CBS); RTGS, IMPS and internet banking, mobile banking, NBFCs and its types; comparison between Banks and NBFCs; payment bankers such as PayTM, Google Pay etc

Module III: Introduction to Financial Markets in India (12 Hours)
Role and Importance of Financial Markets, Financial Markets: Money Market; Capital Market; Factors affecting Financial Markets, Linkages Between Economy and Financial Markets, Debt Market- role and functions of these markets, Issue of Corporate Securities: Public Issue through Prospectus, Rights Issue, On- Line IPO, Book Building of Shares, Disinvestment of PSU, Employees Stock Options, Preferential Issue of Shares,

Module IV: Secondary Market in India (12 Hours)
Introduction to Stock Markets, Regional and Modern Stock Exchanges, International Stock Exchanges, Comparison between NSE and BSE, Raising of funds in International Markets; Indian Stock Indices and their construction, Factors influencing the movement of stock markets, indicators of maturity of stock markets, Major Instruments traded in stock markets, Myths attached to Investing in Stock Markets. Trading of securities on a stock exchange; Selection of broker, capital and margin requirements of a broker, DEMAT System

Module V: Money Markets & Debt Markets in India (12 Hours)
Money Market: Meaning, role and participants in money markets, Segments of money markets, money market instruments. Role of STCI and DFHI in money market, Debt Market: Introduction and meaning, Market for Government/Debt Securities in India, Secondary market for government/debt securities, over subscription and devolvement of Government Securities, Government securities issued by State Governments, Municipal Bonds, Corporate Bonds vs. Government Bonds

Suggested Readings
1. Khan, MY.(2010).Financial Services(5th ed.).Mc Graw Hill Higher Education.
2. Bharati V. Pathak, Indian Financial System, Pearson
3. Shahani, Rakesh(2011). Financial Markets in India : A Research Initiative. Anamica Publications
4. Goel, Sandeep.(2012).Financial services. PHI.
5. Gurusamy, S.(2010).Financial Services. TMH.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M			L	
CO 3		H	H		
CO 4			H	M	M
CO 5				H	

MTCL305T: CORPORATE AND BUSINESS LAW

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s): *The objective of this paper is to introduce students to the different aspects of Corporate and Business Law. To introduce them with the relevance and applications of the different laws*

Course/Learning Outcomes

At the end of this course students will be able to:
CO 1: define what a company is and how it is formed. (Remembering)
CO 2: explain the concepts related to the essential documents of companies (Understanding)
CO 3: explain the knowledge regarding administration of a company (Applying)
CO 4: Identify the legal provisions in the partnership business and its Act. (Analysing)

Module I: Introduction (12 Hours)
Introduction of Companies Act, 2013, meaning and characteristics of a company;types of companies including one person company, small company, and dormant company; association not for profit; illegal association; lifting of corporate veil; Registration and Incorporation of company, on-line filing of documents, promoters, their legal position ,pre-incorporation

contract; on-line registration of a company, Tribunal courts like NCLT, NCLAT etc

Module II: Documents of Companies (12 Hours)
Memorandum of association, Doctrine of ultra vires, Articles of association, Doctrine of constructive notice and indoor management, prospector-shelf and red herring prospectus, misstatement in prospectus, book-building; issue, allotment and forfeiture of share, transmission of shares, buyback and provisions regarding buyback; issue of bonus shares.

Module III: Administration and Management of Company (12 Hours)
Classification of directors, women directors, independent director, small shareholder's director; disqualifications, director identity number (DIN); appointment; Legal positions, powers and duties; removal of directors; Key managerial personnel, managing director, manager;
Meetings: Meetings of shareholders and board of directors; Types of meetings, Convening and conduct of meetings, Requisites of a valid meeting, postal ballot, meeting through video conferencing, e-voting.
Committees of Board of Directors- Audit Committee, Nomination and Remuneration Committee, Stakeholders Relationship Committee, Corporate Social Responsibility Committee

Module IV: The Indian Contract Act, 1872 (12 Hours)
a) Proposal- its communication, acceptance and revocation; Agreement vis-à-vis contract, void agreement & voidable contract
b) Consideration – essential elements, exception to rule- No consideration no contract; privity of contract and consideration
c) Capacity to contract; Free consent – coercion, undue influence, misrepresentation, fraud; Mistake – of fact and of law
d) Legality of object – agreements opposed to public policy and in restraint of marriage, trade & legal proceedings; Contingent contracts
e) Performance of contract–liability of joint promisor; Consequences of breach of contract–liquidated damages and penalty
f) Quasi contract; Indemnity guarantee–surety's liability
g) Bailment–Duties and liabilities of bailor and bailee, bailment of pledges;
h) Agency–types of agency, agents duty to principal and vice-versa, ratification and revocation of agent's authority

Module V: The Partnership Act, 1932 (12 Hours)
a) Nature of Partnership; Relation of partners-inter se; Relation of partners to third parties; Incoming and outgoing partners
b) Dissolution of Firm; Registration of Firms-effect of non-registration

Suggested Readings
1. Chadha, Reena& Chadha, Sumant; Corporate Laws, Scholar Publishing House, New Delhi
2. Kuchhal, M.C &Kuchhal, Vivek, Business Law, Vikas Publishing House
3. Kapoor, N.D; Business Law; Sultan Chand & Sons, New Delhi.

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2	L	H		
CO 3		L	H	
CO 4				L
CO 5				H

MTMP306P: FIELD BASED LEARNING/MINOR PROJECT
(4 credits-60 Hours) (L-T-P: 0-0-4)
Objective(s): *The objective of the minor project is to acquaint the students with the experiential learning through field work / survey on any related areas from the field of management.*

COURSE/LEARNING OUTCOMES
At the end of this course students will be able to:
CO1: define the different types of research project. (Remembering)
CO2: explain the various steps of designing research project (Understanding)
CO3: building questionnaire and schedules (Applying)
CO4: assessing the data for analysis (Analyzing)

CO5: appraising the findings in the report (Evaluating)
CO6: designing a research project report (Creating)

GUIDELINES:

Module I: INTRODUCTION

A. Broad introduction to thesis topic and method. Page or two.
B. Research problem. State broadly, in question form. Give sub-questions. Explain carefully. In one sense, usually the problem is to expand the body of knowledge examined in the literature review.
C. Need for the research. Who will benefit? Discuss applied and scientific contributions.
D. Nominal definitions. Define central terms.
E. Context. Add further info to clarify the research problem.

Module II: THEORY- Literature review

A. Overview. Theoretical foundations
B. Literature. Group articles by ideas. For a given idea, first discuss common strands in the literature, then departures
C. Scope of the study. Theoretical assumptions; discuss limitations they impose.

Module III: METHODS. Outline in a few pages.

A. Introduction. General description of method and design.
B. Design. Experiment, quasi-experiment, survey, and so forth. Detailed description
C. Sample. Universe, population, element, sample design, tolerance, probability.
D. Measurement. Operational definitions. Include, as applicable, detailed discussion of indexes/ scales. Specify methods used to assess validity and reliability.
E. Analysis. Techniques to be used; justification. Nature of relationships expected (e.g., asymmetrical, symmetrical, reciprocal; linear).
F. Methodological assumptions. Discuss limitations they impose.

APPENDICES

A. Schedule. In Gantt Chart form.
B. Facilities. Faculty and staff expertise, library and computer resources, other special facilities contributing to a successful study.
C. Budget.
D. Bibliographic essay. Sources searched (indexes, abstracts, bibliographies, etc.). Strengths and weaknesses of literature.

Module IV: FINDINGS

A. Brief overview.
B. Results of application of method; any unusual situations encountered. Nature of sample.
C. Descriptive analysis. One-way frequency distributions on central variables.
D. Validity/reliability analysis.
E. Tests of hypotheses.

Module V: DISCUSSION

When discussing implications, deal with both the theoretical and the practical. Present only interpretations of the findings, not opinion.

A. Brief overview.
B. Discussion of results of application of method. Implications.
C. Discussion of descriptive analysis. Implications.
D. Discussion of tests of hypothesis. Implications.
E. Post-hoc analysis. Implications.

Module VI: CONCLUSION May include writer's opinion.

A. Summary of entire thesis in a few pages.
B. Conclusions. Refer to lit review.
C. Implications. Speculate about broadest possible consequences, both theoretical and practical. Label speculation clearly.

D. Limitations. Theory, method.
E. Suggestions for future research.

APPENDICES; Bibliographic essay; Questionnaire;Raw data

MTCF400T: CORPORATE FINANCE
(5 Credits - 75 hours) (L-T-P: 5-0-0)
Objective(s): *To acquaint students with the techniques of financial management and their applications for business decision making.*
Course/Learning Outcomes
At the end of this course students will be able to:
CO 1: define the strategic objectives of the organisation for finance function. (Remembering)
CO 2: explain the different sources of corporate finance (Understanding)
CO 3: interpret the impact of risk and cost of capital impact on investment appraisal. (Applying)
CO 4: analyze the factors impacting the cost of capital (Analyzing)
CO 5: evaluate a corporation's capital structure (Evaluating)

Module I: Nature of Financial Management (20 Hours)
Nature of Financial Management: Finance and related disciplines; Scope of Financial Management; Profit Maximization, Wealth Maximization - Traditional and Modern Approach; Functions of finance – Finance Decision, Investment Decision, Dividend Decision; Objectives of Financial Management; Organisation of finance function; Concept of Time Value of Money, present value, future value, and annuity.

Module II: Long -term investment decisions (20 Hours)
Long -term investment decisions: Capital Budgeting - Principles and Techniques; Nature and meaning of capital budgeting; Estimation of relevant cash flows and terminal value; Evaluation techniques - Accounting Rate of Return, Net Present Value, Internal Rate of Return & MIRR.
Concept and Measurement of Cost of Capital: Explicit and Implicit costs; Measurement of cost of capital; Cost of debt; Cost of perpetual debt; Cost of Equity Share; Cost of Preference Share; Cost of Retained Earning; Computation of overall cost of capital based on Historical and Market weights

Module III: Capital Structures (20 Hours)
Capital Structures: Approaches to Capital Structure Theories - Net Income approach, Net Operating Income approach, Modigliani-Miller (MM) approach,Dividend Policy Decision - Dividend and Capital; The irrelevance of dividends: General, MM hypothesis; Relevance of dividends: Walter's model, Gordon's model; Leverage Analysis: Operating and Financial Leverage; EBIT-EPS analysis; Combined leverage.

Module IV: Working Capital Management (15 Hours)
Working Capital Management: Management of Cash - Preparation of Cash Budgets (Receipts and Payment Method only); Cash management technique (Lock box, concentration banking), Receivables Management – Objectives; Credit Policy, Cash Discount, Debtors Outstanding and Ageing Analysis; Costs - Collection Cost, Capital Cost, Default Cost, Delinquency Cost, Inventory Management (Very Briefly) - ABC Analysis; Minimum Level; Maximum Level; Reorder Level; Safety Stock; EOQ (Basic Model), Determination of Working Capital.

Suggested Readings
1. Berk & DeMarzo, Fundamentals of Corporate Finance, Prentice Hall.
2. M.Y. Khan & P.K. Jain , Financial Management, Tata McGraw Hill Publishing Co. Ltd.
3. Rustogi , Financial Management
4. I.M. Pandey , Financial Management
5. L.J. Gitman & C.J. Zutter, Managerial Finance
6. R.A. Brealey, S.C. Myers, F. Allen& P. Mohanty, Principles of Corporate Finance

Mapping of COs to Syllabus

Cos	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		L	M	
CO 3		M	H	

CO 4		M	H	
CO 5				H

MTSC401T: SUPPLY CHAIN MANAGEMENT

(5 credits – 75 Hours) (L-T-P: 5-0-0)

Objective(s): *The objective of this paper is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for an international firm.*

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define the process of supply chain management. (Remembering)
CO2: demonstrate operational purchasing methods and techniques on supplier management (Understanding)
CO3: explain the strategic importance of logistics elements (Understanding)
CO4: apply sales and operations planning, MRP and lean manufacturing concepts. (Applying)
CO5: analyse creation of new value in supply chain for customers & society. (Analysing)

Module I: Basic Framework (15 Hours)

Concept of supply chain management (SCM); SCM and trade Logistics; Business view of SCM; Push and pull of SCM; Decision phases; Impellers and drivers in SCM Process views of SCM, planning and operations; Supply chain modeling; Role of Relationship marketing in SCM; managing relationships with suppliers and customers; Designing strategic distribution network; Factors influencing distribution network.

Module II: Supply Chain and Information Management Systems (15 Hours)

Purchasing Process- Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle; Supplier selection and evaluation; Vendor development; Importance of information management; Distribution and sharing of information; Information Technology as a platform for effective and efficient supply chain management

Module III: Logistic System (10 Hours)

Concept, objectives and scope of logistics; System elements; Inbound and Outbound logistics. Reverse inventory, Value added role of logistics, Logistics interface with manufacturer and marketing, Packing, Marking, Just in time concept; Third party logistic outsourcing–challenges and future directions

Module IV: Transportation (20 Hours)

Importance of effective transportation system; Service choices and their characteristics; inter- modal services; Transport cost characteristics and rate fixation; Carrier selection determinants and decision; Structure of Shipping: World seaborne trade; international shipping - characteristics and structure ;Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Charter, party agreement; Development in sea transportation-Unitization, containerization, inter and multimodal transport; CFC and ICD; Indian shipping – growth, policy and problems; Ports and port trust; International Air transport: International set up for air transport: Freight rates; India's exports and imports by air – Problems and prospects; Carriage of Goods by sea, sea and combined transport.

Module V: Warehousing and Inventory Management (15 Hours)
Warehousing And Marketing Strategy; Objectives and functions of warehousing; Warehouse Strategies; Material handling equipment and material mobility Warehousing evaluation and requirements
Inventory management-inventory categories, EOQ, LT, ICC; Inventory levels; Material planning and sourcing of procurement; Methods of cost reduction**.**

Suggested Readings
1. Ballau, R.H., Business Logistics Management, Prentice Hall, Englewood Cliffs.
2. Bes, J., Chartering Practices.
3. Bes, J., Dictionary of Shipping and chartering Practices.
4. Christopher, M., Logistics and Supply Chain Management, Prentice Hall.
5. ICAO Journal, New York., various issues
6. Indian Shipping and Transport, Mumbai, Various issues.
7. Murphy, Paul R. and Donald F. Wood, Contemporary Logistics, Prentice Hall.
8. Marks, Daniel, Shipping Cartels.
9. Shapiro, R., Logistics Strategy: Cases and Concepts, West Publishing, St. Paul.
10. Coughlan, A., Anderson, E. and Louis W. Stern, Marketing Channels, Prentice Hall.

Mapping of Course Outcomes

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L				
CO 2		M			
CO 3			M		
CO 4		M		H	
CO 5	M		H		H

MTSM402T: SERVICES MARKETING
(Credits: 5- 75 Hours) (L-T-P: 5-0-0)
Objective(s): *The objective of this course is to make the students know the service concept, its evolution and growth. To make the students understand Marketing Mix in service marketing and its effective management and to know the service marketing techniques applied in various sectors.*

COURSE/LEARNING OUTCOMES
At the end of this course students will be able to:
CO1: relate the importance of service economy and Services characteristic. (Remembering)
CO2: explain the concept of Service Marketing Mix (Understanding)
CO3: identify the various service deliver gap and developing appropriate solutions (Applying)
CO4: analyse the reasons for service failure (Analysing)

Module I: Introduction to Service Economy (15 Hours)
Emergence of the service economy, Concept and nature of Service, Difference between goods and services, Service marketing Mix, Service Management Trinity

Module II: Service Consumer Behaviour (20 Hours)
Understanding the Service Customer as a Decision Maker, service purchase and risk association, Service Evaluation process, The Service Consumer Decision Process, and The Decision-making Process in the Service Sector, Components of Customer Expectations, Service Satisfaction, Service Quality Dimensions
Module III: Service Delivery Process (20 Hours)
Managing Service Encounters, Common Encounter Situations, Managing Service Encounters for Satisfactory Outcomes, Service Failure, Service Recovery, Process of Service Recovery, Customer Retention and Benefits

Module IV: Delivering Quality Service (20 Hours)
Causes of Service delivery failure – Quality Gaps. The Customer Expectations *versus* Perceived Service gap. Factors and Techniques to Resolve this Gap. Customer Relationship Management. Gaps in Services – quality standards, Factors and Solutions – The Service Performance Gap – Key Factors and Strategies for Closing the Gap. External Communication to the Customers – the Promise *versus* Delivery Gap – Developing Appropriate and Effective Communication about Service Quality

Suggested Readings

1. Service Marketing, C. Bhattacharjee, Excel Books
2. Service Marketing, R. Nargundkar, Tata McGraw Hill
3. Service Marketing the Indian Perspective, R Shakeran R, Excel Books
4. The Essence of Service Marketing, M.P. Newton, A Payne, PHI
5. Service Marketing - The Indian Context R. Srinivasan, PHI

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M	M	
CO4				H	H

MTCR403T: CORPORATE RESTRUCTURING

(Credits: 5- 75 Hours) (L-T-P: 5-0-0)

Objective(s): *To familiarize the students with various concept and technique that can help in effective corporate structuring in business. Focus will be on the practical application of the concepts learnt.*

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define the concept and function of joint venture (Remembering)
CO2: explain the theories of merger and acquisition (Understanding)
CO3: identify takeover and its types (Applying)
CO4: discover the various techniques of valuation of firms during merger (Analyzing)
CO5: assess the impact of merger on shareholders and different stakeholders (Evaluating)

Module I: Joint Ventures: (15 Hours)

Joint Ventures: Concept & Meaning of Joint Ventures, Need & Types of Joint Ventures, Structures & Problems faced in Joint Ventures, some relevant case study of successful and failed joined ventures.

Module II: Mergers and Acquisitions (20 Hours)

Mergers and Acquisitions: Introduction to mergers, types of mergers, theories of mergers & acquisitions, merger strategy - growth, synergy, operating synergy, financial synergy, diversification; Cross-border mergers and acquisitions, issues and challenges in cross border M&A. Handling cross-culture and taxations issues in cross-border M&A. Analysis of Post-Merger Performance. Demerger, types of demergers, reverse merger, buyback of shares, leverage buy-out strategy, Takeover and its types, takeover strategy, takeover bids, legal framework for mergers and acquisitions, leverages and buyouts; Hostile tender offers and various anti-takeover strategies.

Module III: Mergers and Acquisitions (20 Hours)

Deal Valuation and Evaluation: Factors affecting valuation basics, methods of valuation, cash flow approaches, economic value added (EVA), sensitivity analysis, and valuation under takeover regulation, valuation for slump sale, cost-benefit analysis, and swap ratio determination.

Module IV: Post-Merger Evaluation (20 Hours)

Post-Merger Evaluation: Financial Evaluation of Mergers & Acquisitions, Impact on shareholders' Wealth; Methods of payment and financing options in mergers & acquisitions, financing decision, Merger, Acquisition and Competition law 2002, SEBI (Securities & Exchange Board of India) Takeover Code 2011 and criteria for negotiating friendly takeover.

Suggested Readings

1. Sundarsanam (2006); Creating Value from Mergers and Acquisitions, (1st ed.) Pearson Education
2. Ramanujan. S. (1999); Mergers: The New Dimensions for Corporate Restructuring, McGraw Hill
3. Narayankar, Ravi, (2013): Merger and Acquisitions Corporate Restructuring, Strategy and Practices, (2nded.). International Book House Pvt. Ltd.

Mapping of COs to Modules

COs	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		L		
CO 3			H	
CO 4			H	
CO5				H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	MTBO102T	Business Organisation	4	
2	Minor Course 2	MTMF103T	Management Fundamentals	4	
3	Minor Course 3	MTBI205T	Banking and Insurance	4	
4	Minor Course 4	MTFT206T/ MTCM207T/	Fundamentals of Investment / Compensation Management/ Customer Relationship Management/	4	
5	Minor Course 5	MTSH307T/ MTPF308T/ MTMR309T/ MTGH310T	Strategic HRM/ Personal Financial Planning / Marketing Research/ Ground Handling Services at Airport	4	
6	Minor Course 6	MTIR311T/ MTIP312T/ MTDM313T/ MTAC314T	Management of Industrial Relations/ Investment Analysis and Portfolio Management/ Digital Marketing / Air Cargo Operations	4	
7	Minor Course 7	MTBE404T/ MTAR405T	Business Environment / Airport Resource Planning and Services Management	3	
7	Minor Course 8	MTRM406T	Research Methodology	2	
8	Minor Course 9	MTIB407T	International Business	3	

MTBO102T: BUSINESS ORGANIZATION

(4 credits- 60 Hours) (L-T-P: 4-0-0)

Objective(s): *To familiarize students with the basics of business, the different forms of organisations, the process and the basic concepts and functions of management*

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: explain the nature, objectives and social responsibilities of business (Remembering)
CO2: describe the different forms of organisations (Understanding)
CO3: understand the process and the basic concepts of management (Understanding)
CO4: describe the different functions of management (Applying)
CO5: explain the different types of business (Evaluating)

Module I: Introduction to Business (10 Hours)

Meaning, Nature, Scope and Social responsibility of Business, Objectives, Essentials of successful business; Functional areas of business; Concept of Business Organisation

Module II: Forms of Business Organization (15 Hours)

Sole proprietorship: Definitions, Features, Merits and Demerits. Partnership: Definitions, partnership deed, Features, Merits and Demerits. Joint Stock Company: Definitions, Features, Merits and Demerits. Co-operatives: Definitions, Features, Merits and Demerits

Module III: Public Enterprises (15 Hours)

Departmental Undertaking: Definitions, Features, Merits and Demerits. Public Corporations: Definitions, Features, Merits and Demerits. Government Companies: Definitions, Features, Merits and Demerits

Module IV: Business Combinations (10 Hours)

Meaning Definitions, Causes, Types, Forms, merits and demerits of Business Combinations, Recent Trends in Business Combinations

Module V: Management of Organizations (10 Hours)

Management- Meaning, Definitions, Difference between Management and Administration, Levels of Management, Objectives of Management, Functions of management- planning, organizing, staffing, directing, coordinating, controlling, Principles of Management.

Suggested Readings

1. C B. Gupta - Business Organisation and Management, Sultan Chand & Sons.
2. Dr. S. C. Saxena - Business Administration & Management, Sahitya Bhawan

E Resources

a) https://www.youtube.com/watch?v=BarcVAOT_fs&list=PL9Cd7H8NFRQxDwlEOu_MBT5AUoysg4NgF
b) https://www.youtube.com/watch?v=Ewzhw63biOU&list=PL47Z0ywCYIyykGNxHpB6_LN5MvTO8hPGD

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		H		
CO 3			H	
CO 4				H
CO 5				H

MTMF103T: MANAGEMENT FUNDAMENTALS
(Credits: 4- 60 hours) (L-T-P: 4-0-0)
Objective(s): *The objective for this course to provide an understanding of the task and functions of management and to acquaint the participants with the developments in concept. Theories and practices in the overall field of management.*

Course/Learning Outcomes

At the end of the course students will be able to:
CO1: define the nature and significance of Management (Remembering)
CO2: explain the nature and significance of planning (Understanding)
CO3: describe the staffing functions and explain the significance of communication (Applying)

Module I: Nature and significance of Management (15 Hours)

Nature of management; significance of management; Approaches of management, Contributions of Taylor, Fayol and Barnard, Functions of a Manager, Social responsibility of Managers, Values in management.

Module II: The Nature of significance of Planning (15 Hours)

Nature of Planning, significance of planning, objectives, steps of planning, decision making as key step in planning; process and techniques of decision making; organisation: nature and significance; approaches, departmentation, line and staff relationships; delegation and decentralisation

Module III: Staffing functions (15 Hours)

Nature and significance of staffing functions; selection, interview, training, appraisal and development of managers; directing: Issues in managing human factors, motivation, nature and significance

Module IV: Communication (15 Hours)

Definition and Significance of Communication, Its process, barriers of communication, building effective communication system. Controlling: definition and elements; Control techniques, Coordination, determinants of an effective control system, Managerial Effectiveness.

Suggested Readings

1. Joseph L. Massie :Essentials of Management .PHI, New Delhi; 2015
2. James F.Stoner: Management. Pearsons Education, Delhi; 2020
3. Harold Koontz, Heinz Weihrich: Management. Tata McGraw Hill Pub. Co., Delhi; 2015
4. Amitai Etzioni: Modern Organizations. PHI, New Delhi; 2021
5. Jones, Gareth R. and Jennifer M. George: Contemporary Management. Tata McGraw Hill
6. Charles Hill, W.L. and Steven L.McShane: Principles of Management. Tata McGraw Hill

E Resources

a) https://www.youtube.com/watch?v=I6-QB-EIdsE&list=PLJtJvO3aaWe16eg-L7sJ1Ww3021CWlJU9
b) https://www.youtube.com/watch?v=q6LMjurECZM

Mapping of COs with Syllabus

CO	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M

MTBI205T: BANKING AND INSURANCE
(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)*: This course is designed to provide students with the necessary skills and knowledge in the context of the functioning of banking and insurance*

COURSE/LEARNING OUTCOMES
At the end of the course students will be able to:
CO1: defining the basic principles of banking and insurance. (Remembering)
CO2: relate the various services provided by banks. (Understanding)
CO3: apply the concept of Internet Banking in day-to-day transactions. (Applying)
CO4: examine the situations to relate the risk and insurance. (Analysing)

Module I: Introduction (10 Hours)
Origin of banking: definition, banker and customer relationship, General and special types of customers, Types of deposits, Origin and growth of commercial banks in India. Financial Services offered by banks, changing role of commercial banks, types of banks.

Module II: Cheque and Paying Banker (10 Hours)
Crossing and endorsement - meaning, definitions, types and rules of crossing. Duties, Statutory protection in due course, collecting bankers: duties, statutory protection for holderin due course, Concept of negligence.

Module III: Banking Lending (6 Hours)
Principles of sound lending, secured vs. unsecured advances, types of advances, Advances against various securities.

Module IV: Internet Banking (10 Hours)
Meaning, Benefits, Home banking, Mobile banking, Virtual banking, E-payments, ATM Card/ iometric card, Debit/Credit card, Smart card, NEFT, RTGS, ECS (credit/debit), E-money, electronic purse, Digital cash.

Module V: Insurance (9 Hours)
Basic concept of risk, Types of business risk, Assessment and transfer, Basic principles of utmost good faith, Indemnity, Economic function, Proximate cause, Subrogation and contribution, Types of insurance: Life and Non-life, Re-insurance, Risk and return relationship, Need for coordination. Power, functions, and Role of IRDA, Online Insurance

Suggested Readings
1. Agarwal, O.P., Banking and Insurance, Himalaya Publishing House
2. Satyadevi, C., Financial Services Banking and Insurance, S. Chand
3. Suneja, H.R., Practical and Law of Banking, Himalaya Publishing House
4. Chabra, T.N., Elements of Banking Law, Dhanpat Rai and Sons
5. Arthur C. And C. William Jr., Risk Management and Insurance, McGraw Hill
6. Saxena, G.S. Legal Aspects of Banking Operations, Sultan Chand, and Sons
7. Varshney, P.N., Banking Law and Practice, Sultan Chand, and Sons
8. Jyotsna Sethi and Nishwan Bhatia, Elements of Banking and Insurance, PHI Learning

Mapping of COs to Syllabus

COs	**Module I**	**Module II**	**Module III**	**Module IV**	**Module V**
CO1	M				
CO2		M			

CO3			M		
CO4				M	H

MTFT206T: FUNDAMENTALS OF INVESTMENT

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective(s): *This course aims to provide students with an understanding of fundamental concepts of business finance and investment.*

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: explain the objectives & scope of financial management in context of business (Remembering)
CO2: apply the concept of time value of money (Applying)
CO3: evaluate investment opportunities using the capital budgeting process (Evaluating)
CO4: explain Indian securities market including the derivatives market (Understanding)
CO5: evaluate mutual funds as an investing avenue. (Evaluating)

Module I: Introduction (10 Hours)

Meaning of investment; Basic areas of investment; Investment functions; Forms of business organizations; Goals of investment management; concept of returns and Interest rates: level of Interest rate, determinants of market interest rates

Module II: Time Value of Money (10 Hours)

Future Value: Single period, multiple period; Present Value: single period and multiple period; Future Value and Present value for multiple cash flows; Present value of an annuity; Future value of an annuity

Module III: Capital Investment Decisions (10 Hours)

Concept of investment decisions; Generating investment project proposal; Process of Capital budgeting decision;; Net present value, payback method, internal rate of return.

Module IV: Basics of Investing (20 Hours)

Basics of Investment & Investment Environment: Risk and Return, Instruments of Investment -Equity shares, Preference shares, Bonds and Debentures. Indian Security Markets - Primary Markets (IPO, FPO, Private placement, Offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE, NSE, MSEI. Security Market Indices: Nifty & Sensex.

Module V: Investing in Mutual Funds (10 Hours)

Concept and background on Mutual Funds: Advantages, Disadvantages of investing in Mutual Funds, Types of Mutual funds: Open ended, close ended, equity, debt, hybrid, money market and entry load vs. exit load funds. Factors affecting choice of mutual funds. CRISIL mutual fund ranking and its usage, calculation and use of Net Asset Value

Suggested Readings

1. Principles of Financial Management, Levy H. and M. Sarnat, Pearson Education.
2. Fundamentals of Financial Management, Brigham and Houston, Cengage Learning.
3. Basic Financial Management, Khan and Jain, McGraw Hill Education
4. Fundamentals of Financial Management, Prasanna Chandra, McGraw Hill Education
5. Financial Management-text and Problems, Singh, J.K, DhanapatiRai and Company , Delhi
6. Fundamentals of Financial Management, Rustagi, R.P, Taxmann Publications Pvt.Ltd.
7. Singh J K , Singh Amit Kumar, Investing in Stock Markets, A K Publications, Delhi.
8. Tripathi, Vanita and Pawar, Neeti (2019), Investing in Stock Market, Taxmann Publications
9.

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M				
CO 2		M			
CO 3			M		
CO 4				H	H

MTCM207T: COMPENSATION MANAGEMENT

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Objectives(s): *The course aims to clarify the principles and basic concepts of compensation management in organizations, including the role of human resources management in dealing with employees, and methods used to provide compensation.*

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define Compensation Management (Remembering)
CO2: explain the principles and importance of compensation management. (understanding)
CO3: develop and design compensation system. (Applying)
CO4: analyze the present trends in calculation of incentives and other pay systems. (Analyzing)

Module I: Introduction to Compensation Management (15 Hours)

Definition of Compensation Management - objectives of compensation – Principles of Compensation Management – Importance of Compensation Management - Types of wages. Exploring and defining the compensation context – Intrinsic compensation - Extrinsic compensation -- Compensation Trends in India. - The 3-P compensation concept

Module II: Compensation Planning & Bases of Compensation (15 Hours)

Compensation Planning: Level, Structure and Systems Decision – Factors influencing compensation level planning: internal factors and external factors.
Traditional Bases for Pay-Seniority and Longevity Pay Merit Pay- Performance Appraisal- Methods- Biases -Strengthening the Pay for Performance Link- Possible Limitations of Merit Pay

Module III: Incentive Pay & Other Pay Systems (15 Hours)

Exploring Incentive Pay- Contrasting Incentive Pay with Traditional Pay.
Individual Incentives- Types of Individual Incentives- Advantages and Disadvantages
Group Incentives- Types of Group Incentives- Advantages and Disadvantages
Companywide Incentives- Types- Designing Incentive Pay Programmes
Person Focused Pay- Competency Based Pay, Pay for Knowledge and Skill Based Pay, Team based pay- Concepts.

Module IV: Designing Compensation System (15 Hours)

Building internally consistent Compensation System - Creating Internal Equity through Job Analysis and Job Valuation
Building Market Competitive Compensation System – compensation surveys - Integrating Internal Job Structures with External Market; Building Pay Structures that Recognise Individual Contribution: Constructing pay structure.
Pay structure variations – Broad banding- two tier pay structure.

Suggested Readings

1. Tapomoy Deb, Compensation Management text & cases, Excel Publication, 2014.
2. Joseph J. Martocchio, Strategic Compensation- A Human Resource Management Approach- Pearson Education, 2012, 3rd Ed.
3. Dipak Kumar Bhattacharya, Compensation Management, Oxford University Press, 2014.
4. Richard.I. Henderson: Compensation Management in A Knowledge Based World - Prentice-Hall, 2012, 9th Ed.
5. Milkovich & NewMan, Compensation, Tata McGraw –Hill, New Delhi, 2015.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		M		
CO 3			M	
CO4				H

MINOR 4 C: CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

Objectives(s): *To equip students with a comprehensive understanding of customer relationship management principles and strategies, enabling them to build and maintain strong customer relationships, enhance customer satisfaction, and drive business growth.*

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define the concept of customer relationship management and its importance in business (Remembering)

CO2: explain the customer behavior, needs, and preferences to develop effective CRM strategies. (understanding)
CO3: develop and design CRM tools and technologies to manage customer interactions and data. (Applying)
CO4: analyze the effectiveness of CRM initiatives in achieving business objectives (Analyzing)

Module I: Understanding Customer Relationship Management
Concept of CRM: Definition, evolution, and importance. Customer value and satisfaction: Building customer loyalty and retention. Customer lifecycle management: Acquiring, retaining, and growing customers. CRM strategy development: Aligning CRM with business goals.

Module II: Customer Data and Analysis
Customer data management: Collecting, storing, and analyzing customer information. Customer segmentation and targeting: Identifying customer groups and tailoring offerings. Customer lifetime value: Measuring and maximizing customer profitability. Market research and customer insights: Gathering and utilizing customer feedback.

Module III: CRM Technologies and Implementation
CRM software: Features, benefits, and selection criteria. CRM implementation process: Planning, deployment, and integration. Sales force automation: Managing sales processes and customer interactions. Customer service automation: Enhancing customer support and resolution.

Module IV: Customer Experience Management
Customer journey mapping: Understanding customer interactions and touch-points. Customer experience design: Creating exceptional customer experiences. Customer feedback management: Collecting and responding to customer feedback. Service quality management: Delivering consistent and high-quality service.

Module V: Advanced CRM Topics
Digital CRM: Leveraging digital channels for customer engagement. Social CRM: Building relationships through social media. Mobile CRM: Enhancing customer interactions on mobile devices. CRM metrics and evaluation: Measuring CRM performance and ROI.

Suggested Readings

1. Peppers, D., & Rogers, M. (2005). Customer relationship management: A guide to creating lasting relationships. John Wiley & Sons.
2. Payne, A., Storbacka, K., & Frow, D. (2008). Managing customer relationships. Financial Times/Prentice Hall.
3. Rust, R. T., & Reinartz, W. J. (2003). Customer equity: The strategic imperative for growth and profitability. Free Press.
4. Parvatiyar, A., Sheth, J. N., & Garvin, D. A. (2004). Customer relationship management: A road map for implementation. Tata McGraw-Hill Education.

Mapping of COs to Modules

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		M			
CO 3			H		
CO 4				M	L

MTSH307T: STRATEGIC HUMAN RESOURCE MANAGEMENT

(Credits: 4-60 hours) (L-T-P: 4-0-0)

Objective(s): *The objective of this course is to develop within the students the understanding of the student with relevant concepts, roles and challenges related to strategic human resource management practices in the workplace and design the requisite skills to be competent contributors in the organization's strategic decision-making process and make them competent to for various managerial and administrative positions in different organizations.*

Course/ Learning Outcomes:
At the end of this course students will be able to:
CO1: Define the hierarchy of strategy, classify between traditional HR and strategic HR. (Remembering)
CO2: Demonstrate the aims of strategic HRM (Understanding)
CO3: Analyse the concept of HR strategies, explain the approaches of developing HR strategies (Analysing)
CO4: Examine the strategic role of the HR director, determine the strategic role of the HR specialists (Analysing)

CO5: Evaluate the various approaches to motivation (Creating)

Module I: Introduction to Strategic Human Resource Management (12 Hours)
Introduction, Strategy, Hierarchy of Strategy, Corporate Level Strategy, Business Level Strategy, Functional Level Strategy, Strategic HRM, Emergence of Strategic Human Resource Management (SHRM), The Evolutionary Stages of Strategic HRM, Difference Between Traditional HR and Strategic HR, Case study

Module II: Concepts of Strategic Human Resource Management (12 Hours)
Introduction, Trends in Strategic Human Resource Management, HR Practitioners Role, Human Resource as Competitive Advantage, Aims of Strategic HRM, Approaches to Strategic HRM, Formulation of HR Strategies, The Classical Sequential Approach, The Empirical Need-based Approach, Achieving Strategic Fit, Problems in Achieving Strategic Fit, Benefits of Strategic HRM, Barriers to Strategic HRM, Case study

Module III: Human Resource Strategies and its Implementation (12 Hours)
Introduction, HR Strategies, Types of HR Strategies, Overarching Strategies, Specific HR Strategies, Criteria for an Effective HR Strategy, Developing HR Strategies, Methodology for Formulating HR Strategies, Setting Out the Strategy, conducting a Strategic Review, Implementing HR Strategies Barriers to the Implementation of HR Strategies, Overcoming the Barriers, Case study

Module IV: Roles in Strategic Human Resource Management (12 Hours)
The Strategic Role of Top Management, The Strategic Role of Front-line Management, The Strategic Role of the HR Director, The Strategic Role of the HR Specialists, The New Mandate for HR, The Specific Strategic Roles of HR, Business Partner, The Innovation Role, The Change Manager Role, The Implementer Role, Case study

Module V: Challenges in Strategic Human Resource Management (12 Hours)
Introduction, The Challenges of Workplace Diversity, The Management of Workplace Diversity, Managing Diverse Workforce in an Organisation, Planning a Mentoring Program, Organising Talents Strategically, Retention Strategy, Talent Management Strategy and its components, Approaches to Human Resource Planning, Managing Executive Information Systems, Challenges for HR Managers, HRM Strategic Challenges, Case study

Suggested Readings
1. Deb Tapomoy, Strategic Approach to Human Resource Management Concept, Tools and Application, Atlantic Publishers & Distributors Pvt Ltd.
2. Nayantara Padhi, Strategic Human Resources Management: Theory and Practice, Atlantic Publishers and Distributors Pvt. Ltd; 1 edition
3. Mello Jeffrey A., Strategic Management of Human Resources, Cengage Learning, 3rd edition
4. Sharma A, Khandekar A, Strategic Human Resource Management – An Indian Perspective, SAGE Publications
5. Schuler, R. S., & Jackson, S. E., 2009, Strategic Human Resource Management.2nd ed., Wiley-India
6. Sharma, A and Khandekar, A., 2006, Strategic Human Resource Management: an Indian perspective.1st ed., Response Books

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV	Module V
CO 1	H		M	L	
CO 2		H			
CO 3					M
CO 4		H		H	
CO 5					H

MTPF308T: PERSONAL FINANCIAL PLANNING

(Credits-4-60 hours) (L-T-P: 4-0-0)

Objective(s): *The course aims to familiarize learners with different aspects of personal financial planning like savings, investment, taxation, insurance, and retirement planning and to develop the necessary knowledge and skills for effective financial planning.*

Course/ Learning Outcomes:
At the end of this course students will be able to:
CO1: define the meaning and the relevance of financial planning. (Remembering)

CO2: understand the concept of investment planning and its methods. (Understanding)
CO3. examine the scope and ways of personal tax planning. (Applying)
CO4: analyse insurance planning and its relevance. (Analysing)
CO5: develop insight into retirement planning and its relevance.(Evaluating)

Module I: Introduction to Financial Planning (12 Hours)
Financial goals, steps in financial planning, budgeting incomes and payments, time value of money. Introduction to savings, benefits of savings, management of spending & financial discipline, Setting alerts and maintaining sufficient funds for fixed commitments

Module II: Investment Planning (12 Hours)
Process and objectives of investment, concept and measurement of return & risk for various asset classes, measurement of portfolio risk and return, diversification & portfolio formation. Gold bond; Real estate; Investment in greenfield and brownfield Projects; Investment in fixed income instruments, financial derivatives & commodity market in India. Mutual fund schemes; International investment avenues. Currency derivatives and digital currency

Module III: Personal Tax Planning (12 Hours)
Tax structure in India for personal taxation, Scope of personal tax planning, exemptions and deductions available to individuals under different heads of income and gross total income. Comparison of benefits - Special provision u/s 115 BAC vis-à-vis General provisions of the Income-tax Act, 1961, tax avoidance versus tax evasion

Module IV: Insurance Planning (12 Hours)
Need for insurance. Life insurance, health insurance, property insurance, credit life insurance and professional liability insurance

Module V: Retirement Benefits Planning (12 Hours)
Retirement planning goals, process of retirement planning, Pension plans available in India, Reverse mortgage, Estate planning.

Suggested Readings
1. Deb Tapomoy, Strategic Approach to Human Resource Management Concept, Tools and Application, Atlantic Publishers & Distributors Pvt Ltd.
2. Nayantara Padhi, Strategic Human Resources Management: Theory and Practice, Atlantic Publishers and Distributors Pvt. Ltd; 1 edition
3. Mello Jeffrey A., Strategic Management of Human Resources, Cengage Learning, 3rd edition

Mapping of COs to Modules

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	L	L	L
CO 2	L	H			
CO 3			H		
CO 4		M		H	
CO 5	M		H		H

MMTMR309T: MARKETING RESEARCH

(Credits: 4- 60 Hours) (L-T-P: 4-0-0)

Objective(s): *This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.*

COURSE/LEARNING OUTCOMES
At the end of the course students will be able to:
CO1: define marketing research (Remembering)
CO2: explain sample and sampling design (Understanding)
CO3: identify various data collecting methods and tools (Applying)
CO4: analyse data hypothesis and testing procedures (Analyzing)

Module I: Introduction of Marketing Research: (15 Hours)
Define Marketing Research, Aims and Objectives of Marketing Research. Applications of Marketing Research, Marketing

Information System, Evaluation and Control of Marketing Research, Value of Information in Decision Making, Steps in Marketing Research. Research Design: Formulating the Research Problem, Choice of Research Design, Types of Research Design, Sources of Experimental Errors.

Module II Sample and Sampling Design: (15 Hours)
Some basic terms, Advantages and Limitation of Sampling, Sampling process, Types of Sampling, Types of Sample Designs, Determining the Sample Size, Sampling Distribution of the Mean. Scaling Techniques: The concept of Attitude, Difficulty of Attitude Measurement, Types of Scales, Applications of Scaling in Marketing Research.

Module III: Data Collection: (15 Hours)
Secondary Data, Sources of Secondary Data, Primary Data, Collection of Primary Data, Methods of Data Collection- Observation, Questionnaire, Designing of Questionnaire. Data Processing and Tabulation: Editing, Coding and Tabulation.

Module IV: Data Analysis: (15 Hours)
Testing of Hypothesis, Measurement of Central Tendency, Dispersion, Univariate Analysis, Multiple Regression, Factor Analysis, Cluster Analysis, Multidimensional Scaling, Conjoint Analysis; Interpretation and Report Writing, Types of Research Reports

Suggested Readings
1. Satyabhushan D., Malhotra NK., (2015) Marketing Research: An Applied Orientation,7th Edition, Pearson publisher.
2. Bajpai N., (2011) Business Research Methods: Pearson publisher.
3. Cooper & Schindler (2015) Business Research Methods,12th Edition, Mcgraw-Hill.
4. Green, Tull&Albaum (2010) Research for Marketing Decisions,5th Edition, PHI Pvt. Ltd, New Delhi.
5. Leveine, Khrehbiel& Berenson (2013) Business Statistics,6th Edition, Pearson Education.
6. Luck D. & Rubin D. (2006) Marketing Research, 7th edition, PHI, New Delhi

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M		M	
CO3			**H**		
CO4			M	M	H

MTIR311T: MANAGEMENT OF INDUSTRIAL RELATIONS

(4 Credits: 60 Hours)(L-T-P: 4-0-0)

Objective(s): *The course focuses on acquainting students with concepts of Industrial Relations and various legislations related to Labour Welfare and Industrial laws.*

Course/Learning Outcomes:
At the end of this course students will be able to:
CO1: Define the conceptual knowledge on industrial relations (Remembering)
CO2: Explain the extent to which the workers can participate in management (Understanding)
CO3: Apply the mechanism for resolving industrial disputes (Applying)
CO4: Analyse the provision for payment of wages (Analysing)
CO5: Discuss the legal framework of factories act (Evaluating)

Module I: Concept of Industrial Relations (15 Hours)
Aspects of industrial relations, conflict and cooperation, parties in industrial relations, workers employers and government, trade unions, objectives process, prerequisites of collective bargaining.

Module II: Workers Participation in Management (10 Hours)
Levels & Mode of participation, Works Committee, Joint Management councils, Worker Director, Grievance Procedure, QC.

Module III: Trade Union Act 1926 (15 Hours)
Immunity granted to Registered Trade Unions, Recognition of Trade Unions. The Industrial Employment (Standing Orders) Act 1946, scope, coverage, certification process, modification, interpretation, and enforcement. The Industrial Disputes Act 1947, forum for settlement of disputes.

Module IV: Payment of Wages Act (10 Hours)
Salient features, coverage of employees and employers, rules and benefits relating to The Payment of Wages Act 1936, The Payment of Gratuity Act 1972, The Minimum Wages Act 1948, The Payment of Bonus Act 1965.

Module V: The Factories Act 1948 (10 Hours)
Definition, approval, licensing and registration, health and welfare measures , employment of women and young persons, leave with wages and weekly holidays.

Suggested Readings
1. C.B.Mamoria, Mamoria & Gankar, Dynamics of Industrial Relations, Himalaya Publishing House Pvt Ltd, 13th Edition, 2014
2. C.S. Venkat Rathnam, Industrial Relations, Oxford University Press, New Delhi, 2012.
3. Arun Monappa, Industrial Relations, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
4. T N Chhabra, Industrial Relations and Labour Laws, Dhanpat Rai Publishing House, Edition 5th, 2013 2. S C Srivastava, Industrial Relations and Labour Laws, Vikas Publishing House.2012

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H	M		
CO3		H	H	L	
CO4				H	
CO5					H

MMTIP312T: INVESTMENT ANALYSIS & PORTFOLIO MANAGEMENT

(4 Credits-60 Hours) (L-T-P: 4-0-0)
Objective(s): *To learn the basics of investing and decide where to invest with less risk.*

Course/Learning Outcomes
At the end of this course students will be able to:
CO1: define the investment environment, different types of investment vehicles (Remembering)
CO2: explain the logic of investment process (Understanding)
CO3: apply the quantitative methods for investment decision making (Applying)
CO4: analyse the portfolio theory and the process of investment portfolio formation (Analysing)
CO5: analyze relevance of stocks and bonds for the investments (Analysing)

Module I: Basics of risk and return (15 Hours)
Concept of returns, application of standard deviation, coefficient of variation, beta, alpha. Bonds: present value of a bond, yield to maturity, yield to call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve and theories regarding shape of yield curve. Unsystematic risk and non-risk factors that influence yields. Duration and modified duration, immunization of a bond portfolio. Fundamental analysis, Economic analysis, Expected direction of movement of stock prices with macroeconomic variables in the Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOT analysis, financial analysis of an industry

Module II: Share valuation (15 Hours)
Dividend discount models- no growth, constant growth, two stage growth model, multiple stages; Relative valuation models using P/E ratio, book value to market value. Technical analysis: meaning, assumptions, difference between technical and fundamental analysis; Price indicators- Dow theory, advances and declines, new highs and lows. Volume indicators- Dow Theory, small investor volumes. Other indicators- futures, institutional activity, Trends analysis: line chart, bar chart, candle chart, point & figure chart. Patterns: head & shoulders, triangle, rectangle, flag, cup & saucer, double topped, double bottomed, Indicators: moving averages. Efficient market hypothesis; Concept of efficiency: Random walk.

Module III: Portfolio analysis (15 Hours)
Portfolio risk and return, Markowitz portfolio model: risk and return for 2 and 3 asset portfolios, concept of efficient frontier & optimum portfolio. Market Model: concept of beta systematic and unsystematic risk. Investor risk and return preferences: Indifference curves and the efficient frontier, Portfolio management services: Passive – Index funds, systematic investment plans. Active – market timing, style investing.

Module IV: Capital Asset Pricing Model (CAPM) (15 Hours)
Efficient frontier with a combination of risky and risk-free assets. Assumptions of single period classical CAPM model. Characteristic line, Capital Market Line, Security market Line. Expected return, required return, overvalued and undervalued assets. Mutual Funds: Introduction, calculation of Net Asset Value (NAV) of a Fund, classification of mutual fund schemes by structure and objective, advantages and disadvantages of investing through mutual funds. Performance Evaluation using Sharpe's Treynor's and Jensen's measures .

Suggested Readings
1. Security Analysis & Portfolio Management, Fischer, D.E. & Jordan, R.J ; Pearson Education.
2. Investment Analysis and Portfolio Management, Prasanna Chandra, Tata Mcgraw Hill Education Private Limited

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3	M	H	H	L
CO4		M	H	H
CO5		L	M	H

MTDM313T: DIGITAL MARKETING

(4 credits- 60 hours) (L-T-P: 4-0-0)
Objective(s): *After studying this course, the students will be able to learn about the different knowledge and skills needed for effective digital marketing in the corporate sectors and entrepreneurial ventures.*

COURSE/LEARNING OUTCOMES
At the end of this course students will be able to:
CO 1: define the fundamentals of website marketing. (Remembering)
CO 2: explain the fundamentals of search engine technology (Understanding)
CO 3: interpret the various types of social media marketing. (Applying)
CO 4: analyze the models of digital marketing (Analyzing)
CO 5: evaluate the web analytics and social media analytics (Evaluating**)**

Module I: Introduction to Digital Marketing (10 Hours)
Introduction to Digital Marketing, Fundamentals of Website Marketing, Search Engine Marketing, Social Media Marketing, Key Concepts and Important Terminologies, Fundamentals of Metrics and its importance in digital marketing, Fundamentals of Programmatic Advertisement and Performance Marketing, Traditional marketing vs Digital Marketing

Module II: Search Engine Optimization (15 Hours)
Introduction to SEO, Fundamentals of Search Engine Technology, Overview of Search Engine Upgrades, Fundamentals of Google Search, Basics of Google Ads, Keyword Research, On-page and Off-page optimization, Core Elements of Optimization, Understanding Backlinks and Value Network, Organic and Paid Optimization and Techniques of Optimization

Module III: Social Media Marketing (10 Hours)
Introduction Social Media Marketing, Understanding Platforms; types and categories, Relevance in Marketing, Platform Selection, Performance Marketing, Social Media Mentions and Spread, Social Media Sentiment, Lead Generation, Creating a sales funnel.

Module IV: Models of Digital Marketing (10 Hours)
Communication Model (10-C), 7P's of Marketing for content development, AIDA, Framework for targeting and positioning, BOS framework for Channel Development, Integrated Marketing Communication for Efficiencies.

Module V: **Web and Social Media Analytics (15 Hours)**
Fundamentals of Web Analytics and Social Media Analytics, Understanding Analytical Dimensions, Preparation of Analytical Plan, Identification of Core Metrics and KPIs, Formulation of Metrics, Interpretation of Platform Inbuilt Dashboards (Facebook, Instagram etc and Google Analytics) Channels and Content Development. Designing a website (non-programming), Designing a Social Media Page, Merger of Accounts, Understanding Content, Classification of Content, Content Marketing Channels, Post

Strategies, Target Identification

Suggested Readings

1. Ahuja V.: Digital Marketing, Oxford University Press.
2. Dodson, I. (2016). The Art of Digital Marketing: The Definitive Guide to Creating Strategic,
3. Targeted, and Measurable Online Campaigns (1st ed.). Hoboken, New Jersey Wiley.
4. Kelsey, T., & Springerlink (Online Service. (2017). Introduction to Social Media Marketing : A Guide for Absolute Beginners. Apress.
5. Reza Zafarani, Mohammad Ali Abbasi, & Huan Liu. (2014). Social media mining: an introduction. Cambridge University Press.

Mapping of COs to the Course:

COs	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			M	M	H
CO 4				M	
CO 5					M

MTBE404T: ANALYSIS OF BUSINESS ENVIRONMENT: INDIAN AND GLOBAL

(Credits-3 - 45 hours) (L-T-P: 3-0-0)

Objective(s): *To develop students' understanding of the dynamic and complex business environment, both domestically and globally. Equip them with analytical skills to assess environmental factors, identify opportunities and threats, and make informed strategic decisions.*

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define the concept of business environment and its components. (Remembering)

CO2: explain the Indian and global business environment, identifying key factors influencing business operations (Understanding)

CO3: identify the impact of environmental changes on business strategies and performance (Applying)

CO4: examine the trade environment in details (Analysing)

Module I: Significance of Business Environment

Analysis for strategic business decisions; Elements of Business Environment; the PEST Frame-work; Relevant Variables & Crucial Variables in PEST Analysis; Application of PEST framework for identification of Opportunities and Threats and the most viable option; Sources of information and data for PEST Analysis – sources within the nation & global sources – WEB sources - International Rating Agencies – Case Studies for illustrating the PEST Framework.

Module II: Economic Environment in India

Economic Environment in India; the Macro Fundamentals; Trends and Sectoral Composition of Growth; Trends, Composition and Direction of India's Foreign Trade; Globalisation and Trade Openness; Regulatory Framework; Liberalisation; Current Monetary & Fiscal Policies; Latest Economic Survey & Union Budget; Savings & Investment Trends.

Module III: FDI & Governance

Foreign Direct and portfolio Investment; FDI to and from India; Mode and Non-equity Mode of Investment (NEM);Constraints of doing business in India; Social landscape – Human development & Urbanization; Cultural specificities; Status of Governance and Corruption.

Module IV: Globalisation of Indian Businesses

Indian MNCs; Decision to go global – Why, when, where & How? Application of PEST Framework in the global context; Process and sources of data for estimation of market-size in a specific country for company's product/service; Global economic growth scenario; Dealing with Volatility, Shocks, Cultural Diversity, Political Risks & Technological obsolescence.

Module V: Ease of Doing Business and Country Studies

Trends of global trade in goods and Services - Modes of investing abroad –FDI, Equity Mode and Non-equity Mode of Investment (NEM); Mergers and Acquisitions; International Outsourcing & BPO; Rating of Countries in terms Ease of Doing

Business, Development Status, HDI, Governance, Corruption & Political Risk; Select Country Studies.

Suggested Readings

1. Porter, Michael P.: Competitive Strategy: Techniques for Analysing Industries and Competitions; The Free Press 1980.
2. Steiner, George A. &John F. Steiner: Business, Government and Society: A Managerial Perspective; McGraw-Hill Education; 13th ed 2011
3. Hill, Charles W.L.: International Business: Competing in the Global Marketplace.Tata McGraw-Hill; 2014.
4. Govt. of India: Economic Survey (relevant issues).
5. Reserve Bank of India: Report on Currency and Finance(relevant issues).
6. World Bank: World Development Report (relevant/ latest issues)
7. IMF: World Economic Outlook(relevant/ latest issues)
8. World Trade Organisation: International Trade Statistics (relevant/ latest issues)
9. UNCTAD: World Investment Reports (relevant/ latest issues)
10. UNDP: Human Development Report (relevant/ latest issues)

Mapping of COs to Syllabus

Cos	Module I	Module II	Module III	Module IV	Module V
CO 1	L	L	L		
CO 2	M		H		
CO 3		M		H	
CO 4	L				M

MTRM406T: RESEARCH METHODOLOGY

(Credits: 2- 30 Hours) (L-T-P: 2-0-0)

Objective(s): *This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.*

COURSE/LEARNING OUTCOMES:

At the end of this course students will be able to:

CO1: Understand the various kinds of research, objectives of doing research
(Understanding & remembering)

CO2: Applying basic knowledge on qualitative research techniques, and adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis. (Generating inferences)

CO3: Analyzing of data analysis-and hypothesis testing procedures (Analysis)

Module I: Introduction: (6 Hours)

Meaning of Research, Objectives of Research, Types of Research, Research Process, Research Problem formulation; Research Design: Features of a good research design; Different Research Designs; Measurement in Research; Data types; Sources of Error

Module II: Measurement and Scaling: (8 Hours)

Primary Level of Measurement- Nominal, Ordinal, Interval, Ratio, Comparative and Non-competitive Scaling Techniques, Questionnaire Design, Sampling Process, Sampling Techniques-Probability and Non-Probability Sampling, Sample Size Decision.

Module III: Data Collection: (10 Hours)

Primary & Secondary Data; Survey Method of Data Collection, Classification of Observation Method; Fieldwork and Data Preparation. Hypothesis: Null Hypothesis & Alternative Hypothesis; Type-I & Type-II Errors; Hypothesis Testing: Z-Test, T-Test, ANOVA, Concepts of Multivariate Techniques.

Module IV: Research Report: (6 Hours)

Meaning, Types and Layout of Research Report; Steps in Report Writing, Tabular & Graphical Presentation of Data, Citations, Bibliography and Annexure in Report, Avoid Plagiarism; Use of Statistical Software to Analysis the Data.

Suggested Readings

1. Satyabhushan D., Malhotra NK., (2015) Marketing Research: An Applied Orientation,7th Edition, Pearson publisher.
2. Bajpai N., (2011) Business Research Methods: Pearson publisher.

3. Cooper & Schindler (2015) Business Research Methods,12th Edition, Mcgraw-Hill.
4. Green, Tull &Album (2010) Research for Marketing Decisions,5th Edition, PHI Pvt. Ltd, New Delhi.
5. Leveine ,Khrehbiel & Berenson (2013) Business Statistics,6th Edition, Pearson Education.
6. Luck D. & Rubin D. (2006) Marketing Research, 7th edition, PHI, New Delhi

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			H	M	M

MTIB407T: INTERNATIONAL BUSINESS
(Credits-3 - 45 hours) (L-T-P: 3-0-0)
Objective(s): *This course provides an overview of the environment, concepts, and basic differences involved in international business*

COURSE/LEARNING OUTCOMES
At the end of this course students will be able to:
CO 1: describe the foundation of international business. (Remembering)
CO 2: describe international organizations and multinational corporations. (Understanding)
CO 3: define forms of foreign involvement. (Applying)
CO 4: evaluate various international trade theories. (Evaluating)

Module I: Introduction to Global Business (10 Hours)
Global Business: Scope, Global Linkages today; Culture and Global Business: Elements of culture, Training Challenge; Global Trade and Investment Theory: Mercantilism, Classical Trade Theory, Factor Proportion Theory, International Trade and Product cycle theory, Theory of International Investments; Structure of Indian Foreign Trade: Composition & direction; EXIM Bank; Exit Policy of India; Regulation and Promotion of Foreign Trade.

Module II: Global Financial Markets (10 Hours)
Foreign exchange markets; Fixed and Floating Foreign exchange rates; Significant monetary events; Exchange rates, interest rates and economic policy; Economic Integration; Government Trade Policies.

Module III: Global Business Environment (15 Hours)
Private International Law; Public International Law; Risk to Global Business; Doctrine of Sovereign Immunity; Doctrine of Eminent Domain; Labour Law Differences; Theoretical foundations of International Business; Balance of Payments; International Liquidity; International Economic; Accounting and Tax differences; Multinational Corporations; Foreign Direct Investment.

Module IV: International Finance (10 Hours)
Financing exports and imports; International Capital and Cash Management; Capital Structure: International Dimensions; International Capital Markets; International Banking and Security Markets; IMF; World Bank; IFC; ITA; ADB; WTO.

Suggested Readings
1. Joshi Rakesh Mohan: International Business, Oxford University Press.
2. Cherunilam F: International Business: Text and Cases, PHI Learning.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2		H		
CO 3			H	M
CO 4	H			

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	MTED104L	Entrepreneurship Development	3
2	S E Course 2	MTOM105L	Office Organization and Management	3
3	S E Course 3	MTRM210L	Retail Management	3
8			Virality In Digital Media	2
9 and 10			Business Case Design and Presentation	3

MTED104L: ENTREPRENEURSHIP DEVELOPMENT ~~AND FAMILY BUSINESS~~

(3 Credits-45 Hours) (L-T-P: 4-0-0)

Objective(s): *The purpose of the paper is to orient the learner toward entrepreneurship as a career option and creative thinking and behavior.*

Course/ Learning Outcomes

At the end of the course students will be able to:

CO1: define the concept of entrepreneur. (Remembering)
CO2: classify different types of entrepreneurs and entrepreneurial ventures. (Understanding)
CO3: describe the dimensions of entrepreneurial orientation. (Applying)
CO4: identify strengths, weaknesses of oneself. (Analysing)

Module I: Introduction (8 hours)

Meaning, elements, determinants and importance of entrepreneurship and creative behavior; Entrepreneurship and creative response to the society' problems and at work; Dimensions of entrepreneurship: intrapreneurship, technopreneurship, cultural entrepreneurship, international entrepreneurship, netpreneurship, ecopreneurship, and social entrepreneurship

Module II: Entrepreneurship and Micro, Small and Medium Enterprises (8 hours)

Concept of business groups and role of business houses and family business in India; The contemporary role models in Indian business: their values, business philosophy & behavioural orientations; Conflict in family business and its resolution

Module III: Sustainability of Entrepreneurship (8 hours)

Public and private system of stimulation, support and sustainability of entrepreneurship. Requirement, availability and access to finance, marketing assistance, technology, and industrial accommodation, Role of Industries/entrepreneur's association and self-help groups, The concept, role and functions of business incubators, angel investors, venture capital and private equity fund

Module IV: Sources of business ideas and tests of feasibility (12 hours)

Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation, planning & control; preparation of project report (various aspects of the project report such as size of investment, nature of product, market potential may be covered); Project submission/ presentation and appraisal thereof by external agencies, such as financial/non-financial institutions

Module V: Mobilising Resources (9 hours)

Mobilising resources for start-up. Accommodation and utilities; Preliminary contracts with the vendors, suppliers, bankers, principal customers; Contract management: Basic start-up problems

Suggested Readings

1. Kuratkoand Rao, Entrepreneurship: A South Asian Perspective, Cengage Learning.
2. Hisrich R, Peters M, Dean Shepherd, Entrepreneurship, McGraw Hill Educatio
3. Desai, Vasant. Dynamics of Entrepreneurial Development and Management. Mumbai, Himalaya Publishing House.
4. Dollinger, Mare J. Entrepreneurship: Strategies and Resources. Illinois, Irwin.
5. David H. Entrepreneurship: New Venture Creation. Prentice-Hall of India ,NewDelhi.
6. Singh, Nagendra P. Emerging Trends in Entrepreneurship Development. New Delhi: ASEED.
7. Khanka S S, Entrepreneurial Development, S. Chand &Co, Delhi.

E Resources

a) https://www.youtube.com/watch?v=rA4uKIy5gO0&list=PLsh2FvSr3n7fQlIDbfKutmSL26TsWitGQ
b) https://www.youtube.com/watch?v=DiKduSs7o34

Mapping of COs with Syllabus

COs	Module-1	Module-2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	M
CO4			H	L

MTOM105L: OFFICE ORGANIZATION AND MANAGEMENT

(Credits: 3- 45 hours) (L-T-P: 3-0-0)

Objective(s): *The course aims to establish the importance of office organisation and management and its role in the workplaces. It also prepares the students to acquire basic knowledge and skills necessary for different tasks and aspects in different industries*

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: understand the basic knowledge of office organisation and management (Remembering)
CO2: demonstrate skills in effective office organisation (Understanding)
CO3: organise and to maintain the office records (Applying)
CO4: ability the different types of digital records. (Analysing)
CO5: appraise the different types of organisation structures (Evaluating)

Module I: Fundamentals Of Office Management (10 Hours)

Introduction: Meaning, importance and functions of modern office Modern Office Organisation: Meaning; Steps in office organisation; Principles of Office organisation, Organisation structure types, Nature of office services: Types of services in a modern office, decentralisation and centralisation of office services, Office management: Meaning, Elements and major processes of Office management Office Manager: Functions and qualifications of Office manager

Module II: Administrative Arrangement And Facilities (8 Hours)

Office Accommodation and its Importance: Location of Office, Choice of Location: Urban vs Suburban, Factors to be Considered in Selecting the Site, Securing Office Space, Office Lay-out: Objectives of Office Lay-out, Types of offices: Open Office and Private Office- advantages and disadvantages.

Module III: Office Environment (10 Hours)

Meaning and Components of Office Environment Interior Decoration: Colour Conditioning, Floor Coverings, Furnishings, Furniture and Fixtures: Types of Furniture, Choice between Wooden and Steel Furniture, Principles Governing Selection of Furniture Lighting and Ventilation, Noise: Internal Noise, External Noise , Cleanliness, Sanitation and Health Safety and Security;

Module IV: Introduction to Records & Filing System (8 Hours)

Importance of Records, types of office records, Records Management: Meaning, Principles of Record Keeping, Functions of Records; Management Filing: Elements of Filing and Filing Functions, Objectives and Importance of Filing, Advantages of Filing, Essentials of a Good Filing System, Classification of Files. Filing Methods: Horizontal and vertical Filing. Office manual: contents, Importance, types of office manuals. Indexing: Meaning, importance, advantages and essentials of good indexing, Retention and disposal of files: Meaning and benefits of record retention, need for disposal of files, life-cycle stages of files.

Module V: Office Mechanisation and Data Processing (9 Hours)

Meaning, Importance and Objectives of Office Mechanisation, Advantages and disadvantages of Office Mechanisation, Factors Determining Office Mechanisation Kinds of Office Machines: Duplicating Machines and Photocopying Machines, Distinction between Data and Information, Importance of Data and Information, Classification of Data, Classification of Information, Data Collection Methods- Primary and secondary data collection methods Data processing using computers: Computer Applications in Office Management, Advantages and Limitations of Computerisation

Suggested Readings

1. S.P Arora, Office Organisation and Management, Vikas Publishing House Pvt Ltd
2. M.E Thakuram Rao, Office organisation and Management, Atlantic
3. Judith Read, Mary Lea Ginn, Record Management, 10th Edition, Cengage Learning.

E Resources

a) https://www.youtube.com/watch?v=8iwOCXkImmI
b) https://www.youtube.com/watch?v=QE6TBuGbScA&list=PL7c2_MFoYT-4Wa-ajZ71x4gZt2aZ_Wrbi

Mapping of COs with Syllabus

COs	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4			H	H	
CO5				M	M

MTRM210L: RETAIL MANAGEMENT
(Credits: 3- 45 hours) (L-T-P: 3-0-0)
Objective(s)*: The course aims to establish the importance of retail management. It also prepares the students to acquire basic knowledge and skills necessary for different tasks and aspects of retail management.*
Course/Learning Outcomes

At the end of the course students will be able to:
CO1: list the types and forms of Retail business. (Understanding)
CO3: examine Consumer Behavior in various environments. (Applying)
CO3: analyze various Retail operations and evaluate them. (Analysing)
CO4: determine the retail marketing mix. (Knowledge)
CO5: application of IT in retail sector (Applying)

Module I: Introduction to Retail Business (8 Hours)
Definition – functions of retailing - types of retailing – forms of retail business ownership. Retail theories – Wheel of Retailing – Retail life cycle. Retail business in India: Influencing factors – present Indian retail scenario.

Module II: Consumer Behaviour in Retail Business (10 Hours)
Buying decision process and its implication on retailing – Influence of group and individual factors, Customer shopping behaviour, Customer service and customer satisfaction.

Module III: Retail Operations (12 Hours)
Factors influencing location of Store - Market area analysis – Trade area analysis – Rating Plan method - Site evaluation. Retail Operations: Stores Layout and visual merchandising, Stores designing, Space planning, Inventory management, Merchandise Management, Category Management.

Module IV: Retail Marketing Mix (8 Hours)
Introduction -Product: Decisions related to selection of goods (Merchandise Management revisited) – Decisions related to delivery of service. Pricing: Influencing factors – approaches to pricing Place : Supply channel – SCM principles – Retail logistics – Promotion : Setting objectives – communication effects - promotional mix.

Module V: Information Technology in Retailing (7 Hours)
Non store retailing (e-retailing) - The impact of Information Technology in retailing - Integrated systems and networking – EDI – Bar coding – Electronic article surveillance – Electronic shelf labels – customer database management system.

Suggested Readings
1. Suja Nair; Retail Management, HPH
2. Karthic – Retail Management, HPH
3. S.K. Poddar& others – Retail Management, VBH.
4. R.S Tiwari ; Retail Management, HPH

Mapping of COs with Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H		
CO4				H	

CO5					H

ASE: VIRALITY IN DIGITAL MEDIA
(Credits-2 - 30 hours) (L-T-P: 2-0-0)
Objective(s): To equip students with a comprehensive understanding of the principles and strategies behind viral content creation and distribution. The course will enable students to analyze digital platforms, identify viral trends, and develop effective strategies to create content that resonates with target audiences.

COURSE/LEARNING OUTCOMES
At the end of this course students will be able to:
CO 1: describe the concept of virality and its impact on digital marketing. (Remembering)
CO 2: describe digital platforms and audience behavior to identify viral potential. (Understanding)
CO 3: apply engaging and shareable content that aligns with viral trends. (Applying)
CO 4: evaluate the effectiveness of viral campaigns and optimize for future success. (Evaluating)

Module I: Understanding Virality
Definition and characteristics of viral content**.** The psychology of sharing: social proof, emotions, and triggers**.** Viral loops and feedback mechanisms**.** Case studies of successful viral campaigns.

Module II: Digital Platforms and Audience Analysis
Major social media platforms and their viral ecosystems**.** Understanding target audience demographics and psychographics**.** Identifying viral trends and patterns**.** Influencer marketing and its role in virality

Module III: Content Creation and Curation
Content formats for virality: videos, images, text, and interactive content**.** Storytelling and narrative structure for maximum impact**.** Creating shareable content: hooks, headlines, and visual appeal**.** Content curation and repurposing for sustained engagement

Module IV: Viral Marketing Strategies
Developing a viral marketing plan**.** Leveraging user-generated content (UGC)**.** Utilizing paid promotion for initial reach**.** Measuring and optimizing campaign performance**.** Crisis management for viral content.

Module V: Advanced Topics in Virality
Viral analytics and measurement tools**.** Ethical considerations in viral marketing**.** Global virality and cultural nuances**.** Future trends in viral marketing.

Suggested Readings
1. Jonah Berger, Contagious: Why Things Catch On
2. Emily Bell, The Attention Economy: Understanding the New Culture of Now
3. Kevin Allocca, Why Things Go Viral
4. Charlene Li, Open Leadership: How Social Technology Can Transform the Way You Lead
5. Various academic articles and industry reports on viral marketing and social media

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	MTIN106I	Internship	4
4	Internship	MTIN211I	Internship	4
5	Internship	MTIN315I	Internship	2

MTIN106I/MTIN211I: INTERNSHIP (Exit of 1st Year or 2nd Year)
(4 Credits- 120 Hours) (L-T-P: 0-0-4)

Objective(s)
The students are required to undergo an internship in work related to Commerce and Management during the semester break at the end of fourth Semester or fifth Semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the

classes, in an on-the-job situation.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Identify career alternatives prior to graduation. (Understanding)
CO 2: Translate theory into practice. (Applying)
CO 3: Improve work habits and attitudes towards job success in workplace (Creating)

INTRODUCTION

The field of Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the BBA programme the students are made acquainted with the various facets of General Management, Marketing, HR and Finance functions. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

1. The internship should be for a minimum duration of **three weeks for 120 hours** which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.
2. The students have to undergo the internship at the end of 1st Year or 2nd Year if they choose to leave the programme . Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student
3. The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management.
4. After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department. e. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise of the following:

a. Recommendation Letter from the Department.
b. Completion Certificate from the Organisation where the student has worked as intern.
c. Internship Diary as per the prescribed format.
d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.
e. The Contents of the Report must include:
    I. Introduction.
    II. Objectives of the Internship.
    III. About the Organisation (Sector, Activities, Operations).
    IV. Description of the work.

The Assessment for the internship must have the following components:

a. Internship Report: 20 marks
b. Internship Diary: 20 marks
c. Seminar Presentation: 30 marks
d. Viva-Voce Examination: 30 marks

MTIN315I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits- 60 Hours) (L-T-P: 0-0-2)

Objective(s)

The students are required to undergo an internship in work related to Commerce and Management during the semester break at the end of fourth Semester or fifth Semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Identify career alternatives prior to graduation. (Understanding)
CO 2: Translate theory into practice. (Applying)
CO 3: Improve work habits and attitudes towards job success in workplace (Creating)

INTRODUCTION

The field of Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the BBA programme the students are made acquainted with the various facets of General Management, Marketing, HR and Finance functions. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

1. The internship should be for a minimum duration of **two weeks for 80 hours** which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.
2. The students have to undergo the internship during the semester break at the end of 3rd semester examination or at the end of 5th semester examination. Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student
3. 3.The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management.
4. 4.After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department. e. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise of the following:

a. Recommendation Letter from the Department.
b. Completion Certificate from the Organisation where the student has worked as intern.
c. Internship Diary as per the prescribed format.
d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.
e. The Contents of the Report must include:
    I. Introduction.
    II. Objectives of the Internship.
    III. About the Organisation (Sector, Activities, Operations).
    IV. Description of the work.

The Assessment for the internship must have the following components:

a. Internship Report: 20 marks
b. Internship Diary: 20 marks
c. Seminar Presentation: 30 marks
d. Viva-Voce Examination: 30 marks

RESEARCH PROJECT/DISSERTATION

BBA (Honours)				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	MTDI408P	Dissertation-I	6
8	Research Project/Dissertation	MTDI409P	Dissertation-II	6
BBA (Honours) with Research				
Semester	**Category**	**Course Code**	**Course Name**	**Credits**
7	Research Project/Dissertation	MTDI410P	Dissertation-I	18
8	Research Project/Dissertation	MTDI411P	Dissertation- II	20

MTDI408P: DISSERTATION - 1

(Credits: 5- 75 Hours) (L-T-P: 0-0-75)

Objective: *The basic objective of the project work is to give students an idea of research. In which they need to undertake a field survey for collecting data. Further they need to analyse the data and present a report on the topic in which they have conducted research. The evaluation is done on the basis of the project report, presentation and viva-voce examination.*

Guidelines Related To Project:

The entire project will be carried out in one phase. It includes Introduction and Review of Literature part, Research Methodology, Data Analysis and Interpretation and Findings, suggestions and conclusion part.

Course Outcome

CO1: Define the different types of research project. (Remembering) CO2: Explain the various steps of designing research project (Understanding)
CO3: Building questionnaire and schedules (Applying)
CO4: Assessing the data for analysis (Analyzing)
CO5: Appraising the findings in the report (Evaluating)
CO6: Designing a research project report (Creating)

RESEARCH PROJECT / DISSERTATION-I

(CREDITS: 5- 75 HOURS) (L-T-P: 0-0-75)

Objective: The objective of the course would be to educate the students about the various dimensions of a research-based project work. The students will also be taught about the application of statistical tools through SPSS.

Course Outcomes

At the end of the course students will be able to:
CO1: Define the different types of research project. (Remembering)
CO2: Explain the various steps of designing research project (Understanding)
CO3: Building questionnaire and schedules (Applying)
CO4: Examining the data for analysis (Analyzing)
CO5: Appraising the findings in the report (Evaluating)
CO6: Designing a research project report (Creating)

The Dissertation will comprise of the following:
1. Synopsis: Submission of a write up on a specific area/topic of study
2. Review of Literature: Submission of a specified number of reviews to respective guide
3. Research Methodology: Lecture based on the topic of study
4. Referencing Style: Lecture on referencing style to be followed while submitting report
5. Training on application of Statistical software used in research
6. Submission of Progress Report

Report should comprise of Introduction, Review of Literature, Research Methodology and References. EVALUATION:
A diary is to be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester.
Evaluation will be done by the respective guide based on timely submission of part-work and quality of work as follows:

Synopsis (30 marks)
Review of Literature (30 marks)
Research Methodology (30 marks)
Publication in Referred Journal: (10 marks)

POST GRADUATE PROGRAMMES

CONTENTS

REGULATIONS FOR PG PROGRAMMES

ASSAM DON BOSCO UNIVERSITY REGULATIONS

POST GRADUATE DEGREE PROGRAMMES

SCIENCE AND TECHNOLOGY

The following are the regulations of the Assam Don Bosco University concerning the Post- Graduate Programmes leading to the award of the Master's Degree in the disciplines of Science and Technology made subject to the provisions of its Statutes and Ordinances.

1.0 Academic Calendar

1.1 Each academic year is divided into two semesters of approximately 90 working days: an Autumn Semester (July – December) and a Spring Semester (January – June). The Autumn Semester shall ordinarily begin in July for students already on the rolls and the Spring Semester shall ordinarily begin in January. However, the first semester (Autumn, for newly admitted students) may begin later depending on the completion of admission formalities.

1.2 The schedule of academic activities approved by the Academic Council for each semester, inclusive of the schedule of continuing evaluation for the semester, dates for the conduct of end-semester examinations, the schedule of publication of results, etc., shall be laid down in the Academic Calendar for the semester.

2.0 Duration of the Programme

2.1 The normal duration of the Post Graduate Programme shall be as per the table given below:

Programme	Number of Semesters	Number of Years
Master of Technology (MTECH)	4	2
Master of Science (MSc)	4	2

2.2 However, students who do not fulfill some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to 4 more semesters (2 years) to complete all the requirements of the degree.

2.3 Under exceptional circumstances and depending on the merit of each case, a period of 2 more semesters (1 year) may be allowed for the completion of the programme

3.0 Course Structure

3.1 The University follows Outcome Based Education with Choice Based Credit System (CBCS) for all the Post Graduate Degree Programmes. One credit is equivalent to 15 hours of lecture/tutorial or 30 hours of practical. The courses offered for the Post Graduate Degree Programmes are divided into two baskets – Core Courses and Elective Courses.

3.2 Core Courses: Core courses are those in the curriculum, the knowledge of which is deemed essential for students who are pursuing the said Post Graduate Degree Programme.

3.2.1 A student shall be required to take all the core courses offered for a particular programme.

3.2.2 The number of credits required from core courses shall be as prescribed by the competent academic authority.

3.3. Elective Courses: These are courses in the curriculum which give the student opportunities for specialization and which cater to his/her interests and career goals. These courses may be selected by the student and/or offered by the department conducting the programme, from those listed in the curriculum according to the norms laid down by the competent academic authority.

3.3.1 The number of credits which may be acquired through elective courses shall be prescribed by the competent academic authority.

3.3.2 It shall be the prerogative of the department not to offer an elective course which has less than 5 students opting for it.

The schema of categorisation of courses into baskets is as given below:

Core Courses	
Departmental Core (DC)	Core courses which are offered by the department conducting the programme
School Core (SC)	Core courses which are offered by a department other than the department conducting th programme, from within the same School
Institutional Core (IC)	Core courses which are offered by departments of the University from Schools other than the pare School

Elective Courses	
Departmental Elective (DE)	Elective courses which are offered by the department conducting the programme
School Elective (SE)	Elective courses which are offered by a department other than the department conducting th programme, from within the same School
Institutional Elective (IE)	Elective courses which are offered by departments of the University from Schools others than th parent School

***UGC Equivalent Courses**- Core Paper (DC), Ability Enhancement Compulsory Course (IC/SC), Skill Enhancement Course (IE), General Elective (IE/SE), Discipline Specific Elective (DE)

***AICTE Equivalent Courses** - Basic Science Course (IC), Engineering Science Course(IC), Open Elective Course (IC), Humanities and Social Science Courses (IC),Mandatory Course (IC), Professional Core Course (DC), Professional Elective Course (DE)

3.6 In order to qualify for a Post Graduate Degree, a student is required to complete the minimum credit requirements as prescribed by the competent academic authority.

3.7 In addition to the prescribed credit requirement, a student shall have to complete Institutional mandatory courses with Pass grade, as prescribed by the competent academic authority, from time to time, which shall be recorded in the Grade sheet but not taken into account for computing the SGPA and the CGPA.

3.8 **Audit Course:** Students who secure a CGPA of at least 8 at the end of the first may opt to take one audit course per semester from any Department from the second semester onwards, provided the course teacher permits the auditing of the course. This shall be done under the guidance of the Departmental Faculty Advisor/mentor. The student is free to participate in the evaluation process for such courses. However, an attendance of 75% is necessary for obtaining a P grade for such courses. When auditing courses offered by other departments, it shall be the responsibility of the student to attend such courses without missing courses of one's own department and semester.

3.9 In addition, students may also opt for additional elective courses in consultation with their mentors. Students are required to participate in the evaluation process of such courses. The grades obtained for such courses shall be recorded in the grade sheet, but not taken into account for computing SGPA and CGPA.

3.10 It shall be the prerogative of the department to not offer an elective course which has less than 5 students opting for it.

3.11 The medium of instruction shall be English and examinations and project reports shall be in English.

3.12 The course structure and syllabi of the Post Graduate Degree Programmes shall be approved by the Academic Council of the University. Departmental Boards of Studies (DBOS) shall discuss and recommend the syllabi of all the courses offered by the department from time to time before forwarding the same to the School Board of Studies (SBOS). The SBOS shall consider the proposals from the departments and make recommendations to the Academic Council for consideration and approval.

3.13 The curriculum may include industry training and /or fieldwork for a specified time. This is to be satisfactorily completed before a student is declared eligible for the degree. There shall be credit allocation for such industrial training or fieldwork. Normally these activities shall be arranged during convenient semester breaks as shall be determined by the School Board of Studies.

3.14 **Faculty Advisor/Mentor:** A faculty advisor/mentor (and a co-mentor to perform the duties of a mentor during the absence of the mentor) to shall be assigned for groups of students. Faculty advisors/mentors shall help their mentees to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them.

4.0 Admission

4.1 All admissions to the Post Graduate Degree Programmes of the University shall be on the basis of merit. There may, however, be provision for direct admission for a limited number of NRI/FN students.

4.2 Eligibility Criteria

4.2.1 To be considered for admission to a Post Graduate Degree Programme a candidate should have passed a Bachelor's Degree (or equivalent) programme of a recognised university securing grades/marks as specified in the table below.

4.2.2 Admission will be on the basis of the performance of the candidate at the graduate level, the Post Graduate Entrance Test conducted by the university and/or a personal interview. Candidates for MTECH who have a valid GATE score may be exempted from the entrance test.

Programme	Grade /Marks requirement from qualifying examinations	Entrance Examinations / Personal Interview
MTECH	Completed a Bachelor's Degree programme in the appropriate stream of technology from a recognised university successfully with a minimum CGPA of 6.5 (or equivalent). The Academic Council may establish other eligibility criteria for M Tech in a particular discipline.	Post Graduate Entrance Test of Assam Don Bosco University
MCA	Completed a Bachelor's Degree programme in any stream of a recognised university successfully with a minimum of 50 % marks in the aggregate. In addition, the candidate must have passed Mathematics or equivalent at the higher secondary level or above.	Post Graduate Entrance Test of Assam Don Bosco University
MSc	Completed a Bachelor's Degree programme in Science of a recognised university successfully with a minimum aggregate, specified by the competent academic body.	Satisfactory performance in the Personal Interview

4.3 Reservation of seats for the programme shall be as per the guidelines laid out in the Statutes of the University.

4.4 Admissions shall ordinarily close after a specified period from the date of commencement of the first semester, through a notification. However, in exceptional cases, admission of a candidate after the last date may be recommended to the University with justification, by the School / Departments concerned. Under such an event, this period shall not exceed four weeks from the date of commencement of the first semester.

4.4.1 The attendance of such students shall be computed from the date of admission.

4.4.2 Such students may be offered the opportunity of taking part in in-semester assessment modules which may have already been completed.

4.5 All candidates shall be required to satisfy the norms prescribed by the University for medical fitness prior to admission.

4.6 Candidates may be required to furnish a certificate of good conduct from the institution last attended.

4.7 Bridge Courses: The Departments shall make provision for Bridge Courses to facilitate admission of students from varied backgrounds to a programme of their choice.

4.8 Value-added Courses: Each department shall offer value-added courses, which are optional. Certificates will be awarded to those who successfully complete the course.

4.9 Anti-Ragging Affidavit: Students and Parents Undertaking Affidavit In compliance of the UGC Regulations, it is compulsory for each student and every parent to submit an online Anti-Ragging undertaking affidavit every academic year. The Link to fill out the online undertaking affidavit by students and parents is:
www.antiragging.in/affidavit_registration_disclaimer.html
www.c4yindia.org/Home/Undertaking

5.0 University Registration

5.1 Candidates shall have to register as bona-fide students with the University as per the University regulations within a period specified by the University, by a formal application routed through the Director of the School concerned.

6.0 Attendance

6.1 To be permitted to appear for the end-semester examination of a particular course, a student is required to have a minimum attendance of 75% for that course.

6.2 Deficiency in attendance up to 10% may be condoned by the Director of the School in the case of leave taken for medical and other grievous reasons, which are supported by valid medical certificates and other requisite documents.

6.3 Some students, due to exceptional situations like their own serious sickness and hospitalization or death of members of inner family circle (restricted to only father, mother, siblings), may have attendance below 65%. Such students may be given bonus attendance percentage for a particular course based on his/her attendance for that course during the remaining days of the current semester, as given in the following table:

Attendance during the remaining days of the current semester	Bonus percentage available in the current semester
95% or more	5
90% or more but less than 95%	4
85% or more but less than 90%	3
80% or more but less than 85%	2
75% or more but less than 80%	1

They shall be permitted to appear for the end-semester examination of the course if, on the strength of this bonus attendance percentage, they obtain 65% attendance for that course.

6.4 If the sum of the credits of the courses for which a student is unable to appear at the end- semester examinations exceeds 50% of the total credits allotted for the semester, he/she shall not be permitted to appear for the entire end-semester examinations in view of clause 9.5 of these Regulations.

6.5 The School may propose to set aside a certain portion of the in-semester assessment marks for attendance. The number of marks and modalities of their allotment shall be made known to the students at the beginning of each semester.

6.6 Leave

6.6.1 Any absence from classes should be with prior sanctioned leave. The application for leave shall be submitted to the office of the Director of the concerned School on prescribed forms, through proper channels, stating fully the reasons for the leave requested along with supporting documents.

6.6.2 In case of emergency such as sickness, bereavement or any other unavoidable reason for which prior application could not be made, the parent or guardian must promptly inform the office of the Director of the concerned School.

6.6.3 If the period of absence is likely to exceed 10 days, a prior application for grant of leave shall have to be submitted through the Director of the concerned School to the Registrar of the University with supporting documents in each case; the decision to grant leave shall be taken by the Registrar on the recommendation of the Director of the concerned School.

6.6.4 The Registrar may, on receipt of an application, also decide whether the student be asked to withdraw from the programme for that particular semester because of long absence.

6.7 It shall be the responsibility of the student to intimate the concerned teachers regarding his/her absence before availing the leave.

7.0 Grading System

7.1 Three types of courses are offered in the Post Graduate programmes:

- **Graded courses:** For the majority of the courses, students shall be assessed and given grades.
- **Pass/No-Pass courses**: There are some courses for which the students are expected to obtain a P grade to be eligible for the degree.
- **Audit Courses**: A third category of courses are audit courses. These are optional.

However, students who opt for these courses must have the required attendance to obtain a P grade in the course.

7.2 Based on the performance of a student, each student is awarded a final letter grade in each graded course at the end of the semester and the letter grade is converted into a grade point. The correspondence between percentage marks, letter grades and grade points is given in the table below:

Marks (x) obtained (%)	Grade	Description	Grade Points
90 ≥ x ≤ 100	O	Outstanding	10
80 ≥ x < 90	A+	Excellent	9
70 ≥ x < 80	A	Very Good	8
60 ≥ x < 70	B+	Good	7
50 ≥ x < 60	B	Above Average	6
41 ≥ x < 50	C	Average	5
x = 40	P	Pass	4
x < 40	F	Fail	0
	AB	Absent	0
	PS	Pass	0
	NP	Not Passed	0
	X	Not Permitted	0

In addition, a student may be assigned the grades 'PS' and 'NP' for pass marks and non- passing marks respectively, for Pass/No-pass courses, or the grade 'X' (not permitted).

7.2.1 A student shall be assigned the letter grade 'X' for a course if he/she is not permitted to appear for the end semester examination of that course due to lack of requisite attendance.

7.2.2 A letter grade 'F' or 'X' in any course implies failure in that course.

7.2.3 A student is considered to have completed a course successfully and earned the credits if she/he secures a letter grade other than 'F' or 'X'.

7.3 At the end of each semester, the following measures of the performance of a student in the semester and in the programme up to that semester shall be computed and made known to the student together with the grades obtained by the student in each course:

7.3.1 The Semester Grade Point Average (SGPA): From the grades obtained by a student in the courses of a semester, the SGPA shall be calculated using the following formula:

$$SGPA = \frac{\sum_{i=1}^{n} GP_i \text{ x } NC_i}{\sum_{i=1}^{n} NC_i}$$

Where GP_i = Grade points earned in the i^{th}course
NC_i = Number of credits for the i^{th}course
n = the number of courses in the semester

7.3.2 The Cumulative Grade Point Average (CGPA): From the SGPAs obtained by a student in the completed semesters, the CGPA shall be calculated using the following formula:

$$CGPA = \frac{\sum_{i=1}^{n} SGP_i \text{ x } NSC_i}{\sum_{i=1}^{n} NSC_i}$$

Where SGP_i = Semester Grade point of the i^{th} semester
NSC_i = Number of credits for the i^{th} semester
n = the number of semesters completed

7.3.3 The CGPA may be converted into a percentage by multiplying CGPA by 10.

7.4 Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such. Whenever these CGPA are to be used for official purposes, only the rounded off values shall be used.

7.5 There are academic and non-academic requirements for the Graduate programmes where a student shall be awarded the 'P' and 'NP' grades. Non-credit courses such as Extra Academic Programmes belong to this category. No grade points are associated with these grades and these courses are not taken into account in the calculation of the SGPA or CGPA. However, the award of the degree is subject to obtaining a 'P' grade in all such courses.

7.6 In the case of an audit course, the letters "AU" shall be written alongside the course name in the Grade Sheet. A student is not required to register again for passing failed audit courses.

8.0 Assessment of Performance

8.1 A student's performance is evaluated through a continuous system of evaluation comprising tests, quizzes, assignments, seminars, minor projects, major projects and end-semester examinations.

8.2 Theory Courses: Theory courses shall have two components of evaluation – in- semester assessment of 40% weightage and an end-semester examination having 60% weightage.

8.2.1 The modalities of the conduct of in-semester assessment and weightages attached to its various components shall be as published by the School/Department at the beginning of each semester.

8.3 Lab Courses: Lab courses (Laboratory, Drawing, Workshop, etc.) shall be evaluated on the basis of assessment of tasks assigned and end semester test/viva voce. The weightage assigned for these components of the evaluation is given in the following table:

Component	**Weightage**
Assessment of Tasks Assigned	40
End-semester test / Viva voce	60

8.3.1 The modalities of the conduct of evaluation under the heading "Assessment of tasks assigned", its components and the weightages attached to its various components shall be published by the department concerned at the beginning of each semester.

8.3.2 The evaluation of the end-semester test for a lab course may be done on the basis of criteria and weightage to be specified in the question paper, among which are included

- Organisation of the program/experiment
- Coding, freedom from logical and syntactical errors, and accuracy of the result obtained / conduct of the experiment assigned and accuracy of the result
- Extent of completion
- A comprehensive viva-voce which examines the overall grasp of the subject

8.4 End-Semester examinations

8.4.1 End-semester examinations for the theory courses, generally of three hours' duration, shall be conducted by the University. The Director of the concerned school shall make the arrangements necessary for holding the examinations.

8.4.2 In the end-semester examinations, a student shall be examined on the entire syllabus of the courses.

8.4.3 A student shall not obtain a pass grade for a course without appearing for the end- semester examination in that course.

8.5 Research Seminar

8.5.1 During the course of the Post Graduate programme students may be required to conduct research seminars on a regular basis. The purpose of these research seminars is to encourage the students to conduct literature survey on the recent trends and developments in a chosen area of the discipline.

8.5.2 The literature survey conducted in preparation for these seminars may lead the students to the development of a project model to be executed during the final semesters of the programme.

8.5.3 The Research Seminars shall be evaluated on the basis of a presentation, a report and a viva voce examination.

8.6 The Major Project / Research Project / Dissertation

8.6.1 Students of the Post Graduate Programme shall undertake a Major Project / Research Project / Dissertation during the course of their Post Graduate studies. The Major Project / Research Project / Dissertation (to be referred to as Major Project henceforth) is normally conducted in two phases during the last two semesters of the programme.

8.6.2 The Major Project may be a software project, a research oriented project or research work which leads to a dissertation, as may be relevant to the discipline in which the work is undertaken. If it is a research oriented work, it should expose the students to the current state of research in a chosen area of the discipline and lead to new developments in the area.

8.6.3 The Major Project is to be undertaken individually in the campus or outside as may be specified by the department.

8.6.4 Each department shall constitute a Departmental Project Evaluation Committee (DPEC) consisting of the Director of the School (Chairperson), Head of the Department (Vice Chairperson), Project Co-ordinator and two senior teachers from the department, with the Project Co-ordinator as the convenor. The DPEC shall co-ordinate the conduct and assessment of the project.

8.6.4.1 The DPEC will notify the schedule and modalities for the following stages in the implementation of the project.

- Submission of the topic of the project.
- Notification for assignment of project supervisors.
- Submission of the synopsis
- Schedule for the seminar presentation of synopsis.
- Schedule for Progress Seminars, submission of progress reports and viva voce examination.
- Date for the submission of the project report and a brief summary.
- Dates for the end semester evaluation of the project.

8.6.5 The DPEC may ask a student to resubmit a synopsis if the same does not get its approval.

8.6.6 The project supervisor may be from outside the department or university. Such a supervisor should be approved by the DPEC and jointly supervise a project with a faculty member of the department.

8.6.7 The minimum qualification of a project supervisor shall be laid down by the DPEC in consultation with the Director of the School and authorities of the University.

8.6.8 The Chairperson of the DPEC will submit to the Controller of Examinations a panel of at least three names of external examiners at least three weeks before the end semester examination. The Controller of Examinations will appoint the external examiner(s) from this panel.

8.6.9 Each student shall submit to the DPEC four bound, printed copies of the project report, prepared according to the prescribed format made available, by the due date. The student will submit also three copies of a brief summary of the project that will be forwarded to the concerned examiners.

8.6.10 The DPEC will make the arrangements necessary to conduct the end semester evaluation in consultation with the examiners appointed by the University, during the dates notified.

8.6.11 The project will be evaluated through in-semester and end-semester assessments of equal weightage. The in-semester assessment will be done by the DPEC and the project supervisor. The end-semester assessment will be done by the external examiner(s), the project supervisor and a member of the DPEC appointed by it for the purpose. The weightages attached to their respective evaluations shall be 60:20:20.

8.6.12 The DPEC will forward the in-semester assessment marks to the Controller of Examinations by the date specified by the Examination Department.

8.6.13 Given below are the suggested components of Internal assessment and respective marks assigned:

- Synopsis: 15 marks
- Seminar presentation of the synopsis: 15 marks

- Project implementation: 40 marks
- Pre-submission presentation: 15 marks
- Pre-submission viva voce: 15 marks

8.6.14 Given below are the suggested components of External assessment and respective marks assigned:

- Project implementation: 40 marks
- Seminar presentation: 25 marks
- Viva voce examination: 20 marks
- Project documentation: 15 marks

8.6.15 Publication of papers and registering of patents are encouraged during the Post Graduate programme. Papers published or patents obtained may be awarded extra weightage during the evaluation of the project.

8.6.16 Those who obtain an 'F' grade for the major project will be required to re-enrol for it in the subsequent semester and pay the prescribed fees.

8.7 The Director will forward the marks obtained in the in-semester evaluation to the Controller of Examinations within the prescribed time as may be notified.

8.8 All evaluated work in a subject except the end semester answer scripts will be returned to the students promptly.

8.9 Eligibility for appearing in the end-semester examinations: A student shall be permitted to appear for the end-semester examinations, provided that

8.9.1 A student has not been debarred from appearing in the end semester examinations as disciplinary action for serious breach of conduct.

8.9.2 He/she has satisfactory attendance during the semester according to the norms laid out in section 6 of these regulations.

8.9.3 He/she has paid the prescribed fees or any other dues of the university within the date specified.

8.10 Registration for end-semester Examinations

8.10.1 The University shall, through a notification, invite applications from students to register for the end-semester examinations.

8.10.2 Students who have registered with the University (vide clause 5) and those who have applied for such registration may apply to appear for the end- semester examinations of the university, in response to the notification issued by the University, provided that they fulfil the eligibility norms as laid down in clause 8.9.

8.10.3 All eligible candidates shall be issued an admit card for the relevant examination and for specified courses. A student who does not have a valid admit card may not be permitted to write the end-semester examinations.

8.10.4 A student who secures an 'F' or 'X' grade in any course in a semester may register for the end-semester examination for that course in a subsequent semester when that course is offered again, within the maximum period of time allotted for the completion of the programme. The in-semester assessment marks obtained by him/ her in the last semester in which the said course was attended by him/her shall be retained.

8.10.5 Similarly, in case of an 'NP' grade in Extra Academic Programmes the student shall have to re-register for it in the appropriate semester of the next academic session.

8.10.6 When a student re-registers for the end semester examination of a course, in accordance with clause 8.10.4 above, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

8.11 **Conduct of Examinations**: The University shall conduct the end-semester examinations in accordance with the applicable regulations on such dates as are set down in the Academic Calendar or as notified.

8.12 **Declaration of Results:** The University shall declare the results of a semester and make available to students their grade sheets within the time-frame prescribed by the relevant regulations of the university and specified in the academic calendar.

8.13 The University may withhold the results of a student for any or all of the following reasons

- he/she has not paid his/her dues
- there is a disciplinary action pending against him/her
- he/she has not completed the formalities for University Registration according to the requirement of section 5 of these Regulations.

8.14 Re-examining of answer scripts

8.14.1 If a student feels that the grade awarded to him/her in a course is not correct, he/she may apply to the University for the re-examining of his/her answer script.

8.14.2 Re-examining of scripts may be of two different categories – scrutiny and re- evaluation.

8.14.3 Scrutiny: The activities under this category shall ordinarily be confined to checking

- correctness of the total marks awarded and its conversion into appropriate letter grades
- whether any part/whole of a question has been left unevaluated inadvertently
- correctness of transcription of marks on the tabulation sheet and the gradesheet issued in respect of the course under scrutiny.

8.14.4 Re-evaluation: Re-evaluation of the answer script by independent experts in the concerned subject(s).

8.14.5 Application for re-examining of answer scripts

- A student may apply for scrutiny or re-evaluation for one or more courses of the just-concluded end-semester examinations within seven calendar days from the date of publication of its results in the application form prescribed for this purpose.
- He/she shall pay the prescribed fee to the University as notified.
- A student applying for scrutiny/re-evaluation shall expressly state on the application form whether the application made is for Scrutiny or for Re- evaluation. In each case, the student may also request to see his/her answer script.
- All applications for scrutiny/re-evaluation must be routed through the Director of the concerned School.

8.14.6 If in the process of re-examining, the grade obtained in a course changes, the better of the two grades shall be assigned to the course. If there is a change, the new grade shall be recorded and a new grade sheet shall be issued to the student.

8.14.7 Without prejudice to any of the clauses of section 8.14, a student who has been found to have used unfair means during an examination shall not be eligible to apply for scrutiny or re-evaluation of answer scripts.

8.15 Repeat Examination: The University shall conduct repeat examination for those with F grade at a different time slot, as set down in the Academic Calendar or as notified. Such students should register for these examinations.

8.16 Improvement Examination

8.16.1 After the completion of the entire programme of study, a student may be allowed the provision of improvement examinations. These are to be availed of only once each in the Autumn and Spring semesters that immediately follow the completion of the programme, and within the maximum number of years permissible for a programme.

8.16.2 A student who has taken migration from the University shall not be eligible to appear for Improvement Examination.

8.16.3 A student may not choose more than the number of courses specified in the table below for improvement examinations.

Programme	**Number of Courses for Improvement Examinations**		
	Autumn Semester	Spring Semester	Total
MCA	3	3	6
MSc	3	3	6
MTECH	2	2	4

8.16.4 After the improvement examination, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

8.16.5 If the student improves his/her grades through the improvement examination, new grade sheets and comprehensive transcripts shall be issued to the student.

8.17 Special Examination

8.17.1 The University shall conduct Special Examinations to benefit the following categories of students:

8.17.1.1 Students who, on the completion of the final semester, have some 'F' graded courses in the two final semesters, but no 'F' or 'X' graded courses in any of the previous semesters

8.17.1.2 Students who have only one 'F' graded course in a semester other than the two final semesters and do not have 'F' or 'X' graded courses in the two final semesters.

8.17.2 The Special Examinations shall ordinarily be conducted each year within a month of the declaration of the results of the Spring Semester.

8.17.3 Students who fail to secure 50% of the credits offered in the final semester shall not be eligible to appear for the special examinations. Such students will be governed by the provisions of clause 9.5 of these regulations. However, this restriction shall not apply in the case of students who are unable to appear in the end semester examinations due to exceptional situations like their own serious illness and hospitalisation or death of members of inner family circle (restricted to only father, mother, siblings).

8.17.4 Students who have 'X' graded courses only in the last two semesters may be offered the opportunity for participating in a Tutorial Programme which may be conducted during the semester break immediately following the end- semester examinations of the final semester and students who earn 85% attendance for the programme

shall be permitted to appear for the Special Examinations. Separate fees shall be charged for the Tutorial Programme.

8.17.5 Students who do not obtain pass grades in any course at the special examinations shall have to apply in the prescribed format and appear for the end-semester examination of these courses when they are scheduled by the University during subsequent relevant end-semester examinations.

9.0 Enrolment (for semesters other than the first)

9.1 Every student is required to enrol for the relevant courses before the commencement of each semester within the dates fixed for such enrolment and notified by the Registrar.

9.2 Students who do not enrol within the dates announced for the purpose may be permitted late enrolment up to the notified date on payment of a late fee.

9.3 Only those students shall be permitted to enrol who have

- cleared all University, Departmental, Hostel and Library dues and fines (if any) of the previous semester,
- paid all required University, Departmental and Hostel fees for the current semester, and
- not been debarred from enrolling on any specific ground.

9.4 No student may enrol for a semester if he/she has not appeared, for whatever reason, in the end semester examinations of the previous semester.

9.5 A student who fails to obtain 50% of the credits offered in the third and subsequent semesters shall not be permitted to enrol for the next semester and shall have to re-enrol for and attend all the courses of the said semester in the following academic year. Students who due to X grade (lack of due attendance) have been debarred from exams in any semester (including first and second) will have to re-enrol for the same.

10.0 Eligibility for the Award of the Post Graduate Degree

10.1 A student shall be declared to be eligible for the award of the Post Graduate Degree for which he/she has enrolled if he/she has

10.1.1 completed all the credit requirements for the degree with grade 'C' or higher grade in each of the mandatory graded courses and grade 'PS' in all mandatory non-graded courses.

10.1.2 satisfactorily completed all the non-credit requirements for the degree viz., Extra Academic Activities, Industry Training, field work, internship programme, etc. (if any);

10.1.3 obtained a CGPA of 5.00 or more at the end of the semester in which he/she completes all the requirements for the degree;

10.1.4 owes no dues to the University, School, Department, Hostels; and

10.1.5 has no disciplinary action pending against him/her.

10.2 The award of the Post Graduate Degree must be recommended by the Academic Council and approved by the Board of Management of the University.

11.0 Termination from the Programme

11.1 If more than the number of years permitted for the completion of a programme have elapsed since the student was admitted, and the student has not become eligible for the award of Degree, the student shall be removed from the programme.

11.2 A student may also be required to leave the Programme on disciplinary grounds on the recommendations of the Students' Disciplinary Committee of the concerned School.

ASSAM DON BOSCO UNIVERSITY REGULATIONS

POST GRADUATE DEGREE PROGRAMMES

HUMANITIES AND SOCIAL SCIENCES & COMMERCE AND MANAGEMENT

The following are the regulations of the Assam Don Bosco University concerning the Post- Graduate Programmes leading to the award of the Master's Degree in the disciplines of Humanities and Social Sciences & Commerce and Management made subject to the provisions of its Statutes and Ordinances:

The Master's Degree Programmes of Assam Don Bosco University consist of theory and practicum components, taught and learned through a combination of lectures, field work/field visit and research projects.

1.0 Academic Calendar

1.1 Each academic year is divided into two semesters of approximately 18 weeks duration: an Autumn Semester (July – December) and a Spring Semester (January – June). The Autumn Semester shall ordinarily begin in July for students already on the rolls and the Spring Semester shall ordinarily begin in January. However, the first semester (Autumn, for newly admitted students) may begin later depending on the completion of admission formalities.

1.2 The schedule of academic activities approved by the Academic Council for each semester, inclusive of the schedule of continuing evaluation for the semester, dates for end-semester examinations, the schedule of publication of results, etc., shall be laid down in the Academic Calendar for the semester.

2.0 Duration of the Programme

2.1 The normal duration of the Post Graduate Programme in the disciplines of Humanities and Social Sciences & Commerce and Management shall be 4 semesters (2 years).

2.2 However, students who do not fulfil some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to 4 more semesters (2 years) to complete all the requirements of the degree.

2.3 Under exceptional circumstances and depending on the merit of each case, a period of 2 more semesters (1 year) may be allowed for the completion of the programme

3.0 Course Structure

3.1 The choice based credit system shall be followed for the Masters Degree Programmes. Credits are allotted to the various courses depending on the number of hours of lecture/practicum/Field work assigned to them using the following general pattern:

3.1.1 Lecture: One hour per cycle/week is assigned 1 credit.

3.1.2 Practicum/fieldwork: Two hours per cycle/week is assigned 1 credit.

3.2 The courses are divided into two baskets – core courses and elective courses. (Core courses will include "Core Courses" and "Ability Enhancement Courses" mentioned in CBCS guidelines. Elective Courses will include "Discipline Specific Electives", "Generic Electives", optional "Dissertation or Project", and "Skill Enhancement Courses")

3.3 Core Courses: Core courses are those in the curriculum, the knowledge of which is deemed essential for students who are pursuing the programme.

3.3.1 A student shall be required to take all the core courses offered for a particular programme.

3.3.2 The number of credits required from core courses shall be as prescribed by the competent academic authority.

3.4 Elective Courses: These are courses in the curriculum which give the student opportunities for specialisation and which cater to his/her interests and career goals. These courses may be selected by the student and/or offered by the department conducting the programme, from those listed in the curriculum according to the norms laid down by the competent academic authority.

3.4.1 The number of credits which may be acquired through elective courses shall be prescribed by the Board of studies pertaining to the programme.

3.5 These categories of courses may further be subdivided into departmental, school or institutional, depending on the department which offers the course. The schema of categorisation of courses into baskets is as given below:

***Core Courses**	
Departmental Core (DC)	Core courses which are offered by the department which conducts the programme
School Core (SC)	Core courses which are offered by a department other than the department which conducts the programme, from within the same School
Institutional Core (IC)	Core courses which are offered by departments of the University from Schools other than the parent School

*Elective Courses	
Departmental Elective (DE)	Elective courses which are offered by the department which conducts the programme
School Elective (SE)	Elective courses which are offered by a department other than the department which conducts the programme, from within the same School
Institutional Elective (IE)	Elective courses which are offered by departments of the University from Schools others than the parent School

***UGC Equivalent Courses** - Core Paper (DC), Ability Enhancement Compulsory Course (IC/ SC), Skill Enhancement Course (IE), General Elective (IE/SE), Discipline Specific Elective (DE)

3.6 In order to qualify for a Master's Degree, a student is required to complete the credit requirement as prescribed in the curriculum.

3.7 In addition to the prescribed credit requirement, a student shall have to complete the requirements of Extra Academic Programmes (EAP) as may be prescribed by the Department. Students shall be awarded P/NP grades for the EAP, which shall be recorded in the Gradesheet, but not taken into account for computing the SGPA and the CGPA.

3.8 Students who secure a CGPA of at least 7.5 at the end of the 2nd semester may opt to take one audit course per semester from any Department from the 3rd semester onwards, provided the course teacher permits the auditing of the course. This shall be done under the guidance of the Departmental Faculty Advisor/mentor. The student is free to participate in the evaluation process for such courses. However, an attendance of 75% percentage is necessary for obtaining a P grade for such courses. When auditing courses offered by other departments, it shall be the responsibility of the student to attend such courses without missing courses of one's own department and semester.

3.9 In addition, students may also opt for additional elective courses in consultation with their mentors. Students are required to participate in the evaluation process of such courses. The grades obtained for such courses shall be recorded in the gradesheet, but not taken into account for computing SGPA and CGPA.

3.10 It shall be the prerogative of the department to not offer an elective course which has less than 5 students opting for it.

3.11 The medium of instruction shall be English and examinations and project reports shall be in English.

3.12 The course structure and syllabi of the Post Graduate Degree Programmes shall be approved by the Academic Council of the University. Departmental Boards of Studies (DBOS) shall discuss and recommend the syllabi of all the courses offered by the department from time to time before forwarding the same to the School Board of Studies (SBOS). The SBOS shall consider the proposals from the departments and make recommendations to the Academic Council for consideration and approval.

3.13 The curriculum may include fieldwork / institutional visits / internship for a specified time. These are to be satisfactorily completed before a student is declared eligible for the degree. There shall be credit allocation for such activities. These activities may be arranged during the semester or during convenient semester breaks as shall be determined by the School Board of Studies.

3.14 Faculty Advisor/Mentor: A faculty advisor/mentor shall be assigned for groups of students. Faculty advisors/mentors shall help their mentees to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them.

PROGRAMME SPECIFIC CURRICULAR ASPECTS

4.0 MASTER OF SOCIAL WORK (MSW)

4.1 Area of Concentration: The third and fourth semesters shall have courses from a chosen Area of Concentration (AoC) from among those offered by the department. The AoC is to be opted for at the end of the second semester and will be confirmed by the department depending on the availability of seats and the aptitude and ability of the student. An AoC will be offered by the department only if a minimum of ten students opt for it. The fieldwork and research project of the third and fourth semesters will be based on the AoC.

4.2 Concurrent and Continuous Fieldwork

Fieldwork shall be an essential part of the course structure in all the semesters of the programme. The field work practice in the first semester shall consist of orientation visits, sessions for skills training and placement. In the first year, the focus of the field work shall be the community and in the second year the focus shall be based on the specialisation chosen by the students. In the first semester,, students shall be placed in communities, NGOs,service organizations and government agencies working with communities, and in those settings where they can be exposed to the community and community issues. The students get a close feel of the community and community settings, understand the dynamics and issues in the community and become aware of the sensitivities of people while working with them. They also get a firsthand experience of the programmes and projects implemented in the communities by NGOs and government agencies and the impact that these have on the community. They shall also interact with the personnel from organisations and the community members to understand the tension between tradition and change that the communities in the region are likely to experience, and how it is handled. They shall, with the help of the organisation and the field work supervisor, identify an issue and work on

it following the principles of community organization. The students are expected to be creative and innovative in assisting the agency and community in whatever way possible.

The field work practice in the second semester will consist of lab sessions for skills training and placement. The focus will be on the practice of social case work and Group works. The students shall be placed in NGOs, and government service organizations and government agencies working with individuals and families, and in those settings where they can be exposed to issues related to individuals and groups.

4.2.1 Normally a student shall spend fifteen hours over two days per week in field work. However, keeping in mind the peculiar situation of transport and communications in the region and the expenses involved, the field work practice may be arranged in other convenient ways as the institution deems fit.

4.2.2 The student is required to submit the report on the field work and the field work diary to the field work supervisor, before the commencement of classes on the first day of class following the field work days. The supervisor shall conduct regular field work conferences

4.2.3 A student is expected to have 100 percent attendance in field work. Any shortage shall be compensated by him/her.

4.2.4 At the end of the semester the student shall submit a summary report of the field work for the semester and a viva voce examination shall be conducted.

4.2.5 The field work practice in the Third and Fourth Semesters shall focus upon the Area of Concentration chosen by the students. The students shall be placed in the field for twenty five days of consecutive field work. The field work settings shall be communities, NGOs, service organizations, hospitals, clinics and governmental agencies. Those students who are specializing in Community Development will either be placed in an urban or rural community setting that is identified by the Department. Students who are specializing in Medical and Psychiatric Social Work will be exposed to either a Medical or a Psychiatric setting.

4.3 Rural Camp

Students shall organise and participate in a rural camp during the first / second semester. The duration of the rural camp shall generally be ten days excluding days of travel.

4.3.1 The objectives of the rural camp are:

- To apply the acquired skills of group work and community organisation in communities.
- To understand and assess the problems faced by the rural population.
- To involve oneself positively in the communities to help to remove some of these problems.

4.3.2 At the end of the camp each student shall submit a written report to the department in a specified format. Performance at the Rural Camp shall be considered for the evaluation of the Field Work during the second semester.

4.3.3 The Rural Camp shall be credited along with the fieldwork of the semester along with which it can be conveniently coupled.

4.4 Study Tour

During the programme the students shall undertake a study tour along with the assigned faculty members to a place approved by the department. The places are to be so chosen as to be of educational benefit to students. During the tour, the focus shall be on visiting and interacting with as many NGOs/ state/national/international organisations involved in developmental work as possible. A report of the learning outcomes shall be submitted to the department at the end of the tour. The Study Tour shall be a Pass/No Pass course.

4.5 Block Placement

After the examinations at the end of the fourth semester, the students shall be placed with an NGO or Agency for a period of not less than one month for practical experience and application of their skills. While the Block Fieldwork is not credited, it is mandatory for the completion of the MSW programme. The student shall contact an agency of his/her choice and get the choice of agency approved by the department. Students shall endeavour to choose an agency that is primarily in tune with their AoC and which has credentials in the concerned field. At the end of every week the student shall send a brief report to the supervisor and at the end of the Block Field Work period a summary report shall be submitted. The summary report shall contain a short description of the Agency, the social service skills applied in his/her work and the student's learning outcomes. The report shall be submitted in a format prescribed by the department and shall be submitted together with a certificate from the agency confirming his/her field work, in a prescribed format.

4.6 Research Project Work

Every student shall undertake a research project work which has bearing on his/her AoC and present a written thesis on the research work under the supervision and guidance of a faculty member. The preliminary work may begin at the end of the second semester. The students are expected to complete the data collection before the fourth semester. The thesis is to be submitted to the department before the date notified. The student shall write a dissertation of the

research thesis and appear for a viva voce examination on the research done. The mode and components of evaluation of the research work and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

4.7 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

5.0 MASTER OF SCIENCE (MSC) PSYCHOLOGY

5.1 Field Work

Students shall take part in field work during the first three semesters in mental health agencies, medical institutions, educational institutions etc., under the supervision of professional counsellors and psychologists, where the student of psychological counselling can get a first-hand experience of the application of the learning derived from the classroom. The field work shall be credited and shall be evaluated using norms laid down by the department.

5.2 Study Tour

During the programme the students shall undertake a study tour, along with the faculty members, to a place approved by the department. The places are to be so chosen as to be of educational benefit to students. During the tour, the focus shall be to visit and interact with NGOs, hospitals, state/national/international organisations involved in psychological counselling. A report of the learning outcomes shall be submitted to the department at the end of the tour followed by a presentation. The Study Tour shall be a Pass/No Pass course.

5.3 Summer Internship

Students are required to undergo a summer internship of two weeks' during the semester break between the second and third semesters. It is a P/NP course and shall be recorded in the third semester. The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in class room courses to the "real world" of social service agencies, medical institutions, the criminal justice system, business, and industry. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills. The summer internship enriches the students' academic experience while making a valuable contribution to the community and utilizing the vacation optimally.

5.4 Supervised Internship

Each student shall perform a supervised internship for a period of 90 days (spread across semester three and four with 45days in each semester) in two organizations which offers counselling help to clients. The supervised internship is a credited course and the report for each internship shall be submitted by the students at the end of each semester followed by a presentation on the same. It shall be the prerogative of the department to propose the number of institutions where a student is expected to perform supervised internship. Supervision shall be provided for by the university in collaboration with the organisation where the student performs the internship. Evaluation of the internship shall be based on the documentation, reports from the organisation, report of the supervisor and the presentation and the viva voce examination of the student at the end of the period of Internship.

5.5 Research Project Work

A research project shall be undertaken during the course of the third and the fourth semesters. The topic of the research shall be so chosen that it will be possible for the student to pursue and complete the research work in the institution/hospital where the student is placed for the supervised internship. The preliminary work may begin at the end of the second semester. The students are expected to complete the data collection before the fourth semester. The thesis is to be submitted to the department before the date notified. The student shall write a dissertation of the research thesis and appear for a viva voce examination on the research done. The mode and components of evaluation of the research work and the weightages attached to them shall be published by the Department/ Institute at the beginning of the semester.

5.6 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A Group assignment shall be accompanied by a common presentation.

6.0 MASTER OF ARTS (MA) EDUCATION

6.1 Specialisations

The Master's Degree Programme in Education offers a number of specialisations, of which a student shall be required to choose a specialization after the completion of the first semester. The department shall have the prerogative of not

offering a specialisation if a sufficient number of students do not opt for it.

6.2 Educational Seminar

During the course of the programme, students are expected to present a series of seminars which will address fundamental intellectual, conceptual and practical issues in current educational philosophy and application. They may also deal with other relevant topics which may be suggested by the department. Students shall be assisted through guest lectures, discussions, field work in education related institutions and active engagement with faculty members. During these interactions students shall be provided with an opportunity to explore how best to bring new interdisciplinary scholarship, technology and critical thinking into the development of the chosen seminar area. They shall also consider alternative pedagogic strategies, teaching techniques and technologies. Students shall prepare and present a final paper based on these seminars. Students shall be evaluated on the basis of the seminars and the final paper.

6.3 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

6.4 Research Project Work

Every student shall undertake a research project work which has bearing on his/her field of specialisation and present a written thesis on the research work under the supervision and guidance of a faculty member. The Research Project shall be undertaken individually, in two phases during the third and fourth semesters. Students are expected to make presentations to the department at different stages of the research work. The student shall write a dissertation of the research thesis, submit it to the department and appear for a viva voce examination at times to be notified by the department. The mode and components of evaluation of the research work and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

6.5 School Visits

The students of the Masters Programme in Education shall be engaged in regular school visits with the purpose of understanding and evaluating the process of teaching, learning and evaluation as well as the exigencies of administration of the school.

6.6 Internship

During the final semester of the programme, a student is required to undergo an internship for a period of one month. The internship provides an opportunity for students to experience the ground reality and connect it with the theoretical and methodological perspectives the student has studied and interiorized. During the internship the student will be monitored and guided by his/her supervisor and faculty members. The student will be required to maintain a journal and at the end of the period of internship, submit a written report and to make a presentation of his/her experiences and learnings at the internship. The student will be required also to submit a report from the head of the institution regarding his/her performance there.

The evaluation of the student shall be based on the level of his/her engagement during the internship in addition to his/her ability to communicate this engagement in the journal, the report and the presentation. The journal and the report are to be submitted within a month of the completion of the internship. The department shall specify the criteria for evaluating the journal, the report and the presentation.

6.7 Journaling

During the 1st semester, students shall maintain a reflective journal, to develop within them a reflection that can be described as an inner dialogue, using visible thinking routine (Harvard), as a critical structure for guiding their journal writing. Journaling has to be done six days a week. At the end, the student will be awarded grade/marks after assessing their learning.

7.0 MASTER OF ARTS (MA) MASS COMMUNICATION

7.1 Specialisations

The Master's Degree Programme in Mass Communication offers a number of specialisations, of which a student shall be required to choose a specialisation after the completion of the first semester. The department shall have the prerogative of not offering a specialisation if a sufficient number of students do not opt for it.

7.2 Media House Visits

During the course of the programme, students shall be required to visit a variety of Media Houses in small groups constituted by the department. The purpose of these Media House Visits shall be to gain exposure to the best practices among the day-to- day activities of the media house. A report of the visit is to be submitted in the format specified within two days of the visit. The Media House visit shall be a graded course and grades shall be awarded on the basis of the written reports of the media house visits.

7.3 Research Project Work

Every student shall undertake a research project work which has a bearing on his/her field of specialisation and present a written thesis on the research work under the supervision and guidance of a faculty member. The Research Project shall be undertaken individually, in two phases during the course of two semesters as shall be laid down in the course structure of the programme. Students are expected to make presentations to the department at different stages of the research work. The student shall write a dissertation of the research thesis, submit it to the department and appear for a viva voce examination at times to be notified by the department. The mode and components of evaluation of the research work and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

7.4 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

7.5 Internship

All students shall undergo an internship involving media related activities of four weeks' duration. The purpose of the internship is to give the students an opportunity to have a hands-on field experience to effectively put into practice the theoretical and practical learning from the programme in an area of interest. Students may undergo their internship in a media house of their choice. The student shall be required to discuss the choice of media house with the department and obtain its consent. Before going for the internship, a Letter of Consent from the concerned media house, in the prescribed format, shall be submitted by the student to the Department. After returning from the internship each student shall have to submit a detailed report in a prescribed format. Each student shall also make a presentation of the internship experience and learning in the Department and submit a certificate of successful completion of the internship from the designated authority of the concerned media house. The schedule of the conduct, report submission and evaluation of the internship shall be as notified by the Department. The components of evaluation of the Internship and their weightages shall be as notified by the department at the beginning of the semester.

7.6 Final Project

As a Final Project the students are required to create a Social Awareness and Community Development oriented multi-media project which shall culminate in a Media Event. The purpose of the final project is to showcase all the skills that the students have acquired during the course of the programme as well as demonstrate their Media and Event Management, and Media Entrepreneurship abilities and at the same time use these skills for the service and upliftment of the community. The Final Project shall essentially be a group project and the number of groups shall be specified by the department. The groups shall perform their activities under the guidance of faculty members who shall be assigned to guide each group. The last dates for the submission of the project proposal and the conduct of the event shall be notified by the Department well in advance. The components of evaluation of the Final Project and their weightages shall be as notified by the department at the beginning of the semester.

8.0 MASTER OF ARTS (MA) ENGLISH

8.1 Specialisations

The Master's Degree Programme in English offers a number of specialisations, of which a student shall be required to choose a specialisation after the completion of the second semester. The department shall have the prerogative of not offering a specialisation if a sufficient number of students do not opt for it.

8.2 Educational Seminar

During the course of the programme, students are expected to present a series of seminars related to English literature. They may also deal with other relevant topics which may be suggested by the department. Students shall prepare and present a final paper based on these seminars. Students shall be evaluated on the basis of the seminars and the final paper.

8.3 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

8.4 Dissertation

Students will be required to write a dissertation in the 4th semester.

9.0 MASTER OF (MA) PUBLIC ADMINISTRATION

9.1 Specialisations

The Master's Degree Programme in Public Administration offers a number of specialisations, of which a student shall be required to choose a specialisation. The department shall have the prerogative of not offering a specialisation if a sufficient number of students do not opt for it.

9.2 Project Work/Dissertation

The Master's Degree Programme in Public Administration will require students to do Project work in the 3rd and 4th semesters. The mode and components of evaluation of the project work and the weightages attached to them shall be

published by the department at the beginning of the semester.

9.3 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

9.0 MASTER OF COMMERCE (MCOM)

9.1 Specialisations

The Master's Degree Programme in Commerce offers a number of specialisations, of which a student shall be required to choose a specialisation after the completion of the second semester. The department shall have the prerogative of not offering a specialisation if a sufficient number of students do not opt for it.

9.2 Project Work/Dissertation

The Master's Degree Programme in Commerce will require students to do Project work in the 3rd and 4th semesters. The mode and components of evaluation of the project work and the weightages attached to them shall be published by the department at the beginning of the semester.

9.3 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

10.0 Admission

10.1 All admissions to the Post Graduate Degree Programmes of the University shall be on the basis of merit. There may, however, be provision for direct admission for a limited number of NRI/FN students.

10.2 Eligibility Criteria

10.2.1. To be considered for admission to a Post Graduate Degree Programme a candidate should have passed a Bachelor's Degree (or equivalent) programme of a recognised university securing 50% of the grades/marks.

10.2.2. Admission will be on the basis of the academic records of the candidate, and taking into consideration his/her performance in any or all of the following:

- Written test
- Group Discussion
- Personal Interview

10.3 Candidates whose results for the qualifying examination are not yet declared may be provisionally admitted provided she/he submits proof of fulfilment of the eligibility criteria by 31 October of the year of provisional admission.

10.4 Bridge Courses: The Departments shall make provision for Bridge Courses to facilitate admission of students from varied backgrounds to a programme of their choice.

10.5 Value-added Courses: Each department shall offer value-added courses, which are optional. Certificates will be awarded to those who successfully complete the course.

10.6 Anti-Ragging Affidavit: Students and Parents Undertaking Affidavit In compliance of the UGC Regulations, it is compulsory for each student and every parent to submit an online Anti-Ragging undertaking affidavit every academic year. The Link to fill out the online undertaking affidavit by students and parents is:

www.antiragging.in/affidavit_registration_disclaimer.html

www.c4yindia.org/Home/Undertaking

11.0 University Registration

11.1 Candidates shall have to register as bona-fide students with the University as per the University regulations within a period specified by the University, by a formal application routed through the Director.

12.0 Attendance

12.1 To be permitted to appear for the end-semester examination of a particular course, a student is required to have a minimum attendance of 75% for that course.

12.2 Deficiency in attendance up to 10% may be condoned by the Director in the case of leave taken for medical and other grievous reasons, which are supported by valid medical certificates and other requisite documents.

12.3 Some students, due to exceptional situations like their own serious sickness and hospitalization or death of members of inner family circle, may have attendance below 65%. Such students may be given bonus attendance percentage for a particular course based on his/her attendance for that course during the remaining days of the current semester, as given in the following table:

Attendance during the remaining days of the current semester	Bonus percentage available in the current semester
95% or more	5
90% or more but less than 95%	4
85% or more but less than 90%	3
80% or more but less than 85%	2
75% or more but less than 80%	1

They shall be permitted to appear for the end-semester examination of the course if on the strength of this bonus attendance percentage, they obtain 65% attendance for that course.

12.4 If the sum of the credits of the courses for which a student is unable to appear at the end- semester examinations exceeds 50% of the total credits allotted for the semester, he/she shall not be permitted to appear for the entire end-semester examinations in view of clause 13.5 of these Regulations.

12.5 The School may decide to set aside a certain portion of the in-semester assessment marks for attendance. The number of marks and modalities of their allotment shall be made known to the students at the beginning of each semester.

12.6 Leave

12.6.1 Any absence from classes should be with prior sanctioned leave. The application for leave shall be submitted to the Office of the Director of the School on prescribed forms, through the Head of the Department, stating fully the reasons for the leave requested along with supporting documents.

12.6.2 In case of emergency such as sickness, bereavement or any other unavoidable reason for which prior application could not be made, the parent or guardian must inform the office of the Director promptly.

12.6.3 If the period of absence is likely to exceed 10 days, a prior application for grant of leave shall have to be submitted through the Director to the Registrar with supporting documents in each case; the decision to grant leave shall be taken by the Registrar on the recommendation of the Director.

12.6.4 The Registrar may, on receipt of an application, also decide whether the student be asked to withdraw from the programme for that particular semester because of long absence.

12.6.5 It shall be the responsibility of the student to intimate the concerned teachers regarding his/her absence before availing of the leave.

13.0 Grading System

13.1 Based on the performance of a student, each student is awarded a final letter grade in each graded course at the end of the semester and the letter grade is converted into a grade point. The correspondence between percentage marks, letter grades and grade points is given in the table below:

Marks (x) obtained (%)	Grade	Description	Grade Points
90 ≥ x ≤ 100	O	Outstanding	10
80 ≥ x < 90	A+	Excellent	9
70 ≥ x < 80	A	Very Good	8
60 ≥ x < 70	B+	Good	7
50 ≥ x < 60	B	Above Average	6
41 ≥ x < 50	C	Average	5
x = 40	P	Pass	4
x < 40	F	Fail	0
	AB	Absent	0
	PS	Pass	0
	NP	Not Passed	0
	X	Not Permitted	0

In addition, a student may be assigned the grades 'PS' and 'F' for pass marks and non- passing marks respectively, for Pass/No-pass courses, or the grade 'X' (not permitted).

13.1.1 A student shall be assigned the letter grade 'X' for a course if he/she is not permitted to appear for the end semester examination of that course due to lack of requisite attendance.

13.1.2 A letter grade 'F' or 'X' in any course implies failure in that course.

13.1.3 A student is considered to have completed a course successfully and earned the credits if she/he secures a letter grade other than 'F' or 'X'.

13.2 At the end of each semester, the following measures of the performance of a student in the semester and in the

programme up to that semester shall be computed and made known to the student together with the grades obtained by the student in each course:

13.2.1 The Semester Grade Point Average (SGPA): From the grades obtained by a student in the courses of a semester, the SGPA shall be calculated using the following formula:

$$SGPA = \frac{\sum_{i=1}^{n} GP_i \text{ x } NC_i}{\sum_{i=1}^{n} NC_i}$$

Where GP_i = Grade points earned in the i^{th}course
NC_i = Number of credits for the i^{th}course
n = the number of courses in the semester

13.2.2 The Cumulative Grade Point Average (CGPA): From the SGPAs obtained by a student in the completed semesters, the CGPA shall be calculated using the following formula:

$$CGPA = \frac{\sum_{i=1}^{n} SGP_i \text{ x } NSC_i}{\sum_{i=1}^{n} NSC_i}$$

Where SGP_i = Semester Grade point of the i^{th} semester
NSC_i = Number of credits for the i^{th} semester
n = the number of semesters completed

13.2.3 The CGPA may be converted into a percentage by multiplying CGPA by 10.

13.3 Both the SGPA and CGPA will be rounded off to the second place of decimal and recorded as such. Whenever these CGPA are to be used for official purposes, only the rounded off values will be used.

13.4 There are academic and non-academic requirements for the programme where a student will be awarded the 'P' and 'NP' grades. All non-credit courses (such as Study Tour and Extra Academic Activities) belong to this category. No grade points are associated with these grades and these courses are not taken into account in the calculation of the SGPA or CGPA. However, the award of the degree is subject to obtaining a 'P' grade in all such courses.

14.0 Assessment of Performance

14.1 A student's performance is evaluated through a continuous system of evaluation comprising tests, quizzes, assignments, seminars, projects, research work, concurrent and block field work performance and end-semester examinations.

14.2 Theory Courses: Theory courses will have two components of evaluation – in-semester assessment of 40% weightage and an end-semester examination having 60% weightage.

14.2.1 The modalities of conduct of in-semester evaluation, its components and the weightages attached to its various components shall be published by the department concerned at the beginning of each semester.

14.3 Practicum/Field Work/Lab: These courses shall be evaluated on the basis of attendance, performance of tasks assigned and an end semester test/viva voce examination. The weightage assigned to these components of the evaluation is given in the following table:

Component	**Weightage**
Attendance	10
Performance of tasks assigned	30
End-semester test / viva voce examination	60

14.4 End-Semester examinations

14.4.1 End-semester examinations, generally of three hours' duration, shall be conducted by the University for the theory courses. However, the Director of the Institute shall make the arrangements necessary for holding the examinations.

14.4.2 In the end-semester examinations, a student shall be examined on the entire syllabus of the courses.

14.4.3 A student shall not obtain a pass grade for a course without appearing for the end- semester examination in that course.

14.5The evaluation of performance in Co-curricular Activities will be done by the authorities conducting them and they will communicate the grades to the Director who will forward them to the Controller of Examinations of the University.

14.6 The Director will forward the marks obtained in the in-semester evaluation to the Controller of Examinations within the prescribed time as may be notified.

14.7 All evaluated work in a subject except the end semester answer scripts will be returned to the students promptly. They should be collected back after the students have examined them, and preserved for a period of one semester.

14.8 Eligibility for appearing in the end-semester examinations: A student will be permitted to appear for the end-semester

examinations, provided that

14.8.1 A student has not been debarred from appearing in the end semester examinations as disciplinary action for serious breach of conduct.

14.8.2 He/she has satisfactory attendance during the semester according to the norms laid out in section 9 of these regulations.

14.8.3 He/she has paid the prescribed fees or any other dues of the university, institute and department within the date specified.

14.9 Registration for end-semester Examinations

14.9.1 The University shall, through a notification, invite applications from students to register for the end-semester examinations.

14.9.2 Students who have registered with the University and those who have applied for such registration may apply to appear for the end-semester examinations of the university, in response to the notification issued by the University, provided that they fulfil the eligibility norms as laid down in clause 14.8.

14.9.3 All eligible candidates shall be issued an admit card for the relevant examination and for the specified courses. A student who does not have a valid admit card may not be permitted to write the end-semester examinations.

14.9.4 A student who secures an 'F' or 'X' grade in any course in a semester may register for the end-semester examination for that course in a subsequent semester when that course is offered again, within the maximum period of time allotted for the completion of the programme. The in-semester assessment marks obtained by him/her in the last semester in which the said course was attended by him/her shall be retained.

14.9.5 Similarly, in case of an 'NP' grade in Extra Academic Programmes the student shall have to re-register for it in the appropriate semester of the next academic session.

14.9.6 When a student re-registers for the end semester examination of a course, in accordance with clause 14.9.4 above, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

14.10 Conduct of Examinations: The University shall conduct the end-semester examinations in accordance with the applicable regulations on such dates as are set down in the Academic Calendar or as notified.

14.11 Declaration of Results: The University shall declare the results of a semester and make available to the students their grade sheets within the time-frame prescribed by the relevant regulations of the university and specified in the academic calendar.

14.11.1 The University may withhold the results of a student for any or all of the following reasons

- he/she has not paid his/her dues
- there is a disciplinary action pending against him/her
- he/she has not completed the formalities for University Registration according to the requirement of section 6 of these Regulations.

14.12 Re-examining of answer scripts

14.12.1 If a student feels that the grade awarded to him/her in a course is not correct, he/she may apply to the University for the re-examining of his/her answer script.

14.12.2 Re-examining of scripts may be of two different categories – scrutiny and re-evaluation.

14.12.3 Scrutiny: The activities under this category shall ordinarily be confined to checking

- correctness of the total marks awarded and its conversion into appropriate letter grades
- whether any part/whole of a question has been left unevaluated inadvertently
- correctness of transcription of marks on the tabulation sheet and the grade sheet issued in respect of the course under scrutiny.

14.12.4 e-evaluation: Re-evaluation of the answer script by independent experts in the concerned subject(s).

14.12.5 Application for re-examining of answer scripts

- A student may apply for scrutiny or re-evaluation for one or more courses of the just- concluded end-semester examinations within seven calendar days from the date of publication of its results in the application form prescribed for this purpose.
- He/she shall pay the prescribed fee to the University as notified.
- A student applying for scrutiny/re-evaluation shall expressly state on the application form whether the application made is for Scrutiny or for Re- evaluation. In each case, the student may also request to see his/her answer script.
- All applications for scrutiny/re-evaluation must be routed through the Director of the Institute.

14.12.6 If in the process of re-examining, the grade obtained in a course changes, the better of the two grades shall be assigned to the course. If there is a change, the new grade shall be recorded and a new grade sheet shall be issued to the student.

14.12.7 Without prejudice to any of the clauses of section 14.12, a student who has been found to have used unfair means during an examination shall not be eligible to apply for scrutiny or re-evaluation of answer scripts.

14.13 Repeat Examination: The University shall conduct repeat examination for those with F grade at a different time slot, as set down in the Academic Calendar or as notified. Such students should register for these examinations.

14.14 Improvement Examination

14.14.1 After the completion of the entire programme of study, a student may be allowed the provision of improvement examinations. These are to be availed of only once each in the Autumn and Spring semesters that immediately follow the completion of the programme, and within the maximum number of years permissible for the programme.

14.14.2 A student may choose no more than six courses (three in the Autumn semester and three in the Spring semester) for improvement examinations.

14.14.3 After the improvement examination, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

14.14.4 If the student improves his/her grades through the improvement examination, new grade sheets and comprehensive transcripts shall be issued to the student.

14.15 Special Examination

14.15.1 The University shall conduct Special Examinations to benefit the following categories of students:

14.15.1.1 Students who, on the completion of the final semester, have some 'F' graded courses in the two final semesters, but no 'F' or 'X' graded courses in any of the previous semesters

14.15.1.2 Students who have only one 'F' graded course in a semester other than the two final semesters and do not have 'F' or 'X' graded courses in the two final semesters.

14.15.2 The Special Examinations shall ordinarily be conducted each year within a month of the declaration of the results of the Spring Semester.

14.15.3 Students who fail to secure 50% of the credits offered in the final semester shall not be eligible to appear for the special examinations. Such students will be governed by the provisions of clause 15.5 of these regulations. However, this restriction shall not apply in the case of students who are unable to appear in the end semester examinations due to exceptional situations like their own serious illness and hospitalisation or death of members of inner family circle (restricted to only father, mother, siblings).

14.15.4 Students who have 'X' graded courses only in the last two semesters may be offered the opportunity for participating in a Tutorial Programme which may be conducted during the semester break immediately following the end- semester examinations of the final semester and students who earn 85% attendance for the programme shall be permitted to appear for the Special Examinations. Separate fees shall be charged for the Tutorial Programme.

14.15.5 Students who do not obtain pass grades in any course at the special examinations shall have to apply in the prescribed format and appear for the end-semester examination of these courses when they are scheduled by the University during subsequent relevant end-semester examinations.

15.0 Enrolment (for semesters other than the first)

15.1 Every student is required to enrol for the programme through the designated officer at the commencement of each semester on the days fixed for such enrolment and notified in the Academic Calendar.

15.2 Students who do not enrol on the days announced for the purpose may be permitted late enrolment up to the notified day in the Academic Calendar on payment of a late fee.

15.3 Only those students will be permitted to enrol who have

15.3.1 cleared all University, Institute, Department, Hostel and Library dues and fines (if any) of the previous semester,

15.3.2 paid all required University, Institute, Department and Hostel fees for the current semester, and

15.3.3 not been debarred from enrolling on any specific ground.

15.4 No student may enrol for a semester if he/she has not appeared, for whatever reason, in the end semester examinations of the previous semester.

15.5 A student who fails to obtain 50% of the credits offered in the third and subsequent semesters shall not be permitted to enrol for the next semester and shall have to re-enrol for and attend all the courses of the said semester in the following academic year. Students who due to X grade (lack of due attendance) have been debarred from exams in any semester (including first and second) will have to re-enrol for the same.

16.0 Eligibility for the Award of Degree

16.1 A student shall be declared to be eligible for the award of the degree if he/she has

16.1.1 completed all the credit requirements for the degree with grade 'C' or higher grade in each of the graded courses and grade 'P' in all the non-graded courses.

16.1.2 satisfactorily completed all the non-credit requirements for the degree (if any);

16.1.3 obtained a CGPA of 5.00 or more at the end of the semester in which he/she completes all the requirements for the

degree;

16.1.4 owes no dues to the University, Institute, Department, Hostels; and

16.1.5 has no disciplinary action pending against him/her.

16.2 The award of the degree must be recommended by the Academic Council and approved by the Board of Management of the University.

17.0 Termination from the Programme

17.1 If more than the number of years permitted for the completion of a programme have elapsed since the student was admitted, and the student has not become eligible for the award of Degree, the student shall be removed from the programme.

17.2 A student may also be required to leave the Programme on disciplinary grounds on the recommendations of the Students' Disciplinary Committee of the concerned School.

SCHEME OF IN-SEMESTER EVALUATION

POST GRADUATE DEGREE PROGRAMMES

M.TECH, MCA, MSW, MSC, MA and MCOM

THEORY COURSES

The different components of the scheme of in-semester for the theory courses are given in the table below:

Component	**Weightage**
Class Test (Two class tests of equal weightage)	20
Assignments, Group Presentations/Seminar	10
Non-formal evaluation	5
Attendance	5
Total	**40**

Non-formal Evaluation

Non-formal evaluation may be done using a combination of quizzes, unannounced tests, open book tests, library work reports, class room interaction and participation, etc. The scheme of non- formal evaluation shall be announced by every teacher in the beginning of the semester.

Attendance

Marks for attendance will be given according to the following scheme:

Attendance Percent (x)	**Marks Allotted**
75 <= x < 80	2
80 <= x < 90	3
90 <= x < 95	4
95 <= x 100	5

NB: There shall be no re-test for in-semester Assessment under any circumstance. The original marks of all the in-semester Assessment components shall be retained for all further repeat examinations.

MCA Minor Project

The guidelines for the conduct and evaluation of the MCA Minor Project shall be laid down by the Department. The components of evaluation and allotment of marks will be as follows:

In Semester Evaluation	**Marks**	**End Semester Evaluation (Weightage 40)**	**Marks**
Synopsis	10	Project Implementation	16
Seminar presentation of synopsis (Analysis and Design)	15	Seminar Presentation	8
Progress Seminar (Implementation)	15	Viva Voce Examination	16
Project Documentation	10		
Attendance	10		
Total	60		40

In-Semester Evaluation of MCA Major Project

The in-semester evaluation of the MCA Major Project shall have 60% weightage. The Internal Evaluation of the Major project will be done through two seminar sessions:

Synopsis	:	20
Seminar Presentation of Synopsis (Analysis and Design)	:	30
Progress Seminar (Implementation)	:	30
Project Documentation	:	20

External Evaluation of all Major projects will follow the guidelines laid down in the Regulations.

MSW, MSc Psychology Field Work

The components of evaluation and their weightages for the concurrent/continuous fieldwork are as follows:

Component	Weightage
Field Work Diary	10
Agency Evaluation	15
Faculty Evaluation	20
Attendance	5
Viva Voce Examination	50
Total	100

Practicum

Field Report	:	15
Presentation	:	15
Administration of tests	:	10
Faculty Evaluation	:	10
Viva Voce Examination	:	50

MSW, MSc Psychology Research Project

Phase I

Literature Survey Presentation	:	40
Synopsis Presentation	:	60

Phase II

Examination of Thesis	:	50
Presentation and Viva Voce Exam	:	50

MTECH, MSC (Physics, Chemistry, Mathematics, Biochemistry, Biotechnology, Microbiology, Botany, Zoology)

THEORY COURSES

For theory courses, in-semester assessment carries 40% weightage. Different components along with the weightage of each are given in the table below:

Component	Weightage	Remarks
Class Test (Two Class tests of one and a half hour duration)	20	Average of the two marks shall be considered
Assignments	15	Written Assignments/Seminar on course Topics/ Technical Paper Review
Non-formal evaluation	5	Based on response and interaction in class, quizzes, open book tests, etc.
Total	40	

There shall be no re-test for In-semester assessment under any circumstance. The original marks of all the In-semester assessment components shall be retained for all further repeat examinations.

In-Semester Evaluation of Project (Phase I) / Research Project (Phase I) / Dissertation (Phase I)

The in-semester evaluation of Project Phase I / Research Project (Phase I) / Dissertation (Phase I) shall have 60% weightage. It shall be evaluated in the following seminar sessions having equal weightage:

Seminar 1: Presentation of the synopsis

Synopsis	:	30%
Seminar presentation of the synopsis	:	50%
Viva voce examination	:	20%

Seminar 2: Progress Seminar

Progress report	:	30%
Progress seminar	:	50%

Viva voce Examination	:	20%

In-Semester Evaluation of Project (Phase II) / Research Project (Phase II) / Dissertation (Phase II)

The in-semester evaluation of Project Phase II / Research Project (Phase II) / Dissertation (Phase II) shall have 60% weightage. The in-semester evaluation will be done through two seminar sessions having equal weightage. Each seminar will be evaluated using the following components.

Progress Report	:	30
Progress Seminar	:	50
Viva Voce Examination	:	20

External Evaluation of the project / Research Project / Dissertation shall follow the guidelines laid down in the Regulations.

RULES, PROCEDURES AND BEHAVIOURAL GUIDELINES

1. Dress Code and Identity Card

1.1 The dress code of the University consists of shirt / top (of the prescribed colour and material), trousers (of the prescribed colour and material), shoes (black) and socks (dark grey), a belt (black/dark brown, if required) and a tie (blue, with diagonal stripes). Students are required to come to the University following this dress code. The tie will be required to be worn only on formal occasions. An apron (of the prescribed colour) is to be worn in the Chemistry Lab and during Workshop Practice. During winter, students may wear only a blazer and/or a sweater (full sleeve or sleeveless) of the prescribed colour and material.

1.2 The Student Identity Card is to be brought to the University every day and is to be produced whenever asked for. Entry to the University campus shall be only on production of the Identity Card. The Identity Card is also the Library Card.

1.3 All students should wear the ID card around the neck from entry in the morning to exit in the evening.

2. Morning Assembly

2.1 The morning assembly is a daily programme in the university on all class days during which all members, i.e., students, faculty, staff and management meet together. The assembly starts at the prescribed time. During the assembly, important announcements are made and a thought or insight is shared. The assembly is concluded with an invocation to God to bless the activities of the day. Note that any announcement made at the morning assembly is considered as being equivalent to notifying the same in the notice boards. All students should reach the assembly venue before prescribed time. Immediately after assembly all should proceed to the classroom to start class. Any change in procedures will be notified by the concerned School at the beginning of the Semester.

2.2 One of the following prayers may be used to conclude the Morning Assembly:

The Our Father
Our Father, who art in heaven,
Hallowed be thy name, Thy kingdom come, Thy will be done on earth as it is in heaven.
Give us this day, our daily bread
And forgive us our trespasses
As we forgive those who trespass against us. And lead us not into temptation,
But deliver us from all evil, Amen.

Or

Prayer for Peace
Lord, make me an instrument of your peace,
where there is hatred, let me sow love;
where there is injury, pardon;
where there is doubt, faith;
where there is despair, hope;
where there is darkness, light;
where there is sadness, joy;
O Divine Master, grant that I may not so much seek to be consoled as to console;
to be understood as to understand;
to be loved as to love.
For it is in giving that we receive;
it is in pardoning that we are pardoned;
and it is in dying that we are born to eternal life. Amen

3. Punctuality in Attending Classes

3.1 All are expected to be at their respective assembly venues five minutes before assembly time.

3.2 Normally no student shall leave the University before all the classes are over. In case of an emergency, a student may leave with proper written permission from the HOD of the concerned department.

4. Make-up Classes, Leave of Absence and Earned Attendance

4.1 If any student misses any laboratory class due to illness or other grievous problems, he/she is required to meet the concerned teacher for completing the experiments as soon as possible. Such make-up attendance will be taken into consideration at the end of the semester if attendance is less than 75%. At most two make-up attendances may thus be earned by any student.

4.2 Any student who is required to be engaged in a University activity or a pre-planned training and placement activity during class hours, may apply for the grant of an 'earned attendance' from the concerned HODs in the prescribed form available

at the Reception. Such applications must be forwarded by the Activity In-Charge. For club related activities, Faculty Advisor of the concerned club will be the Activity In- Charge. In all other cases, Faculty In-Charge or Assistant Faculty In-Charge of Student Affairs will be the Activity In-Charge. Filled up forms shall be submitted preferably before or in case of emergency, immediately after the activity for which earned attendance is to granted.

4.3 Any student going to participate in any activity or competition outside the University must apply to the Faculty In-Charge of student Affairs using the prescribed form which must be forwarded by the Assistant Faculty In-Charge of Student Affairs in consultation with respective Club Advisers. On return, these students must report back to the Assistant Faculty In-Charge of Student Affairs for recording the outcome.

4.4 Any student who is not able to attend classes due to medical or other grievous reasons are required to apply for leave in the prescribed form along with valid medical certificates and other requisite documents, to the Faculty In-charge, students' affairs within seven days of joining back. Such applications must be signed by a parent of the student and forwarded by the mentor of the concerned student and the HOD of the concerned department. Only these students will be considered for condonement of deficiency in attendance.

5. Discipline

5.1 Personal, academic and professional integrity, honesty and discipline, a sense of responsibility and a high degree of maturity is expected of all students inside and outside the campus. Integrity calls for being honest in examinations and assignments, avoiding plagiarism and misrepresentation of facts.

5.2 Indulging in acts of violence, riotous or disorderly behaviour directed towards fellow students, faculty members or other employees of the institution/hostel in the campus or outside is considered to be a serious breach of discipline and will attract penalty.

5.3 Respect for Common Facilities: Care and respect for common facilities and utilities are an essential component of social responsibility. Any willful damage to University property must be made good by the persons concerned. Further, maintaining cleanliness of the classrooms and the entire campus is everyone's responsibility.

5.4 Substance Abuse: Chewing of tobacco, betel nut and the likes, smoking and the use of other addictive substances and alcoholic drinks are strictly prohibited. These should not be brought into or used within the campus of the University. Violation of this norm will lead to stern action.

5.5 Use of Cell Phones: Cell phones may be used in the University lawns, canteens andother open areas. However, the use of cell phones in classrooms and labs are strictly prohibited except when used for teaching/learning purposes with the explicit permission of the teacher concerned. The cell phone of anyone found violating this rule shall be confiscated and his/ her SIM card shall be taken away and retained in the University office for 7 days. If a person violates the norm for a second time, his/her mobile will be confiscated and retained in the University office till the end of the semester.

5.6 Use of Internet: The entire campus is wi-fi enabled and the students may use the Internet freely for educational purposes. Students may also use the Computing Centre for browsing the Net. However, the use of Internet to access unauthorized and objectionable websites is strictly prohibited.

5.7 All cases of indiscipline will be brought before the Students' Disciplinary Committee and the decisions made by the Committee for dealing with such cases shall be final.

6. Class Tests and Examinations

6.1 The conduct of examinations will be governed by the norms of the University.

6.2 The Student Identity Card shall be the Admit Card for the class tests

6.3 During class tests, all students are expected to enter the venue of the class test 15 minutes before the scheduled time of commencement. However, no one will be permitted into the examination hall after 15 minutes of the commencement of the class test and No one will be allowed to leave the examination hall until an hour has elapsed from the commencement of the class test.

6.4 No one is to leave the hall during examination for any purpose, except in case of an emergency.

6.5 Malpractices during class tests and examinations will not be tolerated and will attract stern action.

7. Ragging

Ragging and eve-teasing are activities which violate the dignity of a person and they will be met with zero tolerance. Anti-ragging norms have been given to each student at the time of admission and all students and parents have signed the anti-ragging affidavit. Any case of ragging and eve-teasing must be reported to the anti-ragging squad. All cases of violation of anti-ragging norms will be taken up by the anti-ragging Committee and punished according to the norms.

8. Grievance Redressal

The University has constituted a Grievance Redressal Cell to redress any genuine grievance students may have. Any student having a genuine grievance may make a representation to the Grievance Redressal Cell through his/her mentor. The representation should be accompanied by all relevant documents in support of the genuineness of the grievance.

9. School Association

9.1 The School Association is an association of the representatives of the various stake holders of the School – students, staff, faculty and management. It is the responsibility of the School Association to take charge of organizing most of the co-curricular activities such as the annual festivals, quizzes, debates, competitions and social events.

9.2 A male and a female student are elected by the students of each class as "class representatives" to represent them in the School Association. Class representatives are expected to be outstanding students who are academically competent and having qualities of leadership.

10. Participation in University Activities

10.1 In order to provide opportunities for the holistic development of the human person, a large number of co-curricular and extra-curricular activities are designed and implemented under the banner of the University Association and student clubs. Some of the most important activities are D'VERVE & BOSCOSIADE (intra- University sports and cultural festival during University Week), PRAJYUKTTAM (the inter-University technical festival). All students are expected to take part actively in such activities to showcase their talents, to develop leadership qualities and to gain the experience of working in groups.

10.2 **Training and Placement Activities:** The training and Placement Cell of DBCET has been incorporated with the objective of minimizing the gap between industry and academia and giving the students training and exposure so that they can capitalize on every opportunity for placement. It is the prime responsibility of the cell to look after all matters concerning 'Training to enhance employability' and 'guiding students for placement'. In the first two semesters, students are trained for communication skills development under the department of Humanities and Social Sciences, and personal development programmes under the department of campus ministry. From the third semester onwards, in every semester, students are given systematic training in aptitude tests, communication skills, group discussion, etc. They are also made to undergo mock HR and Technical Interviews. These activities of the training and placement cell find a place in the curriculum as Extra Academic Programmes (EAP) and all students are required to get a P grade for these activities by taking an active part in these activities regularly.

Other departments of the University offer customised services in training and placement of their students.

11. Free Time

Some hours without class may be available for some students during the day. Students are expected to use such 'free time' for visiting the library, meeting teachers and mentors, self- study, carrying out lab or project related activities, etc.

12. Faculty Performance Feedback

In order to improve the teaching and learning process in the University, students will be required to give feedback about the performance of their teachers from time-to-time. All students are expected to participate in the online feedback sessions concerning their teachers with sincerity and responsibility.

13. Mentoring

All students are assigned mentors from among the faculty members for their guidance. Directors of Schools in collaboration with the Heads of Departments will take care of assigning mentors. Mentors shall help the students to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them. Although students should meet their mentors on a regular basis to get timely help, specific days have been set aside in the calendar for meeting mentors to ensure proper documentation of achievements, activities, shortcomings and problems faced by the students. Every student must meet the mentor during these days.

14. Interaction Meet with Parents

The University organises interaction meetings with parents once a year in which the parents are invited to interact with teachers and management to appraise themselves about the performance of their ward and also to offer their suggestions for the betterment of the institution. It is the responsibility of the students too to invite their parents to come and participate in the event and make the event meaningful.

MASTER OF TECHNOLOGY (M TECH) PROGRAMMES

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME: MASTER OF TECHNOLOGY (MTECH) COMPUTER SCIENCE AND ENGINEERING

SEMESTER I						
Type	**Category**	**Course Code**	**Course Name**	**L-T-P**	**Credits**	**Page**
	Specialization: Data Science					
Theory	Core 1	CSMF0086	Mathematical foundations of Computer Science	3-0-0	3	1026
	Core 2	CSDT0087	Advanced Data Structures	3-0-0	3	1026
	Core 3	ECRM0042	Research Methodology and IPR	2-0-0	2	
	Prog. Specific Elective I	CSSC0088	Data Science	3-0-0	3	1027
		CSDI0089	Distributed Systems	3-0-0	3	1028
		CSDP0090	Data Preparation and Analysis	3-0-0	3	1029
	Prog. Specific Elective II	CSRS0091	Recommender System	3-0-0	3	1030
		CSML0092	Machine Learning	3-0-0	3	1031
		CSTN0093	Data Storage Technologies and Networks	3-0-0	3	1032
Lab	Lab1	CSDT6076	Advanced Data Structures Lab	0-0-4	2	1072
	Lab2	CSML6077	Machine Learning Lab	0-0-4	2	1073
	Specialization: Internet of Things					
Theory	Core 1	CSMF0086	Mathematical foundations of Computer Science	3-0-0	3	1026
	Core 2	CSDT0087	Advanced Data Structures	3-0-0	3	1026
	Core 3	ECRM0042	Research Methodology and IPR	2-0-0	2	
	Prog. Specific Elective I	CSSC0088	Data Science	3-0-0	3	1027
		CSWA0094	Wireless Access Technologies	3-0-0	3	1032
		CSMS0095	Mobile Applications and Services	3-0-0	3	1034
	Prog. Specific Elective II	CSML0092	Machine Learning	3-0-0	3	1031
		CSSI0096	Smart Sensors and Internet of Things	3-0-0	3	1035
		CSLF0097	Logic and Functional programming	3-0-0	3	1035
Lab	Lab1	CSDT6076	Advanced Data Structures Lab	0-0-4	2	1072
	Lab 2	CSML6077	Machine Learning Lab	0-0-4	2	1073
	Specialization: Information Security					
Theory	Core 1	CSMF0086	Mathematical foundations of Computer Science	3-0-0	3	1026
	Core 2	CSDT0087	Advanced Data Structures	3-0-0	3	1026
	Core 3	ECRM0042	Research Methodology and IPR	2-0-0	2	
	Prog. Specific Elective I	CSDF0098	Digital Forensics	3-0-0	3	1036
		CSEH0099	Ethical Hacking	3-0-0	3	1037
		CSID0100	Intrusion Detection	3-0-0	3	1038
	Prog. Specific Elective II	CSMR0101	Malware Analysis & Reverse Engineering	3-0-0	3	1039
		CSSC0102	Secure Software Design and Enterprise Computing	3-0-0	3	1040
		CSML0092	Machine Learning	3-0-0	3	1031
Lab	Lab1	CSDT6076	Advanced Data Structures Lab	0-0-4	2	1072
	Lab2	CSML6077	Machine Learning Lab	0-0-4	2	1073
Audit	Audit 1	EGRW0015	English for Research Paper Writing	2-0-0	0	1077
Total Credits					18	
SEMESTER II						
	Specialization: Data Science					
Theory	Core 3	CSAA0103	Advance Algorithms	3-0-0	3	1041
	Core 4	CSSP0104	Soft Computing	3-0-0	3	1042
	Prog. Specific Elective III	CSDV0105	Data Visualization	3-0-0	3	1043
		CSBD0106	Big Data Analytics	3-0-0	3	1043
		CSDD0107	Data Warehouse and Data Mining	3-0-0	3	1044
	Prog. Specific Elective IV	CSDS0108	Data Security and Access Control	3-0-0	3	1045
		CSWD0109	Web Analytics and Development	3-0-0	3	1046

		CSKD0110	Knowledge Discovery	3-0-0	3	1047
		CSNL0111	Natural Language Processing	3-0-0	3	1048
Lab	Lab3	CSAA6078	Advanced Algorithm Lab	0-0-2	2	1074
	Lab4	CSDV6079	Data Visualisation Lab	0-0-2	2	1074
	Specialization: Internet of Things					
Theory	Core 3	CSAA0103	Advance Algorithms	3-0-0	3	1041
	Core 4	CSSP0104	Soft Computing	3-0-0	3	1042
	Prog. Specific Elective III	CSNI0112	Sensor Networks and Internet of Things	3-0-0	3	1049
		CSDV0105	Data Visualization			1043
		CSAC0113	IoT Application and Communication Protocols			1050
	Prog. Specific Elective IV	CSBD0106	Big Data Analytics	3-0-0	3	1043
		CSNY0114	Network Security			1051
		CSAM0115	Advanced Machine Learning			1051
Lab	Lab3	CSAA6078	Advanced Algorithm Lab	0-0-2	2	1074
	Lab4	CSDV6079	Data Visualisation Lab	0-0-2	2	1074
	Specialization: Information Security					
Theory	Core 3	CSAA0103	Advance Algorithms	3-0-0	3	1041
	Core 4	CSSP0104	Soft Computing	3-0-0	3	1042
	Prog. Specific Elective III	CSEC0116	Data Encryption & Compression	3-0-0	3	1052
		CSSW0117	Steganography & Digital Watermarking			1053
		CSIT0118	Information Theory & Coding			1054
	Prog. Specific Elective IV	CSRA0119	Security Assessment and Risk Analysis	3-0-0	3	1055
		CSCD0120	Secure Coding			1056
		CSBI0121	Biometrics			1057
Lab	Lab3	CSAA6078	Advanced Algorithm Lab	0-0-2	2	1074
	Lab4	CSEN6080	Data Encryption & Compression Lab	0-0-2	2	1075
Project		CSMI6081	Mini Project with Seminar	0-0-2	2	
Audit	Audit 2 (MOOCs)	EDCI0100	Constitution of India	0-0-0	0	
Total Credits					18	
SEMESTER III						
	Specialization: Data Science					
Theory	Prog. Specific Elective V	CSCG0134	GPU Computing	3-0-0	3	1064
		CSCL0135	Cloud Computing			1065
		CSDD0136	Distributed Databases			1067
	Specialization: Internet of Things					
	Prog. Specific Elective V	CSCL0135	Cloud Computing	3-0-0	3	1065
		CSIS0137	IOT and Smart Cities			1068
		CSEM0138	Emulation and Simulation Methodologies			1069
	Specialization: Information Security					
	Prog. Specific Elective V	CSDM0139	Data Warehousing & Mining	3-0-0	3	1069
		CSWI0140	Web Search & Information Retrieval			1070
		CSDY0141	Database Security and Access Control			1071
	Open Elective	CSBA0142	Business Analytics	3-0-0	3	1071
Project	Dissertation	CSDI6092	Dissertation Phase – I	0-0-20	10	1076
Total Credits				**6-0-20**	16	
SEMESTER IV						
	Specialization: Data Science					
Project	Dissertation	CSDI6093	Dissertation Phase – II	0-0-32	16	1076
	Specialization: Internet of Things					
	Dissertation	CSDI6093	Dissertation Phase – II	0-0-32	16	1076
	Specialization: Information Securities					
	Dissertation	CSDI6093	Dissertation Phase – II	0-0-32	16	1076
Total Credits				0-0-32	16	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

DEPARTMENT OF CIVIL ENGINEERING

PROGRAMME: MASTER OF TECHNOLOGY (MTECH) - CIVIL ENGINEERING

Type	Course Category	Course Code	Course name	L	T	P	Credits	Page
Semester I (First year)								
Theory	Core I	CVSA0108	Advanced structural analysis	3	1	0	4	1080
	Core II	CVPW0109	Physico- chemical Processes of water and waste water	3	1	0	4	1081
	PE1	CVHS0112	1.Hydraulic Structures	3	0	0	3	1085
		CVAP0113	2.Air Pollution and Control					1085
		CVTV0114	3. Theory of Vibration					1087
		CVGT0115	4.Geotextile in Civil Engineering					1088
	PE2	CVIT0116	1.Ground Improvement Techniques	3	0	0	3	1089
		CVRD0117	2. Earthquake resistant design of structures					1090
		CVID0118	3. Irrigation and drainage					1091
		CVSD0119	4.Solid and hazardous Waste Management					1092
Lab	Core Lab 1	CVSD6050	Structural Design Lab	0	0	2	1	1109
	Core Lab 2	CVNA6051	Numerical Analysis Lab	0	0	2	1	1110
Theory	MLC 1	ECRM0042	Research Methodology and IPR	2	0	0	2	
	Audit 1	EDCI0100	Constitution of India	2	0	0	0	
TOTAL				**16**	**2**	**4**	**18**	
Semester II (First year)								
Theory	Core III	CVAF0110	Advanced foundation Engineering	3	1	0	4	1082
	Core IV	CVAH0111	Advanced Hydrology	3	1	0	4	1084
	PE3	CVGE0120	1. Geotechnical Earthquake Engineering	3	0	0	3	1094
		CVDS0121	2. Design of Substructures					1094
		CVAS0122	3. Advanced steel Design					1095
		CVFH0123	4. Fluvial Hydraulics					1097
	PE4	CVAF0124	1. Advanced Fluid Mechanics	3	0	0	3	1098
		CVPA0125	2. Pavement Analysis and Design					1099
		CVCS0126	3. Design of Advanced Concrete Structures					1100
		CVEG0127	4. Environmental Geotechnology					1100
Lab	Core Lab 3	CVSM6052	Soil Mechanics Lab	0	0	2	1	1110
	Core Lab 4	CVCF6053	Computational Fluid Lab	0	0	2	1	1111
	Project	CVMI6054	Mini Project	0	0	4	2	
Theory	Audit 2	EGRW0015	English for Research Paper Writing	2	0	0	0	1077
TOTAL				**14**	**2**	**8**	**18**	
Semester III (Second year)								
Theory	PE5	CVPS0128	1. Design of Prestressed Concrete Structures	3	0	0	3	1101
		CVWT0129	2. Industrial waste treatment technology					1103
		CVCM0130	3. Cost management of Engineering Projects					1104
		CVER0131	4.Earth retaining structures					1105
	PE6	CVCC0132	1. Cement Composite Materials	3	0	0	3	1105
		CVOT0133	2. Optimization Techniques in Civil Engineering					1106
		CVEI0134	3.Environmental Impact Analysis and Assessment					1107
		CVGW0135	4. Ground water Engineering					1108
	Dissertation	CVDI6055	Dissertation Phase I	0	0	20	10	
			TOTAL	**6**	**0**	**20**	**16**	
	Dissertation	CVDI6056	Dissertation Phase II	0	0	32	16	
			TOTAL	**0**	**0**	**32**	**16**	

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAMME: MASTER OF TECHNOLOGY (MTECH) - ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER I						
Type	**Course Type/Category**	**Course Code**	**Course Name**	L-T-P	**Credits**	**Page**
	Specialization: Power Systems					
Theory	Core 1	EESA0048	Power System Analysis	3-0-0	3	1113
	Core 2	EESD0049	Power System Dynamics-I	3-0-0	3	1114
	Core	ECRM0042	Research Methodology and IPR	2-0-0	2	
	Programme Specific Elective I	EEHP0050	High Power Converters	3-0-0	3	1115
		EEWS0051	Wind and Solar Systems			1115
	Programme Specific Elective II	EEPD0052	Electrical Power Distribution System	3-0-0	3	1116
		EEMM0053	Mathematical Methods for Power Engineering			1117
Lab	Lab1	EESS6033	Power System Steady State Analysis Lab	0-0-4	2	1134
	Lab2	EERE6034	Renewable Energy Lab	0-0-4	2	1135
		Specialization: Control Systems				
Theory	Core 1	EEMC0054	Mathematical Methods in Control	3-0-0	3	1118
	Core 2	EENS0055	Non-Linear Systems	3-0-0	3	1119
	Core	ECRM0042	Research Methodology and IPR	2-0-0	2	
	Programme Specific Elective I		Robotics and Automation	3-0-0	3	
		EECL0056	Digital Control			1119
		EENC0057	Non-Linear Control			1120
	Programme Specific Elective II		Systems Biology	3-0-0	3	
		EESC0058	SCADA system and Applications			1121
		EEDA0059	Design Aspects in Control			1122
Lab	Lab1	EECT6035	Control Lab 1	0-0-4	2	1135
	Lab 2	EECL6036	Control Lab 2	0-0-4	2	1136
Audit	Audit 1	EGRW0015	English for Research Paper Writing	2-0-0	0	1077
Total Credits				**16-0-8**	18	
SEMESTER II						
	Specialization: Power Systems					
Theory	Core 3	EEDP0060	Digital Protection of Power System	3-0-0	3	1122
	Core 4	EEPD0061	Power System Dynamics-II	3-0-0	3	1123
	Programme Specific Elective III	EERP0062	Restructured Power Systems	3-0-0	3	1124
		EEAS0063	Advanced Digital Signal Processing			1125
	Programme Specific Elective IV	EEAS0064	Power System Transients	3-0-0	3	1126
		EEFC0065	FACTS and Custom Power Devices			1127
Lab	Lab3	EEPL6037	Power System Protection Lab	0-0-4	2	1136
	Lab4	EEPA6038	Power Electronics Applications to Power Systems Lab	0-0-4	2	1136
	Specialization: Control Systems					
Theory	Core 3	EEOC0066	Optimal Control Theory	3-0-0	3	1127
	Core 4	EESF0067	Stochastic Filtering and Identification	3-0-0	3	1128
	Programme Specific Elective III	EECS0068	Advance Control System	3-0-0	3	1129
		EEAL0069	Adaptive Learning and Control	3-0-0	3	1130

	Programme Specific Elective IV	EEMR0070	Model Reduction in Control	3-0-0	3	1130
		EERC0071	Robust Control	3-0-0	3	1131
			Networked and Multi agent Control Systems			
			Advanced DSP			1135
Lab	Lab3	EEAL6039	Advanced Control Lab 1	0-0-4	2	
	Lab4	EEAC6040	Advanced Control Lab 2	0-0-4	2	323
Project		EEMP6041	Mini Project	0-0-4	2	1137
Audit	Audit 2 (MOOCs)	EDCI0100	Constitution of India	0-0-4	2	
Total Credits				**14-0-12**	**18**	
SEMESTER III						
	Specialization: Power Systems					
Theory	Prog. Specific Elective V	EESC0058	SCADA System and Applications	3-0-0	3	1121
		EEMC0087	Advanced Micro-Controller Based Systems	3-0-0	3	1132
		EEPQ0088	Power Quality			1132
	Specialization: Control Systems					
	Prog. Specific Elective V	EEMD0089	Modeling and Control of Distributed parameter system	3-0-0	3	
		EESC0090	Stochastic Control	3-0-0	3	
			Computational Methods	3-0-0	3	
	Open Elective		1. Business Analytics	3-0-0	3	
			2. Industrial Safety	3-0-0	3	
			3. Operations Research	3-0-0	3	
			4. Cost Management of Engineering Projects	3-0-0	3	
			5. Composite Materials	3-0-0	3	
		EEWE0092	6. Waste to Energy	3-0-0	3	1133
Project	Dissertation	EEDI6050	Dissertation Phase – I	0-0-20	10	1138
Total Credits				**6-0-20**	**16**	
SEMESTER IV						
Project	**Specialization: Power Systems**					
	Dissertation	EEDI6051	Dissertation Phase – II	0-0-32	16	1138
	Specialization: Control Systems					
	Dissertation	EEDI6051	Dissertation Phase – II	0-0-32	16	1138

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAMME: MASTER OF TECHNOLOGY (MTECH) –ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER I						
Type	**Course Type/Category**	**Course Code**	**Course Name**	L-T-P	**Credits**	**Page**
	Specialization: Power Systems					
Theory	Core 1	ECAP0053	Advanced Digital Signal Processing	3-0-0	3	1146
	Core 2	ECDV0054	Digital Image and Video Processing	3-0-0	3	1147
	Core	ECRM0042	Research Methodology and IPR	2-0-0	2	1146
	Prog. Specific Elective I	ECAU0055	Audio Processing	3-0-0	3	1149
		ECCV0056	Computer Vision			1149
		ECAA0057	Advanced Computer Architecture			1151
	Prog. Specific Elective II	ECSI0058	Statistical Information Processing	3-0-0	3	1152
		ECVD0059	Voice and Data Networks			1153
		ECVC0060	Audio Video Coding & Compression			1154
Lab	Lab1	ECAP6041	Advanced Digital Signal Processing Lab	0-0-4	2	1181
	Lab2	ECDV6042	Digital Image and Video Processing Lab	0-0-4	2	1181
	Specialization: Communications					
Theory	Core 1	ECAP0053	Advanced Digital Signal Processing	3-0-0	3	1146
	Core 2	ECWM0061	Wireless and Mobile Communication	3-0-0	3	1155
	Core	ECRM0042	Research Methodology and IPR	2-0-0	2	1146
	Prog. Specific Elective I	ECSC0062	Satellite Communication	3-0-0	3	1156
		ECWN0063	Wireless Sensor Networks			1157
		ECON0064	Optical Networks			1158
	Prog. Specific Elective II	ECCR0065	Cognitive Radio	3-0-0	3	1159
		ECSI0058	Statistical Information Processing			1152
		ECRC0066	RF and Microwave Circuit Design			1160
Lab	Lab1	ECAP6041	Advanced Digital Signal Processing Lab	0-0-4	2	1181
	Lab 2	ECWM6043	Wireless and Mobile Communication Lab			1182
	Specialization: Embedded System					
Theory	Core 1	ECAP0053	Advanced Digital Signal Processing	3-0-0	3	1146
	Core 2	ECMA0067	Microcontroller and Applications	3-0-0	3	1161
	Core	ECRM0042	Research Methodology and IPR	2-0-0	2	1146
	Prog. Specific Elective I	ECPP0068	Parallel Processing	3-0-0	3	1162
		ECAA0057	Advanced Computer Architecture			1151
	Prog. Specific Elective II	ECWM0061	Wireless and Mobile Communication	3-0-0	3	1155
		ECDV0054	Digital Image and Video Processing			1147
Lab	Lab1	ECAP6041	Advanced Digital Signal Processing Lab	0-0-4	2	1181
	Lab2	ECMA6044	Microcontroller and Applications Lab	0-0-4	2	1182
Audit	Audit 1	EGRW0015	English for Research Paper Writing	2-0-0	2	1077
Total Credits				**16-0-8**	18	
SEMESTER II						
	Specialization: Signal Processing					
Theory	Core 3	ECPM0069	Pattern Recognition and Machine Learning	3-0-0	3	1182
	Core 4	ECDE0070	Detection and Estimation Theory	3-0-0	3	1164
	Prog. Specific Elective III	ECIA0071	IOT and Applications	3-0-0	3	1164
		ECDD0072	Digital Design and Verification			1165
	Prog. Specific Elective IV	ECBS0073	Biomedical Signal Processing	3-0-0	3	1166
		ECDS0074	DSP Architecture			1167
Lab	Lab3	ECPM6045	Pattern Recognition and Machine Learning Lab	0-0-4	2	1182
	Lab4	ECDE6046	Detection and Estimation Theory Lab	0-0-4	2	1183

		Specialization: Communications				
Theory	Core 3	ECRS0075	Antennas and Radiating Systems	3-0-0	3	1168
	Core 4	ECCN0076	Advanced Communication Networks	3-0-0	3	1169
	Prog. Specific Elective III	ECDS0074	DSP Architecture	3-0-0	3	1167
		ECIA0071	IOT and Applications			1164
	Prog. Specific Elective IV	ECPM0069	Pattern Recognition and Machine Learning	3-0-0	3	1163
		ECMS0077	MIMO System			1170
Lab	Lab3	ECRS6047	Antennas and Radiating Systems lab	0-0-4	2	1183
	Lab4	ECCN6048	Advanced Communication Networks Lab	0-0-4	2	1184
		Specialization: Embedded System				
Theory	Core 3	ECDS0074	DSP Architecture	3-0-0	3	1167
	Core 4	ECSA0078	Embedded System and Applications	3-0-0	3	1171
	Prog. Specific Elective III	ECDD0072	Digital Design and Verification	3-0-0	3	1165
		ECIA0071	IOT and Applications			1164
	Prog. Specific Elective IV	ECMT0079	Memory Technologies	3-0-0	3	1172
		ECBS0080	Communication Buses and Interfaces			1174
Lab	Lab3	ECDS6049	DSP Architecture lab	0-0-4	2	1184
	Lab4	ECSA6050	Embedded System and Applications Lab	0-0-4	2	1185
Project		ECMI6051	Mini Project	0-0-4	2	1185
Audit	Audit 2 (MOOCs)	EDCI0100	Constitution of India	2-0-0	0	
Total Credits				**14-0-12**	18	
SEMESTER III						
	Specialization: Signal Processing					
Theory	Prog. Specific Elective V	ECAI0096	Artificial Intelligence	3-0-0	3	1174
		ECOT0097	Optimization Techniques			1175
		ECRS0098	Remote Sensing			1176
	Specialization: Communications					
	Prog. Specific Elective V	ECAI0096	Artificial Intelligence	3-0-0	3	1174
		ECOT0097	Optimization Techniques			1175
		ECRS0098	Remote Sensing			1176
	Specialization: Embedded System					
	Prog. Specific Elective V	ECAI0096	Artificial Intelligence	3-0-0	**3**	1174
		ECNN0099	Nanotechnology and Nanoelectronics			1177
		ECSD0100	SoC Design			1179
	Open Elective	ECBI0129	Bioinformatics	3-0-0	3	1180
Project	Dissertation	ECDI6059	Dissertation Phase – I	0-0-20	10	1185
Total Credits				**6-0-20**	**26**	
SEMESTER IV						
Theory	**Specialization: Signal Processing**					
	Dissertation	ECDI6060	Dissertation Phase – II	0-0-32	16	1186
	Specialization: Control Systems					
	Dissertation	ECDI6060	Dissertation Phase – II	0-0-32	16	1186
	Specialization: Embedded System					
	Dissertation	ECDI6060	Dissertation Phase – II	0-0-32	16	1186
Total Credits				0-0-32	16	

LIST OF OPEN ELECTIVES

SEMESTER III						
Type	**Type of Course/ Category**	**Course Code**	**Course Name**	L-T-P	**Credits**	**Page**
Theory	Open Elective	ECBI0129	Bioinformatics	3-0-0	3	1180

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

DEPARTMENT OF COMPUTER APPLICATIONS

PROGRAMME: MASTER OF COMPUTER APPLICATIONS (MCA)

Type	Course Code	Course Name	Credits	Category	Page
Semester I					
Theory	CAMF0043	Mathematical Foundation for Computer Science	4	DC	1199
	CATC0048	Theory of Computation	4	DC	1204
	CAOS0016	Operating Systems	4	DC	1191
	CADA0044	Data Structures and Algorithms	4	DC	1200
	CAPJ0018	Programming Through Java	4	DE	1192
Lab	CAOS6012	Operating Systems Lab	2	DC	1216
	CADA6033	Data Structures and Algorithms Lab	2	DC	1218
	CAPJ6014	Programming Through Java Lab	2	DE	1216
Total Credits			**26**		
Semester II					
Theory	CASE0019	Software Engineering	4	DC	1193
	CACC0045	Data Communication and Computer Networks	4	DC	1201
	CADM0046	Advanced Database Management Systems	4	DC	1202
	CAIT0022	Internet Technology and Applications	4	DC	1195
	CASI0058	Sensor Networks and Internet of Things	3	DE	1212
Lab	CACC6034	Data Communication and Computer Networks Lab	2	DC	1218
	CAIT6017	Internet Technology and Applications Lab	2	DE	1217
	CADM6035	Advanced Database Management Systems Lab	2	DC	1219
Mandatory	CASL0200	Service Learning/Community Engagement	NC	IE	1224
Total Credits			**25**		
Semester III					
Theory	CACL0033	Cyber Law and IT Security	4	DC	1198
	CAML0049	Machine Learning	4	DC	1205
	CAEP0024	Enterprise Resource Planning	4	DC	1196
	ECRM0042	Research Methodology and IPR	2	DE	1214
		ELECTIVE-I Specialization I: Artificial Intelligence OR Specialization II: Data Science	4	DE	
		ELECTIVE-II Specialization I: Artificial Intelligence OR Specialization II: Data Science	4	DE	
Lab	CAML6036	Machine Learning Lab	2	DC	1220
Project	CAMI6038	Minor Project - MCA	5	DC	1221
Audit Courses	EGCS0110	Communication Skills	NC	IE	1226
	CMES0023	Entrepreneurship	NC	IE	1226
Total Credits			**29**		
Semester IV					
Project	CAMP6039	Major Project - MCA	18	DC	1221
		Elective-III Specialization III (Artificial Intelligence/Data Science)	2		
Total Credits			**20**		
Total Programme Credits			**100**		

Course Code	**Specialization I (Artificial Intelligence)**		
CAPA0030	Principles of Artificial Intelligence		
CAHC0050	Human Computer Interaction		1205
CABI0051	Bioinformatics		1206
CADL0052	Deep Learning		1207
CASC0053	Soft Computing		1208
Course Code	**Specialization II (Data Science)**		
CADS0054	Data Science		1209
CAVS0055	Data Visualization for Data Science		1210
CABD0056	Big Data Management		1211
CAWA0057	Web Analytics and Development		1212
Course Code	**Specialization III (Artificial Intelligence/Data Science)**		
	NPTEL Course of 8 - 12 Weeks. List of Courses to be provided by the department.		

LIST OF VALUE-ADDED COURSES OFFERED BY THE DEPARTMENT

VALUE ADDED COURSES		
Course Code	**Course Name**	**Page**
CAAW6053	Advanced Web Application Development Techniques	1224
CABC6052	Blockchain	1223
CARP6051	Robotic Process Automation	1223

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

SCHOOL OF TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

Creating a centre of excellence in teaching, training and research in the field of Computer Science and Engineering, to mould individuals into competent professionals to address local, national and global scientific, technological and social challenges.

MISSION

1. To create professionals sound in the theory and practice of Computer Science and Engineering by providing a learning ambience that promotes innovation and research-based activities.
2. To explore the frontiers of cutting-edge technologies through academia-industry collaboration and continuous learning to solve real-world challenges
3. To inculcate the spirit of self-sustainability through research, consultancy, and development activities.
4. To infuse ethical values, team spirit and a sense of social commitment in individuals for the betterment of the society through technology.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. To prepare the students to have a strong foundation in computer science engineering with impetus to higher studies, consultancy, research and development.
2. To prepare the students to be self-sustainable and proficient to meet the real world challenges ethically and responsibly, in service to socio-economic development of the society.
3. To inculcate the spirit of life-long learning, understanding, and applying new ideas and technologies to provide novel engineering solutions in the rapidly changing environment.

PROGRAM OUTCOMES (MTECH CSE)

PO 1: An understanding of the theoretical foundations and the limits of computing
PO 2: An ability to adapt existing models, techniques, algorithms, data structures, etc. for efficiently solving problems
PO 3: An ability to design, develop and evaluate new computer based systems for novel applications which meet the desired needs of industry and society
PO 4: Understanding and ability to use advanced computing techniques and tools
PO 5: An ability to undertake original research at the cutting edge of computer science & its related areas
PO 6: An ability to function effectively individually or as a part of a team to accomplish a stated goal
PO 7: An understanding of professional and ethical responsibility
PO 8: An ability to communicate effectively with a wide range of audience
PO 9: An ability to learn independently and engage in life¬long learning
PO 10: An understanding of the impact of IT related solutions in an economic, social and environment context.

PROGRAM SPECIFIC OUTCOME (PSO)

Specialisation: Data science

PSO 1: Apply the concept of theoretical knowledge of computer science, data structures, algorithms, mathematical computation and statistical formulae with respect to research methodology.
PSO 2: Develop programs that use data mining techniques on bigdata for clustering, classification and ranking using cloud infrastructure for research.

Specialisation: Internet of Things

PSO 1: Apply the concept of theoretical knowledge of computer science, data structures, algorithms, mathematical computation and statistical formulae with respect to research methodology.
PSO 2: Design and develop code for various sensor-based applications for different sectors that use data collected through IoT deployment.

Specialisation: Information Security

PSO 1: Apply the concept of theoretical knowledge of computer science, data structures, algorithms, mathematical computation and statistical formulae with respect to research methodology.

PSO 2: Design operational and strategic cyber-security strategies, policies, and solutions that use cyber security techniques, information assurance, digital forensics software/tools, encryption, machine learning, and secure coding for securing data.

Semester I												
Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
Advanced Data structure	M	H									H	M
Advanced Data structure Lab	M	M									H	M
Mathematical foundations of Computer Science	H										M	L
Research Methodology and IPR					M				L		H	
Specialisation: Data Science												
Machine Learning			M	H							M	H
Machine Learning Lab				H							M	H
Recommender System										M		
Data Storage Technologies and Networks					M						M	
Data Science		M		H								M
Distributed Systems			M									
Data Preparation and Analysis	M	M		M							H	M
Specialisation: Internet of Things												
Wireless Access Technology(CSMS0095)	M										M	H
Mobile application and services			H									H
Smart sensor and Internet of Things			M								H	H
Logical and functional programming				H								
English for Research Paper Writing								H			M	

Semester II												
Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
Advance Algorithms	M	H									M	H
Advance Algorithms Lab	M	M									M	
Soft Computing	M										M	
Mini Project	M	M	M	M	M	H	L	L	L		M	M
Constitution of India						M		M				L
Specialisation: Data Science												
Data Visualization			M								M	M
Data Visualisation Lab			M								M	M
Big Data Analytics				H						M		H
Data Warehouse and Data Mining	M			M								H
Data Security and Access Control				M			L			L	M	M
Web Analytics and Development				H							M	H
Knowledge Discovery	M	M									M	M

Natural Language Processing		M								L	M	L
Specialisation: Internet of Things												
Advanced machine learning			H	M							M	L
Network Security(CSNY0114)	M	H									M	M
Big Data Analytics				H						M	M	H
Sensor Network and Internet of Things	M	M	M									H
Data Visualization			M									M
Data Visualisation Lab			M									M
IoT Application and Communication Protocol					M						M	H
Specialisation: Information Security												
Data Encryption & Compression	M	H									H	M
Data Encryption & Compression Lab	M	H									M	
Steganography & Digital Watermarking	M		H								M	M
Information Theory & Coding	H	M									H	
Security Assessment and Risk Analysis					H					M	M	M
Secure Coding				M							M	
Biometrics				M							M	

Semester III												
Specialisation: Data Science												
Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
GPU Computing	M										M	M
Cloud Computing	M		H									M
Distributed Databases	M										M	H
Business Analytics				H								H
Dissertation Phase – I		M	M	M		H					M	M
Specialisation: Internet of Things												
IoT and Smart City			H	M							H	M
Emulation and simulation methodology			M	M							M	M
Cloud Computing	M		H									
Business Analytics				H							M	H
Dissertation Phase – I		M	M	M		H					M	M
Specialisation: Information Security												
Data Warehousing & Mining	H										H	L
Web Search & Information Retrieval				M							M	M
Database Security and Access Control	M			H								L
Business Analytics				H							H	M
Dissertation Phase – I		M	M	M		H					M	

Semester IV

Specialisation: Data Science												
Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PSO1	PSO2
Project Phase II		M	M	M		H					M	H
Specialisation: Internet of Things												
Project Phase II		M	M	M		H					M	H

DETAILED SYLLABUS
THEORY COURSES

CSMF0086: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

(3 credits)

Objectives

- To understand the mathematical fundamentals that are prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
- To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
- To study various sampling and classification problems.

Course Outcomes

1. Define and Recall the basic notions of discrete and continuous probability (Remembering)
2. Explain the methods of statistical inference, and the role that sampling distributions play in those methods (Understanding).
3. Apply discrete mathematics in formal representation of various computing constructs. (Applying)
4. Analyse the recent trends in distribution functions in various interdisciplinary fields (Analysing)
5. Evaluating the basic notions of Mathematics in the application areas of Computer Science & Engineering (Evaluating).
6. Elaborate the importance of analytical problem solving approach in engineering problems (Creating).

Module I (7 hours)

Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains

Module II (7 hours)

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood

Module III (8 hours)

Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.

Module IV (9 hours)

Graph Theory: Isomorphism, Planargraphs, graphcolorings, Hamilton circuits and Eulercycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

Module V (10 hours)

Computer science and engineering applications: Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

Module VI (4 hours)

Recent Trends in various distribution functions in the mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

Suggested Readings

1. John Vince, Foundation Mathematics for Computer Science,Springer.
2. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
3. M. Mitzenmacher and E. Upfal. Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
4. Alan Tucker, Applied Combinatorics, Wiley

CSDT0087: ADVANCED DATA STRUCTURES

(3 credits)

Objectives:

The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.

- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Students should be able to come up with analysis of efficiency and proof of correctness.

Course Outcomes

1. Recall the mathematical background and abstractions for analysis of algorithms. (Remembering)
2. Explain the implementation of symbol tables using hashing techniques. (Understanding)
3. Apply amortized analysis on data structures, including binary search trees, mergeable heaps, and disjoint sets. (Applying)
4. Develop and Analyse algorithms for red-black trees, B-trees and Splay trees. (Analysing)
5. Develop and evaluate algorithms for text processing applications.(Evaluating)
6. Choose suitable data structures and develop algorithms for computational geometry problems. (Creating)

Module I (7 Hours)

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.
Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Module II (5 Hours)

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

Module III (7 Hours)

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

Module IV (11 Hours)

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer Moore Algorithm, The Knuth- Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common, Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

Module V (10 Hours)

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.

Module VI (5 Hours)

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

Suggested Readings

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson,2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley,2002.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M				
CO 2	M	H	H			
CO 3	M	M	M	H		
CO 4				H	M	
CO 5				M	H	
CO 6					M	H

CSSC0088: DATA SCIENCE

(3 credits)

Objectives:

- Provide you with the knowledge and expertise to become a proficient data scientist.
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science
- Produce Python code to statistically analyse a dataset
- Critically evaluate data visualisations based on their design and use for communicating stories from data

Course Outcomes

1. Define the basics of the knowledge and expertise required to become a proficient data scientist. (Remembering)
2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science. (Understanding)
3. Develop Python code to statistically Analyse a dataset. (Applying)
4. Analyse data visualizations based on their design (Analysing)
5. Evaluate the use of communicating stories from data (Evaluating)
6. Design and develop analytical report (Creating)

Module I (5 Hours)

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Module II (7 Hours)

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources

Module III (10 Hours)

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naïve Bayes.

Module IV (10 Hours)

Data visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Module V (6 Hours)

Applications of Data Science, Technologies for visualisation, Bokeh (Python)

Module VI (7 Hours)

Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods used in data science.

Suggested Readings

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline.O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge UniversityPress.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M				
CO 2	H	M	H			
CO 3			M	H		
CO 4				H	M	
CO 5				M	H	
CO 6					M	H

CSDI0089: DISTRIBUTED SYSTEMS

(3 Credits)

Objectives

To introduce the fundamental concepts and issues of managing a large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.

Course Outcomes

1. Recall the fundamental concepts and issues of managing a large volume of shared data in a parallel and distributed environment. (Remembering)
2. Explain the distributed system architecture and its application in various fields. (Understanding)
3. Apply network virtualization and analyse pros and cons.(Applying)
4. Analyse design trends in distributed systems. (Analysing)
5. Formulate and evaluate remote method invocation and objects. (Evaluating, Creating)

Module I (8 Hours)

Introduction: Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts Distributed database management system architecture: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

Module II (10 Hours)
Distributed database design: Alternative design strategies; Distributed design issues; Fragmentation; Data allocation Semantics data control: View management; Data security; Semantic Integrity Control Query processing issues: Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

Module III (10 Hours)
Distributed query optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms
Transaction management: The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models
Concurrency control: Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management

Module IV (7 Hours)
Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols

Module V (6 Hours)

Parallel database systems: Parallel architectures; parallel query processing and optimization; load balancing

Module VI (4 Hours)
Advanced topics: Mobile Databases, Distributed Object Management, Multi-databases

Suggested Readings
1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall,1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley,1992.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	H	H	M			
CO 3		M	H	M		
CO 4				H	M	M
CO 5				M	H	

CSDP0090: DATA PREPARATION AND ANALYSIS
(3 Credits)

Objective
To prepare the data for analysis and develop meaningful Data Visualizations

Course Outcomes
1. List the data gathering and preparation techniques. (Remembering)
2. Explain the techniques as per utilisation. (Understanding)
3. Apply explorative analysis techniques. (Applying)
4. Analyse results after application of explorative analysis techniques. (Analysing)
5. Evaluate the data visualisation outcomes (Evaluating)
6. Formulate efficient techniques for data preparation and analysis. (Creating)

Module I (9 Hours)
Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real- time issues

Module II (10 Hours)

Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation And segmentation

Module III (12 Hours)
Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation

Module IV (14 Hours)
Visualization: Designing visualizations, Time series, Geo located data, Correlations and connections, Hierarchies and networks, interactivity

Suggested Readings

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H	H	M	
CO 3		M	H	
CO 4			M	H
CO 5				M
CO6				H

CSRS0091: RECOMMENDER SYSTEM

(3 Credits)

Objectives:

- To learn techniques for making recommendations, including non-personalized, content-based, and collaborative filtering
- To automate a variety of choice – making strategies with the goal of providing affordable, personal, and high- quality recommendations

Course Outcomes

1. Relate techniques for making recommendations, including non-personalized, content- based, and collaborative filtering (Remembering)
2. Illustrate automation of a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations. (Understanding)
3. Apply techniques for making recommendations, including non-personalized, content- based, and collaborative filtering (Applying)
4. Analyse the choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations. (Analysing)
5. Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity. (Evaluating)
6. Design recommendation system for a particular application domain. (Creating)

Module I (8 Hours)

Introduction: Overview of Information Retrieval, Retrieval Models, Search and Filtering, Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

Module II (8 Hours)

Content-based Filtering: High level architecture of content-based systems, Advantages and drawbacks of content-based filtering, Item profiles, discovering features of documents, pre- processing and feature extraction, obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Module III (8 Hours)

Collaborative Filtering: User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

Module IV (8 Hours)

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade, Meta-level, Limitations of hybridization strategies

Module V (5 Hours)

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations.

Module VI (8 Hours)

Types of Recommender Systems: Recommender systems in personalized web search, knowledge- based recommender system, social tagging recommender systems, Trust-centric recommendations, Group recommender systems.

Suggested Readings

1. Jannach D., Zanker M. and Fel Fering A., Recommender Systems: An Introduction, Cambridge University Press (2011),

1sted.
2. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1sted.
3. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer (2011),1sted.
4. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems for Learning, Springer (2013), 1st ed.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M				
CO 2	H	M	H			
CO 3			M	L		
CO 4				M	M	
CO 5				H	H	
CO 6				H		H

CSML0092: MACHINE LEARNING

(3 Credits)

Objectives:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
- To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning techniques and various feature extraction strategies.

Course Outcomes

1. Relate how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.(Remembering)
2. Illustrate supervised and unsupervised learning paradigms of machine learning. (Understanding)
3. Design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances. (Applying, Analysing)
4. Examine the Deep learning techniques and various feature extraction strategies. (Analysing)
5. Evaluate the results and compare in a different environment to have best results. (Evaluating)
6. Create applications as per the requirements in a suitable environment. (Creating)

Module I (10Hours) Supervised Learning (Regression/Classification)

Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, non linearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

Module II (7 Hours) Unsupervised Learning

Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)

Module III (6 Hours)

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical, Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

Module IV (8 Hours)

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

Module V (8 Hours)

Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference

Module VI (6 Hours)

Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.

Suggested Readings

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press,2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer,2007.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	H	H	M			
CO 3			H			
CO 4				H	M	
CO 5			M	M	H	M
CO 6						H

CSTN0093: DATA STORAGE TECHNOLOGIES AND NETWORKS

(3 Credits)

Objective

To provide learners with a basic understanding of Enterprise Data Storage and Management Technologies

Course Outcomes

1. Recall the various data storage techniques (Remembering)
2. Explain the basic understanding of Enterprise Data Storage and Management Technologies (Understanding)
3. Experiment with Storage System Architecture (Applying)
4. Analyse the Virtualization Technologies and Storage Area Network (Analysing)
5. Evaluate and deploy an efficient technique for data storage. (Evaluating & Creating)

Module I (7 Hours)

Storage Media and Technologies – Magnetic, Optical and Semiconductor Media, Techniques for read/write Operations, Issues and Limitations.

Module II (8Hours)

Usage and Access – Positioning in the Memory Hierarchy, Hardware and Software, Design for Access, Performance issues.

Module III (7 Hours)

Large Storages – Hard Disks, Networked Attached Storage, Scalability issues, networking issues.

Module IV (8 Hours)

Storage Architecture- Storage Partitioning, Storage System Design, Caching, Legacy Systems.

Module V (10 Hours)

Storage Area Networks – Hardware and Software Components, Storage Clusters/Grids. Storage QoS– Performance, Reliability, and Security issues.

Module VI (5 Hours)

Recent Trends related to Copy data management, Erasure coding, and Software Defined Storage appliances.

Suggested Readings

1. The Complete Guide to Data Storage Technologies for Network- centric Computing Paperback– Import, Mar 1998 by Computer Technology Research Corporation
2. Data Storage Networking: Real World Skills for the CompTIA Storage by Nigel Poulton

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	H	H	M			
CO 3			H			
CO 4				H	M	
CO 5			M	M	H	M

CSWA0094: WIRELESS ACCESS TECHNOLOGIES

(3 credits)

Objectives:

- Overview of wireless access technologies, Fixed wireless access networks. Terminal mobility issues regarding wireless access to Internet
- Introduction to various Network topologies, hotspot networks, Communication links: point-to- point, point-to-multipoint, multipoint-to-multipoint.
- To provide an overview of Standards for most frequently used wireless access networks: WPAN, UWB, WLAN, WMAN, WWAN. Network services. Wireless access networks planning, design and installation.
- To get an insight of Wireless networking security issues, Wireless access network exploitation and management, software requirements, link quality control.

Course Outcomes

1. Recall basics of wireless access technologies, Fixed wireless access networks and terminal mobility issues regarding wireless access to the Internet (Remembering)
2. Explain the various Network topologies, hotspot networks and Communication links. (Understanding)
3. Explain the standards for most frequently used wireless access networks. (Understanding)
4. Planning, design and installation of Wireless access networks (Applying)
5. Analyse and get an insight of Wireless networking security issues, Wireless access network exploitation and management, software requirements and link quality control. (Analysing)
6. Estimate the requirements of accessories to establish a network (Evaluating)
7. Establish a network as per requirements. (Creating)

Module I (7 Hours)

Necessity for wireless terminals connectivity and networking. Wireless networking advantages and disadvantages, Overview of wireless access technologies. Narrowband and broadband networks, fixed and nomadic networks. Wireless local loop (WLL), Public Switched Telephone Network (PSTN) interfaces.

Module II (7 Hours)

Fixed wireless access (FWA) networks, frequency bands for different networks. Criterions for frequency bands allocation, Network topologies, hotspot networks. Communication links: point- to-point (PTP), point to multipoint (PMP), multipoint-to-multipoint (MTM).

Module III (9 Hours)

Standards for most frequently used wireless access networks: WPAN (802.15, Bluetooth, DECT, IrDA), UWB (Ultra-Wideband), WLAN (802.11, Wi-Fi, HIPERLAN, IrDA), WMAN (802.16, WiMAX, HIPERMAN, HIPERACCESS),
WWAN (802.20), Other technologies for broadband wireless access, Local Multipoint Distribution Service (LMDS), Multichannel Multipoint Distribution Service (MMDS). Ad Hoc networks, Network services. Services types based on carrier frequency and bandwidth.

Module IV (9 Hours)

Wireless access networks planning, design and installation. Services provision, legislative and technical aspects, Technical and economical factors for network planning: expenses, coverage, link capacity, network complexity and carrier-to-interference ratio (C/I). Base station or access point allocation. Base station and access point equipment. Terminal mobility issues regarding wireless access to the Internet. Wireless networking security issues.

Module V (8 Hours)

Example of laptop or handheld PC wireless connection in real environment. PC wireless interface equipment. Wireless access network exploitation and management, software requirements, link quality control. Business model, wireless network services market, market research and marketing, service providers, wireless data application service providers (WDASP) and their role on the public telecommunication services market, billing systems.

Module VI (8 Hours)

Recent trends in wireless networking and various access mechanisms, new standards of wireless communication.

Suggested Readings

1. M. P. Clark, Wireless Access Networks: Fixed Wireless Access and WLL networks -- Design and Operation, John Wiley & Sons, Chichester
2. D. H. Morais, Fixed Broadband Wireless Communications: Principles and Practical Applications, Prentice Hall, Upper Saddle River
3. R. Pandya, Introduction to WLLs: Application and Deployment for Fixed and Broadband Services, IEEE Press, Piscataway

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	L	H	M			
CO 3			H	M		
CO 4				H	M	
CO 5				M	H	
CO 6					M	H

CSMS0095: MOBILE APPLICATIONS AND SERVICES

(3 Credits)

Objectives

- This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.
- It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets.
- It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile

Course Outcomes

1. Relate and explain the emerging technologies and tools used to design and implement feature-rich mobile applications for smartphones and tablets. (Remembering, Understanding)
2. Building the applications for different platform. (Applying)
3. Analyze the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile. (Analyzing)
4. Evaluate the results and compare in different environment to have best outcome. (Evaluating)
5. Create applications as per requirements in suitable environment. (Creating)

Module I (7 Hours)

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User.

Module II (7 Hours)

More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

Module III (9 Hours)

Communications via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony, Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics.

Module IV (9 Hours)

Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer to-Peer Architecture, Android Multimedia.

Module V (8 Hours)

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android.

Module VI (5 Hours)

Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT.

Suggested Readings

1. Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Sons

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H	M			

CO 3			H	M		
CO 4				H	H	
CO 5					M	H

CSSI0096: SMART SENSORS AND INTERNET OF THINGS

(3 Credits)

Objectives

- Able to understand the application areas of IOT.
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
- Able to understand building blocks of Internet of Things and characteristics.

Course Outcomes

1. Explain the revolution of Internet in Mobile Devices, Cloud & Sensor Networks. (Understanding)
2. Identify the application areas of IOT. (Applying)
3. Examine the building blocks of Internet of Things and their characteristics. (Analyzing)
4. Evaluate the results and compare the performance in different environment. (Evaluating)
5. Construct IoT based products as per requirements for a suitable environment. (Creating)
6. List and explain the different sensors and illustrate their applications in smart devices. (Remembering)

Module I (7 Hours)

Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT.

Module II (7 Hours)

Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc.

Module III (9 Hours)

Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors.

Module IV (10 Hours)

Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel

Module V (7 Hours)

Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor and Future scope of research in smart sensor.

Module VI (5 Hours)

Recent trends in smart sensor for day to day life, evolving sensors and their architecture.

Suggested Readings

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing.
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H	M			
CO 3			H	M		
CO 4				H	M	
CO 5					H	M
CO 6						H

CSLF0097: LOGIC AND FUNCTIONAL PROGRAMMING

(3 credits)

Objectives:

- To further the state of the art on the theoretical and practical aspects of developing declarative programming tools in logic programming for IOT data analysis.
- To introduce basics of functional programming and constraint logic programming for nodes in IOT.
- Introduction into formal concepts used as a theoretical basis for both paradigms, basic knowledge and practical experience.

Course Outcomes

1. Define sensors and relate their data collection technique with various criteria set by the users. (Remembering)
2. Explain the state of the art on the theoretical and practical aspects of developing declarative programming tools in logic programming for IOT data analysis. (Understanding)
3. Experiment with the basics of functional programming and constraint logic programming for nodes in IOT. (Applying)
4. Examine the formal concepts used as a theoretical basis for both paradigms, basic knowledge and practical experience. (Analysing)
5. Evaluate the results and compare in different environments to have best results. (Evaluating)
6. Create IoT based products as per requirements in a suitable environment. (Creating)

Module I (5 Hours)

Proposition Logic: Introduction of logic and Functional Paradigm, Propositional Concepts, Semantic Table , Problem Solving with Semantic Table.

Module II (7 Hours)

Natural Deduction and Axiomatic Propositional Logic: Rules of Natural Deduction, Sequent Calculus, Axiomatic Systems, Meta theorems, Important Properties of AL, Resolution, Resolving Arguments

Module III (7 Hours)

Introduction to Predicate Logic Objects, Predicates and Quantifiers, Functions, First Order Language, Quantifiers, Scope and Binding, Substitution, An Axiomatic System for First Order Predicate Logic, Soundness and Completeness, Axiomatic Semantic and Programming

Module IV (12 Hours)

Semantic Tableaux & Resolution in Predicate Logic: Semantic Tableaux, Instantiation Rules, Problem- solving in Predicate Logic, Normal forms, Herbrand Universes and H-interpretation, Resolution, Unification, Resolution as a computing Tool, Nondeterministic Programming, Incomplete Data Structure, Second Order Programming in Prolog, Logic Grammars: Definite Clause Grammar, A Grammar Interpreter.

Module V (9 Hours)

Lazy and Eager Evaluation strategies: Evaluation Strategies, Lazy Evaluation: Evaluation Order and strictness of function, Programming with lazy evaluation, Interactive functional program, Delay of unnecessary Computation, Infinite Data Structure, Eager Evaluation and Reasoning

Module VI (5 Hours)

Recent trends in logical and functional programming, predicate logics and various evaluation strategies.

Suggested Readings

1. John Kelly, “The Essence of Logic”, Prentice-Hall India.
2. Saroj Kaushik, “Logic and Prolog Programming”, New Age International Ltd

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	M	H				
CO 3			H	M		
CO 4				H	M	
CO 5				M	H	M
CO 6					M	H

CSDF0098: DIGITAL FORENSICS

(3 Credits)

Course Outcomes

1. Recall the computer forensics related features of relevant legislations. (Remembering)
2. Explain the digital forensics related processes and procedures. (Understanding)

3. Utilize e-discovery tools to gather evidence from computers, mobiles, network, emails and the web. (Applying)
4. Analyse gathered forensics data to conduct an investigation. (Analysing)
5. Criticize digital forensics related case. (Evaluating)
6. Formulate plans for investigating real-world cyber-crimes. (Creating)

Module 1 (8 Hours)
Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber- criminalistics area, holistic approach to cyber-forensics

Module 2 (7 Hours)
Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Module 3 (8 Hours)
Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Module 4 (10 Hours)
Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

Module 5 (8 Hours)
Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008

Module 6 (4 Hours)
Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

Suggested Readings
1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H			M		
CO2		H				
CO3		M	H			
CO4				H		
CO5			M		H	
CO6				M		H

CSEH0099: ETHICAL HACKING
(3 Credits)

Course Outcomes
1. Recall the features of various cyber laws related to ethical hacking and the code of ethics for ethical hacking. (Remembering)
2. Explain the terms penetration testing, vulnerability analysis, and malware analysis. (Understanding)
3. Utilize various tools to gather data for penetration testing, vulnerability analysis, and malware analysis. (Applying)
4. Analyse gathered data to discover vulnerabilities. (Analysing)
5. Assess the exploitability of vulnerabilities present in a software or hardware. (Evaluating)
6. Maximize a detected vulnerability to hack a computer, mobile or network. (Creating)

Module 1 (9 Hours)
Introduction to Ethical Disclosure: Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure

Module 2 (8 Hours)
Penetration Testing and Tools: Using Metasploit, Using Back Track Live CD Linux Distribution

Module 3 (9 Hours)
Vulnerability Analysis: Passive Analysis, Advanced Static Analysis with IDA Pro, Advanced Reverse Engineering

Module 4 (10 Hours)
Client-side browser exploits, Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit

Module 5 (5 Hours)
Malware Analysis: Collecting Malware and Initial Analysis, Hacking Malware

Module 6 (4 Hours)
Case study of vulnerability of cloud platforms and mobile platforms & devices.

Suggested Readings
1. Shon Harris, Allen Harper, Chris Eagle and Jonathan Ness, Gray Hat Hacking: The Ethical Hackers' Handbook, TMH Edition
2. Jon Erickson, Hacking: The Art of Exploitation, SPD

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H			M		
CO2		H				
CO3		M		H		
CO4			H	M		
CO5			M		H	
CO6				M		H

CSID0100: INTRUSION DETECTION
(3 Credits)

Course Outcomes
1. Recall the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems. (Remembering)
2. Explain the different classes of attacks and anomaly detection systems and algorithms. (Understanding)
3. Identify and describe the parts of all intrusion detection systems and characterize new and emerging IDS technologies according to the basic capabilities all intrusion detection systems share. (Applying)
4. Compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion. (Analysing)
5. Evaluate the security posture of an enterprise. (Evaluating)
6. Formulate a plan to secure an enterprise network using an appropriate intrusion detection system. (Creating)

Module 1 (9 Hours)
The state of threats against computers, and networked systems-Overview of computer security solutions and why they fail-Vulnerability assessment, firewalls, VPN's -Overview of Intrusion Detection and Intrusion Prevention Network and Host-based IDS

Module 2 (8 Hours)
Classes of attacks - Network layer: scans, denial of service, penetration Application layer: software exploits, code injection-Human layer: identity theft, root access-Classes of attackers-Kids/hackers/ sop Hesitated groups-Automated: Drones, Worms, Viruses

Module 3 (8 Hours)
A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS

Module 4 (8 Hours)
Anomaly Detection Systems and Algorithms-Network Behavior Based Anomaly Detectors (rate based)-Host- based Anomaly Detectors-Software Vulnerabilities State transition, Immunology, Payload Anomaly Detection

Module 5 (8 Hours)
Attack trees and Correlation of alerts-Autopsy of Worms and Botnets-Malware Detection- Obfuscation, polymorphism-Document vectors

Module 6 (4 Hours)

Email/IM security issues-Viruses/Spam-From signatures to thumbprints to zero day detection- Insider Threat issues-Taxonomy-Masquerade and Impersonation Traitors, Decoys and Deception- Future: Collaborative Security

Suggested Readings

1. The Art of Computer Virus Research and Defense, Peter Szor, Symantec Press ISBN 0-32130545-3
2. Crimeware, Understanding New Attacks and Defenses, Markus Jakobsson and Zulfikar Ramzan, Symantec Press, ISBN: 978-0-321-50195-0 2008

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H			M		
CO2		H				
CO3		M	H	M		M
CO4			M	H		
CO5			M		M	H
CO6				M	H	M

CSMR0101: MALWARE ANALYSIS & REVERSE ENGINEERING

(3 Credits)

Course Outcomes

1. Recall an insight of fundamentals of malware analysis (Remembering)
2. Explain the concept of malware and reverse engineering. (Understanding)
3. Utilize tools and techniques of malware analysis (Applying)
4. Analyse data with respect to Malware and Kernel Debugging (Analysing)
5. Evaluate results from analysed data. (Evaluating)
6. Create an environment to protect malware. (Creating)

Module 1 (11 Hours)

Fundamentals of Malware Analysis (MA), Reverse Engineering Malware (REM)Methodology, Brief Overview of Malware analysis lab setup and configuration, Introduction to key MA tools and techniques, Behavioral Analysis vs. Code Analysis, Resources for Reverse-Engineering Malware (REM) Understanding Malware Threats, Malware indicators, Malware Classification, Examining Clam AV Signatures, Creating Custom Clam AV Databases, Using YARA to Detect Malware Capabilities, Creating a Controlled and Isolated Laboratory, Introduction to MA Sandboxes, Ubuntu, Zeltser's REMnux, SANS SIFT, Sandbox Setup and Configuration New Course Form, Routing TCP/IP Connections, Capturing and Analysing Network Traffic, Internet simulation using INet Sim, Using Deep Freeze to Preserve Physical Systems, Using FOG for Cloning and Imaging Disks, Using MySQL Database to Automate FOG Tasks, Introduction toPython ,Introduction to x86 Intel assembly language, Scanners: Virus Total, Jotti, and No Virus Thanks, Analysers: Threat Expert, CW Sandbox, Anubis, Joebox, Dynamic Analysis Tools: Process Monitor, Regshot, Handle Diff, Analysis Automation Tools: Virtual Box, VM Ware, Python , Other Analysis Tools

Module 2 (6 Hours)

Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries , Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plugins:, Bypassing Poison Ivy's Locked Files, Bypassing Conficker's File System ACL Restrictions, Detecting Rogue PKI Certificates.

Module 3 (8 Hours)

Opening and Attaching to Processes, Configuration of JIT Debugger for Shell code Analysis, Controlling Program Execution, Setting and Catching Breakpoints, Debugging with Python Scripts and Py Commands, DLL Export Enumeration, Execution, and Debugging, debugging a VMware Workstation Guest (on Windows), Debugging a Parallels Guest (on Mac OS X). Introduction to Win Dbg Commands and Controls, Detecting Rootkits with Win Dbg Scripts, Kernel Debugging with IDA Pro.

Module 4 (8 Hours)

Memory Dumping with Moon Sols Windows Memory Toolkit, Accessing VM Memory Files Overview of Volatility, Investigating Processes in Memory Dumps, Code Injection and Extraction, Detecting and Capturing Suspicious Loaded DLLs, Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA.

Module 5 (7 Hours)

Using WHOIS to Research Domains, DNS Hostname Resolution, Querying Passive DNS, Checking DNS Records, Reverse IP Search New Course Form, Creating Static Maps, Creating Interactive Maps.

Module 6 (5 Hours)
Case study of Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA

Suggested Readings
1. Michael Sikorski, Andrew Honig "Practical Malware Analysis: The Hands-On Guide to DissectingMalicious Software" publisher William Pollock

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2		H				
CO3		M	H			M
CO4				H		
CO5			M		H	
CO6				M		H

CSSC0102: SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING
(3 Credits)

Course Outcomes
1. Recall the various software vulnerabilities. (Remembering)
2. Explain the software process vulnerabilities for an organization. (Understanding)
3. Apply techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment (Applying)
4. Analyse and monitor resources consumption in a software. (Analysing)
5. Evaluate results by interrelating security and software development process. (Evaluating)
6. Create methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws. (Creating)

Module 1 (8 Hours)
Secure Software Design Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance

Module 2 (9 Hours)
Enterprise Application Development Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

Module 3 (8 Hours)
Enterprise Systems Administration Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

Module 4 (8 Hours)
Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

Module 5 (8 Hours)
Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

Module 6 (4 Hours)
Case study of DNS server, DHCP configuration and SQL injection attack.

Suggested Readings
1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2		H				
CO3		M		H		M
CO4			H	M		
CO5			M		H	
CO6				M		H

CSAA0103: ADVANCED ALGORITHMS
(3 credits)

Course Outcomes
1. Recall different algorithms (Remembering)
2. Explain the applications of various algorithms (Understanding)
3. Apply computer algorithms for different purposes. (Applying)
4. Analyse the complexity/ performance of different algorithms. Categorize the different problems in various classes according to their complexity. (Analysing)
5. Evaluate the different problems in various classes according to their complexity. (Evaluation)
6. Elaborate the recent activities in the field of the advanced data structure. (Creating)

Module 1 (6 Hours)
Sorting: Review of various sorting algorithms, topological sorting
Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge weighted case (Dijkstra's), depth-first search and computation of strongly connected, components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Module 2 (7 Hours)
Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.
Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting paths.

Module 3 (8 Hours)
Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute, maximum flow, Edmond-Karp maximum-flow algorithm.
Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

Module 4 (9 Hours)
Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.
Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.
Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm.Schonhage-Strassen Integer Multiplication algorithm

Module 5 (10 Hours)
Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness.
One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method,Advanced Number Theoretic Algorithm

Module 6 (5 Hours)
Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Suggested Readings
1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M			
CO 3		M	H	M		
CO 4			M	H	M	
CO 5					H	M
CO 6						H

CSSP0104: SOFT COMPUTING

(3 Credits)

Objectives:

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate techniques for a given scenario.
- To implement soft computing-based solutions for real-world problems.
- To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
- To provide student hand-on experience on MATLAB to implement various strategies.

Course Outcomes

1. Identify and describe soft computing techniques and their roles in building intelligent machines. (Remembering & understanding)
2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems. (Applying)
3. Analyse genetic algorithms to combinatorial optimization problems. (Analysing)
4. Evaluate and discuss solutions by various soft computing approaches for a given problem. (Evaluating and creating).

Module I (7 Hours)

Introduction to soft computing and neural networks: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

Module II (8 Hours)

Fuzzy logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

Module III (8 Hours)

Neural networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

Module IV (5 Hours)

Genetic algorithms: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

Module V (12 Hours)

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

Module VI (5 Hours)

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithms. Implementation of recently proposed soft computing techniques.

Suggested Readings

1. Jyh Shing Roger Jang, Chuen Tsai Sun, Eiji Mizutani, Neuro Fuzzy and Soft Computing, Prentice: Hall of India,2003.
2. George J. Klirand Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall,1995.
3. MATLAB Toolkit Manual.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					L
CO 2	H	H			M	
CO 3		M		H		

CO 4			M		M	M

CSDV0105: DATA VISUALISATION

(3 Credits)

Objectives:

- familiarize students with the basic and advanced techniques of information visualization and scientific visualization,
- to learn key techniques of the visualization process
- a detailed view of visual perception, the visualized data and the actual visualization interaction and distorting techniques

Course Outcomes

1. Recall the basic and advanced techniques of information and scientific visualization. (Remembering)
2. Explain the key techniques of the visualization process. (Understanding)
3. Apply detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques. (Applying)
4. Analyse different visualization techniques and their applicability to different types of data. (Analysing)
5. Compare techniques for visual mapping, geographic data and collaborative visualization. (Evaluating)
6. Create a process to have an understanding of large-scale abstract data. (Creating)

Module I (8 Hours)

Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

Module II (8 Hours)

Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

Module III (8 Hours)

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

Module IV (10 Hours)

Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

Module V (7 Hours)

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations

Module VI (4 Hours)

Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.

Suggested Readings

1. WARD, GRINSTEIN, KEIM, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick: A K Peters, Ltd.
2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	L	H	H			
CO 3						
CO 4			M	H	H	
CO 5					H	
CO 6			H	H	H	M

CSBD0106: BIG DATA ANALYTICS

(3 Credits)

Objectives:

- Understand big data for business intelligence. Learn business case studies for big data analytics.
- Understand no sql big data management. Perform map-reduce analytics using Hadoop and related tools

Course Outcomes

1. Describe big data and use cases from selected business domains. (Remembering & Understanding)

2. Applying NoSQL big data management. (Applying)
3. Install, configure, and run Hadoop and HDFS and analyse the data. (Analysing)
4. Perform map-reduce analytics using Hadoop (Evaluating)
5. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for creating big data analytics. (Creating)

Module I (8 Hours)
What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and bigdata, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and bigdata, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Module II (8 Hours)
Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map- reduce calculations.

Module III (8 Hours)
Data format, Analysing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java Interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

Module IV (8 Hours)

Map Reduce workflows, unit tests with MR Unit, test data and local tests, anatomy of Map Reduce jobrun, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

Module V (7 Hours)
Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.

Module VI (6 Hours)
Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

Suggested Readings

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, “Big Data, Big Analytics:Emerging
2. Business Intelligence and Analytic Trends for Today’s Businesses”, Wiley, 2013.
3. P.J. Sadalage and M. Fowler, “NoSQL Distilled: A Brief Guide to the Emerging Worldof
4. Polyglot Persistence”, Addison-Wesley Professional,2012.
5. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’Reilly,2012.
6. Eric Sammer, “Hadoop Operations”, O’Reilly,2012.
7. E. Capriolo, D. Wampler, and J. Rutherglen, “Programming Hive”, O’Reilly,2012.
8. Lars George, “HBase: The Definitive Guide”, O’Reilly,2011.
9. Eben Hewitt, “Cassandra: The Definitive Guide”, O’Reilly,2010.
10. Alan Gates, “Programming Pig”, O’Reilly, 2011.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	L	H	M			
CO 3			H			
CO 4			M	H	H	
CO 5					H	M

CSDD0107: DATA WAREHOUSING AND DATA MINING

(3 Credits)

Objectives:
- The objective of this course is to introduce data warehousing and mining techniques.
- Application of data mining in web mining, pattern matching and cluster analysis is included to aware students of broad data mining areas.

Course Outcomes

1. List the various data warehousing and data mining techniques. (Remembering)
2. Explain the principles, concepts, functions and various applications of data warehouse. (Understanding)
3. Apply data mining techniques for classification and prediction. (Applying)
4. Perform cluster, periodicity and social network analysis. (Analysing)
5. Evaluate and compare various data mining solutions for a given problem. (Evaluating)
6. Choose appropriate data warehousing and data mining techniques to build real-world systems. (Creating)

Module I (7 Hours)

Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;

Module II (7 Hours)

Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,

Module III (8 Hours)

Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis;

Module IV (9 Hours)

Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis;

Module V (9 Hours)

Web Mining, Mining the webpage layout structure, mining weblink structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.

Module VI (5 Hours)

Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis

Suggested Readings

1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques, Second Edition, Elsevier Publication,2011.
2. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley,2006.
3. G Dong and J Pei, Sequence Data Mining, Springer,2007.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H				
CO 3		H	M			
CO 4		M	H	M		
CO 5				H	M	M
CO 6						H

CSDS0108: DATA SECURITY AND ACCESS CONTROL

(3 Credits)

Objective

The objective of the course is to provide fundamentals of database security. Various access control techniques mechanisms were introduced along with application areas of access control techniques.

Course Outcomes

1. Define access control in the database. (Remembering)
2. Explain the purpose and fundamentals of access control. (Understanding)
3. Identify the capabilities and limitations of various access control mechanisms. (Applying)
4. Analyse the data, identify the problems, and choose the relevant models and algorithms to apply. (Analysing)
5. Assess the strengths and weaknesses of various access control models and to Analyse their behaviour. (Evaluating)
6. Design and develop access control mechanisms for enterprise IT infrastructures. (Creating)

Module I (7 Hours)

Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of

Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.

Module II (8 Hours)
Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy.

Module III (9 Hours)
Biba Integrity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system Temporal Constraints in RBAC, MAC AND DAC. Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi-line Insurance Company

Module IV (10 Hours)
Smart Card based Information Security, Smart card operating system fundamentals, design and implantation principles, memory organization, smart card files, file management, atomic operation, smart card data transmission ATR, PPS Security techniques- user identification, smart card security, quality assurance and testing, smart card life cycle-5 phases, smart card terminals.

Module V (7 Hours)
Recent trends in Database security and access control mechanisms. Case study of Role-Based Access Control (RBAC) systems.

Module VI (4 Hours)
Recent Trends related to data security management, vulnerabilities in different DBMS.

Suggested Readings
1. Role Based Access Control: David F. Ferraiolo, D. Richard Kuhn, Ramaswamy Chandramouli.
2. http://www.smartcard.co.uk/tutorials/sct-itsc.pdf : Smart Card Tutorial.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H				
CO 3		M	M			
CO 4		M	H	H		
CO 5				M	M	L
CO 6					H	M

CSWD0109: WEB ANALYTICS AND DEVELOPMENT
(3 Credits)

Objective
The course explores use of social network analysis to understand growing connectivity and complexity in the world ranging from small groups to WWW.

Course Outcomes
1. Relate with core research communities, publications, focused on web and social media analytics and research questions engaged. (Remembering)
2. Discuss clickstream data collection techniques, their impact on metrics, and their inherent limitations. (Understanding)
3. Identify and interpret commonly used web metrics (Applying)
4. Analyse and evaluate tasks and techniques used in web analytics. (Analysis/Evaluation)
5. Elaborate the resulting insights to support website design decisions, campaign optimisation, search analytics, etc. (Creating)

Module I (8 Hours)
Introduction – Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization

Module II (8 Hours)
Web Analytics tools: Click Stream Analysis, A/B testing, Online Surveys

Module III (8 Hours)

Web Search and Retrieval: Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models

Module IV (12 Hours)
Making Connection: Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity

Module V (9 Hours)
Connection: Connection Search, Collapse, Robustness Social involvements and diffusion of innovation

Suggested Readings

1. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analysing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann,304.
2. Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.
3. Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press. http://www.cs.cornell.edu/home/kleinber/networks- book/
4. Wasserman, S. &Faust, K. (1994). Social network analysis: Methods and applications. NewYork: Cambridge University Press.
5. Monge, P.R. &Contractor, N.S. (2003). Theories of communication networks. NewYork: Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	H			
CO 3		M	H		
CO 4		M	M	H	
CO 5				M	H

CSKD0110: KNOWLEDGE DISCOVERY

(3 Credits)

Objective
To conduct case studies on real data mining examples

Course Outcomes

1. Recall the basic terminologies like learning goals, concept representation, decision tree, computational learning, artificial neural network, classification. (Remembering)
2. Explain different categories of machine learning and machine learning methodologies and illustrate the theory behind designing a learning model. (Understanding)
3. Compare efficiency of different learning algorithms, classify supervised and unsupervised learning goals. (Understanding)
4. Apply different learning algorithms for real life classification problem, sketch the structure of different learning model such as neural network, support vector machine, naive bayes etc. (Applying)
5. Analyse decision tree learning, computational learning, artificial neural network and instance-based learning and how one learning overcomes the drawback in the other. (Analysing)
6. Judge in terms of different complexity which algorithms betters in what situation. (Evaluating).
7. Create and design ensemble-based learning, propose new learning for optimizing real life problems. (Creating)

Module I (7 Hours)
Introduction KDD and Data Mining - Data Mining and Machine Learning, Machine Learning and Statistics, Generalization as Search, Data Mining and Ethics

Module II (8 Hours)
Knowledge Representation - Decision Tables, Decision Trees, Classification Rules, Association Rules, Rules involving Relations, Trees for Numeric Predictions, Neural Networks, Clusters

Module III (9 Hours)
Decision Trees - Divide and Conquer, Calculating Information, Entropy, Pruning, Estimating Error Rates, The C4.5 Algorithm Evaluation of Learned Results- Training and Testing, Predicting Performance, Cross-Validation

Module IV (8 Hours)
Classification Rules - Inferring Rudimentary Rules, Covering Algorithms for Rule Construction, Probability Measure for Rule Evaluation, Association Rules, Item Sets, Rule Efficiency

Module V (6 Hours)
Numeric Predictions - Linear Models for Classification and Numeric Predictions, Numeric Predictions with Regression Trees,

Evaluating Numeric Predictions

Module VI (7 Hours)
Artificial Neural Networks – Perceptrons, Multilayer Networks, The Backpropagation Algorithm Clustering - Iterative Distance-based Clustering, Incremental Clustering, The EM Algorithm

Suggested Readings
1. Data mining and knowledge discovery handbook by Maimon, Oded(etal.)
2. Data Cleansing: A Prelude to knowledge Discovery

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	H	M		
CO 3		M	M	H		
CO 4		M	H	H		
CO 5				M	M	L
CO 6					H	M
CO 7				H	L	L

CSNL0111: NATURAL LANGUAGE PROCESSING

(3 Credits)

Objectives
The goals for this course are to study:
- algorithms and methods for building computational models of natural language understanding, including syntactic analysis, semantic representations, discourse analysis, and statistical and corpus- based methods for text processing and knowledge acquisition
- issues involved in natural language understanding
- applications that can benefit from natural language processing, such as information extraction, question answering, machine translation, and spoken language understanding. By the end of the course, students will have a good understanding of and appreciation for natural language processing, and have the necessary skills to build natural language processing tools.

Course Outcomes
1. Recall algorithms and methods for building computational models of natural language processing (Remembering)
2. Explain syntactic analysis, semantic representations, discourse analysis, and statistical and corpus-based methods for text processing and knowledge acquisition. (Understanding)
3. Apply the methods of natural language processing. (Applying)
4. Analyse Issues involved in natural language processing. (Analysing)
5. Evaluate and generate applications that can benefit from natural language processing, such asinformation extraction, question answering, machine translation, and spoken language understanding. (Evaluating &creating)

Module I (10 hours)
Introduction to NLP, Knowledge in language processing, Representation and Understanding, Organization of NLP systems, Models and algorithms, Linguistic Essentials

Module II (15 hours)
Grammars and Parsing - Syntactic Processing: Collocations; Regular Expression and Automata; Morphology and Finite-State Transducers; N-grams; Word Classes and Part-of-Speech Tagging; Context-Free Grammars for English; Parsing with Context-Free Grammars: Top-down parsing, Bottom-up parsing; Features and Unification; Lexicalized and Probabilistic Parsing

Module III (10 hours)
Semantic processing: Representing Meaning; Semantic Analysis: Integrating semantic analysis to parsers, Semantic Grammars; Lexical Semantics; Word Sense Disambiguation and Information Retrieval: Selection- Restriction based disambiguation, Machine learning approaches; Dictionary based approaches, Information retrieval

Module IV (7 hours)
Pragmatics: Discourse, Dialogue and Conversational Agents: Dialogue acts, Automatic Interpretation of Dialogue acts; Natural Language Generation: Discourse Planning; Machine Translation: Direct Translations, Translation using Statistical techniques
Module V (3 hours)
NLP Applications and Tools: Sentiment Analysis, Text Summarization, Text Entailment, Machine Translation, Question

Answering, Cross Lingual Information Retrieval (CLIR), NLTK, WordNet

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	H	M		
CO 3		M	H	L	
CO 4		M	M	H	M
CO 5				M	H

CSNI0112: SENSOR NETWORKS AND INTERNET OF THINGS

(3 credits)

Objectives

- The course gives an overview of various topics related to wireless sensor networks, which are expected to be the basis for the emerging internet-of-things.
- The course covers topics with relation to various sub disciplines of computer science such as hardware, operating systems, distributed systems, networking, security and databases.
- Able to understand wireless sensor network (WSN) specific issues such as localization, time synchronization, and topology control are addressed as well.

Course Outcomes

1. Define the function of sensors. (Remembering)
2. Explain how to connect sensors to the environment. (Understanding)
3. Organize and connect sensors together to have generated output. (Applying)
4. Examine hardware and software level consideration for IoT sensors. (Analyzing)
5. Evaluate results from data. (Evaluating)
6. Creating a real time application. (Creating)

Module I (7 Hours)

Introduction and Applications: smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security.

Module II (8 Hours)

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints hardware, Data representation and visualization, Interaction and remote control.

Module III (8 Hours)

Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation- Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Module IV (10 Hours)

Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases.

Module V (7 Hours)

IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device Board, Linux on Raspberry, Interface and Programming & IOT Device

Module VI (5 Hours)

Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT.

Suggested Readings

1. Mandler, B., Barja, J., MitreCampista, M.E., Cagá_ová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6

CO 1	H	M				
CO 2		H				
CO 3			H	H		
CO 4				H	M	
CO 5					H	
CO 6						H

CSAC0113: IOT APPLICATIONS AND COMMUNICATION PROTOCOLS
(3 credits)

Objectives

- Basic introduction of all the elements of IoT-Mechanical, Electronics/sensor platform, Wireless and wireline protocols, Mobile to Electronics integration, Mobile to enterprise integration.
- Open source/commercial electronics platform for IoT-Raspberry Pi, Arduino, Arm Mbed LPC.
- Open source /commercial enterprise cloud platform for IoT-Ayla, iO Bridge, Libellium, Axeda, Cisco fog cloud.

Course Outcomes

1. Define IoT and respective protocols. (Remembering)
2. Explain the functions of different layers of communication protocol. (Understanding)
3. Identify the different functions with respect to different layers. (Applying)
4. Distinguish protocol and functionalities. (Analyzing)
5. Evaluate the sensor collected data in connection to communication layer. (Evaluating)
6. Create applications using different communication protocol. (Creating)

Module I (7 Hours)
Basic function and architecture of a sensor — sensor body, sensor mechanism, sensor calibration, sensor maintenance, cost and pricing structure, legacy and modern sensor network. Development of sensor electronics — IoTvs legacy, and open-source vs traditional PCB design style Development of sensor communication protocols, Protocols: Modbus, relay, Zigbee, Zwave, X10, Bluetooth, ANT, etc. Business driver for sensor deployment — FDA/EPA regulation, fraud/ tempering detection, supervision, quality control and process management Different kind of calibration Techniques: manual, automation, infield, primary and secondary calibration — and their implication in IoT Powering options for sensors: battery, solar, Witricity, Mobile and PoE.

Module II (9 Hours)
Zigbee and Zwave — advantage of low power mesh networking. Long distance Zigbee. Introduction to different Zigbee chips. Bluetooth/BLE: Low power vs high power, speed of detection, class of BLE. Introduction of Bluetooth vendors & their review. Wireless protocols such as Piconet and packet structure for BLE and Zigbee Other long distance RF communication link. LOS vs NLOS links, Capacity and throughput calculation Application issues in wireless protocols: power consumption, reliability, PER, QoS, LOS.

Module III (9 Hours)
PCB vs FPGA vs ASIC design Prototyping electronics vs Production electronics, QA certificate for IoT CE/CSA/UL/IEC/RoHS/IP65 Basic introduction of multi-layer PCB design and its workflow Electronics reliability-basic concept of FIT and early mortality rate Environmental and reliability testing-basic concepts Basic Open source platforms: Arduino, Raspberry Pi, Beaglebone.

Module IV (7 Hours)
Introduction to Mobile app platform for IoT: Protocol stack of Mobile app for IoT, Mobile to server integration, iBeacon in IoS, Window Azure, Linkafy Mobile platform for IoT, Axeda, Xively.

Module V (8 Hours)
Database implementation for IoT : Cloud based IoT platforms, SQL vsNoSQL, Open sourced vs. Licensed Database, Available M2M cloud platform, AxedaXively, Omega NovoTech, Ayla Libellium, CISCO M2M platform, AT &T M2M platform, Google M2M platform.

Module VI (5 Hours)
Recent trends in home automation, IOT-locks, Energy optimization in home

Suggested Readings

1. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley-Blackwell.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6

CO 1	H	M				
CO 2		H	M			
CO 3			H	M		
CO 4			M	H	M	
CO 5					H	
CO 6						H

CSNY0114: NETWORK SECURITY
(3 credits)

Objectives:
- To learn the basics of security and various types of security issues.
- To study different cryptography techniques available and various security attacks.
- Explore network security and how they are implemented in real world.
- To get an insight of various issues of Web security and biometric authentication.

Course Outcomes
1. Recall the basics of security and various types of security issues. (Remembering)
2. Explain the different cryptography techniques available and various security attacks. (Understanding)
3. Apply network security and how they are implemented in the real world. (Applying)
4. Analyse available biometric techniques and how they are used in today's world. (Analysing)
5. Evaluate the security issues on the web and how to tackle them. (Evaluating)
6. Elaborate the various issues of web security and biometric authentication. (Creating)

Module I (6 Hours)
Data security: Review of cryptography. Examples RSA, DES, ECC.

Module II (7 Hours)
Authentication, non-repudiation and message integrity. Digital signatures and certificates. Protocols using cryptography (example Kerberos). Attacks on protocols

Module III (9 Hours)
Network security: Firewalls, Proxy-Servers, Network intrusion detection. Transport security: Mechanisms of TLS, SSL, IPSec.

Module IV (10 Hours)
Web security – SQL injection, XSS, etc. Software security and buffer overflow. Malware types and case studies. Access Control, firewalls and host/network intrusion detection.

Module V (8 Hours)
Other topics: Biometric authentication, Secure E-Commerce (ex. SET), Smart Cards, Security in Wireless Communication.

Module VI (5 Hours)
Recent trends in IOT security, IDS and Biometric.

Suggested Readings
1. W. R. Cheswick and S. M. Bellovin. Firewalls and Internet Security. Addison Wesley, 1994.
2. W. Stallings. Cryptography and Network Security. Prentice Hall, 1999.
3. Schneier. Applied Cryptography. Wiley, 1999

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H				
CO 3		M	H			
CO 4			M	H		
CO 5				M	H	
CO 6					H	M

CSAM0115: ADVANCED MACHINE LEARNING
(3 credits)

Objectives:

- To introduce key concepts in pattern recognition and machine learning; including specific algorithms for classification, regression, clustering and probabilistic modeling.
- To give a broad view of the general issues arising in the application of algorithms to analysing data, common terms used, and common errors made if applied incorrectly.
- To demonstrate a toolbox of techniques that can be immediately applied to real world problems, or used as a basis for future research into the topic

Course Outcomes

1. Recall and explain the key concepts in pattern recognition and machine learning; including specific algorithms for classification, regression, clustering and probabilistic modeling. (Remembering, Understanding)
2. Explain the general issues arising in the application of algorithms, commonly used terms, and the common errors made if applied incorrectly. (Understanding)
3. Demonstrate a toolbox of techniques that can be immediately applied to real world problems, or used as a basis for future research into the topic. (Applying)
4. Analyse the Kernel methods for handling high dimensional and non-linear patterns. (Analysing)
5. Evaluate the State-of-the-art algorithms such as Support Vector Machines and Bayesian networks.
6. (Evaluating)
7. Solve real-world machine learning tasks: from data to inference. (Creating)

Module I (7 Hours)

Key concepts, Supervised/Unsupervised Learning, Loss functions and generalization, Probability Theory, Parametric vs Non-parametric methods, Elements of Computational Learning Theory Ensemble Learning, Bagging, Boosting, Random Forest

Module II (7 Hours)

Kernel Methods for non-linear data, Support Vector Machines, Kernel Ridge Regression, Structure Kernels, K ernel PCA, Latent Semantic Analysis

Module III (8 Hours)

Bayesian methods for using prior knowledge and data, Bayesian inference, Bayesian Belief Networks and Graphical models, Probabilistic Latent Semantic Analysis, The Expectation-Maximisation (EM) algorithm, Gaussian Processes

Module IV (9 Hours)

Dimensionality Reduction - CCA, LDA, ICA, NMF – Canonical Variates - Feature Selection vs Feature Extraction

Module V (9 Hours)

Filter Methods - Sub-space approaches - Embedded methods, Low-Rank approaches - Recommender Systems Application areas - Security - Business - Scientific

Module VI (5 Hours)

Recent trends in supervised and unsupervised learning algorithm, dimensional reducibility, feature selection and extraction

Suggested Readings

1. Christopher M. Bishop, Pattern Recognition and Machine Learning.
2. John Shawe -Taylor and Nello Cristianini, Kernel Methods for Pattern Analysis

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H				
CO 3		M	H	M		
CO 4			M	H		
CO 5				M	H	
CO 6					M	H

CSEC0116: DATA ENCRYPTION AND COMPRESSION

(3 Credits)

Course Outcomes

1. List the different encryption techniques adopted in both traditional and modern cryptographic mechanisms. (Remembering)
2. Infer the logic adopted in different cryptographic algorithms, and their countermeasures.
3. (Understanding)

4. Apply the concepts gathered from the fundamentals of cryptographic approaches in solving related problems. (Applying)
5. Analyse the working of the different encryption and compression algorithms. (Analysing)
6. Compare and contrast the working of different data encryption and compression mechanisms.
7. (Evaluating)
8. Choose appropriate encryption and compression algorithms to build real-world systems. (Creating)

Module 1 (8 Hours)
Introduction to Security: Need for security, Security approaches, Principles of security, Types of attacks.
Encryption Techniques: Plaintext, Cipher text, Substitution Vs Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.

Module 2 (10 Hours)
Symmetric & Asymmetric Key Cryptography: Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric &Asymmetric key together, Digital signature, Knapsack algorithm. User Authentication Mechanism: Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication, Firewall.

Module 3 (9 Hours)
Case Studies of Cryptography: Denial of service attacks, IP spoofing attacks, Secure inter branch payment transactions, Conventional Encryption and Message Confidentiality, Conventional Encryption Principles, Conventional Encryption Algorithms, Location of Encryption Devices, Key Distribution. Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management.

Module 4 (7 Hours)
Introduction: Need for data compression, Fundamental concept of data compression coding, Communication model, Compression ratio, Requirements of data compression, Classification. Methods of Data Compression: Data compression-- Loss less and Lossy.

Module 5 (10 Hours)
Entropy encoding-- Repetitive character encoding, run length encoding, Zero/Blank encoding; Statistical encoding-- Huffman, Arithmetic & Lempel-Zivcoding; Source encoding-- Vector quantization (Simple vector quantization & with error term); Differential encoding—Predictive coding, Differential pulse code modulation, Delta modulation, Adaptive differential pulse code modulation; Transform based coding: Discrete cosine transform JPEG standards; Fractal compression

Module 6 (4 Hours)
Recent trends in encryption and data compression techniques.

Suggested Readings
1. Cryptography and Network Security by B. Forouzan, McGraw-Hill.
2. The Data Compression Book by Nelson, BPB.
3. Cryptography & Network Security by Atul Kahate, TMH.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H	M	L		
CO 3		M	H	M		
CO 4		L	M	H	M	
CO 5				M	H	M
CO 6				L	M	H

CSSW0117: STEGANOGRAPHY AND DIGITAL WATERMARKING

(3 Credits)

Course Outcomes
1. Define the terms Steganography, Steganalysis and Digital Watermarking. (Remembering)
2. Explain the various techniques for Steganography, Steganalysis and Digital Watermarking.
3. (Understanding)
4. Utilize various tools available to perform Steganography. (Applying)
5. Analyse data to detect and extract hidden information. (Analysing)
6. Defend against steganography and digital watermarking attacks. (Evaluating)
7. Develop frameworks for secure communication. (Creating)

Module 1 (8 Hours)
Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.), Issues: Security, Capacity and Imperceptibility, Steganalysis: Active and Malicious Attackers, Active and passive steganalysis.

Module 2 (10 Hours)
Frameworks for secret communication (pure Steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive),

Module 3 (7 Hours)
Steganography techniques: Substitution systems, Spatial Domain, transform domain techniques, spread spectrum, Statistical steganography, Cover Generation and cover selection, Tools: EzStego, FFEn code, hide 4PGP, Hide and Seek, S Tools etc.)

Module 4 (5 Hours)
Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets, Texture based

Module 5 (10 Hours)
Digital Watermarking: Introduction, Difference between Watermarking and steganography, History,
Classification (Characteristics and Applications), Types and techniques (Spatial-domain, Frequency- domain, and Vector quantization-based watermarking), Attacks and Tools (Attacks by Filtering, Re-modulation, Distortion, Geometric Compression, Linear Compression etc.), Watermark security & authentication.

Module 6 (5 Hours)
Recent trends in Steganography and digital watermarking techniques. Case study of LSB Embedding, LSBSteganalysis using primary sets.

Suggested Readings
1. Peter Wayner, "Disappearing Cryptography–Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002.
2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, New York, 2008.
3. Information Hiding: Steganography and Watermarking-Attacks and Countermeasures by Neil F. Johnson, Zoran Duric, Sushil Jajodia.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L			
CO 2	M	H	M	L		
CO 3		M	H	M		
CO 4		L	M	H	M	
CO 5					H	M
CO 6				L	M	H

CSIT0118: INFORMATION THEORY AND CODING
(3 Credits)

Course Outcomes
1. List the various coding and compression techniques. (Remembering)
2. Explain the working of lossless and lossy compression techniques. (Understanding)
3. Apply encoding techniques to encode data and perform error detection and correction.
4. (Applying)
5. Compare the various coding and compression techniques for text, video and image. (Analysing)
6. Measure information in terms of probability and entropy. (Evaluating)
7. Combine compression and coding techniques to build end-to-end systems. (Creating)

Module 1 (8 Hours)
Information and entropy information measures, Shannon's concept of Information. Channel coding, channel mutual information capacity (BW)

Module 2 (10 Hours)
Theorem for discrete memory less channel, information capacity theorem, Error Detecting and error correcting codes

Module 3 (8 Hours)
Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques

Module 4 (5 Hours)
Compression: loss less and lossy, Huffman codes, LZW algorithm, Binary Image compression schemes, run length encoding, CCITT group 3 1-DCompression, CCITT group 3 2D compression, CCITT group 42DCompression.

Module 5 (10 Hours)
Convolutional codes, sequential decoding. Video image Compression: CITT H261 Video coding algorithm, audio (speech) Compression. Cryptography and cipher.

Module 6 (4 Hours)
Case study of CCITT group 3 1-DCompression, CCITT group 3 2Dcompression.

Suggested Readings
1. Fundamentals in information theory and coding, Monica Borda, Springer.
2. Communication Systems: Analog and digital, Singh and Sapre, Tata McGraw Hill. Multimedia Communications Fred Halsall.
3. Information Theory, Coding and Cryptography R Bose.
4. Multimedia system Design Prabhat K Andleigh and Kiran Thakrar.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M	L		
CO 3	L	M	H	M		
CO 4		L	M	H	M	
CO 5				L	H	M
CO 6					M	H

CSRA0119: SECURITY ASSESSMENT AND RISK ANALYSIS

(3 Credits)

Course Outcomes
1. List and define the various Contingency Planning components. (Remembering)
2. Explain the escalation process from incident to disaster in case of security disaster. (Understanding)
3. Plan countermeasures to threats. (Applying)
4. Analyse risks. (Analysing)
5. Recommend contingency strategies including data backup and recovery and alternate site selection for business resumption planning. (Evaluating)
6. Design Incident Response Plan, Disaster Recovery Plan and Business Continuity Plan for sustained organizational operations. (Creating)

Module 1 (8 Hours)
SECURITY BASICS: Information Security (INFOSEC) Overview: critical information characteristics – availability information states – processing security counter measures education, training and awareness, critical information characteristics – confidentiality critical information characteristics–integrity, information states – storage, information states – transmission, security countermeasures -policy, procedures and practices, threats, vulnerabilities.

Module 2 (11 Hours)
Threats to and Vulnerabilities of Systems: definition of terms (e.g., threats, vulnerabilities, risk), major categories of threats (e.g., fraud, Hostile Intelligence Service (HOIS), malicious logic, hackers, environmental and technological hazards, disgruntled employees, careless employees, HUMINT, and monitoring), threat impact areas, Countermeasures: assessments (e.g., surveys, inspections), Concepts of Risk Management: consequences (e.g., corrective action, risk assessment),cost/ benefit analysis of controls, implementation of cost effective controls, monitoring the efficiency and effectiveness of controls (e.g., unauthorized or inadvertent disclosure of information), threat and vulnerability assessment

Module 3 (8 Hours)

Security Planning: directives and procedures for policy mechanism, Risk Management: acceptance of risk(accreditation), corrective actions information identification, risk analysis and/or vulnerability assessment components, risk analysis results evaluation, roles and responsibilities of all the players in the risk analysis process, Contingency Planning/Disaster Recovery: agency response procedures and continuity of operations, contingency plan components, determination of backup requirements, development of plans for recovery actions after a disruptive event, development of procedures for off-site processing, emergency destruction procedures, guidelines for determining critical and essential workload, team member responsibilities in responding to an emergency situation

Module 4 (7 Hours)
Policies and Procedures Physical Security Measures: alarms, building construction, cabling, communications centre, environmental controls (humidity and air conditioning), filtered power, physical access control systems (key cards, locks and alarms) Personnel Security Practices and Procedures: access authorization/ verification(need-to-know), contractors, employee clearances, position sensitivity, security training and awareness, systems maintenance personnel, Administrative
Security Procedural Controls: attribution, copyright protection and licensing, Auditing and Monitoring: conducting security reviews, effectiveness of security programs, investigation of security breaches, privacy review of accountability controls, review of audit trails and logs

Module 5 (8 Hours)
Operations Security (OPSEC): OPSEC surveys/OPSEC planning INFOSEC: computer security – audit, Cryptography-encryption (e.g., point-to-point network, link), cryptography-key management (to include electronic key), cryptography-strength (e.g., complexity, secrecy, characteristics of the key)

Module 6 (3 Hours)
Case study of threat and vulnerability assessment

Suggested Readings
1. Principles of Incident Response and Disaster Recovery, Whitman &Mattord, Course Technology ISBN:141883663X
2. (Web link) http://www.cnss.gov/Assets/pdf/nstissi_4011.pdf

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L			
CO 2	M	H	M	M		
CO 3		M	H	M	L	
CO 4			M	H	M	
CO 5			L	M	H	M
CO 6				L	M	H

CSCD0120: SECURE CODING
(3 Credits)

Course Outcomes
1. Recall the basics of secure programming. (Remembering)
2. Explain the most frequent programming errors leading to software vulnerabilities. (Understanding)
3. Identify security problems in software. (Applying)
4. Compare the solutions for handling security problems in software. (Analysing)
5. Assess the vulnerabilities present in software. (Evaluating)
6. Design and develop secure programs. (Creating)

Module 1 (10 Hours)
Introduction to software security, managing software security risk, selecting software development Technologies, An open source and closed source, Guiding Principles for software security, Auditing software, Buffet overflows, Access control, Race conditions, Input validation, Password authentication

Module 2 (6Hours)
Anti-tampering, protecting against denial-of-service attack, copy protection schemes, Client-side security, Database security, applied cryptography, Randomness and determinism

Module 3 (8 Hours)
Buffer Overrun, Format String Problems, Integer Overflow, and Software Security Fundamentals SQL Injection, Command Injection, Failure to Handle Errors, and Security Touch points

Module 4 (8 Hours)
Cross Site Scripting, Magic URLs, Weak Passwords, Failing to Protect Data, Weak random numbers, improper use of cryptography

Module 5 (8 Hours)
Information Leakage, Race Conditions, Poor usability, failing to protect network traffic, improper use of PKI, trusting network name resolution

Module 6 (5 Hours)
Case study of Cross Site Scripting, Magic URLs, Weak Passwords Buffer Overflows, Access control, Race conditions

Suggested Readings
1. J. Viega, M. Messier. Secure Programming Cookbook, O'Reilly.
2. M. Howard, D. LeBlanc. Writing Secure Code, Microsoft
3. J. Viega, G. McGraw. Building Secure Software, Addison Wesley

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M			
CO 3	L	M	H	M		
CO 4	L		M	H	M	
CO 5			L	M	H	M
CO 6				L	M	H

CSBI0121: BIOMETRICS
(3 Credits)

Course Outcomes
1. Define biometrics. (Remembering)
2. Explain the various modules constituting a biometric system. (Understanding)
3. Identify Biometric System Vulnerabilities. (Applying)
4. Compare the various Biometric technologies. (Analysing)
5. Evaluate the challenges and limitations associated with biometrics. (Evaluating)
6. Design security systems incorporating biometrics. (Creating)

Module 1 (7 Hours)
Introduction and Definitions of biometrics, Traditional authenticated methods and technologies.

Module 2 (10 Hours)
Biometric technologies: Fingerprint, Face, Iris, Hand Geometry, Gait Recognition, Ear, Voice, Palm print, On-Line Signature Verification, 3D Face Recognition, Dental Identification and DNA.

Module 3 (6 Hours)
The Law and the use of multi biometrics systems.

Module 4 (11 Hours)
Statistical measurement of Biometric.Biometrics in Government Sector andCommercial Sector.

Module 5 (9 Hours)
Case Studies of biometric system, Biometric Transaction. Biometric System Vulnerabilities.

Module 6 (5 Hours)
Recent trends in Biometric technologies and applications in various domains.Casestudy of 3D face recognition and DNA matching.

Suggested Readings
1. Biometrics for network security, Paul Reid, Hand book of Pearson
2. D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar, Handbook of Fingerprint Recognition,Springer Verlag,2003.
3. A. K. Jain, R. Bolle, S. Pankanti (Eds.), BIOMETRICS: Personal Identification in NetworkedSociety, Kluwer Academic Publishers, 1999.
4. J. Wayman, A.K. Jain, D. Maltoni, and D. Maio (Eds.), Biometric Systems: Technology,Design and Performance Evaluation, Springer, 2004.

5. Anil Jain, Arun A. Ross, Karthik Nanda Kumar, Introduction to biometric, Springer, 2011.
6. Biometric Systems: Technology, Design and Performance Evaluation, J. Wayman, A.K. Jain, D. Maltoni, and D. Maio.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M			
CO 3		M	H	M	L	
CO 4		L	M	H	M	
CO 5					H	M
CO 6					M	H

CSFA0122: FORMAL LANGUAGE AND AUTOMATA THEORY

(3 Credits-45 Hour)

Course Outcomes

1. Define basic terminology like Deterministic and Non deterministic automata, Pushdown Automata, Parse Tree, Regular Languages, Turing Machines etc. (Remembering)
2. Explain the concepts, core terms and tools used in automata theory.(Understanding)
3. Choose the techniques, components and tools of a typical automated machine and apply it in designing new machines. (Applying)
4. Identify which input pattern would be accepted by a Turing Machine, Pushdown Automata, Finite Automata etc. (Applying)
5. Compare and contrast various types of machines in Automata theory and relate it to everyday appliances like washing machines, fans, etc. (Analyzing)
6. Evaluate the correctness, computation cost and complexity for an automation. (Evaluating)
7. Design new automata and Turing machines for given problems by using most appropriate algorithmic strategy considering the problem domain. (Creating)

Module I: Theory of Automata (7 Hours)

Definition of an Automaton, Description of a Finite Automaton, Transition Systems, Properties of Transition Functions, Acceptability of a String by a Finite Automaton, Nondeterministic Finite State Machines, The Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata.

Module II: Formal Languages, Regular Sets and Regular Grammars (12 Hours)

Definition of formal languages, Chomsky Classification of Languages, Languages and Their Relation, Recursive and Recursively Enumerable Sets, Operations on Languages, Languages and Automata; Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma for Regular Sets, Application of Pumping Lemma, Regular Sets and Regular Grammars Exercises.

Module III: Context-free Languages (13 Hours)

Context-free Languages and Derivation tree, Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars, Pumping Lemma for Context-free Languages, Decision Algorithms for Context-free Languages Exercises

Module IV: Pushdown Automata Turing Machines and Linear Bounded Automata (13 Hours)

Basic Definitions, Acceptance by pda, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata; Turing machine Model, Representation of Turing Machine, Language Acceptability by Turing Machines, Design of Turing Machines, Universal Turing Machine and Other Modification, The Model of Linear Bounded Automaton, Turing Machines and Type 0 Grammars, Linear Bounded Automata and Languages, Halting Problem of Turing Machines, NP-Completeness.

Suggested Readings

1. K.L.P. Mishra, N. Chandrasekaran, Theory of Computer Science, BPB Publication, Prentice-Hall of India, Second Edition.
2. H.R. Lewis and C.H.Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall of India.
3. H.E. Hopcraft and J.D. Ullamn, Introduction to Automata Theory, Languages and Computation, Narosa Publications.
4. J.C. Martin, Introduction to Languages and the Theory of Automata, Tata McGraw-Hill International, 2003..
5. C.H. Papadimitriou, Computation Complexity, Addison-Wesley.
6. Linz Peter, An Introduction to Formal Languages and Automata,Narosa.
7. Kain, Theory of Automata and Formal Language, McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4

CO1	H			H
CO2	H	M		H
CO3		M		H
CO4	H		L	
CO5		M	H	
CO6	H			M
CO7		L		H

CSOS0123: OPERATING SYSTEMS

(3 Credits-45 Hours)

Course Outcomes

1. Elaborate what operating systems are, what they do and how they are designed and constructed. (Creating)
2. Define process concept like process scheduling, inter-process communication, process synchronization and concurrency. (Remembering)
3. Explain different memory management schemes, relate various approaches to memory management and effectiveness of a particular algorithm. (Understanding)
4. Identify different page replacement algorithms to solve problems. (Applying)
5. Explain how the file system, mass storage and I/O are handled in a modern computer system. (Remembering, Understanding)
6. Analyze the mechanisms necessary for the protection and security of computer systems. (Analysing)

Module I: Introduction (5 hours)

Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Module II: Processes (7 hours)

Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching, Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Module 3: Inter-process Communication (7 hours)

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Module 4: Deadlocks (5 hours)

Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Module 5: Memory Management (10 hours)

Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation, Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory, Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Module 6: (11 hours)

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Suggested Readings:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student

Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
4. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
5. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
6. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H	M			
CO 3		H	H	H		
CO 4			H	M		
CO 5				M	H	
CO 6				M	M	H

CSDC0124: DATA COMMUNICATIONS

(3 Credits-45 Hours)

Course Outcomes

1. Recall the fundamentals of data communication and various techniques of communications. Students will also be able to recall the layered structure of computer network. (REMEMBERING)
2. Explain about different network topology and the type of protocol required for different communication technique. (UNDERSTANDING)
3. Develop different network topology using various networking devices. (APPLYING)
4. Compare different networking devices. Students will also be able to analyse different network behaviour depending on performance parameters. (ANALYSING)
5. Evaluation of network performance based on implementation policy, protocol, topology etc. (Evaluating)
6. Construct networks required for organization, depending on availability of hardwares and softwares (CREATING)

Module I (12hours)

Introduction to data communications: A communications model, Data communications, Networking, Protocols and Protocol architecture, Characteristics of data transmission: Concepts and Terminology, Analog and digital data transmission, Transmission impairments. Transmission media: Guided transmission media, Wireless transmission data encoding, Digital data-Digital signals, Digital data- Analog signals, Analog data-Digital signals, and Analog data-Analog signals.

Module II (10 hours)

Data communication interface: Asynchronous and Synchronous transmission, Line configurations, Interfacing. Data link control, Flow control, Error detection, Error control, High-level data link control (HDLC), Other data link control protocols.

Module III (12 hours)

Data communications hardware: Terminals- Introduction, Basic terminal components, Enhanced terminal components, General-purpose terminals, Remote job entry terminals, Transaction terminals, Clustering of terminal devices. Communications processing hardware introduction, Switching processors, Multidrop lines, Multiplexers, Concentrators, Front-end processors.

Module IV (11 hours)

Modems: Network attachment and regulations, Line conditioning and leased lines, Modems and modem circuits. Multiplexing: Frequency-division multiplexing, Synchronous time- division multiplexing: Characteristics, TDM Link control, Digital carrier systems statistical time-division multiplexing: Characteristics.

Suggested Readings

1. William Stallings, Data and Computer Communications, Sixth Edition, Pearson Education Asia.
2. Prakash C. Gupta, Data Communications and Computer Networks, PHI
3. B.A. Forouzan, Data Communications and Networking, TMH.
4. William L. Scweber, Data Communication, McGraw Hill.
5. Tenenbaum, A. S., Computer Networks (Fourth Edition), New Delhi: Prentice-Hall India
6. Larry L. Peterson and Bruce S. Davie, Computer Networks: A systems approach, 3rd Edition, Morgan Kaufmann Publishers.
7. Mary E.S. Loomis, Data Communications, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4

CO 1	H			
CO 2	M	H		
CO 3		M	H	
CO 4			H	M
CO 5			M	M
CO 6				H

CSSE0127: SOFTWARE ENGINEERING

(3 Credits-45 Hour)

Course Outcome

1. Relate and recall the life cycle models of a software. (Remembering)
2. Classify and differentiate various software complexities. (Understanding)
3. Utilize different software architectures and identify the best feasible one. (Applying)
4. Examine and design any software product. (Analysing)
5. Formulate various design diagrams and find solutions to problems. (Creating)
6. Justify a practical solution towards a software applying development and also deploy a product of their own. (Evaluating).

Module I (7 Hours):

a. The Product and The Process: The Product - Evolving Role of Software, Software (Characteristics, Components and Applications;
b. The Process – Software Engineering A Layered Technology, The Software Process, Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Process Models (The Incremental Model, The Spiral Model, The Component Assembly Model, The Concurrent Development Model), The Formal Methods Model, Fourth Generation Techniques;
c. Project Management Concepts – The Management Spectrum (People, The Problem, The Process and The Project);
d. Software Process and Project Metrics – Measures, Metrics and Indicators, Metrics in the Process and Project Domains, Software Measurement, Reconciling Different Metrics Approaches, Metrics for Software Quality;
e. Software Project Planning – Observation on Estimating, Project Planning Objectives, Software Scope, Resources, Project Estimation Technique – Empirical estimation techniques (Expert Judgement Technique, Delphi Cost Estimation), Heuristic estimation techniques (COCOMO Model), Halstead Software Science (An Analytical Technique), The Make-Buy Decision;

Module II (7 Hours)

a. Project Scheduling and Tracking - Basic Concepts, The Relationship between People and Effort, Defining a Task set for the Software Project, Selecting Software Engineering Tasks, Defining a Task Network, Scheduling, The Project Plan;
b. Software Projects Risks, Quality Assurance and Configuration Management: Risk Management- Reactive Vs. Proactive Risk Strategies, Software Risk, Risk Identification, Risk Projection, Risk (Mitigation, Monitoring and Management), Safety Risks and Hazards, The RMMM Plan;
c. Software Quality Assurance - Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Statistical Quality Assurance, Software Reliability, The SQA Plan, The ISO 9000 Quality Standards;
d. Software Configuration Management - Software Configuration Management, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting;
e. System Engineering - Computer Based Systems, Product Engineering

Module III (15 Hours)

a. Analysis and Design: Analysis Concepts and Principles - Requirements Analysis, Communication Techniques, Analysis Principles, Software Prototyping, Specification, Specification Review;
b. Analysis Modeling- The Elements of the Analysis Model, Data Modeling, Functional Modeling and Information Flow, Behavioral Modeling, The Mechanics of Structured Analysis, The Data Dictionary;
c. Design Concepts and Principles - Software Design and Software Engineering, The Design Process, Design Principles, Design Concepts, Effective Modular Design, Design Heuristic for Effective Modularity, The Design Model, Design Documentation;
d. Design Methods - Data Design, Architectural Design, The Architectural Design Process, Architectural Design Optimization, Interface Design, Human-Computer Interface Design, Interface Design Guidelines, Procedural Design;
e. Design For Real Time systems - Real Time Systems;
f. Case studies on diagram - Use case, Class, Activity, Sequence

Module IV (8Hours)

a. Software Testing: Software Testing Methods - Software Testing Fundamentals, Test Case Design, White Box Testing, Basis Path Testing, Control Structure Testing, Black Box Testing, Testing for Specialized Environments;

b. Software Testing Strategies - A Strategic Approach to Software Testing, Strategic Issues, Unit Testing, Integration Testing, Validation Testing, System Testing, The Art of Debugging;
c. Technical Metrics for Software - Software Quality, A Framework for Technical Software Metrics, Metrics for the Analysis Model, Metrics for the Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Maintenance

Module V (7 Hours)

a. Object Oriented Software Engineering: Object Oriented Concepts and Principles - The Object-Oriented Paradigm, Object Oriented Concepts, Identifying the Elements of an Object Model, Management of Object-Oriented Software Projects
b. Object Oriented Analysis - Object Oriented Analysis, Domain Analysis, Generic Components of the Object-Oriented Analysis Model, The OOA Process, The Object Relationship Model, The Object Behavior Model
c. Object Oriented Design - Design for Object Oriented Systems, The Generic Components of the OO Design Model, The Systems Design Process, The Object Design Process, Design Patterns, Object Oriented Programming
d. Advanced Topics In Software Engineering: Cleanroom Software Engineering- The Cleanroom Approach, Functional Specification, Design Refinement and Verification, Cleanroom Testing
e. Software Reuse - Management Issues, The Reuse Process, Domain Engineering, Building Reusable Components, Classifying and Retrieving Components, Economics of Software Reuse
f. Reengineering - Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering, Economics of Reengineering.
g. Computer Aided Software Engineering - Case Definition, Building Blocks of Case, Taxonomy of Case Tools, Integrated Case Environments, The Integration Architecture, The Case Repository

Suggested Readings

1. Roger S. Pressman, Software Engineering A Practitioner's Approach, Fourth Edition, Tata McGraw Hill.
2. Rajib Mall, Fundamentals of Software Engineering, Second Edition, Prentice Hall of India Private Limited.
3. Ian Sommerville, Software Engineering, Sixth Edition, Addison Wesley, Pearson Education.
4. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals Of Software Engineering, Second Edition, Prentice Hall of India Private Limited, New Delhi, 2002.
5. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, Modern Systems Analysis and Design, Second Edition, Pearson Education.
6. Richard E Fairley, Software Engineering Concepts, Tata McGraw Hill Publishing Company Limited, New Delhi, 1997.
7. Hans Van Vilet, Software Engineering Principles and Practice, Second Edition, John Wiley and Sons, Ltd

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H	M			
CO 3		H	H	H		
CO 4			H	M		
CO 5			M	M	H	
CO 6				H	M	H

CSCD0128: COMPILER DESIGN

(3 credits- 45 hours)

Course Outcomes

1. Recall the application of compiler in program execution (Remembering)
2. Demonstrate the various types of parser and their merits and demerits. It also explains about error handling technique in compiler construction. (UNDERSTANDING)
3. Applying different parsing technique to input string. (APPLYING)
4. Compare and analysis different techniques of parsing. (ANALYSING)
5. Decide which parsing technique will be most suitable for any input given to them. Students will also be able to know how to convert the given grammar to its respective non-left recursive grammar if it requires for certain type of parsing technique. (EVALUATING).
6. Construct intermediate code generation, code optimization, run time environment etc. during compilation.(CREATING)

Module I (9 hours)

Introduction to compiling: Compilers – Analysis of the source program – Phases of a compiler – Cousins of the Compiler – Grouping of Phases – Compiler construction tools – Lexical Analysis. Role of Lexical Analyser –Input Buffering – Specification of Tokens.

Module II (9 hours)

Syntax Analysis: Role of the parser –Writing Grammars –Context-Free Grammars – Top Down parsing – Recursive Descent Parsing – Predictive Parsing – Bottom-up parsing – Shift Reduce Parsing – Operator Precedent Parsing – LR Parsers – SLR Parser – Canonical LR Parser – LALR Parser. Syntax Directed translation: Syntax Directed definition, Construction of syntax trees, Bottom Up Evaluation of S-Attributed Definitions.

Module III (15 hours)

a. Intermediate Code Generation: Intermediate languages – Declarations – Assignment Statements –Boolean Expressions – Case Statements – Back patching – Procedure calls.
b. Code Generation: Issues in the design of code generator – The target machine – Runtime Storage management – Basic Blocks and Flow Graphs – Next-use Information – A simple Code generator – DAG representation of Basic Blocks – Peephole Optimization.

Module IV (12 hours)

Code Optimization and Run time Environments: Introduction – Principal Sources of Optimization – Optimization of basic Blocks – Introduction to Global Data Flow Analysis – Runtime Environments – Source Language issues – Storage Organization – Storage Allocation strategies – Access to non-local names – Parameter Passing.

Suggested Readings

1. Compilers Principles, Techniques and Tools- Alfred Aho, Ravi Sethi, Jeffrey D Ullman, Pearson Education.
2. Introduction to Compiler Techniques- J.P. Bennet, Tata McGraw-Hill.
3. Compiler Construction: Principles and Practice Learning. - Kenneth C. Louden, Thompson.
4. Practice and Principles of Compiler Building with C- HenkAlblas and Albert Nymeyer, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2	M	M		
CO 3		H	M	
CO 4		M		
CO 5		M	M	
CO 6			M	H

CSNT0129: COMPUTER NETWORKS

(3 credits- 45 hours)

Course Outcomes

1. Define topology implementing different routing protocols that best suits a real time demand application, network and transport layer. (Remembering)
2. Explain the different network topologies, network, transport and application design issues and the importance of QoS in a network. (Understanding)
3. Solve different problems related to sub-netting, configuring working routing protocols in some model network topology and implement presentation layer security. (Applying)
4. Distinguish TCP from OSI and Analyze different layer protocols, sub-netting application layer security. (Analyzing)
5. Judge which protocol operate in which layer and why. (Evaluating)
6. Formulate the pros, cons and implementation of different IEEE based protocols. (Creating)

Module I (7 hours)

Review of OSI, TCP/IP models, Switching Techniques: Circuit Switching, Switching Techniques: Packet Switching, Multiple Accesses –RANDOM ACCESS-ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization.

Module II (9 hours)

X.25, ATM, LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 – FDDI - SONET –Bridges.

Module III (12 hours)

Network Layer: IP addressing methods, Subnetting, ARP, RARP, BOOTP, DHCP – Routing – Distance Vector Routing – Link State Routing – Routers.

Module IV (9 hours)

Transport layer: Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

Module V (8 hours)
Application Layer: Domain Name Space (DNS), EMAIL, Network Security-PLAYFAIR CIPHER, AES, DES, Public key cryptosystem and RSA, Message authentication code using Hash Function, Introduction to Kerberos.

Suggested Readings
1. Andrew S. Tanenbaum , Computer Networks, PHI
2. Larry L. Peterson and Bruce S. Davie, Computer Networks –A system approach.
3. Behrouz A. Forouzan, Data communication and Networking, Tata McGraw-Hill.
4. William Stallings, Data and Computer Communication, Pearson Education.
5. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	M1	M2	M3	M4	M5
CO 1			H	M	M
CO 2			M	H	M
CO 3			M		H
CO 4	H			L	
CO 5	L		H	L	
CO 6	M	H			

CSCG0134: GPU COMPUTING
(3 Credits)

Objectives
The objective of the course is to learn concepts of parallel programming, learn parallel programming with Graphics Processing Units (GPUs), implement programs on GPUs, and learn debugging and profiling of programs written for GPUs.

Course Outcomes
1. Describe the basic concepts of GPUs and parallel programming (Remembering)
2. Explain the hardware and software aspects of GPU (Understanding)
3. Use GPU for applications such as Image Processing, Graph algorithms, Simulations and Deep Learning. (Applying)
4. Analyze GPU programs to detect errors (Analyzing)
5. Evaluate the efficiency of GPU programs (Evaluating)
6. Develop GPU programs including programs for concurrent data structures and programs employing different synchronization techniques (Creating)

Module I (12 Hours)
Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU/GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA Open CL/Open ACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps/Wave fronts, Thread blocks/Workgroups, Streaming multiprocessors, 1D/2D/3D thread mapping, Device properties, Simple Programs

Module II (7 Hours)
Memory:Memoryhierarchy,DRAM/global,local/shared,private/local,textures,ConstantMemory,Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories

Module III (9 Hours)
Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU
Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

Module IV (7 Hours)
Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects
Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based-Synchronization - Overlapping data transfer and kernel execution, pitfalls.

Module V (5 Hours)
Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning

Module VI (5 Hours)

Advanced topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing.

Suggested Readings

1. Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wen-meiHwu; Morgan Kaufman; 2010 (ISBN:978-0123814722)
2. CUDA Programming: A Developer's Guide to Parallel Computing with GPUs; Shane Cook; Morgan Kaufman; 2012 (ISBN:978-0124159334)

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					M
CO 2	M	H	M			
CO 3		M	H	L		
CO 4		M	M	H	M	
CO 5				M	H	
CO 6			H	H		L

CSCL0135: CLOUD COMPUTING

(3 Credits)

Objectives:

- The student will also learn how to apply trust – based security model to real – world security problems.
- An overview of the concepts, processes, and best practices needed to success fully secure information within Cloud infrastructures.
- Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Course Outcomes

1. Basics of cloud computing(Remembering)
2. Understanding cloud computing architecture and cloud computing model(Understanding)
3. Identify security aspects of each cloud model (Applying)
4. Develop a risk management strategy for moving to the cloud (Analysing)
5. Implement a public cloud instance using a public cloud service provider (Evaluating)
6. Apply trust based security model to different layer (Creating)

Module I (8 Hours)

IntroductiontoCloudComputing

Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloudcomputing.

Module II (8 Hours)

Cloud Computing Architecture Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model

Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

Module III (8 hours)

Security Issues in Cloud Computing, Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security

Identity and Access Management, Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

Module IV (8 hours)

Security Management in the Cloud: Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS

Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications,

U.S. Laws and Regulations, International Laws and Regulations.

Module V (8 hours)

Audit and Compliance: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/ External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud

Module VI (5 hours)
ADVANCED TOPICS: Recent developments in hybrid cloud and cloud security

Suggested Readings
1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2,2009
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice),Tim Mather, ISBN-10: 0596802765, O' Reilly Media, September2009

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H				
CO 3		M	H	L		
CO 4		M	M	H	M	
CO 5			M	H	M	M
CO 6			H	H		L

CSCL0135: CLOUD COMPUTING

(3 credits)

Objectives:
- The student will also learn how to apply trust-based security model to real-world security problems.
- An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
- Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Course Outcomes
1. The basics of cloud computing(Remembering)
2. Illustrate cloud computing architecture and cloud computing model(Understanding)
3. Identify and apply security aspects of each cloud model (Applying)
4. Analyse a risk management strategy for moving to the cloud (Analysing)
5. Implement and evaluate a public cloud instance using a public cloud service provider (Evaluating)
6. Create a trust based security model to different layer (Creating)

Module I (10 Hours)
Introduction to Cloud Computing
Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

Module II (11 Hours)
Cloud Computing Architecture Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model
Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

Module III (10 hours)
Security Issues in Cloud Computing, Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security
Identity and Access Management, Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

Module IV (11 hours)
Security Management in the Cloud: Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS
Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications,

U.S. Laws and Regulations, International Laws and Regulations.

Module V ((8 hours)
Audit and Compliance: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/ External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud

Module VI (4 hours)
ADVANCED TOPICS: Recent developments in hybrid cloud and cloud security

Suggested Readings
1. Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009
2. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H				
CO 3			H	M		
CO 4			M	H	H	
CO 5					H	
CO 6						H

CSDD0136: DISTRIBUTED DATABASES

(3 Credits)

Objectives
The objective of course is to provide insight to distributed database, normalization techniques and integrity rules, and to learn about parallel database systems along with object oriented models.

Course Outcomes
1. Describe the concepts related to distributed database, normalization techniques and integrity rules, parallel database systems, and distributed object database management systems. (Remembering)
2. Explain concepts related to distributed DBMS architecture, query processing, transaction management, distributed concurrency control, distributed object database management systems etc. (Understanding)
3. Apply normalization to make efficient retrieval from database and query. (Applying)
4. Analyze design issues and efficiency of query statements. (Analyzing)
5. Choose appropriate distributed database design for a given application. (Evaluating)
6. Create distributed databases, parallel database systems, and object database systems for a given problem. (Creating)

Module I (10 Hours)
Introduction: Distributed Data processing, Distributed database system (DDBMS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS.

Module II (7 Hours)
Distributed DBMS Architecture: DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture. Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, Semantic Integrity Control.

Module III (8 Hours)
Overview of Query Processing: Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing.
Introduction to Transaction Management: Definition of Transaction, Properties of transaction, types of transaction. Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanisms, locking based concurrency control algorithms.

Module IV (7 Hours)
Parallel Database Systems: Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture.

Module V (8 Hours)

Distributed Object Database Management systems: Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing. Transaction management. Database Interoperability: Database Integration, Query processing.

Module VI (5 Hours)
Recent approaches, models and current trends in improving the performance of Distributed Database.

Suggested Readings
1. Principles of Distributed Database Systems, Second Edition, M. Tamer Ozsu Patrick Valduriez
2. Distributed Databases principles and systems, Stefano Ceri, Giuseppe Pelagatti, Tata McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H				
CO 3		M	H	L		
CO 4		M	M	H	M	
CO 5			M	H	M	M
CO 6				M	H	L

CSIS0137: IOT AND SMART CITIES

(3 Credits)

Objectives
- Explain the basic methodologies and techniques of the arts and humanities, social sciences, business, and science and technology
- To describe the current practices and future trends about smart city
- Capacity of critique the current practice and provide recommendations

Course Outcomes
1. List the various applications of smart cities (Remembering)
2. Explain the IoT reference architecture, fundamental knowledge of the sustainable and smart city (Understanding)
3. Identify different technologies used for sustainable smart cities (Applying)
4. Analyze the learnt knowledge to conduct a case study in an organized way. (Analyzing)
5. Estimate the ability to present the study clearly to audiences; Demonstration of critical thinking and discovering. (Evaluating)
6. Formulate the methods to design public mobile services aimed at efficiency, cost-saving and participation with attention for e-inclusion (Creating)

Module I (8 hours)
Introduction and Applications: smart transportation, smart cities, smart living, smart energy, smart health, and smart learning.

Module II (9 hours)
IoT Reference Architecture- methods to assist local governments to develop international good e-practice

Module III (8 hours)
Methods to redesign and redefine back and front offices in order to build smarter and transparent governments

Module IV (8 hours)
Methods to design public mobile services aimed at efficiency, cost-saving and participation with attention for e-inclusion

Module V (10 hours)
Methodologies for user involvement, profiling customers and identifying needs; test methodologies to transfer these needs in appropriate services; and test techniques to fit the right channel to the specific services and customers thereby setting a framework for a higher level of e-services in the NSR

Module VI (5 hours)
Pilot new service channels, bluetooth services for public transport, online forms in mobile phones and wireless city services

Suggested Readings
1. Smart City on Future Life - Scientific Planning and Construction by XianyiLi
2. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) byNicosKomninos
3. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H				
CO 3			H	M		
CO 4			M	H	H	
CO 5					H	
CO 6						H

CSEM0138: EMULATION AND SIMULATION METHODOLOGIES

(3 Credits)

Objectives

- This module teaches the fundamentals of simulation and emulation methodologies providing guidance on how to design a performance evaluation campaign
- Set up a test scenario, select the appropriate models, level of granularity
- Metrics for statistical correctness, and discuss the differences between simulation and emulation platforms and how to use them for accurate performance evaluation of communications.

Course Outcomes

1. Define and explain the fundamental concepts of Discrete Event Simulations. (Remembering)
2. Explain about the communication and networking techniques used in DES. (Understanding)
3. Identify the various Application-based Granularity Requirements. (Applying)
4. Analyze the performance evaluation of Statistical Tools (Analyzing)
5. Assess the evaluation of communications for ITS. (Evaluating)
6. Discuss the recent trends of simulation and emulation for IOT. (Creating)

Module I (8 hours)

Fundamentals of Discrete Event Simulations (DES)

Module II (8 hours)

Model-based representation for DES, from communication and networking, to mobility and data traffic.

Module III (8 hours)

Application-based Granularity Requirements: from bit-level, packet-level, to system-level evaluation, and their appropriate selection as a function of the application requirements.

Module IV (12 hours)

Fundamentals on Random Numbers, Fundamentals on Statistical Tools for Performance Evaluation, Simulation vs. Emulations

Module V (8 hours)

Case study for the evaluation of communications for ITS.

Module VI (4 hours)

Recent trends in simulation and emulation for IOT, model based and application based granularity presentation

Suggested Readings

Jack L. Burbank, An Introduction to Network Simulator 3, Wiley

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H				
CO 3			H			
CO 4				H		
CO 5					H	
CO 6					M	H

CSDM0139: DATA WAREHOUSING & MINING

(3 Credits)

Course Outcomes

1. Illustrate different classification, prediction, sequential pattern algorithms (remembering and Understanding)
2. Construct cluster, periodicity and social network analysis. (Applying)
3. Analyze technique to extract patterns from time series data and it application in real world (Analysing)
4. Apprise the Graph mining algorithms to Web mining (Evaluating)
5. Design computing framework for Big Data (Creating)

Module 1 (12 hours)
Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods; Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns.

Module 2 (15 hours)
Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis; Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis;

Module 3 (12 hours)
Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.

Module 4 (6 hours)
Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis

Suggested Readings
1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.
2. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley,2006.
3. G Dong and J Pei, Sequence Data Mining, Springer, 2007

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H			M
CO2		H		
CO3		M	H	
CO4				H
CO5			M	H

CSWI0140: WEB SEARCH& INFORMATION RETRIEVAL

Course Outcomes
1. Recall basic theories and analysis tools as they apply to information retrieval. (Remembering and Understanding)
2. Apply the understanding of problems and potentials of current IR systems. (Applying)
3. Analyze different retrieval algorithms and systems. (Analysing)
4. Evaluate various indexing, matching, organizing, and evaluating methods to IR problems. (Evaluating)
5. Formulate various theoretical IR research. (Creating)

Module 1 (15 hours)
Information retrieval model, Information retrieval evaluation, Searching the Web, Document Representation, Query languages and query operation, Meta-data search.

Module 2 (15 hours)
Indexing and searching, Scoring and ranking feature vectors, Ontology, domain specific search, parallel and distributed information retrieval.

Module 3 (10 hours)
Text and multimedia languages, Social networks.

Module 4 (5 hours)
Recent trends in Web search and Information retrieval techniques.

Suggested Readings
1. C. D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, CambridgeUniversity Press, 2008 (available at http://nlp.stanford.edu/IR-book).

2. Chakrabarti, S. (2002). Mining the web: Mining the Web: Discovering knowledge from hypertext data. Morgan-kaufman.
3. B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, AddisonWesley, 2009 (available at http://ciir.cs.umass.edu/irbook/).
4. R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 2011 (2ndEdition).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		H		
CO3		M	H	
CO4			M	H
CO5				H

CSDY0141: DATABASE SECURITY AND ACCESS CONTROL

(3 Credits)

Course Outcomes

1. Summarize the access control and implement classical models and algorithms. (Remembering and Understanding)
2. Identify the capabilities and limitations of various access control mechanisms. (Applying)
3. Analyze the data, identify the problems, and choose the relevant models and algorithms to apply. (Analysing)
4. Assess the strengths and weaknesses of various access control models and to analyze their behaviour. (Evaluating)
5. Design and develop access control mechanisms for enterprise IT infrastructures.(Creating)

Module 1 (15 hours)

Introduction to Access Control, Purpose and fundamentals of access control, brief history,Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control , Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations,

Module 2 (15 hours)

Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy, Biba Integrity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system, Temporal Constraints in RBAC, MAC AND DAC. Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multiline Insurance Company.

Module 3 (10 hours)

Smart Card based Information Security, Smart card operating system, fundamentals, design and implantation principles, memory organization, smartcard files, file management, atomic operation, smart card data transmission, ATR,PPS Security techniques- user identification , smart card security, quality, assurance and testing , smart card life cycle-5 phases, smart card terminals.

Module 4 (5 hours)

Recent trends in Database security and access control mechanisms. Case study ofRole-Based Access Control (RBAC) systems.

Suggested Readings

1. Role Based Access Control: David F. Ferraiolo, D. Richard Kuhn, RamaswamyChandramouli.
2. http://www.smartcard.co.uk/tutorials/sct-itsc.pdf : Smart Card Tutorial.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		H		
CO3		M	H	
CO5			H	

CSBA0142: BUSINESS ANALYTICS

(3 Credits)

Course Outcomes

1. Recall the scope of business analytics (Remembering)

2. Interpret the modeling relationships and trends in data, simple linear regression. (Understanding)
3. Experiment with knowledge of data analytics (Applying)
4. Analyze critically in making decisions based on data and deep analytics. (Analysis)
5. Asses technical skills in predictive and prescriptive modeling to support business decision-making.(Evaluating)
6. Adapt the ability to translate data into clear, actionable insights.(Creating)

Module 1 (8 hours)
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Module 2 (8 hours)
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Module 3 (8 hours)
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predictive Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

Module 4 (9 hours)
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.
Monte Carlo Simulation and Risk Analysis: Monte Carlo Simulation Using Analytic Solver Platform, New- Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Module 5 (8 hours)
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making.

Module 6 (4 hours)
Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Suggested Readings
1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2		H				
CO3		M	H			M
CO4				H		
CO5			M		H	
CO6				M		H

LABORATORY COURSES

CSDT6076: ADVANCED DATA STRUCTURES LAB
(3 Credits)

Course Outcomes:
1. Demonstrate and explain the various operations of Binary search trees. (Understanding)

2. Develop a program to implement B-Trees and 2-3 Trees. (Applying)
3. Develop a program and test for the pattern matching algorithms like Bayer-Moore and Knuth-Morris-Pratt algorithms. (Creating)
4. Demonstrate the implementation of compression algorithms using program. (Understanding)
5. Develop algorithms for text processing applications. (Creating)

Program List:

Experiment No.	**List of Experiments**
Module 1	
1	Implementation of BST and AVL trees.
2	Implementation of 2-3 trees, B-trees.
3	Implementation of Red Black Trees
Module 2	
4	Pattern matching using Boyer-Moore algorithm.
5	Knuth-Morris-Pratt algorithm for pattern matching.
Module 3	
6	Huffman Algorithm for data compression.
7	Finding Longest Common Subsequence using a dynamic programming technique.
8	Implementation of Standard tries, Suffix tries and Compressed tries
Module 4	
9	Construction of Priority Search Trees, Searching in a Priority Search Tree.
10	Construction of Priority range Trees
Module 5	
11	Implementation of Quad Trees

Suggested Readings:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H				
CO 3			M			
CO 4				H	M	
CO 5						H

CSML6077: MACHINE LEARNING LAB

(2 Credits)

Course Outcomes

1. Apply various classification algorithms to solve classification problem on real world data. (Applying)
2. Apply Clustering algorithms to solve any clustering problem. (Applying)
3. Analyse the performance of various classification algorithms. (Analysing)
4. Select appropriate models for solving a specific problem. (Evaluating)
5. Design neural network based classifiers to classify real world data. (Creating)

List of Experiments

1. Write a program to implement Linear Regression. Use an appropriate dataset to illustrate the working of linear regression.
2. Write a program to implement Decision Tree. Illustrate the classification of sample data using an appropriate dataset.
3. Write a program to demonstrate the classification of sample data using KNN algorithm.
4. Write a program to implement Bayes Classifier for the classification of sample data.
5. Write a program to implement logistic regression for the classification of sample data.
6. Write a program to implement Support Vector Machine. Illustrate the classification of sample data using an appropriate dataset.
7. Write a program to demonstrate the classification of sample data using Random Forest algorithm.
8. Performance analysis of various classification methods using standard matrices applied on confusion matrix.
9. Write a program to implement K-Means Clustering Algorithm.

10. Write a program to implement Agglomerative Clustering Algorithm.
11. Write a program to implement a classifier using MLP. Use appropriate dataset to demonstrate the process of classification.
12. Write a program to implement a sample CNN. Use appropriate dataset to test the performance of the classifier.
13. Implement transfer learning using state of art CNN models. Use appropriate dataset to test the performances of such models.

Mapping of COs to Syllabus

Course Outcome	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13
CO 1	H	H	H	H	H	H	H				H	H	
CO 2									H	H			
CO 3								H					H
CO 4											H		H
CO 5											H	H	

CSAA6078: ADVANCED ALGORITHM LAB

(3 Credits)

Course Outcomes

1. Recall and explain the fundamentals of design and analysis of basic data structures and experiment with the implementation process. (Remembering, Understanding, Applying)
2. Examine and evaluate the concepts in the specification and analysis of programs. (Analysing, Evaluating)
3. Elaborate the principles for good program design, especially the uses of data abstraction. (Creating)

Module 1:

1. Program to find Breadth First Search of a graph.
2. Program to find Depth First Search of a graph.
3. Program to find strongly connected components of a graph.
4. Implement Prim's algorithm to find a minimal spanning tree of a graph.
5. Implement Kruskal's algorithm to find a minimal spanning tree of a graph.
6. Implement Dijkstra's algorithm to find the shortest path in a graph.

Module 2:

1. Implementation of algorithms to compute a maximum weight maximal independent set.
2. Implementation of graph matching algorithms.
3. Implementation of Ford-Fulkerson Method to compute maximum flow.
4. Implementation of Edmond-Karp maximum-flow algorithm.

Module 3:

1. Implement Strassen's Algorithm.
2. Implement Floyd Warshall Algorithm.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	
CO 2	M	H	M
CO 3		M	H

CSDV6079: DATA VISUALISATION LAB

(2 credits)

Course Outcomes

1. Recall the design process to develop visualization methods and visualization systems, and methods for their evaluation. (Remembering)
2. Create and process data and visual mapping and the visualization (Creating).
3. Illustrate an understanding of large-scale abstract data. (Understanding)
4. Analyse data in various perspectives. (Analysing)

5. Evaluate the results generated from various applications. (Evaluating)
6. Create visualization methods for different applications. (Creating)

List of Experiments

1. Program to recursively subdivide a tetrahedron to form a 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.
2. Program to implement Liang-Barsky line clipping algorithm.
3. Program to draw a color cube and spin it using OpenGL transformation matrices.
4. Program to create a house-like figure and rotate it about a given fixed point using OpenGL functions.
5. Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.
6. Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral.
7. Program, using OpenGL functions, to draw a simple shaded scene consisting of a teapot on a table. Define suitably the position and properties of the light source along with the properties of the properties of the surfaces of the solid object used in the scene.
8. Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.
9. Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)
10. Program to display a set of values {fij} as a rectangular mesh. Project: 11. Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL..
11. Program to recursively subdivide a tetrahedron to form 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.
12. Program to implement Liang-Barsky line clipping algorithm.
13. Program to draw a color cube and spin it using OpenGL transformation matrices.
14. Program to create a house-like figure and rotate it about a given fixed point using OpenGL functions.
15. Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.
16. Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral.
17. Program, using OpenGL functions, to draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the properties of the surfaces of the solid object used in the scene.
18. Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.
19. Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.) Program to display a set of values {fij} as a rectangular mesh.
20. Project: 1. Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL.

CSEN6080: DATA ENCRYPTION AND COMPRESSION LAB

(3 Credits)

Course Outcomes

1. Recall the different encryption techniques adopted in both traditional and modern cryptographic mechanisms. (Remembering)
2. Interpret cryptographic algorithms, and their countermeasures. (Understanding)
3. Apply fundamental cryptographic approaches in solving related problems. (Applying)
4. Analyse the working of the different encryption and compression algorithms. (Analysing)
5. Compare and contrast the working of different data encryption and compression mechanisms. (Evaluating)
6. Choose appropriate encryption and compression algorithms to build real-world systems. (Creating)

Module 1:

1. Implementation of run length encoding
2. Implementation of Lempel-Ziv coding

Module 2:

1. Implementation of Huffman Encoding of a sequence
2. Implementation of Huffman Decoding of a compressed bit sequence.

Module 3:

1. Implementation of RC4 algorithm.
2. Implementation of S-DES algorithm for data encryption

Module 4:
1. Implementation of RSA Algorithm

Module 5:
1. Implementation of SHA
2. Implementation of MD5

Module 6:
1. Implementation of JPEG algorithm.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M			
CO 3		M	H	M		
CO 4			M	H	M	
CO 5				L	H	M
CO 6					M	H

CSDI6092: DISSERTATION- I / INDUSTRIAL PROJECT

(10 Credits)

Course Outcomes
1. Recall the enhanced research areas which can be undertaken (Remembering).
2. Illustrate the research gap within the topic that he / she undertakes (Understanding).
3. Apply algorithm to solve the problem stated (Applying).
4. Analyse and categorize the data to be collected to carry on with the research (Analysis).
5. To evaluate the outcome which is expected from the research (Evaluating).
6. Create and implement the methodology to have an outcome (Creation).

CSDI6093: DISSERTATION II

(16 Credits)

Course Outcomes
1. Recall and relate desertation phase I to identify the basic problem specific outcome (Remembering).
2. Illustrate the research gap within the topic that he / she undertake (Understanding).
3. Make use of the algorithm implemented in Phase I for accuracy (Application).
4. Compare the results with the existing system to identify its accuracy (Analysis).
5. Evaluate and summarize the outcome which is expected from the research (Evaluating).
6. Creating an outcome based on the methodology implemented (Creation).

EGRW0015: ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course)

Course Objectives: Students will be able to:
- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section of a research paper
- Understand the skills needed when writing a title for ensuring the good quality of paper at very first-time submission.

Module I (4 hours)

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Module II (4 hours)

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

Module III (4 hours)

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Module IV (4 hours)

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Module V (4 hours)

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed whenwriting the Discussion, skills are needed when writing the Conclusions

Module VI (4 hours)

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Readings

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg

EGRW0015: ENGLISH FOR RESEARCH TECHNICAL WRITING (Audit Course)

***Objectives**: Students will be able to:*

- *Understand that how to improve your writing skills and level of readability*
- *Learn about what to write in each section*
- *Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.*

Module I (4 hours)

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Module II (4 hours)

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

Module III (4 hours)

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Module IV (4 hours)

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Module V (4 hours)

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Module VI (4 hours)

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Readings

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg

SCHOOL OF TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

VISION

To be a recognized leader in Civil Engineering education and learning experiences providing state of the art education guided by innovativ42e research and consultancy, inclusive technology and managerial skills for industry as well as societal needs towards sustainable development.

MISSION

1. To make the department a center of excellence in Civil Engineering education which equips students with a strong conceptual foundation coupled with practical insight to meet the global industrial and environmental challenges.
2. To produce spiritually inspired socially committed and intellectually competent professionals of high caliber and strong ethical principles to serve the society and nation through teamwork and societal leadership.
3. To establish the department as a recognized center of research for developing sustainable solutions to engineering problems by providing knowledge base and consultancy services to the community.

PROGRAMME OUTCOMES

PO1. An ability to conduct field and laboratory experiments and interpret data in construction industry

PO2. An ability to design a system to meet desired needs within realistic constraints such as economic, environmental, social, safety and sustainability in construction industry

PO3. An ability to use the techniques, skills and modern engineering tools

PO4. An understanding of professional and ethical responsibility while working in construction industry

PO5. an ability to engage in life-long learning to update the knowledge in construction materials and management

PROGRAMME SPECIFIC OUTCOMES

1. Exhibit detailed professional knowledge in core sub-specializations of civil engineering including structural engineering, geotechnical engineering, hydraulic and environmental engineering and transportation engineering.
2. Demonstrate analytical and design skills using various technical supports.
3. Display the ability to tackle research projects and development works in various field of civil engineering using analytical, computational and experimental techniques.
4. Ability to integrate the knowledge gained from the various core and elective courses for collaborative and multi-disciplinary solutions of different civil engineering challenges.

Mapping of POs, PSOs vs. Courses

Course	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
Advanced Structural Analysis		H	M		H	H	H	H	M
Physico- chemical Processes of water and waste water	L	H	M		M	H	H	H	L
Advanced foundation Engineering		H	M		H	H	H	H	H
Advanced Hydrology		H	M			H	H	M	L
Hydraulic Structures						H	H	M	L
Air Pollution			H	H		H	H	H	L
Theory of Vibration	L		H	H	M	H	H	H	M
Geotextile in Civil Engineering			H		H	H	H	M	M
Ground Improvement Techniques	L	H	H	H	H	H	H	M	M

Earthquake resistant design of structures		H	H	H	M	H	H	M	H
Irrigation and drainage		H	H	H		H	M	M	L
Solid and hazardous Waste Management	M	H	H	H	L				
Structural Design Lab	H					H	H	M	L
Numerical Analysis Lab	H					H	L	H	L
Research Methodology and IPR	M								
Constitution of India				H					
Geotechnical Earthquake Engineering	L	H	H			H	H	H	M
Design of Substructures		H	H		M	H	H	H	M
Advanced steel Design		H	H			H	H	H	L
Fluvial Hydraulics	L	H	M		H	H	H	H	L
Advanced Fluid Mechanics	H	H	H			H	H	H	L
Pavement Analysis and Design	M	H	H		H	H	H	H	L
Design of Advanced Concrete Structures		H	H		H	H	H	H	M
Environmental Geotechnology	H	H	H	H	H	H	H	M	M
Soil Mechanics Lab	H	M	M	L	H	H	H	H	L
Computational Fluid Lab	H		H			H	H	H	L
Mini Project	H			H		H	H	H	H
English in Research paper writing				H				M	
Design of Prestressed Concrete Structures		H	H			H	H	M	M
Industrial waste treatment technology	M	M	M	H		H	M	H	H
Cost management of Engineering Projects		M	M	H	L	M	M	L	M
Earth retaining structures		H	H	M	M	M	M	H	H
Cement Composite Materials	M	H	H		M	H	L	H	H
Optimization Techniques in Civil Engineering		H	M		M	H	H		M
Environmental Impact Analysis and Assessment				H		M			M
Ground water Engineering	M	H			M	H	L	H	M
Dissertation Phase I	H			M	H	H	H	H	H
Dissertation Phase II	H			M	H	H	H	H	H

PROGRAMME: MTECH IN CIVIL ENGINEERING

DETAILED SYLLABUS

CVSA0108: ADVANCED STRUCTURAL ANALYSIS (L-T-P: 3-1-0)
(4 Credit- 60 hours)
Objectives:
The main objective of the course is to equip students with an advanced understanding of structural analysis techniques and their practical application in solving complex engineering problems. This course will develop the analytical skills of students, to tackle real-world structural engineering challenges effectively.

Course/Learning Outcomes:
At the end of the course, students will be able to:
CO1: Identify the physical significance of coefficients on structural behavior using various approaches. (Understanding)
CO2: Design large structural systems using Matrix analysis and advanced computational methods. (Create)
CO3: Examine the linear and nonlinear structures to ensure structural integrity under various conditions. (Analyze)
CO4: Develop the boundary values using approximate methods. (Create)
CO5: Evaluate the effectiveness of plastic analysis methods in predicting structural behavior. (Evaluate)

Module I: (13 hours)
Influence Coefficients: Physical significance, effects of settlements, temperature change and lack of fit, member approach and structure approach.
Applications to Simple Problems: Beams, plane trusses, plane rigid jointed frames and grids by structure approach and member approach.

Module II: (22 hours)
Matrix Method (Flexibility Method and Stiffness Method) of Analysis: Local coordinates and global coordinates, boundary conditions, solution of matrix equations and calculation of reactions and member forces, Introduction to finite element method.

Module III: (13 hours)
Boundary Value Problems (BVP): Approximate solution of boundary value problems, modified Galerkin method for 1-D BVP, Matrix formulation of the modified Galerkin method.
Plastic Analysis: Incremental plastic analysis, formation of plastic hinges.

Module IV: (12 hours)
Linear Element: Shape functions, solution for Poisson's equation, general One Dimensional equilibrium problem.
Non-Linear Element: Consideration of geometric and material nonlinearity in direct stiffness method, P-delta effects.

Suggested Readings
1. C. K. Wang. "Intermediate Structural Analysis", 1st edition (2017), Tata McGraw Hill.
2. W. Weaver Jr. and James M. Gere. "Matrix Analysis of Framed Structures", 3rd edition (1990), CBS Publishers.
3. W. McGuire, R. H. Gallagher and R. D. Ziemian. "Matrix Structural Analysis", 2nd edition (2020), Faculty Books.
4. Guo-Qiang Li and Jin-Jun Li. "Advanced Analysis and Design of Steel Frames", 1st edition, John Wiley & Sons Inc.
5. Pramod Singh. "Plastic Analysis and Design of Steel Structures", 1st edition (2008), Butterworth-Heinemann Ltd.

Mapping of COs to Syllabus:

	CO1	CO2	CO3	CO4	CO5
Module 1	H		L		
Module 2		H	M		
Module 3				H	H
Module 4		M	H		

CVPW0109: PHYSICO- CHEMICAL TREATMENT OF WATER AND WASTE WATER
4 Credits (4-0-0)
Objectives:
The goal is to provide a theoretical understanding of various chemical and physical unit operations, with direct application of these operations to the design and operation of water and wastewater treatment systems. Students will use the concepts learned in this class to better understand the design and operation of engineered and natural aquatic systems.

Course Outcomes:
On successful Completion of the course , students will be able to:
CO1: Assess and analyze the quality of water and wastewater by examining impurities, characteristics, and conducting various tests to ensure compliance with potable water standards.(Analyse)
CO2: Apply principles of unit operations and processes to design and operate the systems effectively (Create)
CO3: Utilize process techniques to enhance water and wastewater treatment and sludge treatment and understand mechanisms of treatment processes to , manage select suitable treatment system to execute different processes for treating and disinfecting water and wastewater and the sludge , ensuring compliance with quality standards(Analyse)
CO4: Assess the quantity of water and wastewater, understand the spectrum of particulate size distribution, and manage variation of flows to design efficient water and wastewater systems.(Evaluate)

Module I: 10 Hours
Quality of water and wastewater , Wholesome water , Impurity of water ,Characteristics of water,Examination of water ,Standards of potable water quality ,Characteristics of sewage,Examination of sewage ,Standards of quality of treated water and wastewater ,Quantity of water and waste water ,Waste water and gas flow , Water requirement for domestic and industrial purposes , Waste water formation and estimation ,Spectrum of particulate size distribution , Variation of flows.

Module II: 5 Hours
Purpose of screenings and terms: blinding, stratification , contamination , gradation, grading,Flow equalization Types of bar racks and screens Disposal of screenings Removal of oil, grease etc. Floatation Skimming tank Disposal of skimming.

Module III: 15 Hours
SEDIMENTATION - Principles of Sedimentation and Stokes' law applied to fluids Characteristics of the settleable solids ,Classification of sedimentation tanks for water and waste water Factors influencing sedimentation ,Deciding size of sedimentation tank for water and wastewater ,Standard design loading ,Detention period .
Coagulation – purpose, principle ,Types of coagulants and its suitability ,Determination of optimum coagulation dose,Feeding of coagulant and feeding devices ,Flocculation and flocculation tanks and design criteria of flocculator ,Clarifiers, its types and design criteria,Settling efficiency of particles .Grit removal

Module IV: 5 Hours
Theory of filtration- Mechanism for particle size , Hydraulics of filters , Types of filters and their flow direction, Filter clogging, Filter washing,Break through ,Deciding size of filter unit, Advances in filtration

Module V: 15 Hours

Chemical precipitation, Water and wastewater softening,Estimation of dose of chemical, Methods of softening - ammonia, borax, lye, lime-soda, chelating, Ion exchange method etc.,Methods of removal of dissolved solids - solar distillation gadgets and plants, direct freezing, reverse osmosis, electrolysis,Methods of disinfection -chlorination – chlorine dose, chlorine demand, application of chlorine,Use of various forms of chlorine, break through chlorination,Removal of colour

Module VI: 10 Hours

Sources of sludge- Estimation of bulk density of sludge, Estimation of rate of filtration. Principles of dewatering, Methods of dewatering and suitability, Thickening of sludge,Chemical conditioning, Elutriation of sludge, Vacuum and pressure filtration, Sludge lagging

Suggested Readings

1. Weber, W.J., “Physico-chemical Processess”, Wiley Interscience, 1983.
2. Eckenfelder W.W., “Industrial Water Pollution Control”, 2nd Ed., McGraw Hill, 1999.
3. Tchobanoglous G., Burton F.L., Stensel H.D., “Metcalf and Eddy Inc.- Waste Water Engineering Treatment and Reuse”, Tata McGraw-Hill, 2017
4. Arceivala S.J. and Asolekar S.R., “Wastewater Treatment for Pollution Control and Reuse”, 3rd Ed., Tata McGraw Hill, 2007.
5. Sincero A.P. and Sincero G.A., “Environmental Engineering – A Design Approach”, Prentice-Hall, 1996.
6. R.L.Droste, “Theory and Practice of Water and Wastewater Treatment”, John Wiley, 1997.
7. S. Vigneswaran and C. Visvanathan, “Water Treatment Processes: Simple Options”, CRC Press, 1995.

Mapping of COs to Syllabus

Module No.	CO1	CO2	CO3	CO4	CO5	CO6
I	H					H
II		H				M
III		H	H			
IV			H	H		
V	M			H		
VI					H	

CVAF0110: ADVANCED FOUNDATION ENGINEERING

4 credits-60 Hours (L:T:P:4:0:0)

Objective:

1. The students will be able to decide the type of foundations to be recommended for construction of different engineering structures
2. The students will be able to design different types of foundations

Course Outcomes:

CO1: Identify a suitable foundation system for a structure, methods of soil exploration, (understand)

CO2: Calculate Lateral earth pressure and retaining wall, Bearing capacity and settlement of shallow foundation, Analyse and design shallow foundations, and pile foundations.(Evaluate, Apply)

CO3: Evaluate the importance of raft foundation, analyse and design of well foundation.(Analyse , Apply)

CO4: Examine and discuss various machine foundations, Analyse and design Sheet piles and cofferdams, foundation on problematic soil. (Create)

Module 1: (10 hours)

Introduction: Foundation Engineering, Importance and Purpose, Classification and general requirement, Factors influencing the choice of a foundation, Selection of the type

Soil Exploration Introduction, Methods of exploration, Planning the exploration programme, Method of boring, Soil sampling and soil samplers, Vertical and lateral extent of borings, Field tests like

Penetration test (Standard Penetration Test, Static Cone Penetration Test, Dynamic Cone Penetration Test) Pressure meter tests, dialatometer test and field Vane shear test. Groundwater observations, Borehole logs, Site investigation reports

Module II: (15 hours)
Lateral Earth Pressure Theories and Retaining Walls [10 Hours]: Introduction, Effect of wall movement on Earth pressure, Earth pressure at Rest, Classical Earth Pressure Theories, Rankine's theory, Coulomb's theory, Yielding of wall of limited height, Graphical solution for coulomb's earth pressure, Trial wedge method for earth pressure, proportioning of retaining walls, Stability of retaining walls
Flexible Retaining Structures and Coffer Dams [3 Hours]: Introduction, Cantilever sheet pile wall, Anchored wall, Coffer dams

Module V: (10 hours)
Bearing Capacity and Settlement of Shallow Foundations [6 Hours]: Introduction, Basic Definitions and their relationship, Principle modes of soil failure, Bearing capacity by classical Earth pressure theory of Rankine, Pauker and Bell's bearing capacity theory of failure, Prandtl's theory of failure, Terzaghi's method of determining bearing capacity of soil, Effect of water table on bearing capacity, Extension of Terzaghis bearing capacity theory, Recent bearing capacity theories, Bearing capacity from In-situ tests (Plate load test), Types of settlement and their relationships. Allowable settlement and allowable bearing pressure, Steps involved in the proportion of footings. Design of shallow Foudation

Module VI: (8 hours)
Mat Foundations [4 Hours]: Introduction, Common types of mat foundation, bearing capacity and settlement of mat foundations Compensated foundation, Analysis of mat foundation.
Beams on Elastic Foundation

Module VII: (7 hours)
Pile Foundations [6 Hours]: Introduction, Types and uses of piles, Construction of piles, Selection of pile type, Types of foundations to suit subsoil conditions, Pile driving formula, Static pile load formulae, Load test on piles, Dynamics pile formulae, Pile capacity from in-situ tests. Group action of piles, Negative skin friction, laterally load piles, Piles subjected to uplift loads, Uplift capacity of piles, foundations/anchors under uplift loads, well foundation

Module VIII: (10 hours)
Well Foundations : Introduction, Types of wells or caissons, Components of a well foundation, Shapes of wells, Depth of a well foundation, Forces acting on well foundation, Lateral stability of well foundation, Construction and sinking of a well.
Foundations on problematic soils: Foundations for collapsible and expansive soil. : IS and IRC codal provisions, elastic theory and ultimate resistance methods for well foundations, foundations on problematic soils: foundations for collapsible and expansive soil.

Suggested Readings
1. "Foundation Analysis and Design" Joseph E.Bowels. McGraw-Hill International Editions, Fifth Edition, 1997
2. "Principles of Foundation Engineering" Braja M. Das, Fifth Edition, 2003. Thomson/Brookscole
3. "Basic and Applied soil mechanics "Gopal Ranjan and ASR Rao, Second Edition New Age International publishers,2000
4. "Soil mechanics and Foundation Engineering" K. R. Arora Standard Publisher Distribution 1997
5. "A Text Book of Soil Mechanics and Foundation Engineering in SI units "V.N.S. Murthy UBS Publishers Distributors Ltd.Fourth Edition 1993.
6. "A Text Book of Foundation Engineering", Dr. R.K.Poudel and R.Neupane, 1st Edition, 2006.
7. "Pile Foundation Analysis and Design" H.G.Poulos and E.H.Davis, John Wiley and Sons, 1980

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	H	L		
Module II	H			

Module III		H		
Module IV				H
Module V	L	H		
Module VI			H	
Module VII			H	
Module VIII				H

CVAH0111: ADVANCED HYDROLOGY

4 Credits 60 hours (L-T-P :3-1-0)

Objectives: The objective of this course is to provide students with an advanced understanding of the analysis and development of the basic tools for analysis of hydrologic processes, apply time series models for hydrologic data generation and forecasting, estimate the design flows and assess impact of climate change and Land use/Land cover on water availability.

COURSE OUTCOMES:

At the end of the course, students will be able to ,

CO1: Understand the hydrologic systems and hydrologic inputs(Understand)

CO2.Analyse the hydrologic abstractions, streamflow measurement and Unit hydrographs (Analyse)

CO3.Analyse and solve problems on Linear and Nonlinear models, Physically based models and hydrological routing.(Apply)

CO4. Analyse and solve problems on frequency analysis, time series analysis, impact of climate change and Land use/Land cover on basin response.(Evaluate)

Module I: (15 hours)

Introduction to hydrologic system and hydrologic budget, fundamental laws of hydrology; atmospheric water vapor, introduction to hydrologic Inputs like precipitation and its forms, snowfall and rainfall; measurement techniques and space-time characteristics.

Module II: (15 hours)

Introduction to Hydrologic Abstractions like infiltration, depression storage, evapotranspiration and its measurement techniques, space time characteristics and their modeling, introduction to stream flow measurement techniques, space-time characteristics, rating curves, introduction to Unit Hydrograph IUH, GIUH.

Module III: (15 hours)

Mathematical Modelling using Linear and Nonlinear models, physically based models, hydrological routing, flood forecasting.

Module IV: (15 hours)

Advanced method of frequency analysis, outliers, time series analysis, study the impact of climate change and Land use/Land cover on basin response.

Suggested Readings

1. Chow, V.T., Maidment, D.R. and Mays, W.L., "Applied Hydrology", McGraw Hill. 1988
2. Ojha, C.S.P., Berndtsson, R. and Bhunya, P., “Engineering Hydrology”, Oxford University Press. 200
3. Wanielista, M., Kersten, R. and Eaglin, R., “Hydrology”, John Wiley. 1997

Mapping of COs to Syllabus

	CO I	CO II	CO III	CO IV
Module I	**H**			
Module II		**H**		
Module III			**H**	
Module IV				**H**

CVHS0112: HYDRAULIC STRUCTURES

3 Credits 45 hours (L-T-P :3-0-0)

Objectives: The objective of this course is to provide students with an advanced understanding of the analysis and design of various types of hydraulic structures.

COURSE OUTCOMES
CO1: Understand the hydraulic structures for water resources projects(Understand)
CO2: Analyse the construction and design principles of embankment and gravity dam(Analyse)
CO3: Analyse and solve problems on dam outlet works and terminal structures(Apply)
CO4: Analyse and solve problems on dimensional analysis and design of physical models of hydraulic structures (Apply)

Module I: (10 hours)
Introduction: Hydraulic structures for water resources projects.

Module II: (15 hours)
Introduction to embankment dams, its types, design considerations, seepage analysis and control, stability analysis, construction techniques, introduction to gravity dam, forces acting on and failure of a gravity dam, stress analysis, elementary profile, design of gravity dam, other functional features of a gravity dam.

Module III: (10 hours)
Introduction to dam outlet works, types of outlet structures, ogee spillway, chute spillway, siphon spillway, side channel spillway, labyrinth and piano key weir, introduction to terminal structure, hydraulic jump types, stilling basin, roller bucket, ski jump basin, baffled spillway, drop structure.

Module IV: (10 hours)
Introduction to hydraulic modeling and its basic principles, dimensional analysis, design of physical models of hydraulic structures.

Suggested Readings
1. Peterka, A.J, "Hydraulic Design of Stilling Basins and Energy Dissipators", USBR Engineering Monographs No. 25". 1984
2. Design of Small Dams", Third Edition, Water Resources Technical Publication – US Bureau of Reclamation. 1987
3. Singh, B., and Varshney, R.S., "Embankment Dam and Engineering", Nem Chand and Brothers. 2004
4. Novak, P. and Nalluri, C., "Hydraulic Structures", Edition 4, Taylor & Francis. 2007
5. Creager, Justin and Hinds, "Engineering for Dams", Vol. I and II, John Wiley

Mapping of COs to Syllabus

	CO I	CO II	CO III	CO IV
Module I	**H**			
Module II		**H**		
Module III			**H**	
Module IV				**H**

CVAP0113: AIR POLLUTION AND CONTROL

Objective:
The objective of the course is to provide the understanding of causes and effects of air pollution and their controlling mechanisms. The course also imparts knowledge on the impacts of air pollution on policy, human health and various contemporary technological innovation for betterment of air quality.

COURSE OUTCOMES:
After Successful completion of this course, the student should be able to:
CO1. Identify several types of air pollution problems and the chemistry and physics affecting them(Understand)

CO2. Discuss (physical, chemical, biological, and social) mechanisms leading to impacts of air pollution on human health, welfare, and the environment. (Understand)
CO3. Discuss air pollution management practices (regulations, strategies, technologies).(Apply)
CO4. Analyze (quantitatively and qualitatively) impacts of air pollution management decisions on air quality, human health, and the environment. (Analyse)
CO5. Select methods for measurement, control, and prevention of air pollution.(Apply)

Module I: (10 Hours)
Air Pollution: Introduction and Impacts of air pollution on human health, vegetation, animals, building materials, structures, and atmosphere, soil and water bodies.Sources, classification and formation/transformation of air pollutants:
Indoor air pollution: sources, types and health impacts. Sampling, assessment and evaluation of Indoor air quality.

Module II:(15 Hours)
Meteorology and Atmospheric Stability.Lapse Rate, Plume Behaviour, and Air Quality Monitoring, Air Quality Index (AQI); Air Quality Modelling, Gaussian dispersion models: point, line and area source models;
Emissions Inventory: Transport, Industrial, Agricultural, Residential and Commercial sectors.
Global and regional environmental issues of air pollution: Ozone depletion, Climate change, Global warming, Acid rain.

Module III: (8 Hours)
Air pollution control devices, equipment and their design

Module IV: **(7 Hours)**
Air pollution emission standards, National and international policies, acts, rules and regulations
Emerging technologies and strategies to mitigate air pollution, Current challenges and way forward

Module V: (**5 Hours)**
Lab-based measurements of air pollutants.

Suggested Readings:
1. Wark, K., Warner, C.F., and Davis, W.T., "Air Pollution: Its Origin and Control", Addison-Wesley Longman. 1998.
2. Boubel, R.W., Fox, D.L., Turner, D.B., Stern, A.C., "Fundamentals of Air Pollution", Academic Press. 2005.
3. Seinfeld, J.H., Pandis, S.N., "Atmospheric Chemistry and Physics", John Wiley. 2006.
4. Lodge, J.P. (Ed.), "Methods of Air Sampling and Analysis", CRC Press. 1988.
5. Gurjar, B.R., Molina, L., Ojha, C.S.P. (Eds.), "Air Pollution: Health and Environmental Impacts", CRC Press. 2010.
6. MOOC course : https://onlinecourses.nptel.ac.in/noc23_ce14/preview

Mapping of COs to Syllabus

	CO I	CO II	CO III	CO IV	CO V
Module I	**H**				
Module II		**H**			**L**
Module III			**H**		**H**
Module IV				**H**	
Module V				**L**	

CVTV0114: THEORY OF VIBRATION
(3-0-0)

Objectives
The course deals with the dynamic analysis of structures and applications in design. The main objectives are listed below:

- To understand and apply the method to develop dynamic equation of motions
- To know the method to find out the response time history of structure subjected to different types of excitations.
- To be familiar with the analysis of single degree freedom, multi degree freedom and continuous system
- To know the numerical techniques to solve the problems in structural dynamics

COURSE OUTCOMES

After successful completion of the course , students will be able to:

CO1: Familiarize with the formulation of problems for dynamic analysis (Understand)

CO2: Develop equations of motions for SDF system and different approaches for solution(Apply)

CO3: Find the response of MDF and continuous systems using modal analysis(Evaluate)

CO4: Familiar with different numerical methods to find out the dynamic response of a system (Understand)

Module I Introduction (4 hours)

Importance of vibration analysis, effects of vibration, Nature of excitation, deterministic and random excitation, vibration terminology, Degrees of freedom, Mathematical modelling of dynamic system, initial value and boundary value problems, Types of vibration-Free and forced vibration, Characteristics of discrete systems.

Module II Single Degree Freedom system (12 hours)

Equation of motion, energy method, natural frequency of SDF, viscous damping, damped and undamped oscillation, free vibration response, underdamped, critically damped and overdamped system, logarithmic decrement. Forced vibration, response to harmonic excitation, support motion, vibration isolation, vibration measuring instruments, response to arbitrary excitation, Duhamel integral, concept of response spectra.

Module III Multidegree freedom system (8 hours)

Two degrees of freedom system, natural frequencies and normal modes, forced vibration of multi degree freedom system, mode superposition technique, orthogonality condition of normal modes, modelling of multistoried buildings, response of shear building to base excitation, Rayleigh's approximate method, state-space solution

Module IV: Numerical approach in Structural Dynamics (8 hours)

Numerical solutions of Duhamel integral, numerical Solution to Response using Newmark Method and Wilson Method, Numerical Solution for State Space Response using Direct Integration

Module V: Continuous system (8 hours)

Relation between discrete and continuous system, Axial vibration of rods, Bending vibrations of beams, boundary conditions and eigen value problems, mode shape functions and natural frequencies, orthogonality of mode shape functions, modal analysis.

Module VI: Special topics in Structural Dynamics (5 hours)

Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations of industrial machines, wave propagation

Suggested Readings

1. Thompson, W. T , "Theory of Vibration with applications", CBS Publishers, New Delhi, 1990
2. Meriovitch, L "Elements of Vibration Analysis", Mc Graw Hill Book Co., New York, 1996
3. Chopra, A. K, "Dynamics of Structures: Theory and Applications to Earthquake Engineering" , Prentice Hall of India, New Delhi, 2001
4. Clough R J; Penzien J, "Dynamics of Structures", Mc Graw Hill, New Delhi, 1993
5. Inman, D , "Engineering Vibration" Pearson, New Delhi, 2014
6. Paz, M and Kim , Y. H, "Structural Dynamics: Theory and Computation", Springer, 2018

Mapping of COs to Syllabus

Module No.	CO1	CO2	CO3	CO4
I	L			
II		M	H	H
III	M	H	H	M
IV		L	L	H
V				H
VI	H			

CVGT0115: GEOTEXTILE IN CIVIL ENGINEERING

(3-0-0=3)

Course objectives

The course is framed for Master Degree students with the following objects

- Understand different types of geotextiles
- Design of geotextiles for various geotechnical challenge
- Understand the usage of geotextiles in pavement construction, slope stability and drainage

Course Outcomes

CO1: Understand different types of geotextiles(Understand)
CO2: Summerise the properties and tests for geotextiles(Understand)
CO3: Design of reinforced soil earthen wall(Create)
CO4: Application to different Civil Engineering problems(Apply)

Module I Introduction (4 hours)

Introduction to Geotextiles, historical background, functions, reinforced earth-mechanism and concepts

Module II Types of geotextiles (6 hours)

Classification of geotextiles, woven, nonwoven and combined, natural fibres, manufacturing process

Module III Properties of geotextiles (10 hours)

Tensile strength, impact strength, resistance to stress induced crack, heat resistance and hydraulic properties, laboratory tests, quality control and assurance, sustainability aspects of using geotextiles.

Module IV Geogrid Reinforced Soil wall (10 hours)

Geo-grid reinforced soil wall, guide lines for design of reinforced slopes, geotextiles in road construction, controlling soil erosion, backfill pressure in bridge abutment

Module V Slope Stability (9 hours)

Slope stability analysis-finite and infinite slopes, in-situ slope stabilization, design of reinforced slope, embankments on soft soil

Module VI Drainage facility (6 hours)

Drainage facility improvement using geo synthetics, accelerated consolidation of soft clays using geosynthetics, geotextile tubes for dewatering and decontamination of soil.

Suggested Readings

1. Senthil Kumar R, “Textiles for Industrial Applications “ CRC Press
2. Koerner, R. M, “Geotextiles: From Design to Applications” Woodhead Publishing series
3. Koeerner, R. M, Designing with Geosynthesis, Prentice Hall
4. Shukla, S K, “Geosynthesis and their applications”, Thomas Telford Publishig, London UK

CVIT0116: GROUND IMPROVEMENT TECHNIQUES

3 credits - (L-T-P: 3-0-0)

Objectives: This course aims to provide students with a comprehensive understanding of ground improvement techniques and their applications to various soil conditions and construction

requirements. It covers mechanical, hydraulic, chemical and thermal modification methods as well as soil reinforcement with geosynthetics and promotes the ability to design and analyze stable and efficient reinforced soil structures.

COURSE / LEARNING OUTCOMES

CO1: Understand the need and different situations requiring ground improvement.
CO2: Explain and apply various mechanical and hydraulic modification techniques for ground improvement.(Understand)
CO3: Demonstrate knowledge of chemical modification techniques and their application.(Apply)
CO4: Understand and apply thermal modification techniques for ground improvement.(Understand)
CO5: Analyze and select appropriate soil reinforcement techniques for different scenarios.(Analyse)
CO6: Design and analyze structures using soil reinforcement techniques.(Create)

Module I: Introduction: Need for Ground Improvement, Different types of problematic soils, Emerging trends in ground Improvement.

Module II: Mechanical modification: Dynamic compaction, impact loading, compaction by blasting, vibro-compaction; pre-compression, stone columns; Hydraulic modification: dewatering systems, preloading and vertical drains, electro-kinetic dewatering

Module III: Chemical modification: Modification by admixtures, stabilization using industrial wastes, grouting

Module IV: Thermal modification: Ground freezing and thawing.

Module V: Soil reinforcement: Reinforced earth, basic mechanism, type of reinforcements, selection of stabilisation/improvement of ground using Geotextiles, Goegrid, geomembranes, geocells, geonets, and soil nails.

Module VI: Application of soil reinforcement: Shallow foundations on reinforced earth, design of reinforced earth retaining walls, reinforced earth embankments structures, wall with reinforced backfill, analysis and design of shallow foundations on reinforced earth, road designs with geosynthetics

Suggested Readings

1. S. K. Gulhati and M. Datta, "Geotechnical Engineering", Tata McGraw Hill.
2. H.R. Hausmann, "Principles of Ground Modification", McGraw-Hill Book Company.
3. Purushothama Raj. P, “Ground Improvement Techniques”, Firewall Media. Supplementary Readings
4. M. R. Hausmann, “Engineering Principles of Ground Modification”, McGraw-Hill Pub, Co.
5. P. Nicholson, “Soil Improvement and Ground Modification Methods”, Butterworth-Heinemann Ltd.
6. R. M. Koerner, “Designing with Geosynthetics”, Prentice Hall Inc

Mapping of COs to Syllabus

	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
I	H					
II	L	H				
III	L		H			
IV	L			H		
V	L	M	M	M	H	
VI	L	M	M	M	H	H

CVRD0117: EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

3 credits - (L-T-P: 3-0-0)

Objectives:

The course deals with the principles of earthquake resistant design of structures, measures to be taken to identify seismically deficient buildings and to improve their resistance. The main objectives are listed below:

- To understand the effects of earthquakes on structures
- To carry out lateral load analysis with reference to Indian standard codes
- To be familiar with earthquake resistant design of buildings
- To know the methods for improving earthquake resistance of buildings

Course Outcomes

After successful completion of the course , students will be able to ,

CO1: Familiarization with the damaging effects of earthquakes on different types of buildings (Understand)

CO2: Mode the structures to find dynamic characteristics needed to find seismic forces (Apply)

CO3: Estimate seismic forces on buildings using guidelines of Indian Standard codes(evaluate)

CO4: Understanding earthquake resistant design philosophy, design procedure and to improve earthquake resistance of the buildings.(Understand, Apply)

Module I: Effect of earthquake on structures (6 hours)

Earthquake and its consequences, force generation mechanics, factors affecting structural damage, seismic waves, intensity, magnitude and energy of an earthquake, measurement of ground motions, prominent past earthquakes.

Module II: Modelling of structure for seismic analysis (9 hours)

Basics of structural dynamics, SDF and MDF systems in modelling of structures for dynamic load, Time periods and modes of oscillation, resonance condition, role of damping, base excitation in structure, vibration transmission and isolation, concept of response spectrum.

Module III: Estimation of seismic forces in buildings (10 hours)

Philosophy of earthquake resistant design, lessons learnt from past earthquakes, seismic codes and guidelines, Seismic load calculation as per IS 1893- 2016, Seismic zones in India, Equivalent static approach, Dynamic analysis methods modal participation factors, combination of modes, unsymmetrical configuration of buildings and torsion.

Module IV: Earthquake resistant design of RC building (8 hours)

Earthquake resistant measures at planning stage, architectural features, horizontal and vertical layout of buildings, provisions of IS 4326-1993, Reinforced concrete framed buildings, capacity based design, beam-column joint in moment resistant frame, ductile detailing, provisions of IS 13920-13.

Module V: Earthquake resistant design of Masonry Buildings (6 hours)

Earthquake resistant design of masonry structures, stresses in brick wall due to lateral load, damaging effect of earthquakes and earthquake resistant features of masonry load bearing structures, seismic bands, improving earthquake resistance of low strength brick wall, provisions of IS 13828-1993.

Module VI: Geotechnical consideration and vulnerability studies (6 hours)

Geotechnical consideration in design of structures, liquefaction and its effects, measures to reduce liquefaction potential, vulnerability atlas of India, assessment of seismic vulnerability of buildings, retrofitting and rehabilitation of structures.

Suggested Readings

1. Dowrick D J, “Earthquake resistance Design for Engineers and Architects”, John Wiley and Sons, New York, 1987
2. Agarwal, P ; Shrikhande, M, “Earthquake resistant design of structures”, Prentice Hall of India, New Delhi, 2011
3. Chopra, A. K, “Dynamics of Structures: Theory and Applications to Earthquake Engineering” Prentice Hall of India, New Delhi, 2001
4. Arya, A. S, “Masonry and timber structures including earthquake resistant design”, Nemchand

and Brothers, Roorkee, 1987
5. Krishna J, Chandrasekaran A R, Chandra, B, "Elements of Earthquake Engineering", South Asian Publisher, New Delhi, 1976
6. Guidelines: Improving earthquake resistance of housing, Building Materials and Technology Promotion Council, New Delhi; 2000

Mapping of COs to Syllabus

Module No.	CO1	CO2	CO3	CO4
I	L			
II	M	H	H	
III	M	H	H	M
IV	L		M	H
V				H
VI				H

CVID0118: IRRIGATION AND DRAINAGE

(*3* credits) (L-T-P: *3*-0-0)

Objective:

To take up the basic concepts of irrigation and basic concepts of water, plants, and their interactions, as well as irrigation and drainage systems design. The structures involved the elementary hydraulic design of different structures and the concepts of maintenance shall also form part. To develop analytical skills relevant to the areas mentioned above, particularly the design of irrigation and drainage projects

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COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: Explain the objectives, types, and suitability of different irrigation methods, along with the concepts of soil-water relationships, crop evaporative needs, and irrigation efficiency.(Understand)

CO2: Apply various surface irrigation techniques and employ field measurement techniques for flow measurement.(Apply)

CO3: Design irrigation systems and evaluate drainage needs.(create)

Module I: (10 Hours)

Introduction, objectives of irrigation, type of irrigation and suitability; selection of irrigation method. Irrigation requirement, water balance, soil water relationships, water storage zone, infiltration. Flow of moisture through root zone, soil physical and chemical properties, crop evaporative and drainage requirements, irrigation efficiency and uniformity

Module II: (10 Hours)

Surface irrigation systems, types of surface systems, basin irrigation, border irrigation, furrow irrigation, field measurement techniques, flow measurement, flumes, weirs, irrigation events, advance, wetting, depletion and recession phases.

Module III: (10 Hours)

Infiltration, infiltrometer, ponding methods, soil water, tensiometers, neutron probe, time domain reflectometer, evapotranspiration, crop coefficient, leaf area index, FAO guide lines on evapotranspiration estimation.

Module IV: (10 Hours)

Fundamentals of surface irrigation hydraulics, continuity equation, momentum equation

Module V: (5 Hours)

Drainage principles, need for drainage, steady state equations, Hooghoudt, Kirkham, Dagan and Ernst equations.

Suggested Readings

1. Walker, W.R., and Skogerboe, G.V., "Surface Irrigation Theory and Practice", Prentice Hall, INC. 1987
2. Drainage Principles and Applications, "International Institute for Land Reclamation and Improvement", Wageningen. 1973
3. Michael, A.M., "Irrigation: Theory and Practice", Vikas Publishing House. 1978
4. Asawa, G.L., "Irrigation Engineering", New Age International Publishers. 1996
5. Majumdar, D.K., “Irrigation Water Management”, PHI Learning. 2009
6. Luthin, J.N., "Drainage Engineering", John Wiley. 1966

Mapping of COs to Syllabus

	CO1	CO2	CO3
Module I	H		
Module II	L	H	
Module III	L	H	
Module IV			M
Module V		M	H

CVSD0119: SOLID AND HAZARDOUS WASTE MANAGEMENT

3 Credits-(L-T-P:3-0-0)

Objectives:

1. Understanding of problems of municipal waste, biomedical waste, hazardous waste, e waste, industrial waste etc.
2. Knowledge of legal, institutional and financial aspects of management of solid wastes.
3. Become aware of Environment and health impacts solid waste mismanagement
4. Understand engineering, financial and technical options for waste management

COURSE OUTCOMES:

After completion of the course students should be able to:
CO 1: Comprehend the health and environmental impacts associated with solid waste management.(Understand)
CO 2:Perform sampling and characterization of solid waste.(Apply)
CO 3: Analyze hazardous waste constituents, addressing quality assurance and quality control (QA/QC) issues.(Analyze)
CO 4: Implement the steps in solid waste management, including waste reduction at the source, collection techniques, materials and resource recovery/recycling, transportation and disposal.(Apply)
CO 5: Develop sustainable waste management practices tailored to rural settings.(Apply)

Module I:

Solid Wastes: Origin, Analysis, Composition and Characteristics:Solid Waste- Types and classification Waste sources and generation rates Integrated Solid Waste Management System: Collection, Storage, Segregation, Reuse and Recycling possibilities, Transportation, Treatment / Processing and Transformation Techniques, Final Disposal. Factors influencing waste generation and health hazards ,Waste composition ,Waste collection , Characterization of wastes

Module II

Management of: Municipal, Biomedical, Nuclear, Electronic and Industrial Solid Wastes and the rules and regulations.Waste processing : Size and volume reduction Waste minimization, waste hierarchy and waste audit,Recycling of solid wastes.

Hazardous waste- Definition, sources, classification, collection and segregation,Hazardous waste characterization, treatment and disposal,Radioactive wastes

Module III

Composting ,Vermicomposting , Biogas production from solid waste,Thermal treatment of solid waste – Incineration Thermal treatment of solid waste – Pyrolysis and gasification

Module IV

Landfill disposal, Current Management Practices, Environmental audit, Pollution Prevention, Facility Development and operation, Site Remediation: Quantitative risk assessment, site and subsurface characterization, Containment,remedial alternatives.

Module V

Solid waste disposal – Sanitary landfilling- , Landfill leachate, Ground water contamination and gas management,Landfill bioreactors, Fly ash- Generation and management ,Fly ash management ,Solid waste management rules, 2016 , Hazardous and other waste (management and transboundary movement) amendment rules, 2016 Plastic waste management rules, 2016,Basel Convention on the control of transboundary movement of hazardous waste and their disposal ,Mechanical biological treatment of solid wastes

Module VI

Solid waste management in rural areas ,Swachh Bharat Abhiyan , Recent advances in solid waste management

Suggested Readings

1. Prüss A., Giroult E. and Rushbrook P. (1999) Safe Management of Wastes from Health-care Activities, Geneva, World Health Organization.
2. SW-846 (1980) Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Washington, DC, USEPA, Available at http://www.epa.gov/epawaste/hazard/ testmethods/sw846/index.htm.
3. Tchobanoglous G., Theisen H. and Vigil S. (1993) Integrated Solid Waste Management: Engineering Principles and Management Issues, New York, McGraw-Hill.
4. Vesilind P.A., Worrell W.A. and Reinhart D.R. (2001) Solid Waste Engineering, Australia, CL Engineering
5. qu Batstone R., Smith J.E. (Jr.) and Wilson D. (1989) The Safe Disposal of Hazardous Wastes-the Special Needs and Problems of Developing Countries, The World Bank Technical Paper No. 93, Vol. I, II and III, Washington, DC, The World Bank.
6. Central Public Health and Environmental Engineering Organization (CPHEEO) (2000) Manual on Municipal Solid Waste Management, New Delhi, Controller of Publications.
7. Freeman H.M. (1988) Standard Handbook of Hazardous Waste Treatment and Disposal, New York, McGraw-Hill.
8. E Resources: https://onlinecourses.swayam2.ac.in/ugc19_bt18/preview

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H	H			
Module II	H		H		
Module III					
Module IV	H				
Module V	M			H	
Module VI					H

CVGE0120: GEOTECHNICAL EARTHQUAKE ENGINEERING

3 credits - (L-T-P: 3-0-0)

Objectives: The aim of the course is to familiarise students with the causes and quantification of earthquakes and to familiarise them with the effects of earthquakes and the design criteria required for the design of various geotechnical structures.

COURSE / LEARNING OUTCOMES

Upon completion of this course, students will be able to

CO1: Demonstrate the principles of earthquake loading (Apply)

CO2: Quantify earthquake intensity and various ground motions(Evaluate))

CO3: Perform a deterministic and probabilistic seismic hazard analysis considering different soil properties and site conditions (Apply)

CO4: Analyse the liquefaction susceptibility of a site(Analyze)

CO 5: Design earthquake-resistant foundations, retaining walls, slopes etc.(Create)

Module I: Earthquake seismology: Causes of earthquake, Plate tectonics, Earthquake fault sources, Seismic waves, Elastic rebound theory, Quantification of earthquake, Intensity and magnitudes, Earthquake source models.

Module II: Earthquake ground motion: -Strong motion measurement, ground motion parameters and their estimation, seismic hazard analysis - deterministic and probabilistic, wave Propagation - Waves in a Semi- infinite body, layered body, attenuation of stress waves.

Module III: Ground response analysis: One, two and three-dimensional ground response analysis.

Module IV: Liquefaction and lateral spreading - Liquefaction related phenomena, Liquefaction susceptibility: Historical, Geological, Compositional and State criteria. Evaluation of liquefaction by cyclic stress and cyclic strain approaches, Lateral deformation and spreading, Criteria for mapping liquefaction hazard zones.

Module V: Seismic design of foundations, Seismic slope stability analysis: Internal stability and weakening instability and Seismic design of retaining walls.

Suggested Readings

1. S.L. Kramer, Geotechnical Earthquake Engineering, Pentice Hall, international series, Pearson Education (Singapore) Pvt. Ltd., 2004.
2. S.Saran, Soil Dynamics and Machine Foundation, Galgotia publications Pvt. Ltd., New Delhi 1999.
3. Ansal, Recent Advances in Earthquake Geotechnical Engineering and Microzonation, Springer, 2006.
4. Towhata, Geotechnical Earthquake Engineering, Springer, 2008.

Mapping of COs to Syllabus

Unit/COs	CO 1	CO 2	CO 3	CO 4	CO 5
I	H				
II	H	H			
III		M	H		
IV	L			H	
V	L	L	M	M	H

CVDS0121: DESIGN OF SUB-STRUCTURES

3 credits-45 Hours (L:T:P: 3:0:0)

COURSE OUTCOMES: At the end of the course, students will be able to

CO1. Decide the suitability of soil strata for different projects.(Understand)

CO2. Design shallow foundations deciding the bearing capacity of soil, and Analyze and design the pile foundation, foundation on expansive soil. (Apply)

CO3. Understand analysis methods for well foundation, Analyze and design of the machine foundation (Understand, Create)

Module I (10 hours): Shallow Foundation

Soil investigation – Basic requirements of foundation, types and selection of foundations, bearing capacity of soil, plate load test, design of reinforced concrete isolated, strip, combined and strap footings, mat foundation.

Module II (10 hours): Pile Foundation
Introduction, Types of pile foundations, load carrying capacity, pile load test, structural design of straight piles, configuration of piles, different shapes of pile cap, structural design of pile cap.

Module III (10 hours): Well Foundation
Types of well foundation, grip length, load carrying capacity, construction of wells, failures and remedies, design of well foundation, lateral stability

Module IV (8 hours): Machine Foundation
Introduction, types of machine foundation, basic principles of design of machine foundation, dynamic properties of soil, vibration analysis of machine foundation, design of foundation for reciprocating machines and impact machines, reinforcement and construction details, vibration analysis.

Module V (7 hours): Special Foundation
Foundation on expansive soils, choice of foundation, under-reamed pile foundation, foundation for concrete towers, chimneys, design of anchors, reinforced earth retaining walls.

Suggested Readings

1. "Foundation Analysis and Design" Joseph E.Bowels. McGraw-Hill International Editions, Fifth Edition, 1997
2. "Principles of Foundation Engineering" Braja M. Das, Fifth Edition, 2003. Thomson/Brookscole
3. "Basic and Applied soil mechanics "Gopal Ranjan and ASR Rao, Second Edition New Age International publishers,2000
4. "Soil mechanics and Foundation Engineering" K. R. Arora Standard Publisher Distribution 1997
5. "A Text Book of Soil Mechanics and Foundation Engineering in SI units "V.N.S. Murthy UBS Publishers Distributors Ltd.Fourth Edition 1993.
6. "A Text Book of Foundation Engineering", Dr. R.K.Poudel and R.Neupane, 1st Edition, 2006.
7. "Pile Foundation Analysis and Design" H.G.Poulos and E.H.Davis, John Wiley and Sons, 1980

Mapping of COs to Syllabus

	CO1	CO2	CO3
Module I	1	3	
Module II	1	3	
Module III			3
Module IV			3
Module V	1	3	

CVAS0122: ADVANCED STEEL DESIGN (3: 0: 0=3 CREDITS)

Objectives

The steel structures have found significant applications in different infrastructural projects as they offer various advantages over reinforced concrete construction. To understand the behaviour of steel structures and design philosophy, the course is framed for the post graduate students with following objectives:

- To apply the design principles in beams and frames
- To understand design philosophy and stability of beams and columns
- To apply the design methods for industrial buildings.

Course Outcomes

After Successful completion of the course , students will be able to :

CO1: Familiarize with plastic design of steel structures and its applications (Understand)

CO2: Understand failure criteria of tension member and stability of steel columns(Understand)

CO3: Understand the concept of shear centre in steel structure and calculation of stresses in unsymmetrical bending. (Evaluate)

CO4: Design components of industrial buildings(create)

Module I: Properties of Steel (5 hours)
Introduction, Types of structural steel, Mechanical Properties, Residual stress, stress concentration, hysteresis, ductility, Cold formed steel, hot rolled section, High performance and stainless steel.

Module II: Basis of Structural Design (10 hours)
Structural systems and integrity, Joints and mechanical fasteners, Design actions, Methods of Design- Allowable stress, plastic method, Load resistance Factor design, Strength and Drift Criteria: P-Δ Effect, Deformation Based Design; elastic and inelastic analysis, plastic analysis of steel structures, concept of plastic hinge and collapse mechanism, effect of axial force on plastic moment capacity, deflection at ultimate load.

Module III: Axially loaded member (10 hours)
Failure criteria of tension member, staggered bolts, stress concentration due to holes, stability of steel column, Buckling analysis, imperfection in column and its effect on the strength of column, compound columns for heavily loaded structures, Members subjected to combined axial force and bending moment, local buckling of flanges and webs, critical load for steel frames, torsional buckling, column base, design of anchor bolts

Module IV: Flexural member (8 hours)
Stability of Beams, laterally restrained beams, unrestrained beams, flexure-torsional buckling in unrestrained beam, Plastic design of continuous beams and frames, Built up beams, prevention of web buckling, stiffener design, steel-concrete composite construction, composite sectional properties, design of shear connector.

Module V: Unsymmetrical bending (6 hours)
Unsymmetrical steel sections, principal axes, maximum bending stress, shear centre and its calculation for steel section, design of beams under unsymmetrical bending.

Module VI: Industrial Building (6 hours)
Structural framing, selection of roofing and wall material, Roof trusses, Wind load calculations as per IS 875=Pt III, gantry girder, design of sections, columns and foundations.

Suggested Readings
1. Subramanian, N, “Design of Steel Structures”, Oxford University Press, 2008
2. Duggal S K, “Limit state design of steel structures”Tata Mc Graw Hill, New Delhi 2010
3. Neal, B. G, “Plastic Methods of Structural Analysis” Chapman and Hall London, 1977
4. Arya A S ; Ajmani A S, “Design of Steel Structures” Nemchand and Bros,Roorkee. 2011
5. IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.
6. IS-875 Pt III: 2015-“Design loads for building (other than earthquake), Wind load BIS New Delhi

Mapping of COs to Syllabus

Module No.	CO1	CO2	CO3	CO4
I	L			
II		H	H	M
III		M	H	H
IV		M	H	H
V			M	H
VI			M	H

CVFH0123: FLUVIAL HYDRAULICS
(*3* credits) (L-T-P:*3*-0-0)

Objective:
The primary objective of this course is to provide students with a comprehensive understanding of sediment dynamics in river systems. The course covers the properties of sediments, the mechanisms of

sediment transport, and the challenges associated with sediment problems. Students will learn to analyze and design stable channels and sediment control structures using both physical and mathematical models. Emphasis will be placed on practical applications such as bed level variations, local scour, degradation, aggradation, and reservoir sedimentation, along with the design of guide bunds and other river training banks.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1. Explain the properties of sediments, the challenges associated with sediment problems, and the concepts of incipient motion for both uniform and non-uniform sediments. (Understand)

CO2. Analyze the formation of bed forms and the factors contributing to channel resistance and evaluate sediment transport mechanisms, including bed load and suspended load transport, for both uniform and non-uniform bed materials. (Analyse)

CO3. Design stable channels and guide bunds and other river training banks, addressing issues such as bed level variations, local scour, degradation, aggradation, and reservoir sedimentation. (Create)

Module I : (10 Hours)

The sediment problems, properties of sediments, incipient motion of uniform and nonuniform sediments.

Module II : (10 Hours)

Bed forms and channel resistance. Bed load and suspended load transport for uniform and non-uniform bed material, total load equations, sediment sampling.

Module III: (15 Hours)

Stable channel design and sediment control. Bed level variations, local scour, degradation, aggradation and reservoir sedimentation. Physical and mathematical models.

Module IV: (10 Hours)

Design of guide bunds and other river training banks.

Suggested Readings

1. Garde, R.J., “River Morphology”, New International Publishers. 2006
2. Julien, P.Y., “Erosion and Sedimentation”, Cambridge University Press. 1998
3. Jansen, P.P.H., “Principals of River Engineering”, VSSD Publications. 1994
4. Garde, R.J. and Ranga Raju, K.G., "Mechanics of Sediment Transportation and Alluvial Stream Problems", Wiley Eastern Limited. 2006

Mapping of COs to Syllabus

	CO1	CO2	CO3
Module I	H		
Module II		H	L
Module III		M	H
Module IV			H

CVAF0124: ADVANCED FLUID MECHANICS

(*3* credits) (L-T-P:*3*-0-0)

Objective:

The subject Fluid Mechanics has a wide scope and is of prime importance in several fields of engineering and science. Present course emphasizes the fundamental underlying fluid mechanical principles and application of those principles to solve real life problems.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1. Understand and explain the kinematics of fluid flow and the equation of continuity. (Understand)

CO2. Apply standard 2D flow patterns, such as sources, sinks, and doublets, to construct complex flows through superposition and solve the Laplace equation using graphical, relaxation methods, and conformal mapping.(Apply)

CO3. Evaluate and analyze turbulent flows and interpret turbulence characteristics.(Evaluate, Analyse)

Module I: (5 Hours)
Kinematics of Flow: Equation of continuity in cartesian, polar and cylindrical coordinates.

Module II: (10 Hours)
Standard 2D Flow Patterns: Source, sink, doublet and their combinations, construction of flows by superposition, D'Alembert's paradox, Laplace Equation: Solution by graphical and relaxation methods, conformal mapping, solution by separation of variables

Module III: (8 Hours)
Laminar Flow: Derivation of Navier-Stokes equations – exact solutions for flow between parallel plates, Couette flow, flow near a suddenly accelerated plate and an oscillating plate.

Module IV: **(10 Hours)**
Boundary Layers: Similarity solutions of boundary layer equations, Falkner-Skan Wedge flows, Karman's momentum integral equations, Karman-Puhlhausen approximate solution, separation in boundary layer under adverse pressure gradient, turbulent boundary layer.

Module V: (12 Hours)
Turbulent Flows: Reynolds equations of motion, semi-empirical theories of turbulence, velocity profiles for inner, outer and overlap layers, equilibrium boundary layers. Measurement of Turbulence and Statistical Theory of Turbulence: Isotropic and homogeneous turbulence, probability density functions, correlation coefficients, decay of isotropic turbulence.

Mapping of COs to Syllabus

	CO1	CO2	CO3
Module I	H		
Module II	L	H	
Module III		H	
Module IV		M	L
Module V			H

Suggested Readings

1. White, F.M., "Fluid Mechanics", McGraw-Hill. 1979
2. Schlichting, H., "Boundary Layer Theory", McGraw-Hill. 1979
3. Garde, R.J., "Turbulent Flow", Wiley Eastern Limited. 1994
4. Pope, S. B., "Turbulent Flows", Cambridge University Press. 2000
5. Rouse, H., "Advanced Mechanics of Fluids", John Wiley and Sons. 1959
6. Ojha, C.S.P., Berndtsson, R. and Chandaramouli, P.N., "Fluid Mechanics", Oxford University Press. 2010

CVPA0125: PAVEMENT ANALYSIS AND DESIGN
(3 credits — 45 hours) (L-T-P:3-0-0)
Objectives: *The objective of the course is to provide postgraduate students with a thorough understanding of the principles and practices involved in the design of flexible and rigid pavements. The course covers analytical methods for pavement analysis, selection of design input parameters, material characterisation, drainage, and failure criteria. Students will learn to design pavements using various methods, compare different design approaches, and design overlays and drainage systems, enhancing their expertise in pavement engineering.*

COURSE /LEARNING OUTCOMES
At the end of the course students will be able to:
CO1: Understand the fundamental principles behind the design of flexible and rigid pavements, demonstrating foundational knowledge in pavement engineering. (Understand)

CO2: Analyse and apply various analytical methods to evaluate pavement structures, enhancing their analytical and problem-solving skills. Analyse. Apply)
CO3: Evaluate design inputs, critically assess and select appropriate pavement design input parameters such as traffic loading, volume, and material properties, ensuring accurate and reliable design. (Evaluate)
CO4: Design flexible and rigid pavements using different methodologies, showcasing their ability to synthesise and apply theoretical knowledge to practical scenarios. (Apply)
CO5: Evaluate and compare different pavement design approaches, including overlays and drainage systems, to determine the most effective solutions, demonstrating their capacity for critical thinking and optimisation.(Evaluate)

Module I: Fundamentals and Philosophy of Pavement Design (8 hours)

a) Introduction to pavement types: flexible and rigid pavements, Basic principles and philosophies underlying pavement design, Functional requirements of pavements: structural and serviceability considerations.
b) Analytical methods for pavement analysis: empirical, mechanistic-empirical, and theoretical approaches, Stress-strain behaviour of pavement materials under load.

Module II: Pavement Design Input Parameters and Material Characterisation (10 hours)

a) Traffic data collection and analysis for pavement design, Load equivalency factors and load spectra, Impact of axle loads and tire pressures on pavement performance.
b) Material properties and characterisation techniques for pavement materials, Failure criteria for flexible and rigid pavements, Reliability concepts in pavement design and performance prediction.

Module III: Design Methods for Flexible and Rigid Pavements (17 hours)

Design methodologies for flexible and rigid pavements, Mechanistic-empirical design approaches for both flexible and rigid pavements, Software tools for pavement design

Module IV: Comparative Approaches, Overlays, and Drainage Systems (10 hours)

Comparative analysis of different pavement design approaches: strengths and limitations, Design and rehabilitation of pavement overlays: flexible and rigid, Advanced drainage system design and its integration with pavement structures.

Suggested Readings

1. Yang and H. Huang, Pavement Analysis and Design, Pearson Prentice Hall, 2004.
2. Yoder and Witzech, Pavement Design, McGraw-Hill, 1982.
3. Sharma and Sharma, Principles and Practice of Highway Engg., Asia Publishing House, 1980.
4. Teng, Functional Designing of Pavements, McGraw- Hill, 1980.

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4	CO5
Module I	H			L	L
Module II	L	H	L		
Module III		H	H	M	L
Module IV	M	L	M	H	H

CVCS0126: DESIGN OF ADVANCED CONCRETE STRUCTURES

Credit: 3 (L:T:P-3:0:0)

Objective:

The objective of this course is to provide students with an advanced understanding of the principles and practices involved in the structural design of reinforced concrete and steel structures.

COURSE OUTCOMES

At the end of the course, students will be able to

CO1: Evaluate different design approaches and select appropriate methodologies for analyzing and

designing structural systems.(Evaluate)
CO2: Design reinforced concrete structures with advanced techniques using various relevant design codes and able to apply them in practical design scenarios.(create)
CO3: Analyze various steel structures for various engineering applications applying relevant standards such as IS code, AISC standards, and Eurocode. (Analyse)
Module I: (8 hours)
Design Philosophy: Modeling of Loads, Material Characteristics, principles that prioritize safety, durability, sustainability, and efficiency.

Module II: (22 hours)
Reinforced Concrete Structure: Axial load (P) - Bending moment (M), M-phi Relationships, Strut-and-Tie Method, Design of Deep Beam and Corbel, Design of Shear Walls, Compression Field Theory for Shear Design, Design against Torsion; IS, ACI and Eurocode.

Module III: (15 hours)
Steel Structures: Stability Design, Torsional Buckling - Pure, Flexural and Lateral, Design of Beam-Columns, Fatigue Resistant Design, IS code, AISC Standards and Eurocode.

Mapping of COs to Syllabus

	CO1	CO2	CO3
Module I	H		
Module II		H	
Module III			H

CVEG0127: ENVIRONMENTAL GEOTECHNOLOGY

3 Credits: 45 Hours (L:T:P-3:0:0)
Objectives:
The main objectives of this course are:
1. To understand the soil-environment interaction, Soil mineralogy and Mechanisms of soil-water interaction
2. To learn ground water flow and contaminant transport phenomenon.
3. To Learn about the principles and practices of waste management, including the design and construction of landfills, hazardous waste containment systems, and other waste disposal methods.

Course Outcomes:
After Successful completion of the course students will be able to:
CO1: Understand Soil-environment interaction, Soil mineralogy and Mechanism of soil-water interaction (Understand)
CO2: Demonstrate a thorough understanding of the physical, chemical, and biological processes that govern the behavior and transport of contaminants in soil and groundwater.(Apply)
CO3: Apply principles of geotechnical engineering to design effective waste management systems, including landfills and hazardous waste containment systems.(Apply)
CO4: Select and implement appropriate remediation technologies for various types of contaminated sites, assessing their effectiveness and limitations.(Understand, Apply))

Module I: [8 hours]
Introduction to Geo Environmental Engineering., Sources & Impact of Contamination and Soil-Waste Interaction**.**
Concepts of Integrated SWM & Geoenvironmental Engineering.

Module II: [7 Hours]
Concepts of waste containment; Sources, production and classification of wastes, Environmental laws and regulations, ground water flow and contaminant transport,desirable properties of soil; contaminant transport and retention; contaminated site remediation.

Module II: [10 Hours]

Mechanisms of soil-water interaction: Diffuse double layer models; Force of attraction and repulsion; Soil-water-contaminant interaction; Theories of ion exchange; Influence of organic and inorganic chemical interaction

Principles and Planning of Landfills,Liners for Landlls,Landfill Covers, Generation and Control of Leachate and Gas from Landlls,Stability of Slopes and Settlement of Landlls

Module III: [10 Hours]

Contaminant analysis. Contaminated site characterization, estimation of landfill quantities, landfill site location, design of various landfill components such as liners, covers, leachate collection and removal, gas generation and management, ground water monitoring, end uses of landfill sites.

Solved examples, Monitoring and Detection of Subsurface Contamination, Costs, Construction Aspects and Site Selection of Landlls. Control, Rehabilitation of Old Dumps and Contaminated Sites.

Module IV: [10 Hours]

Slurry Deposited Waste and their Geotechnical Properties .Planning & Design, Incremental Raisings and Failures of Slurry Ponds ,slurry walls and barrier systems, design and construction, stability, compatibility and performance, remediation technologies,stabilization of contaminated soils and risk assessment approaches. Environmental Control Measures at Slurry Ponds, Geotechnical Reuse of Waste

Suggested Readings

1. Mitchell, J.K and Soga, K., Fundamentals of Soil Behavior, John Wiley and Sons Inc., 2005.
2. Fang, H-Y., Introduction to Environmental Geotechnology, CRC Press,1997.
3. Daniel, D.E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993.
4. Rowe, R.K., Quigley, R.M. and Booker, J.R., Clay Barrier Systems for Waste Disposal Facilities, E & FN Spon, 1995.
5. Rowe, R.K, Geotechnical and Geoenvironmental Engineering Handbook, Kluwer
6. Academic Publishers, 2001.
7. Reddi, L.N. and Inyang, H.F, Geoenvironmental Engineering - Principles and Applications, Marcel Dekker Inc, 2000.
8. Sharma, H.D. and Lewis, S.P, Waste Containment Systems, Waste Stabilization and Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994.
9. Moocs Course :https://archive.nptel.ac.in/courses/105/102/105102160/

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4
Module I	H			
Module II	M	H		
Module III			H	M
Module IV				H

CVPS0128: DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Credit: 3 (L:T:P-3:0:0)

Course Objective:

The objective of the course is to provide students with a comprehensive understanding of the principles and practices involved in the design and analysis of prestressed concrete systems. At the end of this course, students will be equipped with the necessary knowledge and skills to effectively design and analyze prestressed concrete structures, preparing them for professional practice in the field of civil and structural engineering.

Course Outcomes: At the end of the course, students will be able to

CO1: Identify different prestressing systems and understand the behavior of high-strength concrete and high-strength steel.

CO2: Perform deflection and crack width calculations to assess the serviceability of prestressed concrete structures under various loading conditions(Evaluate)

CO3: Perform analysis and design of prestressed flexural members for limit states of collapse, serviceability, shear and torsion(Apply)
CO4: Analyze the transmission of prestress in anchorage zones and design the end blocks.(Analyze)
CO5: Perform analysis and design of statically indeterminate members leading to the determination of cable profile (Apply)

Module I: (4 hours)
Concept of Prestressing, Types of Prestressing, Advantages, Limitations, Pre stressing systems - Pre-tensioning and Post tensioning methods, Anchoring devices, Materials - High strength concrete and High strength steel, Stress-Strain curve for High strength concrete, Analysis of prestressed concrete flexural members – Basic concepts, Ultimate strength in flexure – Codal provisions.

Module II: (5 hours)
Losses in Pre stress: Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel, Deflection and Crack Width Calculations - Deflection due to gravity loads, Deflection due to prestressing force, Total deflection, Limits of deflection, Limits of span-to-effective depth ratio, Calculation of Crack Width - Limits of crack width.

Module III: (14 hours)
Statically Determinate members – Analyze and Design flexural members for ultimate and serviceability limit states, Analyze and design for Shear and Torsion, Codal provisions

Module IV: (14 hours)
Design of End Blocks - Transmission of prestress in Pre-tensioned members, Anchorage zone stresses for Post-tensioned members.

Module V: (8 hours)
Statically Indeterminate members - Analysis and design of continuous beams and frames, Choice of cable profile, Linear transformation and concordancy, Analysis and design of prestressed concrete pipes and columns with moments.

Suggested Readings
1. Prestressed Concrete**,** Author**:** N. Krishna Raju**,** Publisher: McGraw-Hill**.**
2. Design of Prestressed Concrete Structures, Author: T.Y. Lin and Ned H. Burns, Publisher: John Wiley and Sons.
3. Prestressed Concrete: A Fundamental Approach, Author: Edward G. Nawy, Publisher: Pearson College Div.
4. Principles of Prestressed Concrete, Author: N. Rajagopalan, Publisher: Narosa Book Distributors
5. Prestressed Concrete Structures, Author: P. Dayaratnam, Publisher: Medtech
6. IS 1343: Code of Practice for Prestressed Concrete, Publisher: Bureau of Indian Standards
7. IRC 112: Code of Practice for Concrete Road Bridges, Publisher: The Indian Roads Congress

Course Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4	CO5
Module I	H				
Module II		H			
Module III			H		
Module IV				H	
Module V					H

CVWT0129: INDUSTRIAL WASTE TREATMENT TECHNOLOGY
[3-0-0]
Objectives:
This course aims to provide a comprehensive understanding of the characteristics and environmental impacts of industrial wastewater. Students will learn about the physico-chemical and biological

treatment methods, and sludge management. This course equips students with the knowledge and skills to develop sustainable and efficient industrial waste treatment solutions.

COURSE OUTCOMES:
Upon completing the course students will be able to:
CO1:Analyze and Characterize Industrial Wastewater.?(Analyze)
CO2: Design and Implement Waste Minimization Strategies.(Apply)
CO3: Apply Physico-Chemical and Biological Treatment Methods for Industrial waste water.(Apply)
CO4: Manage the production of Sludge and its treatment.(Understand , Apply)
CO5: Evaluate and Implement Wastewater Reuse Systems. (Apply)

Module I [5 Hours]
Industrial wastewater – Characteristics – Environmental impacts – Effects of industrial wastes on streams, land – Effluent standards – Scenario in India –

Module II [10 Hours]
Regulatory requirements for industrial wastewater – Prevention Vs control of industrial pollution – Volume reduction – Process Modification – Strength reduction – Methods and materials changes – Waste minimization strategies – Zero discharge concept.

Module III [10 Hours]
Physico-chemical treatment of industrial wastewater – Equalization and neutralization – Separation of solids – Removal of organic and inorganic solids – Oil separation – Precipitation – Membrane methods – Reverse Osmosis – Biological treatment methods – Aerobic and anaerobic methods.

Module IV[10 Hours]
Separation Vs degradation methods – Chemical oxidation – Phototcatalysis – Ozonation – Ion exchange – Advanced oxidation processes – Electrochemical methods – Nutrient removal – Land treatment – Sludge production and its management – Quantification and characteristics of sludge – Treatment of sludge and its disposal.

Module V[10 Hours]
Reuse of industrial wastewater – Advantages – Quality requirements for reuse – Zero effluent discharge systems – Residuals of industrial wastewater treatments – Individual and common effluent treatment plants.

Suggested Readings
1. Eckenfelder, W. W., Industrial Water Pollution Control, McGraw Hill, 2014.
2. Nemerow N. L., Industrial Water Pollution, Addison-Wesley Publishing Company Inc., USA, 1978.
3. Narayana Rao M. and Amal K. Dutta, Wastewater Treatment, Oxford & IBH Publishing Co., Pvt., Ltd., New Delhi, 2001.
4. Bhatia S. C., Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003
5. Mahajan, S. P., Pollution Control in Process Industries, Tata McGraw Hill Publishing company, New Delhi, 1991.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H	L			
Module II	M	H			
Module III			H		
Module IV			H	H	
Module V					H

CVCM0130: COST MANAGEMENT OF ENGINEERING PROJECTS

3 credits - (L-T-P: 3-0-0)

Objectives: The course aims to provide comprehensive knowledge of the cost management process and cost accounting systems and to enable students to understand basic concepts of project planning, implementation and control. It covers different types of costs and their behavior, integrates the principles of quality management, and identifies different types of budgets involved in the cost management process. In addition, the course is designed to enhance students' career potential by equipping them with advanced techniques and problem-solving skills in cost management.

COURSE / LEARNING OUTCOMES

After Completion of the Course, Student will able to

CO1: Understand the concepts of the strategic cost management process.(Understand)

CO2: Apply cost concepts in decision making and cost management projects.(Apply)

CO3: Implement different phases of project execution in a team project.(Apply)

CO4: Analyse different decision problems.(Analyse)

CO5: Evaluate different qualitative techniques and cost behaviour.(Evaluate)

Module I:3 Hours

Introduction: Introduction and overview of the process of strategic cost management.

ModuleII: 7 Hours

Cost concepts: cost concepts in decision making; relevant costs, differential costs, incremental costs and opportunity costs. Objectives of a cost accounting system; inventory valuation; creating a database for operational control; providing data for decision making.

Module III:15 hours

Project: meaning, different types, why manage, cost overrun centres, different phases of project execution: conception to commissioning. Project execution as a conglomerate of technical and non-technical activities. Detailed engineering activities. The most important approvals and documents prior to project implementation. Project team: role of the individual members. Significance of the project location: Required data with significance. Project contracts: Types and contents. Project implementation Project cost control. Bar charts and network diagrams. Project commissioning: mechanics and procedures.

Module IV: 15 Hours

Cost behavior and profit planning Marginal costing: Distinction between marginal costing and absorption costing; break-even analysis, cost-volume-profit analysis. Various decision problems. Standard cost accounting and variance analysis. Pricing strategies: Pareto analysis. Target costing, life cycle costing. Cost accounting in the service sector. Just-in-time approach, material requirements planning, enterprise resource planning, total quality management and theory of constraints. Activity-based cost management, benchmarking; balanced score card and value chain analysis. Budget control; flexible budgets; performance budgets; zero-based budgets. Measuring the profitability of business units; pricing decisions including transfer pricing.

Module V: **5 Hours**

Quantitative techniques for cost management, linear programming, PERT/CPM, transportation problems, allocation problems, simulation, learning curve theory.

Suggested Readings

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Mapping of COs to Syllabus

Unit/COs	CO 1	CO 2	CO 3	CO 4	CO 5
I	H				
II	M	H			
III			H		
IV	L			H	
V	L			M	H

CVER0131 :EARTH RETAINING STRUCTURE

(Provided with B Tech Syllabus -Elective course)

CVCC0132: CEMENT COMPOSITE MATERIALS

(*3* credits) (L-T-P:*3*-0-0)

Objective:

The course aims to equip students with a solid foundation in composite materials, particularly cement composites, and their applications in various structural elements. The course emphasizes both theoretical knowledge and practical skills necessary for analyzing and designing composite material structures.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1. Understand and explain the classification, characteristics, and stress-strain relations of composite materials, including orthotropic and anisotropic materials.

CO2. Analyze the mechanical behavior of composite materials using the mechanics of materials approach and elasticity approach to stiffness, and compare different methods.

CO3. Design and apply various types of cement composites such as ferrocement, SIFCON, and fiber-reinforced concrete in practical applications.

Module I: (10 Hours)

Introduction: Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

Module II: (10 Hours)

Mechanical Behaviour: Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

Module III: (10 Hours)

Cement Composites: Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete - Ferrocement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing. Mechanical Properties of Cement Composites: BehaviorofFerrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

Module IV: (10 Hours)

Application of Cement Composites: FRC andFerrocement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants.

Module V: (5 Hours)

Analysis and Design of Cement Composite Structural Elements - Ferrocement, SIFCON andFibre Reinforced Concrete.

Suggested Readings

1. Mechanics of Composite Materials, Jones R. M,, 2nd Ed., Taylor and Francis,BSP Books, 1998.
2. Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.
3. New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman & Hall, 1983.
4. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
5. Hand Book of Composite Materials-ed-Lubin.
6. Composite Materials – K.K.Chawla.
7. Composite Materials Science and Applications – Deborah D.L. Chung.

Mapping of COs to Syllabus

	CO1	CO2	CO3
Module I	H	M	
Module II		H	
Module III		L	H
Module IV		M	H
Module V		M	H

CVOT0133: OPTIMIZATION TECHNIQUES IN CIVIL ENGINEERING

(3 Credits) (L: T:P: 3-0-0)

Objectives

- Impart knowledge on the theory of optimization and conditions for optimality for unconstraint and constraint optimization problems
- Instil modelling skills necessary to formulate and solve optimization problems in the domain of Civil Engineering.
- Familiarize the learners with the working principle of optimization algorithms used to solve linear and non-linear problems

COURSE/ LEARNING OUTCOMES

At the end of this course:

1. Students will learn the basic philosophy of optimization problems.
2. Students will be able to formulate and solve linear programming problems.
3. Students will be able to demonstrate the usage of various direct and indirect non-linear search methods in solving design problems.
4. Students will be able to find the optimum solution of their problems using genetic algorithm.

Module I (5 hours)

Introduction to optimization, classification of optimization problems, classical optimization techniques

Module II (10 hours)

Linear Programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming.

Module III (10 hours)

Non-Linear Programming: - One dimensional minimization, unconstrained and constrained minimization, direct and indirect methods.

Module IV (10 hours)

Geometric programming, Optimum design of structural elements like beams and columns.

Module V (10 hours)

Introduction to Genetic Algorithms, Operators, applications to engineering optimization problems.

Suggested Readings

1. S. S. Rao, "Engineering Optimization: Theory and Practice", Wiley, 2008.
2. K. Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall, 2005.
3. S. R. Komaragiri and N. Kumar, "Multicriterion Analysis in Engineering and Management", Prentice Hall, 2010.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4
Module I	H		L	
Module II	M	H		
Module III	M		H	
Module IV	M		H	
Module V				H

CVEI0134: ENVIRONMENTAL IMPACT ANALYSIS AND ASSESSMENT

(3 Credits) (L: T:P: 3-0-0)

Objectives:

- *Understand the concept, historical context and wider importance of EIA*
- *Know the key steps in the EIA process.*
- *Understand the importance of Social Impact Assessments and public participation in the EIA process. Gain an overview of methods and tools that are commonly used to develop an EIA.*
- *Improve collaborative skills and thus gain skills relevant for collaborative EIA development.*

COURSE OUTCOMES

CO1. Identify Environmental Impacts and methods of their assessment. (Understand)
CO2. Select the mitigation methods of different Environmental Impacts. (Apply)
CO3. Interpret the implications Environmental attributes, Environmental settings and EIA notifications.(Evaluate)
CO4. Implement the Prediction Methods of assessments of Impacts (Apply)

Module I:(5 Hours)

Introduction to Environment Management & EIA, Legal, Policy & Regulatory Framework

Module II:[8 Hours]

EIA Procedure - Scoping & Screening and Establishing Baseline Conditions**,** EIA Methodologies

Module III: [8 Hours]

Connectedness: connected spaces and subspaces, Connectedness of the real line, Intermediate value theorem**,** EIA Methods, Tools and Techniques

Module IV:[8 Hours]

Public Involvement in EIA **,** Impact Management - Mitigation & Preparation of Environment Management Plans (EMP)

Module V: [8 Hours]

EIA Reporting & Review of EIA Quality**,** Decision Making & Project Management

Module VI:[8 Hours]

Implementation & Follow up**,** EIA Case Examples

Suggested Readings

1) Wathern P., “Environmental Impact Assessment: Theory and Practice”,Routledge Publishers,1990
2) Marriott B., “Environmental Impact Assessment: A Practical Guide”,McGraw-Hill Publication,1997
3) Shrivastava A.K., Baxter Nicola, Grimm Jacob, “Environmental Impact Assessment”, APH Publishers, 2003
4) Anjaneyulu Y., Manickam Valli, “Environmental Impact Assessment Methodologies”, CRC Press 2011
5) Glasson J., Therivel Riki, Chadwick Andrew, “Introduction to Environmental Impact Assessment”, Oxford Brookes University 2012/ 4th edition
6)E resource: https://onlinecourses.nptel.ac.in/noc22_ar07/preview

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	H			
Module II			H	
Module III	H			
Module IV		H		
Module V				M
Module VI				H

CVGW0135: GROUND WATER ENGINEERING

(3 Credits) (L: T:P: 3-0-0)

Objectives

- To learn the fundamentals of groundwater flow.
- To learn the hydraulics of different kinds of wells.
- To evaluate the aquifer parameters and groundwater level variations for different hydro-geological boundary conditions.
- To understand the various facets of ground water quality modelling.
- Enable the learners to understand the significance of conjunctive use of ground water along with other fresh water sources.

COURSE/ LEARNING OUTCOMES

At the end of this course students will be able to:

1. Understand aquifer properties and movement of ground water.(Understand)
2. Comprehend well hydraulics problems under various hydro-geological scenarios.(Understand)
3. Summerise basic concepts and techniques associated with ground water flow modelling.(Understand)
4. Identify major sources and types of groundwater contamination.(Understand)
5. Understand the challenges and subsequent strategies necessary for groundwater management.(Understand)

Module I (15 hours)

Introduction: Definition of groundwater, role of groundwater in hydrological cycle, groundwater bearing formations, classification of aquifers, flow and storage characteristics of
aquifers, Darcy's law, anisotropy and heterogeneity, Governing Equations for Groundwater Flow: Dupuit-Forchheimer assumptions, general differential equations governing groundwater flows and their analytical solutions.

Module II (10 hours)

Wells and Well Hydraulics: Different types of wells, construction of wells, steady and unsteady state solutions for confined, unconfined and leaky aquifers, effect of boundaries, method of images, pumping test analysis.

Module III (10 hours)

Groundwater Flow Modelling: Role of groundwater flow models, basic introduction to hydraulic, Hele-Shaw and analog models, introduction to numerical modeling.

Module IV (5 hours)

Groundwater Quality: General problem of contamination of groundwater, sources, remedial and preventive measures, seawater intrusion in coastal aquifers.

Module V (5 hours)

Groundwater Conservation: Regional groundwater budget; resource assessment; estimation of recharge, Indian practice for artificial recharge, Planning of Groundwater Development: constraints on the development, role of flow models, optimal groundwater development.

Suggested Readings

1. Todd, D.K., "Groundwater Hydrology", John Wiley. 1959
2. Bear, J., "Hydraulics of Groundwater", McGraw. 1979
3. Bouwer, H., "Groundwater Hydrology", McGraw Hill. 1978
4. Walton, W.C., "Groundwater Resources Evaluation", McGraw Hill. 1970
5. Freeze and Cherry, "Groundwater", Prentice Hall. 1979
6. Driscoll, F.G., "Ground Water and Wells", Johnson Division. 1986
7. Raghunath, H. M., "Ground Water", New Age International (P) Limited. 2007

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H	M	M		
Module II	M	H	M		
Module III	H	M	H		
Module IV				H	M
Module V		L	M	H	H

CVSD6050: STRUCTURAL DESIGN LAB

Credits: 2 (L:T:P--0:0:4)

Course Objective:

The course will equip students with the necessary skills and knowledge to independently design and produce detailed drawings of complete structures. Through hands-on projects, students will gain practical experience in applying design principles and standards to real-world structural engineering scenarios. Furthermore, students will learn to design complete multistory buildings using both the Equivalent Static Method and Dynamic Analysis Method.

Course Outcomes: At the end of the course, students will be able to

- **CO1:** Design and Detail all the Structural Components of Frame Buildings.
- **CO2:** Design and Detail complete Multi-Storey Buildings using equivalent static and dynamic analysis method.

List of Experiments/Assignments:

- ***Experiment I:*** Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.
- ***Experiment II:*** Design a Multi-Storey building using Equivalent Static Method.
- ***Experiment III:*** Design a Multi-Storey building using Dynamic Analysis Method.

Suggested Readings:

- Sap2000 (Structural Analysis and Design) software.
- STADD Pro (3D Structural Analysis and Design) Software.
- AutoCAD software for 2D and 3D structures
- ETABS (Building Analysis and Design) software.

CVNA6051: NUMERICAL ANALYSIS LAB

2 credits-30 Hours (L:T:P:0:0:2)

Objectives: The course aims to provide the knowledge of computer programming to write the codes for the numerical methods learned in “Numerical Analysis” using C language and/or MATLAB.

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1. Write computer programs to solve engineering problems with MATLAB and/or C Language(Apply)

CO2. Implement numerical methods in MATLAB /C Language.(Apply)

CO3. Analyze the stability of the algorithm.(Analyze)

CO4. Analyze and evaluate the accuracy of common numerical methods.(Evaluate)

CO5. Ability to use approximation algorithms in real-world problems.(Apply)

List of Practicals:

1. Gaussian elimination, Jacobi, Gauss Seidel methods.
2. Bisection method, fixed point iteration scheme, Newton-Raphson method, secant method.
3. Lagrange's interpolation formula, Newton's divided difference formula.
4. Trapezoidal rule, Simpson's 1/3,3/8-rules.
5. Euler's method modified Euler's method, Runge-Kutta method, Milne's method, Adams-predictor-corrector method.

Suggested Readings

1. W. H. Press, B. P. Flannery, S. A. Teukolsky, W. T. Vetterling, "Numerical Recipes in C", Cambridge University Press, 1st edition,1988.
2. M. Pal, Numerical Analysis for Scientists and Engineers: Theory and C Programs, Narosa, 2008.

CVSM6052 :SOIL MECHANICS LAB

2 credits - (L-T-P: 0-0-4)

COURSE / LEARNING OUTCOMES

At the end of the course student will be able

CO1: Identify the index properties of soil (Undertand)
CO2: Determine the engineering properties of soil (Apply)
CO3: Assess shear strength using the vane shear test (Evaluate)
CO4: Analyze data from standard, static, and dynamic cone penetration tests(Analyse)

List of Practicals:

1. Determination of Moisture Content and Specific gravity of soil
2. Grain Size Distribution Analysis and Hydrometer Analysis
3. Atterberg Limits (Liquid Limit, Plastic limit, Shrinkage limit)
4. Standard and modified proctor compaction test
5. Falling head permeability test and Constant head permeability test
6. Consolidation test
7. Unconfined compression test
8. Direct shear test
9. Tri-axial compression test – UU, CU, CD tests
10. Laboratory vane shear test
11. Field Vane shear test
12. Standard penetration test
13. Static cone penetration test
14. Dynamic cone penetration test

CVCF6053: COMPUTATIONAL FLUID DYNAMICS LAB

(2 Credits)

Objectives

- To develop basic programming skills in computational fluid dynamics to address engineering problems.
- To understand the basic structure and capabilities of free and opensource CFD framework OpenFOAM.
- To demonstrate the capabilities of OpenFOAM, in conjunction with other opensource software, for simulating flow past 2-dimensional bluff bodies.

COURSE/ LEARNING OUTCOMES

At the end of this course students will be able to:

1. Write simple scripts in GNU Octave for solving partial differential equations using explicit and implicit finite difference method.(Apply)
2. Learn the basic methodology of adopted for any CFD simulation process.(Understand)
3. Comprehend the strengths and weaknesses of the opensource finite volume framework

OpenFOAM.(Understand)

4. Understand the basic structure and usage of OpenFOAM and other opensource packages like GMSH and ParaView demonstrating the significant steps involved in CFD analysis. (Undertsand)
5. Analyze basic bluff body hydrodynamics problems using OpenFOAM.(Analyze)

List of Experiments

1. Solution of one-dimensional unsteady diffusion equation using explicit finite difference method (FDM).
2. Solution of one-dimensional unsteady diffusion equation using implicit FDM.
3. Solution of elliptic partial differential equation – Laplace Equation using FDM.
4. Geometry creation and mesh generation of a 2-dimensional circular cylinder.
5. Simulation of laminar flow past a circular cylinder using OpenFOAM
6. Post-processing of the simulation data using ParaView.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Expt. 1	H				
Expt. 2	H				
Expt. 3	H				
Expt. 4		H	L	H	L
Expt. 5		H	H	H	M
Expt. 6		H	M	H	H

SCHOOL OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To be a centre of technological excellence for outstanding education and research in electrical and electronics engineering, contributing to the world socially committed engineers capable of accepting the continuous challenges of technological advancements.

MISSION

The department of Electrical and Electronics Engineering of Don Bosco College of Engineering and Technology, School of Technology, Assam Don Bosco University seeks to:

- Achieve excellence in teaching, research, practice and extension activities in the fields of Engineering in general and Electrical and Electronics Engineering in particular.
- Provide a strong foundation for the students to make them professionally competent for industry and research.
- Create an environment for the holistic development of individuals, encouraging them to serve the society with commitment and integrity.
- Offer necessary support and guidance to individuals to shape their ideas into reality.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

- To create an environment, give opportunity and also encourage the individuals to build a strong foundation of Electrical and Electronics Engineering as well as in related interdisciplinary fields of study, to be able to contribute to the need of the industry and the society at large.
- To make students capable of generating ideas, apply their knowledge and analyse the situations for executing live projects in Electrical and Electronics Engineering, with modern tools, equipment and software.
- To inculcate the habit of teamwork and infuse management skills in the students for their future professional life.
- To guide students to become ethical professionals in their own fields of work and be conscious about the effect of technology on the environment.

PROGRAMME-SPECIFIC OUTCOMES (PSO) OF M.TECH. IN ELECTRICAL AND ELECTRONICS ENGINEERING (SPECIALIZATION- POWER SYSTEMS)

PSO 1: Ability to apply the enhanced knowledge in advanced technologies for modeling, analyzing and solving contemporary issues in the power sector with a global perspective and to carry out detailed and independent investigation on multifaceted complex problems in the area of power systems and to envisage advanced research in allied thrust areas.

PSO 2: Ability to express ideas clearly and communicate orally as well as in writing with others in an effective manner, adhering to various national and international standards and practices for the documentation and presentation of the contents.

PSO 3: Ability to critically analyze and identify real-life engineering problems in the area of power systems; and professionally and ethically provide strategic solutions satisfying the safety, societal, cultural, financial and environmental aspects/ needs with an eagerness for continued pursuance of research to design, develop or propose theoretical and practical methodologies towards the research and development support for the power system infrastructure.

PSO 4: Ability to utilize and develop modern tools for modeling, analyzing and solving various scientific problems related to power systems and to take up technical/administrative challenges including the management of various projects of interdisciplinary nature, working in a team with mutual understandings to take unsophisticated challenges leading and motivating the group to inculcate multidisciplinary and collaborative approach.

PROGRAMME-SPECIFIC OUTCOMES (PSO) OF M.TECH. IN ELECTRICAL AND ELECTRONICS ENGINEERING (SPECIALIZATION- CONTROL SYSTEMS)

PSO 1: Ability to apply the enhanced knowledge in advanced technologies for modeling, analyzing and solving contemporary issues in system and control engineering with a global perspective and to carry out detailed and independent investigation on multifaceted complex problems in the area of system engineering and control and to envisage advanced research in allied thrust areas.

PSO 2: Ability to express ideas clearly and communicate orally as well as in writing with others in an effective manner, adhering to various national and international standards and practices for the documentation and presentation of the contents.

PSO 3: Ability to critically analyze and identify real-life engineering problems in the area of control systems; and professionally as well as ethically provide strategic solutions satisfying the safety, societal, cultural, financial and environmental aspects/ needs with an eagerness for continued pursuance of research to design, develop or propose methodologies, both of academic and applied nature, in the area of mathematical and applied control systems.

PSO 4: Ability to use the techniques, skills and modern control engineering tools necessary for engineering practices and to take up technical/administrative challenges including the management of various projects of interdisciplinary nature, while working in a team with mutual understandings to take unsophisticated challenges leading and motivating the group to inculcate multidisciplinary and collaborative approach.

DETAILED SYLLABUS

THEORY COURSES

EESA0048: POWER SYSTEM ANALYSIS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to give the knowledge of various methods of load flow, analysis of various types of faults in power systems, concept of security & contingency analysis of power systems and their needs for maintaining security of the system. It also introduces the concept of state estimation and the phenomenon of voltage instability in power systems.

Course Outcomes

1. Find different parameters for the analysis of power system. (Remembering)
2. Explain methods of state estimation in power system. (Understanding)
3. Organize various contingencies according to their severity. (Applying)
4. Analyse simultaneous fault using generalized method. (Analysing)
5. Determine voltage magnitude and phase-angles at all buses for the given data using various methods of load flow. (Evaluating)

Module I: Load Flow (10 hours)

Overview of Newton-Raphson, Gauss-Seidel, fast-decoupled methods, convergence properties, sparsity techniques, handling Q-max violations in constant matrix, inclusion in frequency effects, AVR in load flow, handling of discrete variables in load flow.

Module II: Fault Analysis (7 hours)

Simultaneous faults, short circuit and open conductor faults, generalized method of analysis of simultaneous faults in power systems.

Module III: Security Analysis (7 hours)

Security state diagram, contingency analysis, generator shift distribution factors, line outage distribution factor, multiple line outages, overload index ranking.

Module IV: Power System Equivalents (5 hours)

WARD equivalents (Kron reduction), WARD equivalent circuits for power flow studies, REI equivalents for power systems.

Module V: State Estimation (8 hours)

Sources of errors in measurement, Virtual and Pseudo, Measurement, Observability, Tracking state estimation, WSL method, bad data correction.

Module VI: Voltage Stability (8 hours)

Introduction to voltage instability scenario in a single machine infinite bus system, Voltage collapse, P-V curve, multiple power flow solution, continuation power flow, optimal multiplies load flow.

Suggested Readings

1. J. J. Grainger and W. D. Stevenson, “Power system analysis”, McGraw Hill, 2003.
2. A. R. Bergen and Vijay Vittal, “Power System Analysis”, Pearson, 2000.

3. L. P. Singh, “Advanced Power System Analysis and Dynamics”, New Age International, 2006.
4. G. L. Kusic, “Computer aided power system analysis”, Prentice Hall India, 1986.
5. A. J. Wood, “Power generation, operation and control”, John Wiley, 1994.
6. P. M. Anderson, “Faulted power system analysis”, IEEE Press, 1995.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M		H			H
CO 2		M		M	H	
CO 3			H	H		
CO 4		H	M			
CO 5	H					H

EESD0049: POWER SYSTEM DYNAMICS-I

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to give the concept of power system dynamics and its physical interpretation, development of mathematical models for synchronous machine and modeling of induction motor, prime mover controller, load modeling in power systems and stability analysis with and without power system stabilizer.

Course Outcomes

1. List the various stability problems in power systems. (Remembering)
2. Describe the modeling of electrical machines and excitation systems. (Understanding)
3. Solve problems related to various electrical machines and excitation systems. (Applying)
4. Find different parameters of Electrical machines. (Alalyzing)
5. Experiments to observe power system dynamics using simulation. (Evaluating)

Module I: Synchronous Machine (8 hours)

a. Basic concepts of stability, types of stability, stability phenomena Armature and field structure, MMF waveforms, equations, Direct and quadrature axes, Mathematical description of a synchronous machine, Basic equations of synchronous machine.
b. Park’s Transformation (modified), Flux-linkage equations.

Module II: Synchronous Machine Equations (8 hours)

Voltage and current equations, Stator self and mutual inductances, mutual inductances between stator and rotor, Electrical power and torque equations
per unit stator and rotor voltage, flux, inductance, power and torque, phasor representation, dq-0 transformations of stator and rotor Current and Voltage, rotor angle, Formulation of State-space equations, Equivalent

Module III: Modeling and Analysis of Synchronous Machine (6 hours)

Sub-transient and transient inductance and Time constants, Simplified models of synchronous machines

Module IV: Small Signal Model (8 hours)

Introduction to frequency model. Models of governor, turbine, power system stabilizer and FACTS devices.

Module V: Excitation System and Load (8 hours)

Excitation systems requirements, Elements of an excitation system, types of excitation systems: dc excitation systems, ac excitation systems, static excitation systems, Recent developments and future trends, Philips-Heffron model, PSS Load modeling.

Module VI: Induction Motors (7 hours)

Modeling of Induction Motors, equation of induction machines, steady state characteristics modeling of Prime mover, Prime mover controllers.

Suggested Readings

1. P. M. Anderson & A. A. Fouad “Power System Control and Stability”, Galgotia, New Delhi, 1981.
2. J. Machowski, J. Bialek & J. R. W. Bumby, “Power System Dynamics and Stability”, John Wiley & Sons, 1997.
3. P. Kundur, “Power System Stability and Control”, McGraw Hill Inc., 1994.
4. E. W. Kimbark, “Power system stability”, Vol. I & III, John Wiley & Sons, New York 2002.

5. D. Mondal, A. Chakrabarti & A. Sengupta, "Power System Small Signal Stability Analysis and Control", Academic Press, 2014.
6. J Machowski, J Bialek& J. R W. Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997.
7. E.W. Kimbark, "Power system stability", Vol. I & III, John Wiley & Sons, New York 2002.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2	H	H	L		M	M
CO 3	H	H				M
CO 4		H	M	M	M	
CO 5	L					

EEHP0050: HIGH POWER CONVERTERS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

Students will be able to understand the need of high power rated converters and analyze the different topologies involved for these converters. It will provide a holistic approach to comprehend the design of protection circuits for these converters.

Course Outcomes

1. Define the characteristics of PSDs such as SCRs, GTOs, IGBTs and use them in practical systems. (Remembering)
2. Explain the working of multi-level VSIs, DC-DC switched mode converters, Cyclo-converters and PWM techniques. (Understanding)
3. Analyze performance of converters based on output characteristics. (Analyzing)
4. Compare various types of Power Inverters. (Evaluating)

Module I: Power Switching Devices (10 hours)

Power electronic systems: an overview of PSDs, multi-pulse diode rectifier, multi-pulse SCR rectifier .

Module II: Power Inverters (15 hours)

Phase shifting transformers, multilevel voltage source inverters: two level voltage source inverter, Cascaded, H bridge multilevel inverter. Diode clamped multilevel inverters, flying capacitor multilevel inverter, PWM current source inverters.

Module III: Power Inverters (13 hours)

DC to DC switch mode converters, AC voltage controllers: Cyclo-converters, matrix converter.

Module IV: Power Inverters (7 hours)

Power conditioners and UPS, design aspects of converters, protection of devices and circuits.

Suggested Readings

1. N. Mohan, T. M. Undel & W. P. Robbins, "Power Electronics: Converter, Applications and Design", John Wiley and Sons, 1989.
2. M. H. Rashid, "Power Electronics", Prentice Hall of India, 1994.
3. B. K. Bose, "Power Electronics and A.C. Drives", Prentice Hall, 1986.
4. Bin Wu, "High power converters and drives", IEEE press, Wiley Enter science.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2			M	
CO 3			M	M
CO 4				M

EEWS0051: WIND AND SOLAR SYSTEMS)

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective:

The objectives of this course are-

To expose the students to wind and solar energy systems.To make the students understand the factors involved in installation and commissioning of a Solar or Wind plant and to facilitate the students learn the dynamics involved when solar and wind energy systems are interconnected with power system grid.

Course Outcomes

1. Distinguish the various renewable energy sources. (Understanding)
2. Identify various advantages and disadvantages of wind and solar energy systems. (Applying)
3. Identify the possibility of solar power generation in India and across the globe. (Applying)
4. Develop new renewable energy generation system. (Creating)

Module I (8 hours)

Historical development and current status of wind and solar systems. Characteristics of wind and solar power generation. Network integration issues of renewable energy systems.

Module II (8 hours)

Generators and power electronics for wind turbines, Use of DFIG for wind energy, power quality standards for wind turbines, Technical regulations for interconnections of wind farms with power systems.

Module III (8 hours)

Isolated wind systems, reactive power and voltage control, economic aspects.

Module IV (8 hours)

Impact of wind energy systems on power system dynamics and stability, Wind energy systems grid connection and power system interconnection issues.

Module V (6 hours)

Introduction of solar systems, merits and demerits of solar energy conversion systems, solar concentrators, various applications of solar energy conversion systems.

Module VI (7 hours)

Solar thermal power generation, PV power generation, Energy Storage device. Designing the solar system for small installations.

Suggested Readings

1. Thomas Ackermann (Editor), “Wind Power in Power Systems”, John Wiley & Sons. Ltd., 2005.
2. Siegfried Heier, “Grid Integration of Wind Energy Conversion Systems”, 2nd Edition, John Wiley and Sons Ltd, 2006.
3. K. Sukhatme & S. P. Sukhatme, “Solar Energy”, 3rd Edition, Tata McGraw Hill, 1996.
4. NPTEL Lectures

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M			
CO 3					H	H
CO 4				H	H	

EEPD0052: ELECTRICAL POWER DISTRIBUTION SYSTEM

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to make the students familiar with topics on electrical distribution system planning, load characteristics, application of distribution transformers, design of sub-transmission lines, distribution substations, primary systems, and secondary systems, voltage drop and power-loss calculations, application of capacitors, harmonics on distribution systems, voltage regulation, and smart grid concepts.

Course Outcomes

1. Demonstrate the knowledge of various distribution transformers, load characteristics, and associated factors. (Understanding)
2. Illustrate primary and secondary distribution networks. (Understanding)
3. Analyze voltage drops in distribution systems and choose proper measures to counteract voltage drops. (Analyzing)
4. Explain the integration of smart grid with the distribution management system. (Evaluating)

Module I: Distribution System Planning and Automation (8 hours)
Introduction, Distribution System Planning, Factors Affecting System Planning, Present Distribution System Planning Techniques, Central Role of the Computer in Distribution Planning, Distribution System Automation, load characteristics, Diversified demand, Non-coincident demand, Coincidence factor, Contribution factor problems, Relationship between the Load and Loss Factors, Load Forecasting, Rate structure, Customer billing.

Module II: Application of Distribution Transformers (8 hours)
Types of Distribution transformers, Regulation, Efficiency, single-phase transformer connections, Three-phase transformer connections, Auto-transformer, Booster transformer, phasor diagrams, Grounding Transformers.

Module III: Design of Sub-transmission Lines and Distribution Substations (8 hours)
Sub-station bus schemes, Rating of distribution substation, Service area with multiple feeders, Sub-station application curves, Percent voltage drop calculations, Substation Grounding, Types of Ground Faults.

Module IV: Design Considerations of Primary and Secondary Systems (8 hours)
Radial type, Loop type primary feeder, primary feeder loading, Radial Feeders with Uniformly Distributed Load, Introduction to Secondary Systems, secondary Banking, Secondary networks, Network transformers, Economic Design of Secondaries - General Total Annual cost (TAC), equation with and without constraints, Unbalanced loads and voltages.

Module V: Voltage-Drop and Application of capacitors (8 hours)
3-phase and Non 3-phase primary lines, Single-phase two-wire laterals with ungrounded neutral, Single-phase two-wire ungrounded laterals, Application of capacitors to distribution systems, Effect of series and shunt capacitors, power factor correction, Economic justification for capacitors, Optimum location for capacitor bank.

Module VI: Concept of Smart Grid (5 hours)
Need for Establishment of Smart Grid, Distributed Automation, SCADA, Integration of Smart Grid with the Distribution Management System, Evolution of Smart Grid, Smart Microgrids, Topology of a Microgrid, Consumer Information Service (CIS), Automatic Meter Reading (AMR).

Suggested Readings
1. Turan Gönen, “Electric Power Distribution Engineering”, CRC Press, 2014.
2. A. S. Pabla, “Electric Power Distribution”, McGraw Hill Education (India) Private Limited, 2011.
3. T. A. Short, “Electric Power Distribution Equipment And Systems”, CRC Press, 2004.
4. Kamalesh Das, “Electrical power Systems for Industrial Plants”, Jaico Publishing House, 2007.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H		M		L
CO 2			H	H		
CO 3			M		H	
CO 4	M					H

EEMM0053: MATHEMATICAL METHODS OF POWER ENGINEERING

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective
The objective of this course is to make the students understand the relevance of mathematical methods to solve engineering problems and to facilitate the students to learn how to apply the mathematical methods for a given engineering problem.

Course Outcomes
1. Demonstrate an understanding about vector sources, linear transformation, Eigen values and eigenvectors of linear operators. (Understanding).
2. Apply the knowledge of linear programming problems in various fields of power engineering. (Applying).
3. Utilize various techniques of nonlinear programming for solving constrained and unconstrained nonlinear programming problems. (Applying)
4. Justify the use of stochastic processes in the field of power engineering. (Evaluating)

Module I: Vectors and Linear Transformation (6 hours)
Definition of group and field, Vectors and vector spaces, Characterization of vector spaces, Linear transformation, Singular and Non-singular transformation, Matrix representation of linear transformation.

Module II: Eigen Vectors of Linear Operator (6 hours)
Eigen values and Eigen vectors of linear operator, Eigen spaces, Eigen basis for matrices, Eigen decomposition.

Module III: Introduction to Linear Programming (9 hours)
Linear programming problems, Graphical method, Simplex method, Dual-Simplex method, Duality, Non Linear programming problems.

Module IV: Introduction to Non-Linear Programming (8 hours)
Unconstrained problems, Newton's method, Hessian matrix, Search methods, Constrained problems.

Module V: Constrained Optimization (8 hours)
Lagrange method, Interpretation of Lagrange multipliers, Quadratic Programming problem, Kuhn-Tucker conditions, Random variables, Distributions.

Module VI: Stochastic Model/ Process (8 hours)
Definition, Independent random variables, Marginal and Conditional distributions, Elements of Stochastic process, State space, Index set.

Suggested Readings

1. Kenneth Hoffman & Ray Kunze, "Linear Algebra", 2nd Edition, PHI, 1992.
2. Erwin Kreyszig, "Introductory Functional Analysis with Applications", John Wiley & Sons, 2004.
3. Irwin Miller and Marylees Miller, "John E. Freund's Mathematical Statistics", 6th Edition, PHI, 2002.
4. J. Medhi, "Stochastic Processes", New Age International, New Delhi, 1994.
5. Papoulis and S. Pillai, "Probability, Random Variables and Stochastic Processes", 3rd Edition, McGraw Hill, 2002.
6. John B. Thomas, "An Introduction to Applied Probability and Random Processes", John Wiley, 2000.
7. Hillier F. S. and Liebermann G. J., "Introduction to Operations Research", 7th Edition, McGraw Hill, 2001.
8. Simmons D. M., "Non Linear Programming for Operations Research", PHI, 1975.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H				
CO 2			H			
CO 3				H	H	
CO 4						H

EEMC0054: MATHEMATICAL METHODS IN CONTROL

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective
This course aims to give the students an understanding of foundational concepts in linear algebra and random processes for use in control systems. Students will understand Probability and Random variables.

Course Outcomes
1. Define vector space vector space axioms, vector space properties. (Remembering)
2. Explain responses of linear systems to any given input signal. (Understanding)
3. Apply matrix properties and functions to a given problem. (Applying)
4. Solve problems of control system Engineering using probability theory. (Creating)

Module I (10 hours)
Linear Spaces – Vectors and Matrices, Transformations, Norms, Matrix Factorization.

Module II (10 hours)
Eigen value, Eigenvectors and Applications, SVD and Applications, Projections and Least Square Solutions.

Module III (10 hours)
Probability, Random variables, Probability distribution and density functions, Joint density and conditional distribution, Functions of random variables and random vectors.

Module IV (5 hours)
Characteristic functions and correlation matrices, Random Processes and properties.

Module V (5 hours)
Response of Linear systems to stochastic inputs, PSD theorem.

Suggested Readings
1. G. Strang, "Introduction to Linear Algebra", 4th Edition, Wellesley-Cambridge Press, 2009.
2. Papoulis and S. Pillai, "Probability, random variable and stochastic processes", Mcgraw Hill, 2002.
3. H. Stark and J. W. Woods, "Probability and random processes with application to signal processing", Pearson Education Asia, 2002.
4. J. A. Gubner, "Probability and Random processes for Electrical and Computer engineers", Cambridge Univ. Press. 2006.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L			
CO 2			H		
CO 3				H	
CO 4					H

EENS0055: NON-LINEAR SYSTEMS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective
This course aims at introducing fundamental concepts of nonlinear dynamical systems and understanding basic tools for mathematical analysis as well as applications.

Course Outcomes
1. Choose tools for stability analysis and response evaluation of control problems with significant nonlinearities. (Remembering)
2. Identify the design problem and distinguish between the controls strategies. (Applying)
3. Analyse non linear systems using describing function methods. (Analysing)
4. Interpret stability of nonlinear systems from Lyapunav stability analysis. (Understanding)

Module I (10 hours)
Introduction to nonlinear systems: Examples of phenomena, models & derivation of system equations.

Module II (15 hours)
Fundamental properties: Existence & uniqueness, Dependence on initial conditions & parameters. Phase plane analysis. Limit cycles & oscillations. Describing function method and applications. Circle criterion.

Module III (12 hours)
Lyapunov stability of autonomous systems. Perturbation theory & Averaging. Singular perturbation model and stability analysis.

Module IV (8 hours)
Basic results on Lie algebra. Controllability and Observability of nonlinear systems. Bifurcations. Chaos. Synchronization.

Suggested Readings
1. H. K. Khalil, "Nonlinear systems", 3 rd edition, Prentice Hall, 2001.
2. J. J. E. Slotine and W. Li, "Applied nonlinear systems", Prentice Hall, 1991.
3. A. Nijemjer and A. van der schaft, "Nonlinear dynamical control systems", Springer, 1989.
4. M. Vidyasagar, "Nonlinear Systems Analysis, Society for Industrial and Applied Mathematics", 2002.
5. S. Strogatz, "Nonlinear Dynamics and Chaos", West view Press, 2001.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1		H	H	
CO 2	H	L	L	
CO 3		H		
CO 4			H	

EECL0056: DIGITAL CONTROL

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective
This course aims to familiarize the student with the concept of discretization. The objective is to introduce the students to discrete-time system representations and digital control and make the learn to design controllers for digital systems.

Course Outcomes
1. Define a discrete time system. (Remembering)
2. Explain sampled data system. (Understanding)
3. Model control system on differential samping. (Applying)
4. Analyse digital systems in time domain and frequency domain. (Analysing)

Module I (15 hours)
Introduction to discrete-time systems, Frequency domain approach – Analysis and discretization, Time domain approach, analysis and discretization, State space formulation for discretized systems.

Module II (15 hours)
Engineering aspects of computer controlled systems, Sampled data systems, Control of Sampled data systems.

Module III (15 hours)
Concept of differential sampling, Closed loop analysis of differentially sampled systems, Control design based on differential sampling, Recent applications of Digital Control.

Suggested Readings
1. K. Ogata, "Discrete-time Control Systems", 2nd Ed., Prentice-Hall, 1995.
2. Benjamin C. Kuo, "Digital Control Systems", 2nd Ed., Oxford University Press, 1999.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2		H	
CO 3			H
CO 4	H		

EENC0057: NONLINEAR CONTROL
(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective
This course aims to study concepts and techniques for stability analysis and learning control design of nonlinear systems.

Course Outcomes
1. Define tangent vectors, vector fields. (Remembering)
2. Explain Passivity analysis and applications to control design. (Understanding)
3. Apply deeper ideas from mathematics and specifically from geometry to engineering problems. (Applying)
4. Design control system using disturbance decoupling.(creating)

Module I (8 hours)
Overview of nonlinear Control-Introduction to Advanced Calculus, Elementary notions of Topology, Smooth Manifolds, Sub-manifolds, Tangent Vectors, Vector Fields.

Module II (7 hours)
Lyapunov stability for autonomous and non-autonomous systems, Input-Output Stability and Input-to-State Stability Absolute Stability.

Module III (8 hours)
Passivity analysis and applications to control design, Lyapunov-based feedback control design. Feedback linearization and back stepping.

Module IV (7 hours)
Sussmann's Theorem and global Decompositions, The Control Lie Algebra, the observation space.

Module V (8 hours)

Local Co-ordinates, Transformations, Exact Linearization via Feedback, The Zero dynamics, Local Asymptotic Stabilization, Asymptotic Output Tracking.

Module VI (7 hours)
Disturbance Decoupling, High Gain Feedback, Additional Results on Exact Linearization, Observers with Linear Error Dynamics.

Suggested Readings

1. H. K. Khalil, "Nonlinear Systems", 3rd edition, Prentice Hall, 2001.
2. H. K. Khalil, "Nonlinear Control", Pearson, 2015.
3. J. J. E. Slotine and W. Li, "Applied nonlinear systems", Prentice Hall, 1991.
4. A. Nijemjer and A. van der schaft, "Nonlinear dynamical control systems", Springer, 1989.
5. M. Vidyasagar, "Nonlinear Systems Analysis", Society for Industrial and Applied Mathematics, 2002.
6. Alberto Isidori, "Nonlinear Control Systems", Third Edition, Springer, 1995.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2			H			
CO 3				L	H	
CO 4						H

EESC0058: SCADA SYSTEM AND APPLICATIONS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective
This course aims to familiarize the student with the concept of SCADA and its functions, to know SCADA communication and to get an insight into its application.

Course Outcomes
1. Explain the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications. (Understanding)
2. Make use of knowledge about SCADA architecture, various advantages and disadvantages of each system. (Applying)
3. Analyse the single unified standard architecture IEC 61850. (Analysing)
4. Select suitable SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server. (Evaluating)

Module I (15 hours)
Introduction to SCADA: Data acquisition system, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation and Industries SCADA.

Module II (15 hours)
Industries SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices(IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems, SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture -IEC 61850.

Module III (15 hours)
SCADA Communication: various industrial communication technologies - wired and wireless methods and fiber optics, Industries - oil, gas and water. Case studies, Implementation, Simulation Exercises.

Suggested Readings

1. Stuart A. Boyer, "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, 2004.
2. Gordon Clarke and Deon Reynders, "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK, 2004.
3. William T. Shaw, "Cybersecurity for SCADA systems", Penn Well Books, 2006.
4. David Bailey and Edwin Wright, "Practical SCADA for industry", Newnes, 2003.
5. Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", Penn Well, 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M	L			L

CO 2				H		
CO 3				H	M	
CO4			H			

EDA0059: DESIGN ASPECTS IN CONTROL

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

This course aims to familiarize the student to the tools and techniques of control system design. Introduction to various aspects of controller design philosophy, learning PID Controller are incorporated into the course.

Course Outcomes

1. Tell about FOPDT and SOPDT systems. (Remembering)
2. Explain zero dynamics in servo control. (Understanding)
3. Model a control system given its parameters. (Applying)
4. Design observer. controllers like PI, PID in a given control system. (Evaluating)

Module I (15 hours)

System Modelling, review of concepts, FOPDT and SOPDT systems and identification of Smith Predictor and its variations.

Module II (15 hours)

PID Controllers – review PID Tuning – Ziegler Nichols, Cohen-Coon techniques. State feedback review – pole placement, Eigen structure assignment, Eigen structure – time response relation, Controller gain selection, controller robustness, disturbance rejection.

Module III (15 hours)

Frequency Domain Loop Shaping, Lag, Lead and Lag-lead compensators, Zero dynamics in servo control, Unstable zero dynamics – control design, Observer – concept and design, Case studies – Applications.

Suggested Readings

1. Karl J. Astrom and Richard M. Murray, “Feedback Systems: An Introduction for Scientists and Engineers”, Princeton University Press, 2010.
2. Thomas Kailath, “Linear Systems”, Prentice-Hall.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2			H
CO 3		H	
CO4	M		H

EEDP0060: DIGITAL PROTECTION OF POWER SYSTEM

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. Illustrate the use of mathematical methods for relaying purposes. (Understanding)
2. Apply the digital relaying techniques in power system protection. (Applying)
3. Assess effectiveness of digital relays over the electromechanical ones for power system protection requirements. (Evaluating)
4. Design digital protection systems for power system applications. (Creating)

Objective

The objectives of this course are-

- To provide an overview of the numerical relays and their working
- Introduce a mathematical approach towards protection
- To provide a detailed treatment of algorithms for numerical protection

Module I (6 hours)

Evolution of digital relays from electromechanical relays, Types of digital relays, Performance and operational characteristics of digital protection.

Module II (6 hours)
Mathematical background to protection algorithms, Finite difference techniques.

Module III (8 hours)
Interpolation formulae, forward, backward and central difference interpolation, Numerical differentiation, Curve fitting and smoothing, Least squares method, Fourier analysis, Fourier series and Fourier transform, Walsh function analysis.

Module IV (8 hours)
Basic elements of digital protection, Signal conditioning: transducers, surge protection, analog filtering, analog multiplexers, Conversion subsystem: the sampling theorem, signal aliasing. Error, sample and hold circuits, multiplexers, analog to digital conversion, digital filtering concepts, digital relay as a unit consisting of hardware and software, Integration of Digital Relays into SCADA systems.

Module V (8 hours)
Mathematical basis of numerical techniques and relay algorithms, Sinusoidal wave based algorithms, Sample and first derivative (Mann and Morrison) algorithm. Fourier and Walsh based algorithms.

Module VI (8 hours)
Fourier Algorithm: Full cycle window algorithm, fractional cycle window algorithm, Walsh function based algorithm. Least Squares based algorithms. Differential equation based algorithms. Traveling Wave based Techniques. Digital Differential Protection of Transformers.Digital Line Differential Protection. Recent Advances in Digital Protection of Power Systems.

Suggested Readings
1. A. G. Phadke and J. S. Thorp, “Computer Relaying for Power Systems”, Wiley/Research studies Press, 2009.
2. A. T. Johns and S. K. Salman, “Digital Protection of Power Systems”, IEEE Press, 1999.
3. Gerhard Zeigler, “Numerical Distance Protection”, Siemens Publicis Corporate Publishing, 2006.
4. S. R. Bhide, “Digital Power System Protection” PHI Learning Pvt. Ltd., 2014.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1		H		M	
CO 2	M		H		L
CO 3	H		L		
CO 4			M		H

EEPD0061: POWER SYSTEM DYNAMICS-II

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes
1. Recall the basic concepts of dynamic systems and stability definition. (Remembering)
2. Explain the different stability problems arise in power system. (Understanding)
3. Identify different stability problems faced by modern power systems, e.g., multi-machine stability, large signal stability, etc. (Applying)
4. Analyze the stability problems and implement modern control strategies, e.g., damper, AGC etc. (Analyzing)
5. Assess voltage and frequency stability in power systems. (Evaluating)

Objective
The objective of this course is to give the concept of power system dynamics, interpretation of power system dynamic phenomena and various forms of stability problems in power systems & their mitigation technique.

Module I: Power System Stability (8 hours)
Basic Concepts of Dynamic Systems and Stability Definition, Small Signal Stability (Low Frequency Oscillations) of Unregulated and Regulated System, Analysis of stability.

Module II: Damper (8 hours)
Effect of Damper, Flux Linkage Variation and AVR.

Module III: Large Signal Stability (8 hours)
Large Signal Rotor Angle Stability, Dynamic Equivalents and Coherency, Direct Method of Stability Assessment, Stability Enhancing Techniques, Mitigation Using Power System Stabilizer.

Module IV: Multi-Machine Stability (6 hours)

Asynchronous Operation and Resynchronization, concept of multi-Machine Stability.

Module V: Voltage Stability (6 hours)
Dynamic Analysis of Voltage Stability, Voltage Collapse and classification, typical scenario of voltage collapse, Prevention of voltage collapse.

Module VI: Frequency Stability (6 hours)
Introduction to Frequency Stability, Automatic Generation Control, Primary and Secondary Control, Sub-Synchronous Resonance and Counter Measures.

Suggested Readings
1. P. Kundur, "Power System Stability and Control", McGraw Hill Inc, 1994.
2. J. Machowski, J. Bialek and J. Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997.
3. L. Leonard Grigsby (Ed.), "Power System Stability and Control", Second edition, CRC Press, 2007.
4. V. Ajjarapu, "Computational Techniques for voltage stability assessment & control", Springer, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H		M		M	M
CO 2		H	H	M	L	L
CO 3			H	H	M	
CO 4		H		H		
CO 5					H	H

EERP0062: RESTRUCTURED POWER SYSTEMS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes
1. Explain the various types of regulations in power systems. (Understanding).
2. Illustrate the Technical and Non-technical issues in Deregulated Power Industry.(Understanding).
3. Identify the need of regulation and deregulation. (Applying)
4. Interpret different market mechanisms and various entities in the market. (Applying)

Objective
The objective of this course is to introduce the concepts of restructuring and deregulation of electricity market. This will enable the students to understand the need behind the requirement for deregulation of the electricity market. This course focuses on the understanding of the money, power & information flow in a deregulated power system.

Module I: Introduction to Electricity Market (10 hours)
Fundamentals of electricity market deregulation and restructured system, Market power, Market models and architecture, Independent System Operator (ISO), Power Exchange (PX), Market Clearing Price (MCP), Day-Ahead and Hour-Ahead Markets, Elastic and Inelastic Markets, Social welfare maximization.

Module II: Optimal Power Flow (11 hours)
OPF: Role in vertically integrated systems and in restructured markets, Transmission Open Access, Power Wheeling, Congestion management, Transfer Capability: Definitions and calculations- Available Transfer Capability (ATC).

Module III: Hedging Tools for Managing Risks in Electricity Markets (8 hours)
Optimal bidding; Risk assessment, Hedging; Transmission Pricing; Electricity Pricing: Volatility, Risk and Forecasting.

Module IV: Ancillary Services & Distributed Generations (6 hours)
Ancillary Services, Distributed generation in restructured markets, IT applications in restructured markets.

Module V: Indian sector and Global Electric Utility Markets (10 hours)
Developments in India, Working of restructured power systems in various countries, Standard Market Design (SMD), PJM, Recent trends in Restructuring.

Suggested Readings
1. Mohammad Shahidehpour and Muwaffaq Alomoush, "Restructured electrical power systems: operation, trading and volatility", Marcel Dekker.

2. Kankar Bhattacharya, Jaap E. Daadler and Math H. J. Boolen, "Operation of restructured power systems", Kluwer Academic Pub., 2001.
3. Lorrin Philipson and H. Lee Willis, "Understanding electric utilities and de-regulation", Marcel Dekker Pub., 1998.
4. L. L. Lai, "Power System Restructuring and Deregulation: Trading, Performance and Information Technology", Wiley, 2001.
5. Steven Stoft, "Power system economics: designing markets for electricity", John Wiley and Sons, 2002.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	L			
CO 2		H	H		
CO 3			M	H	
CO 4				M	H

EEAS0063: ADVANCED DIGITAL SIGNAL PROCESSING

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. Demonstrate knowledge about the time domain and frequency domain representations as well analysis of discrete time. (Understanding)
2. Apply the design techniques for IIR and FIR filters and their realization structures. (Applying)
3. Utilize knowledge about the finite word length effects in implementation of digital filters. (Applying)
4. Make use of the knowledge about the various linear signal models and estimation of the power spectrum of stationary random signals. (Applying)

Objective

The course helps to develop an in-depth understanding of the digital signal processing techniques. The course helps in learning of the methods used to structure and design various filters and understand their characteristics.

Module I: Fundamentals of Discrete-Time Signal and System (8 hours)

Discrete time signals, Linear shift invariant systems, Stability and causality, Sampling of continuous time signals, discrete time Fourier transform- Discrete Fourier series- Discrete Fourier transform, Z transform-Properties of different transforms.

Module II: Discrete-Time Signals in the Transfer Domain (8 hours)

Linear convolution using DFT, Computation of DFT Design of IIR digital filters from analog filters, Impulse invariance method, Bi-linear transformation method.

Module III: Digital Filter Structures and Design (8 hours)

FIR filter design using window functions, Comparison of IIR and FIR digital filters, Basic IIR and FIR filter realization structures, Signal flow graph representations Quantization process and errors, Coefficient quantization effects in IIR and FIR filters.

Module IV: Analysis of Finite Word length Effects (8 hours)

A/D conversion noise- Arithmetic round-off errors, Dynamic range scaling, Overflow oscillations and zero Input limit cycles in IIR filters, Linear Signal Models.

Module V: Linear Signal Models and Power Spectrum Estimation (7 hours)

All pole, All zero and Pole-zero models, Power spectrum estimation- Spectral analysis of deterministic signals, Estimation of power spectrum of stationary random signals.

Module VI: Optimum Linear Filters (6 hours)

Optimum linear filters, Optimum signal estimation, Mean square error estimation, Optimum FIR and IIR Filters.

Suggested Readings

1. Sanjit K. Mitra, "Digital Signal Processing: A computer-based approach", Tata McGraw-Hill Edition, 1998.
2. Dimitris G. Manolakis, Vinay K. Ingle & Stephen M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill international edition 2000.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H				L
CO 2			H	M	L	H

CO 3	M		M	H		
CO 4		M			H	M

EEAS0064: POWER SYSTEM TRANSIENTS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. Explain the reasons for occurrence of transients in a power system. (Understanding)
2. Utilize the knowledge of various transients that could occur in power systems and their mathematical formulation. (Applying)
3. Illustrate the use of insulation in various equipment in power systems. (Applying)
4. Analyze the power system for transient analysis. (Analyzing)
5. Design various protective devices in power systems for protecting equipment and personnel. (Creating)

Objective

The objective of this course is to introduce the concepts of power system transients. Students will be able to learn the reasons for occurrence of transients in a power system. This will enable the students to understand the change in parameters like voltage & frequency during transient. This course also focuses on the lightning phenomenon and its effect on the power system.

Module I: (8 hours)

Fundamental circuit analysis of electrical transients; Laplace Transform method of solving simple Switching transients; Damping circuits-Abnormal switching transients; Three-phase circuits and transients; Computation of power system transients.

Module II (7 hours)

Principle of digital computation-Matrix method of solution; Modal analysis- Z transform; Computation using EMTP; Lightning, switching and temporary over voltage; Physical phenomena of lightning.

Module III (6 hours)

Interaction between lightning and power system; Influence of tower footing resistance and Earth Resistance; Switching: Short line or kilometric fault; Energizing transients - closing and re-closing of lines; line dropping, load rejection - over voltages induced by faults.

Module IV (8 hours)

Switching HVDC line; Travelling waves on transmission line, Circuits with distributed Parameters; Wave Equation; Reflection, Refraction, Behaviour of Travelling waves at the line terminations; Lattice Diagrams - Attenuation and Distortion; Multi-conductor system and Velocity wave.

Module V (8 hours)

Insulation co-ordination: Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS); Coordination between insulation and protection level; Statistical approach.

Module VI (8 hours)

Protective devices; Protection of system against over voltages, lightning arresters, substation earthing.

Suggested Readings

1. Allan Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc. New York, 1991.
2. Y. G. Paithankar, “Fundamentals of Power System Protection”, Prentice Hall India Learning Private Limited, 2010.
3. Akihiro Ametani, Naoto Nagaoka, Yoshihiro Baba, Teruo Ohno and Koichi Yamabuki, “Power System Transients: Theory and Applications”, CRC Press, 2016.
4. Prabha Kundur, “Power System Stability and Control”, McGraw Hill Education, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H	H	L		
CO 3					H	
CO 4			M	H		
CO 5						H

EEFC0065: FACTS AND CUSTOM POWER DEVICES

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. List various FACTS devices. (Remembering)
2. Describe fundamental principles of Passive and Active Reactive Power Compensation Schemes. (Understanding)
3. Identify suitable FACTS devices for specific applications. (Applying)
4. Experiments with various FACTS devices to improve Power quality. (Evaluating)

Objective

This course gives an introduction to the of flexible ac transmission systems to enhance controllability and power transfer capability in ac systems, involves applications of power electronics in power systems in the range of a few tens to hundred megawatts to improve reliability of power supply and opens up new opportunities for controlling power and enhancing the usable capacity of present, as well as new and upgraded lines.

Module I: Power flow control (6 hours)

Reactive power flow control in Power Systems, Control of dynamic power unbalances in Power System - Power flow control, Constraints of maximum transmission line loading, Benefits of FACTS Transmission line compensation, Uncompensated line - Shunt compensation, Series compensation Phase angle control, Reactive power compensation Shunt and Series compensation principles, Reactive compensation at transmission and distribution level.

Module II: Shunt compensator (10 hours)

Static versus passive VAR compensator, Static shunt compensators: SVC and STATCOM, Operation and control of TSC, TCR and STATCOM -Compensator control, Comparison between SVC and STATCOM.

Module III: Series compensator and regulators (15hours)

Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators, TCVR and TCPAR Operation and Control, Applications, Static series compensation, GCSC, TSSC, TCSC and Static synchronous series compensators and their Control.

Module IV: Combined compensator (8 hours)

SSR and its damping Unified Power Flow Controller, Circuit Arrangement, Operation, and control of UPFC, Basic Principle of P and Q control, Independent real and reactive power flow control-Applications, Introduction to interline power flow controller.

Module V: Power quality (6hours)

Modeling and analysis of FACTS, Controllers, Simulation of FACTS controllers, Power quality problems in distribution systems, harmonics, loads that create harmonics, modeling, harmonic propagation, series and parallel resonances mitigation of harmonics, passive filters, active filtering – shunt, series and hybrid and their control, Voltage swells, sags, flicker, unbalance and mitigation of these problems by power line conditioners, IEEE standards on power quality.

Suggested Readings

1. K. R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International Publishers, 2007.
2. X. P. Zhang, C Rehtanz and B. Pal, “Flexible AC Transmission Systems- Modelling and Control”, Springer, Verlag, Berlin, 2006.
3. N. G. Hingorani, L. Gyugyi, “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems”, IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.
4. K. S. Suresh Kumar and S. Ashok, “FACTS Controllers & Applications”, E-book edition, Nalanda Digital Library, NIT Calicut, 2003.
5. G. T. Heydt, “Power Quality”, McGraw-Hill Professional, 2007.
6. T. J. E. Miller, “Static Reactive Power Compensation”, John Wiley and Sons, New York, 1982.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	L	H	H	H	
CO 3		H	H	H	M
CO 4		M	M		

EEOC0066: OPTIMAL CONTROL THEORY

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. Relate the mathematical methods used in optimal control to derive the solution to variations of the problems studied in the course. (Remembering)
2. Explain dynamic programming and its use in control system engineering. (Understanding)
3. Apply principle of optimality to decision making. (Applying)
4. Utilize the standard algorithms for numerical solution of optimal control problems and use MATLAB to solve fairly simple but realistic problems. (Applying)

Objective

This course aims at introducing the basic and fundamental concepts of optimal control theory, controller design. The course also introduces computational aspects of optimal control.

Module I (15 hours)

Review of Matrix Computations. Maximization of functional of a single and several functions using calculus of variations, Constrained externals, Euler-Lagrange Equation, Necessary conditions for optimal control, Pontryagin's minimum principle and state inequality constraints, Minimum time problems, Minimum control effort problems.

Module II (15 hours)

Linear quadratic regulator problems, Riccati Equation, Singular intervals in optimal control problems, The principle of optimality, Application of the principle of optimality to decision making, Dynamic programming applied to routing problems.

Module III (15 hours)

Solving optimal control problems using dynamic programming, Discrete linear regulator problem, Hamilton-Jacobi-Bellman Equation, Numerical Techniques to determine optimal trajectories, Numerical Aspects of Optimization.

Suggested Readings

1. M. Athans and P. L. Falb, "Optimal Control: An Introduction to the Theory and Its Applications", Dover Books on Engineering, 2006.
2. D. S. Naidu, "Optimal Control Systems", CRC Press, 2002.
3. D. Liberzon, "Calculus Of Variations and Optimal Control Theory: A Concise Introduction", Princeton University Press, Dec 2011.
4. Frank L. Lewis, Draguna Vrabie and Vassilis L. Syrmos, "Optimal Control", 3rd Edition, Wiley, 2012.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	
CO 2		M	H
CO 3		H	
CO 4	M		H

EESF0067: STOCHASTIC FILTERING AND IDENTIFICATION

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. Tell about different filtering and prediction methods for system design. (Remembering)
2. Take part in convergence analysis of Recursive Identification methods. (Analyzing)
3. Elaborate essential stochastic modeling tools including Markov chains and queuing theory. (Creating)
4. Design control system based on adaptive control. (Creating)

Objective

This course aims at introducing fundamental concepts of stochastic filtering, prediction, control. The course introduces non-linear system identification.

Module I (15 hours)

Introduction to Parameter Estimation and System Identification, MMSE estimation including LMS, Gaussian case, Wiener filtering & prediction, Kalman filtering & prediction, Extended Kalman filtering and its variations, Predictors for difference equation based models including ARMA, Box Jenkins & others.

Module II (15 hours)

Statistical properties of Least Squares estimation and its relationship with Bayes estimation (ML, MAP), convergence analysis, CR bound, Recursive Least Squares, Iterative methods for nonlinear Least Squares Identification problem: Different approaches for linear dynamical system, Offline identification methods including Least Squares, Prediction error framework, Pseudo-linear regression (PLR) & Instrument variable methods. Recursive Identification of linear dynamical system: RLS, PLR, Prediction error framework & its application to ARMA & Innovations representation, Convergence Analysis of Recursive Identification methods: Associated ODE, Martingale.

Module III (15 hours)
Nonlinear system identification, Subspace based method of system identification, Applications including LQG and adaptive control.

Suggested Readings
1. A. Papoulis and S. Pillai, “Probability, random variable and stochastic processes”, McGraw Hill, 2002.
2. T. Soderstrom and P. Stoica, “System Identification”, Prentice-Hall, 1989.
3. Lennart Ljung, “System Identification”, Prentice-Hall, 2nd edition, 1999.
4. S. Thomas Alexander: “Adaptive Signal processing, Theory and applications”, Springer-Verlag, 1986.
5. R. Isermann and M. Munchhof, “Identification of Dynamic Systems”, Springer-Verlag, 2011.
6. B. D. O. Anderson and J. B. Moore, “Optimal Filtering”, Dover Books on Electrical Engineering, 2005.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	H
CO 3		H	
CO 4			H

EECS0068: ADVANCE CONTROL SYSTEM

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes
1. Define different approaches for modeling of dynamic systems. (Remembering)
2. Explain philosophy of optimal control system. (Understanding)
3. Apply the concepts of linear algebra and their applications to control systems. (Applying)
4. Design linear quadratic controller, reduced order observer,compensator (Creating)

Objective
The course provides glimpses into the advanced methods of modelling and analysis of the dynamical systems. The course is a strong step in inculcating the research aptitude in the students.

Module I (15 hours)
Math Modelling of Dynamical Systems: Newtonian and Lagrangian approaches, Concept of dynamical state of a system, Concept of equilibrium point, linearization of nonlinear model. Review of Linear Algebra concepts: Field, Vector space, linear combination, linear independence, bases of a vector space, representation of any vector on different basis, matrix representation of a linear operator, change of basis, rank, nullity, range space and null space of a matrix, Eigen value and Eigen vector of a matrix, similarity transform, Diagonalisation

Module II (15 hours)
Modern Control Analysis: Concept and computation of systems modes, controllability theorem and its proof, Observability theorem and its proof, Controllable and observable subspaces. Stability Analysis: Stability of linear systems, stability types and their definitions for any general system, Stability of an equilibrium point, Lyapunov stability theory for LTI systems, Quadratic forms and Lyapunov functions.

Module III (15 hours)
Modern Control Design: Converting the math model to controllable canonical form and its use for pole placement, Concept of linear observer and its design, Design of reduced order observer, Compensator design using separation principle, Poles of compensator, Open-loop and close-loop systems. Optimal Control Theory: Introduction to the philosophy of optimal control, formulation of optimal control problem, different performance criterion, Linear quadratic regulator (LQR) and optimum gain matrix, Riccati equations, conceptual models and statistical models for random processes, Kalman filter.

Suggested Readings

1. Bernard Friedland, “Control System Design: An Introduction to State-Space Methods”, Dover Publications, Inc. Mineola, New York, 2012.
2. Thomas Kailath, “Linear Systems”, Prentice-Hall Inc., New Jersey, 1986.
3. M. Gopal, “Modern Control System Theory”, New Age International (P) Limited, New Delhi, 2000.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3	H		
CO4	L		H

EEAL0069: ADAPTIVE LEARNING AND CONTROL

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. Recall detailed knowledge of classical system identification and the development and properties of various methods. (Remembering)
2. Utilize detailed knowledge of robust adaptive control, neural network based control (Applying)
3. Apply adaptive and learning techniques for control design for uncertain dynamical systems. (Applying)
4. Design control system based on predictive control. (Creating)

Objective

The course introduces adaptive and learning techniques for control design for uncertain dynamical systems. The course also introduces learning based control.

Module I (15 hours)

Introduction to adaptive control, Direct and indirect adaptive control, Model reference adaptive control, Parameter convergence, Persistence of excitation, Review of Lyapunov stability theory.

Module II (15 hours)

Adaptive backstepping, Adaptive control of nonlinear systems, Composite adaptation, Robust adaptive control, Neural Network-based control.

Module III (15 hours)

Reinforcement learning-based control, Repetitive learning control, Predictive control,

Suggested Readings

1. Bernard Friedland, “Control System Design: An Introduction to State-Space Methods”, Dover Publications, Inc. Mineola, New York, 2012.
2. Thomas Kailath, “Linear Systems”, Prentice-Hall Inc., New Jersey, 1986.
3. M. Gopal, “Modern Control System Theory”, New Age International (P) Limited, New Delhi, 2000.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3		H	
CO4		M	H

EEMR0070: MODEL REDUCTION IN CONTROL

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. Identify Source of Large Models. (Remembering)
2. Explain sliding mode control for control system design. (Understanding)
3. Make use of Pade approximation for control system design. (Applying)
4. Apply model reduction techniques for a given control design problem. (Applying)

Objective
The course introduces the concept of model reduction of large scale dynamics models from various engineering disciplines. The course also introduces model reduction in control.

Module I (15 hours)
Introduction to Model Reduction, Source of Large Models – Circuits, EM systems, Mechanical Systems. Classical Model Reduction Methods – Modal reduction.

Module II (15 hours)
Pade approximation and moment matching, Routh Approximants, Modern Methods - SVD (Grammian) based methods, Krylov based methods, SVD-Krylov based methods, MOR for Nonlinear Systems – SVD & POD Methods.

Module III (15 hours)
Model Reduction in Control, Sliding Mode Control – Review, SMC as model reducing control, Higher Order Sliding Mode.

Suggested Readings
1. A. C. Antoulas, “Approximation of Large Scale Dynamical Systems”, SIAM, 2005.
2. Ed. Alfio Quarteroni and Gianluigi Rozza, “Reduced Order Methods for Modeling and Computational Reduction”, Springer, 2014.
3. M. Jamshidi, “Large-scale systems: modelling & control”, North Holland, New York, 1983.
4. C. Edwards and S. Spurgeon, “Sliding Mode Control: Theory and Applications”, CRC Press, 1998.
5. B. Bandyopadhyay, S. Janardhanan and S. Spurgeon, “Advances in Sliding Mode”, Springer, 2013.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3		H	
CO4	M		H

EERC0071: ROBUST CONTROL

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes
1. Define LTI systems and its applications. (Remembering)
2. Explain Passive system for frequency domain and time domain. (Understanding)
3. Assess stability and performance of passive systems. (Evaluating)
4. Design robust control system based on Riccatti equation (Creating)

Objective
This course introduces the concept of to control techniques with greater emphasis on robustness to modelling uncertainty. The course introduces how to handle parameter variations, and presence of disturbances and noise.

Module I (15 hours)
Modelling of uncertain systems, Signals and Norms, Lyapunov theory for LTI systems.

Module II (15 hours)
Passive systems- frequency domain, Passive systems- time domain, Robust Stability and performance, Stabilizing controllers - Co prime factorization.

Module III (15 hours)
LQR, LQG problems, Ricatti equations and solutions, Ricatti equation solution through LMI, H-infinity control and mu-synthesis, Linear matrix inequalities for robust control.

Suggested Readings
1. L. Fortuna, M. Frasca (Eds.), “Optimal and Robust Control”, CRC Press, 2012.
2. K. Zhou, J. C. Doyle and K. Glover, “Robust and Optimal Control”, Prentice Hall, 1996.
3. J. C. Doyle, B. A. Francis and A. R. Tannenbaum, “Feedback Control Theory”, Macmillan, 1992.
4. Benefits of FACTS Transmission line compensation, Uncompensated line –

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3		H	
CO4		M	H

EEMC0087: ADVANCED MICROCONTROLLER BASED SYSTEMS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. List the various functional blocks of a basic computer. (Remembering)
2. Recall the architecture of PIC microcontrollers. (Remembering)
3. Summarize the architecture of Intel 8051 and 8086 microcontrollers and microprocessors. (Understanding)
4. Summarize the architecture of DSP processors and FPGA. (Understanding)
5. Develop Intel and PIC microcontroller based systems. (Applying)

Objective

The course will help to develop an in-depth understanding of the basic computer architecture and organizations. Students will be able to understand the architecture and application of advanced microcontrollers, DSP processors and FPGA.

Module I: Basic Computer Organization (7 hours)

Basic computer organization. Accumulator based processes, Architecture, Memory Organization, I/O organization.

Module II: Intel 8051 Microcontroller and 8086 Microprocessor (14 hours)

Intel 8051, Intel 8086- Registers, Memories. I/O Ports, Serial communication. Timers, Interrupts, Programming. Intel 8051- Assembly language programming, Addressing operations, Stack & Subroutines, Interrupts-DMA.

Module III: PIC Microcontrollers (8 hours)

PIC 16F877- Architecture Programming, Interfacing Memory/ I/O Devices, Serial I/O and data communication.

Module IV: Digital Signal Processors (8 hours)

Digital Signal Proc Processor (DSP) – Architecture, Programming, Introduction to FPGA.

Module V: Applications (8 hours)

Microcontroller development for motor control applications. Stepper motor control using microcontroller.

Suggested Readings

1. John. F. Wakerly, “Microcomputer Architecture and Programming”, John Wiley and Sons 1981.
2. Ramesh S. Gaonker, “Microprocessor Architecture, Programming and Applications with the 8085”, Penram International Publishing (India), 1994.
3. Raj Kamal, “The Concepts and Features of Microcontrollers”, Wheeler Publishing, 2005.
4. Kenneth J. Ayala, “The 8051 microcontroller”, Cengage Learning, 2004.
5. John Morton, “The PIC microcontroller: your personal introductory course”, Elsevier, 2005.
6. Dogan Ibrahim, “Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F Series”, Elsevier, 2008.
7. Microchip datasheets for PIC16F877.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L	L	L	
CO 2			H		H
CO 3		H			H
CO 4				H	L
CO 5		L	L	L	H

EEPQ0088: POWER QUALITY

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. Explain about the harmonics, harmonic introducing devices and effect of harmonics on system equipment and loads. (Understanding)

2. Explain the series and shunt active power filtering techniques for harmonics. (Understanding)
3. Classify different power quality issues. (Analyzing)
4. Develop analytical modeling skills needed for modeling and analysis of harmonics in networks and components. (Creating)
5. Improve power factor based on static VAR compensators. (Creating)

Objective

The objective of this course is to introduce the different power quality issues faced by the power system and understand the recommended practices by various standard bodies like IEEE, IEC, etc. on voltage & frequency, harmonics and understanding the concept of STATIC VAR Compensators in power systems.

Module I: Power quality issues (8 hours)

Introduction-power quality-voltage quality-overview of power, Quality phenomena classification of power quality issues, Power quality measures and standards-THD-TIF-DIN-C-message weights, Flicker factor transient phenomena-occurrence of power quality problems, Power acceptability curves-IEEE guides, Standards and recommended practices.

Module II: Harmonics (8 hours)

Harmonics-individual and total harmonic distortion, RMS value of a harmonic waveform, Triplex harmonics. Important harmonic introducing devices, SMPS, Three-phase power converters-arcing devices, saturable devices, Harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

Module III: Modeling of systems (6 hours)

Modeling of networks and components under non-sinusoidal conditions, Transmission and distribution systems, Shunt capacitors-transformers, Electric machines, Ground systems loads that cause power quality problems, Power quality problems created by drives and its impact on drive.

Module IV: Improvement and control in power system (6 hours)

Power factor improvement- Passive Compensation, Passive Filtering, Harmonic, Resonance, Impedance Scan Analysis, Active Power Factor Corrected Single Phase Front End, Control Methods for Single Phase APFC, Three-Phase APFC and Control Techniques, PFC based on Bilateral Single Phase and Three Phase Converter.

Module V: Hamilton-Jacobi-Bellman model (8 hours)

Introduction to Hamilton-Jacobi-Bellman equation - model reference adaptive systems (MRAS) - Design hypothesis.

Module VI: Control methods (8 hours)

Introduction to design method based on the use of Liapunov function, Design and simulation of variable structure adaptive model following control.

Suggested Readings

1. G. T. Heydt, “Electric power quality”, McGraw-Hill Professional, 2007.
2. Math H. Bollen, “Understanding Power Quality Problems”, IEEE Press, 2000.
3. J. Arrillaga, “Power System Quality Assessment”, John Wiley, 2000.
4. J. Arrillaga, B. C. Smith, N. R. Watson and A. R. Wood, “Power system Harmonic Analysis”, Wiley, 1997.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1		H		L	
CO 2			H		H
CO 3		H		H	
CO 4		H			
CO 5			L	H	

EEWE0092: WASTE TO ENERGY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Course Outcomes

1. Select the appropriate method for Biomass pyrolysis, biomass gasification and biomass combustion for waste to energy conversion. (Remembering)
2. Explain waste management systems with respect to its physical properties, and associated critical considerations in view of emerging technologies. (Understanding)
3. Implement energy conversion system for conversion of waste to electrical energy. (Applying)

4. Design cooking stoves, digester, gasifier. (Creating)

Objective

The objective of this course is to introduce different sources, processes to carry on waste to energy conversion. The students will be able to design different systems and devices for converting waste materials to useful energy.

Module I: Introduction to Energy from waste (9 hours)

Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW, Conversion devices, Incinerators, gasifiers, digestors.

Module II: Biomass Pyrolysis (9 hours)

Pyrolysis, Types, slow, fast, Manufacture of charcoal, Methods, Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Module III: Biomass Gasification (9 hours)

FiFixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation, Gasifier burner arrangement for thermal heating, Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.

Module IV: Biomass Combustion (9 hours)

Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation, Operation of all the above biomass combustors.

Module V: Biogas (9 hours)

Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system, Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, Direct combustion, Types of biogas Plants, Applications, Alcohol production from biomass, Bio-diesel production, Urban waste to energy conversion, Biomass energy programme in India.

Suggested Readings:

1. Ashok V. Desai, “Non Conventional Energy”, Wiley Eastern Ltd., 1990.
2. K. C. Khandelwal and S. S. Mahdi, “Biogas Technology - A Practical Hand Book - Vol. I & II”, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. D. S. Challal, “Food, Feed and Fuel from Biomass”, IBH Publishing Co. Pvt. Ltd., 1991.
4. C. Y. WereKo-Brobby and E. B. Hagan, “Biomass Conversion and Technology”, John Wiley & Sons, 1996.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	H	H	H	
CO 2	H	M	M	M	M
CO 3			H	H	
CO 4				H	M

LABORATORY COURSES

EESS6033: POWER SYSTEM STEADY STATE ANALYSIS LAB

(2 Credits - 60 hours) (L-T-P: 0-0-4)

Course Outcomes

1. Recall characteristics of IGBT and thyristor. (Remembering)
2. Demonstrate the knowledge of Y-bus and Z-bus formation. (Understanding)
3. Find various performance parameters of a power system by using given data. (Analyzing)
4. Develop program for economic dispatch problems of electrical energy. (Creating)

List of Experiments:

1. Simulation of IGBT Inverters
2. Simulation of Thyristor Converters
3. Transient Stability Studies

4. Short Circuit Studies
5. Evaluation of Z-Bus and Y-Bus
6. Economic Load Dispatch
7. Gauss Seidel Load Flow analysis
8. Newton Raphson Load Flow analysis
9. Load Forecasting and Unit Commitment

Suggested Readings

1. C.L. Wadhwa, Electrical Power systems, (5th Edition) New Age International Publishers.
2. D.P. Kothari, I.J. Nagrath, Power System Engineering, Second edition, Tata McGraw Hill.

Mapping of COs to Experiments

Course Outcomes	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9
CO 1	M	M							
CO 2			H	H					
CO 3					H		H	H	
CO 4						H			H

EERE6034: RENEWABLE ENERGY LAB

(2 Credits - 60 hours) (L-T-P: 0-0-4)

Course Outcomes

1. Identify the V-I characteristics of solar panels. (Applying)
2. Utilize the concepts of Solar Energy and Wind Energy conversion techniques in practical situations. (Applying)
3. Determine the power output from Solar and Wind Farms. (Evaluating)

List of Experiments:

1. Power Curves
2. Build a Wind Farm model.
3. Test the Capabilities of Solar PV array in partial shading condition.
4. Effect of Temperature on Solar Panel Output
5. Variables Affecting Solar Panel Output
6. Effect of Load on Solar Panel Output
7. Wind Turbine Output: The Effect of Load
8. Test the Capabilities of Solar Panels and Wind Turbines

Mapping of COs to Syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8
CO 1	H							
CO 2		H	M	H			H	H
CO 3					H	H		

EECT6035: CONTROL LAB 1

(2 Credits - 60 hours) (L-T-P: 0-0-4)

Course Outcomes

1. Name the MATLAB commands associated with a robust control system. (Remembering)
2. Model common non-linearities used in control systems. (Applying)
3. Model and analyse digital control system. (Applying)
4. Design and simulate control system models. (Creating)

List of experiments:

1. Design and simulation of Linearised models using MATLAB/PSPICE.
2. Simulation and analysis of State space models for continuous time and discrete time systems using MATLAB/PSPICE.
3. Design and Simulation of LTI models of Feedback Control System using MATLAB/PSPICE.
4. Simulation and analysis of Digital Control System using MATLAB/PSPICE.
5. Simulation and Stability analysis of control systems with common nonlinearities using MATLAB/PSPICE.
6. Familiarization and use of the MATLAB command associated with Robust Control Systems.

7. Familiarization and use of PSIM software.

EECL6036: CONTROL LAB 2

(2 Credits - 60 hours) (L-T-P: 0-0-4)

Course Outcomes

1. Compare position, velocity, and adaptive control. (Understanding)
2. Explain adaptive control system (understanding)
3. Explain analog and digital servo system. (Understanding)
4. Construct PLC based system.(Creating)
5. Design ladder logic for PLC. (Creating)

List of experiments:

1. Designing of Ladder logic for various practical applications.
2. Execution of the Ladders using PLC's.
3. Study of Analog and Digital Servo Systems.
4. Experiment on Position Control System.
5. Experiment on Velocity Control System.
6. Experiment on Adaptive Control System.
7. Experiment on Nonlinear Control Systems.

EEPL6037: POWER SYSTEM PROTECTION LAB

(2 Credits) (L-T-P: 0-0-4)

Course Outcomes

1. Show the ability to propose models for radial and parallel feeder protection. (Remembering)
2. Demonstrate applications of practical power system protection schemes. (Understanding)
3. Apply the knowledge of different types of relays components in practical power system applications. (Applying)
4. Examine the performance characteristics of relays in equipment protection. (Analyzing)
5. Evaluate fault currents due to different types of faults in a network. (Evaluating)

List of experiments (any 8):

1. Introduction to Power System Protection
2. Evaluate fault currents due to different types of faults in a network
3. Over Current Relay (OCR) Testing System - To Plot IDMT Characteristics of OCR
4. Over Current Relay Testing System - To Perform Experiment on Definite/ Instantaneous Mode Setting of the relay.
5. Characteristics of a Differential Relay - To Plot Characteristics of % Biased Differential Relay (Merz-Price Method).
6. Pick-up Test for Differential Relay
7. Transformer Differential Protection Testing - For Transformer In-Zone Trips Fault
8. Transformer Differential Protection Testing - For Transformer Out-Zone or Non-Trip Faults
9. Principle of Reverse Power Protection
10. Concept of Radial Feeder Protection
11. Concept of Parallel Feeder Protection

Mapping of COs to Syllabus

Course Outcomes	Exp.1	Exp. 2	Exp.3	Exp.4	Exp.5	Exp.6	Exp.7	Exp.8	Exp.9	Exp.10	Exp.11
CO 1	H	H				M			M	H	H
CO 2	L	L	H	H			H	H			
CO 3			H	M	H	M			H	H	H
CO 4			H	M	H	H			L		
CO 5	L	H	H			H	H				

EEPA6038: POWER ELECTRONICS APPLICATION TO POWER SYSTEM LABORATORY

(2 Credits - 30 hours) (L-T-P: 0-0-4)

Course Outcomes

1. Identify the suitable power electronic devices for designing different power electronic converters. (Applying)
2. Examine the performance characteristics of different types of FACTS devices. (Analyzing)

3. Experiment with various power electronic circuits used in power system applications. (Evaluating)
4. Design different types of power electronic converters. (Creating)

List of Experiments:

Any ten experiments will be performed

1. Three phase fully controlled rectifier
2. Multi-level inverters
3. Active power filters
4. Non-isolated DC- DC converter
5. Characteristic of SVC
6. Characteristic of STATCOM
7. Characteristic of TCSC
8. Improvement of power quality using shunt compensation
9. Improvement of power quality using series compensation
10. Solar power integration to grid
11. Vector control of inverter

Suggested Readings

1. N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.
2. M.R. Rashid, Power Electronic Circuits, Devices and Applications, Third Edition, PHI.

Mapping of COs to Experiments

Course Outcomes	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt.10	Expt.11
CO 1	H	H	H	H							
CO 2					H	H	H	L	L		L
CO 3	M	M	M								
CO 4	H	H		M						L	

EEMP6041: MINI PROJECT (M.Tech)

(2 Credits - 60 hours) (L-T-P: 0-0-4)

Course Outcomes

1. Apply practical knowledge within the chosen area of technology for project development. (Applying)
2. Demonstrate the skills to carry out research work independently. (Understanding)
3. Plan for executing projects with a comprehensive and systematic approach. (Applying)
4. Take part in development of technical projects as an individual or in a team. (Analyzing)
5. Develop effective communication skills for presentation of project related activities. (Creating)

Process:

1. Literature Review
2. Synopsis Presentation
3. Progress Presentation
4. Hardware/Software Project Execution
5. Final Presentation and Demonstration of the Project

EEMM6042: MICROPROCESSOR AND MICROCONTROLLER LAB

(1 Credits - 30 hours) (L-T-P: 0-0-2)

Course Outcomes

1. Demonstrate the usage of Keil software in writing, compiling and debugging 8051 programs (Understanding)
2. Make use of the 8051 assembly language instructions to write programs for a given problem. (Applying)
3. Examine the output of each line of an 8051 program code. (Analysing)

List of Experiments

1. Interfacing of 8051 development kit to PC and programmer.
2. Data transfer operation from registers and internal data memory.
3. Addition and subtraction of two 8 bit numbers.

4. Addition of two 16-bit numbers.
5. Addition of an array of 8-bit numbers.
6. Subtraction of two 16-bit numbers.
7. Multiplication and division of two 8-bit numbers.
8. Multiplication of two 16-bit numbers.
9. Interfacing of LEDs and Switches.
10. Interfacing of seven segment displays.
11. Interfacing of 16 x 2 LCD.
12. Interfacing of ADC.

Mapping of COs to Syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	H											
CO 2		H	H	H	H	H	H	H	H	H	H	H
CO 3		H	H	H	H	H	H	H	M	M	M	M

EEDI6050: DISSERTATION PHASE-I

(10 Credits) (L-T-P : 0-0-20)

Course Outcomes

1. Select a project of interest. (Remembering)
2. Defend the topic of interest for continuing work, by doing initial studies on it. (Understanding)
3. Prepare a working methodology for the project for its successful completion. (Applying)
4. Design and experiment on the selected project. (Analysing)
5. Devise tools and methods for experimenting and troubleshooting for getting expected outcomes. (Evaluating)
6. Explain, justify and defend the project work by presenting the work and writing a report. (Creating)

Objective

During this Phase-I of the M.Tech dissertation, the student will start a research project, applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightage attached to them shall be published by the department/Institute at the beginning of the semester. At least one review paper is expected to be published by the student in this phase.

EEDI6051: DISSERTATION PHASE–II

(16 Credits) (L-T-P: 0-0-32)

Course Outcomes

1. Define the problem encountered in Phase-I and find suitable methodology to be adopted for the project work. (Remembering)
2. Classify the whole project work in various modules and explain the working model of the proposed work by demonstrating the different modules. (Understanding)
3. Apply mathematical skills to learn how these skills are important in engineering and construct software implementation skills and design skills especially from a systems perspective. (Applying)
4. Analyse the advanced electrical power or control systems and different problems encountered in designing a system. (Analysing)
5. Evaluate the complete system and perceive future scopes of the work carried out. (Evaluating)
6. Elaborate the performance of the work done, contrast on limitations of the system designed. and compile a technical report on the project (Creating)

Objective

During the Phase-II of M.Tech dissertation, the student will carry forward and complete the work that they have started in Phase-I. It is required that the student will publish at least one research paper in a well-known reputed journal to augment their work during this phase. Published papers will carry extra weightage during evaluation. The mode and components of evaluation and the weightage attached to them shall be published by the department at the beginning of the semester.

VALUE ADDED COURSES

EEAL0113: AUTOCAD ELECTRICAL

(2 Credits: 30 hours) (L-T-P : 0-1-2)

Course Outcomes

1. Demonstrate methods of customizing AutoCAD Electrical symbols, circuits, and databases, title block linking, reporting tools, templates, and project files. (Understanding)
2. Build schematic drawings such as ladder logic and single wire and multi wire circuits, panel drawings, and PLC-I/O circuits using automated commands for symbol insertion, component tagging, wire numbering, and drawing modification. (Creating)

Objective

The main objective of this course is to learn how to use the powerful electrical drawing creation tools in the AutoCAD Electrical software.

Module I: Introduction to auto CAD Electrical (6 hours)

Introduction to Electrical CAD interface, Electrical Components and wires, Design methodologies,Project files, Accessing project files,Add a drawing to a project file, managing drawings in a project, Project manager Drawing list.

Module II: Schematic I and schematic II (6 hours)

a. schematic I: Single wires/ Components, Referencing, Ladders, Insert wires, Edit wires, 3 phase components,Source and destination Signal Arrows, Insert component, parent/child components
b. Schematic II: Multiwire and circuits, Dashed Link Lines, 3 Phase Ladders.

Module III Editing Commands and panel drawings (6 hours)

a. Editing commands: Edit Component, Updating Drawings, Scoot & Align, Move & Copy Component, Delete & Surfer Component, Copy Catalogue Assignment, Copy Installation/Location Code Values, Attribute Editing Commands:
b. Insert Footprint and component, Edit footprint, Assign Item numbers, Add balloons.

Module IV: Terminals and Point-to-Point Wiring Drawings (6 hours)

a. Terminals: Insert Terminal Symbols, Multiple Level Terminals, Multiple Insert Component command, insert jumpers, Terminal Strip Editor, DIN Rail Command.
b. Point-to-Point Wiring Drawings: Insert & Edit Connectors, Insert Splices, Insert Multiple Wires, Bend Wires.

Module V: Symbol creation (6 hours)

Schematic Symbols, Naming Convention, Icon Menu Wizard, AutoCAD Electrical Databases, Project & Catalog Databases, Footprint Lookup Database, Insert PLC, Insert Individual PLC I/O Points.

Suggested Readings:

1. James D. Bethune, “Engineering Graphics with AutoCAD 2020”, Macromedia Press.
2. Gaurav Verma and Matt Weber, “AutoCAD Electrical 2021 Black Book”, 6th Edition, Cadcamcae Works.
3. Sham Tickoo, “AutoCAD Electrical 2021: A Tutorial Approach”, 2nd Edition, CADCIM Technologies.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module v
CO 1	H	M	M	M	H
CO 2		H	M	M	

EEAR0112: INTRODUCTION TO ARDUINO AND RASPBERRY PI

(2 Credits - 30 hours) (L-T-P:0-1-2)

Course Outcomes

1. List the different I/O pins available on the Arduino and Raspberry Pi. (Remembering)
2. Execute software programs on Arduino and Raspberry Pi. (Applying)

Module I : Introduction to Arduino (15 hours)

Introduction to Arduino, Arduino boards and their specification, Arduino integrated development environment, Arduino UNO development board, Programming the Arduino boards, Interfacing LEDs, Interfacing switches, interfacing LCDs, Serial

communication, Interfacing analog sensors, PWM control, DC motor interfacing, Servo motor interfacing, Stepper motor interfacing. Circuit design, programming, testing and debugging.

Module II: Introduction to the Raspberry Pi (15 hours)
Introduction to the Raspberry Pi: Features, GPIO. Linux System Administration: Overview, Files & Process, Directories, Basic commands etc. Some common Troubleshooting, Network configuration: interfaces, Configuring the Raspberry Pi: config.txt, cmdline.txt. Pi as Media Centre, Web Server etc.Introduction to python: IDLE, variables, input, loop, installing GPIO library. Hardware hacking, Pi with Arduino, IOT etc.

Suggested Readings:
1. Arduino Programming: Step-by-step guide to mastering arduino hardware and software by Mark Torvalds
2. Raspberry Pi User Guide by Gareth Halfacree and Eben Upton

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	H

EEEL0114: ELECTRICAL WIRING

(2 Credits - 30 hours) (L-T-P: 0-1-2)

Course Outcomes
1. Define and explain the difference between direct current and alternating current. (Remembering)
2. Describe conditions likely to affect severity of electrical shock while maintaining safety during installation. (Remembering)
3. Demonstrate the different conductor systems used in residential and light commercial wiring in accordance with the codes and authorities for installation. (Applying)
4. Analyze the essential tools for residential wiring and be able to discuss the basic principles of tool-use and care. (Analysing)

Objective
To improve student electrical wiring skills through systematic training to enable students to create and test different electrical circuits using suitable electrical equipment, wires, protective devices and wiring accessories.

Module I: Basic Electrical Circuits (9 hours)
Measurement of Electrical quantities like Voltage, Currents, Resistance, Impedance, power factor and energy, Various Electrical Symbols, Electricity conductor, insulator, and resistance, Single-phase & three-phase circuits, Serial connection-diagram, Series and Direct Board-different types.

Module II: Different types of electrical wiring / installations (12 hours)
Two-way switch-wiring, 3-phase wiring, Overhead service connection, Definition and testing procedure of voltage current power MCB and bus bars, Earthing Connection – Different earthing systems.

Module III: Fundamentals of electricity-safety measures and precautions, first aid/Tools and equipment (12 hours)
Safely handling Tools & Equipment /Fire Fighting and use of fire extinguishers, Fires in electrical Circuits & Precautions, General Safety of Tools & equipment, Measuring tools, wire gauges etc. Classification, Identification of the electrical equipment cables, wires and electrical accessories.

Module IV: House Wiring Practical (12 hours)
House Wiring by PVC Casing Capping including Testing, House Wiring by PVC Rigid Pipe including Testing, Industrial Wiring by MS Pipe Including Testing, Measurement of Earth Resistance by Earth Tester, Common Faults in AC & DC Fans, Regulators and Remedies.

Suggested Readings
1. J.B. Gupta, “A Course in Electrical Installation Estimating and Costing”, S.K. Kataria & Sons.
2. S.L. Uppal and G.C. Garg, “Electrical Wiring Estimating & Costing”, Khanna Publishers.
3. Satheesh Kumar, “Electrical Wiring: An Introduction”, Ane Books Pvt. Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	L	

CO 2	L	L	H
CO 3	M	H	L
CO 4	M	M	H

EEPY0115: PYTHON FOR ELECTRICAL ENGINEERING

(2 Credits: 30 hours) (L-T-P: 0-1-2)

Course Outcomes

1. Simulate Electrical Systems using Python. (Applying)
2. Evaluate the performance of new Electrical designs using Python. (Evaluating)
3. Construct Electrical systems using Python. (Creating)

Objective

The objective of this course is to familiarize the students with the Python Programming environment and its various applications in simulating Electrical Systems. The course will be a combination of tutorial and practical classes, focusing on hands-on exercises to be done by the students using Python and its various modules.

Module I: Introduction to Python (8 hours)

Python Packages, Anaconda, Python Editors, Resources, Installing Python. Python IDE, Python Shell, Running Python from the Console, Scripting Mode. Basic Python Program, Variables, Built-in Functions, Python Standard Library, Using Python Libraries, Packages and Modules, Plotting in Python.

Module II: Python Programming (6 hours)

Loops in Python programming, Creating Functions in Python, Creating Classes in Python, Creating Python Modules, File Handling in Python, Error Handling in Python, Debugging in Python, Installing and using Python Packages.

Module III: Python for Mathematics Applications (6 hours)

Mathematics in Python, Linear Algebra in Python, Complex Numbers in Python, Differential Equations, Optimization. Using Python for Simulations, Differential Equations, Discrete Systems, Real-Time Simulations.

Module IV: Python for Electrical Engineering Applications (10 hours)

Numerical Methods using Python, Numerical integration, Solving ordinary differential equations, Root finding, Interpolation, Curve fitting, Fourier transforms.

Python used for Control Applications, Transfer Functions, State Space Models, Frequency Response, Stability Analysis.

Applications of Python in- Electromagnetics, Circuit Analysis, Electrical Power Systems, Power Electronics, Signal Processing, Electrical System Modeling and Simulation.

Suggested Readings

1. Hans-Petter Halvorsen, “Python”. Available: https://www.halvorsen.blog/documents/programming/python/python.php
2. Hans-Petter Halvorsen, “Python for Science and Engineering”, 2019. Available: https://www.halvorsen.blog/documents/programming/python/resources/Python%20for%20Science%20and%20Engineering.pdf
3. Hans-Petter Halvorsen, “Python for Science and Engineering- YouTube Video playlist”.Available:https://www.youtube.com/playlist?list=PLdb-TcK6Aqj2hlH55Bn5oxFlvyoVbXxQS
4. Hans-Petter Halvorsen, “Python for Control Engineering”, 2020, Available: https://www.halvorsen.blog/documents/programming/python/resources/Python%20for%20Control%20Engineering.pdf
5. Hans-Petter Halvorsen, “Python for Control Engineering- YouTube Video Playlist”, Available:https://www.youtube.com/playlist?list=PLdb-TcK6Aqj1Kg6pV3zlrpUnPIRwG2_Ox
6. Hans Fangohr, ‘Introduction to Python for Computational Science and Engineering”,2018.Available: https://fangohr.github.io/python/book/Introduction-to-Python-for-Computational-Science-and-Engineering.pdf

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	M		H
CO 2			M	H
CO 3		M	L	H

EESL0200: SERVICE LEARNING

(2 Credits – 30 hours)

Course Outcomes

1. Define and explain the understanding of Community-University Engagement (CUE) and outline CUE in relation to higher education policy in India. (Remembering)
2. Analyze and identify the social responsibility of higher education institutions to facilitate engaged teaching, research & service. (Analyzing)
3. Determine the various methods and tools on Community-Based Participatory Research (CBPR). (Evaluating)
4. Evaluate how Higher education institutions can undertake community engagement post COVID-19. (Evaluating)
5. Design a plan for the engagement of students with the community through engaged teaching, research and service. (Creating)

Objective

The objective of this course is to understand the theory and practice of community university engagement. The students provide an insight on the theme of Social Responsibility of Higher Education Institution (HEI) and to introduce community based participatory research and the tools to facilitate engaged research.

Module I: Community University Engagement (CUE) (6 Hours)

History of Community University Engagement (CUE) in Indian Higher Education Policy, Fostering Social Responsibility by Higher Education: COVID-19 and Beyond, Current status and possible interventions, Recent initiatives, Principles of community engagement,

Module II: Social Responsibility of HEIs (5 Hours)

Understanding Social Responsibility of HEIs – Engaged Teaching, Research & Service, Community Engaged teaching and research, Community based participatory research, practice based learning, Community service, Effective Methods and Tools for Engaging Community in Research

Module III: Community Engagement through Electrical and Electronics Engineering (19 Hours)

Power sector scenario including generation, transmission, and distribution scenario of India, Duties and responsibilities of Assistant Electricity Meter Reader, Billing and cash collector and their career progression, Develop circuit and wiring diagram and electrical signage, code specifications to plan wiring layouts, consumption points accurately, as may be required, Standard location of service line connection, layout of main switch, circuit breakers required at main board, Install the protective device i.e.ratings as per the load, Replacement of damaged switches, MCB, fan- capacitor, regulator, lighting points i.e. holder, choke, starters, water coolers and their pump & motor, Operate principle of single phase motor, various types of motors like self start, capacitor start, capacitor run, universal motors and their applications and functions of condenser, Earth testing, Build a wind farm model, Application of drone technology in agriculture, search and rescue, wildlife tracking etc.

Suggested Readings

1. W. James Jacob, Stewart E. Sutin, John C. Weidman, John L. Yeager, “Community Engagement in Higher Education: Policy Reforms and Practice”, Springer, 2015.
2. David Coghlan, Mary Brydon-Miller, “The SAGE Encyclopedia of Action Research”, SAGE, 2014.
3. Book on Electricity rules.
4. Kronick, Robert F., “Emerging Perspectives on Community Schools and the Engaged University”, IGI Global,2019
5. Tami L. Moore, “Community-University Engagement: A Process for Building Democratic Communities”, John Wiley & Sons, 2014.
6. Marshall Welch, “Engaging Higher Education: Purpose, Platforms, and Programs for Community Engagement”, Stylus Publishing, 2016.
7. Barbara Jacoby, “Building Partnerships for Service-Learning”, John Wiley & Sons, 2003.
8. Becca Berkey, Emily A. Eddins, Patrick M. Green, Cara Meixner, “Reconceptualizing Faculty Development in Service-Learning/Community Engagement: Exploring Intersections, Frameworks, and Models of Practice”, Stylus Publishing, 2018.
9. Datasheets from the internet.

SCHOOL OF TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To cultivate nation builders, with scientific and engineering expertise and moral integrity, committed towards the upliftment of society.

MISSION

The department of Electronics and Communication Engineering of Don Bosco College of Engineering and Technology, School of Technology, Assam Don Bosco University seeks to provide young and enthusiastic minds with sound theoretical and practical knowledge in electronics and communication technologies, so that they grow up into competent individuals, capable of:

- Converting ideas into reality
- Standing up to challenges to lead from the front and provide progressive solutions
- Contributing towards the growth and development of new technologies
- Creating a positive impact on global society and contributing towards the welfare of mankind

PROGRAM EDUCATIONAL OBJECTIVES

- To create highly professional graduates with sound knowledge in the field of Electronics and Communication Engineering through quality education.
- To cater to global technological needs and to contribute to the industry by delivering the expertise acquired, through problem solving and working on need based projects.
- To groom young minds with a strong sense of commitment towards the betterment of society and environment.

PROGRAMME OUTCOMES OF M.TECH. IN SIGNAL PROCESSING:

PO 1: Ability to apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.

PO 2: Ability to identify, formulate and solve engineering problems in the signal processing areas such as Developing robust and problem specific algorithms for acquisition, processing, analysis, synthesis of signals, to be applied in Signal Processing, Machine Vision and Communication Networks.

PO 3: Ability to understand and use different software tools in the domain of signal processing. Analysis and Verification of algorithms, Functional and timing Simulation on platforms like MATLAB, code composer studio and assembly language.

PO 4: Ability to design and conduct experiments, analyze and interpret data, imbibe programming skills for development of simulation experiments.

PO 5: Ability to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

PROGRAMME OUTCOMES OF M.TECH IN COMMUNICATIONS:

PO 1: Ability to apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.

PO 2: Ability to identify, formulate and solve engineering problems in the broad areas like Systems Design using communication and networking platforms and tools. Explore recent developments in areas like optical communication, satellite communication, wireless communication, networking, RF-microwave, antennas, measurements and standards in communication.

PO 3: Ability to understand and use different software tools for Design, Analysis and Verification in the domain of communication and networking. System results are obtained through progressive steps such as Design entry, Synthesis, Functional and Timing Simulation.

PO 4: Ability to design and conduct experiments, analyze and interpret data, imbibe programming skills for development of simulation experiments.

PO 5: Ability to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

PROGRAMME OUTCOMES OF M.TECH IN VLSI AND EMBEDDED SYSTEM:

PO 1: Ability to apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.

PO 2: Identify, formulate and solve engineering problems in the broad areas like System Design using VLSI and Embedded Platforms and tools, Semiconductor Technologies, Applications in Signal Processing, Machine Vision and Communication Networks.

PO 3: Use different software tools in the domain of VLSI and Embedded Systems Design, Analysis and Verification such as Design entry, Synthesis, Functional and Timing Simulation, Floor-planning, Place and route, Layout editors, RTL schematic, Platform specific EDA sets, MATLAB.

PO 4: Design and conduct experiments, analyze and interpret data, imbibe programming skills for development of simulation experiments.

PO 5: Function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

MAPPING of COURSES to PO/PSOs (M.Tech – Signal Processing)

Sl. No.	Course Type	COURSE	PO1	PO2	PO3	PO4	PO5	Remarks
1	Core 1	ECAP0053	H	H	H			Employability
2	Core 2	ECDV0054	M	H	H	M	L	Employability
3	Core	ECRM0042	L			M	H	
4	Audit 1	EGRW0015				L	M	
5	Prog. Specific Elective I	ECAU0055		H	H	M		Skill Development
6		ECCV0056		H	H	M	L	Skill Development
7		ECAA0057		H	H	M		Employability
8	Prog. Specific Elective II	ECSI0058	M	H	M	M		
9		ECVD0059	M	H	M	M		Skill Development
10		ECVC0060	L	H	H	H		Employability
11	Lab1	ECAP6041	M	H	H	H		
12	Lab2	ECDV6042	M	H	H	H		
13	Core 3	ECPM0069	L	H	H	H	L	Skill Development
14	Core 4	ECDE0070	M	H	M	M		
15	Prog. Specific Elective III	ECIA0071	M	H	M	H	H	Entrepreneurship
16		ECDD0072	H	M	H	L		Skill Development
17	Prog. Specific Elective IV	ECBS0073	M	H	H	H	M	Skill Development
18		ECDS0074	M	H	H			Employability
19	Lab3	ECPM6045	L	H	H	H	M	
20	Lab4	ECDE6046	M	M	H	H	M	
21	Project	ECMI6051	M	M	H	H	H	
22	Audit 2 (MOOCs)	EDCI0100					M	
23	Prog. Specific Elective V	ECAI0096	M	H	H	H	L	
24		ECOT0097	M	H	H	H		
25		ECRS0098	M	H	H	H	L	
26	Open Elective	Bioinformatics	H	H				
27	Dissertation (Phase I & II)	ECDI6059	M	M	H	H	H	

MAPPING of COURSES to PO/PSOs (M.Tech – Communication)

Sl. No.	Course Type	COURSE	PO1	PO2	PO3	PO4	PO5	Remarks
1	Core 1	ECAP0053	H	M	H			Employability
2	Core 2	ECWM0061	M	H		M		Employability
3	Core	ECRM0042	L			M	H	
4	Audit 1	EGRW0015				L	M	
5	Prog. Specific Elective I	ECSC0062	M	H	M			Skill Development
6		ECWN0063	L	H	H	H		Employability
7		ECON0064	L	H	H			Employability
8	Prog. Specific Elective II	ECCR0065		H	M			
9		ECSI0058	M	M	H	M		Skill Development
10		ECRC0066	M	H				
11	Lab1	ECAP6041	M	M	H	H		
12	Lab2	ECWM6043	M	H	H			

13	Core 3	ECRS0075	M	H	H	M		Skill Development
14	Core 4	ECCN0076		H	M			
15	Prog. Specific Elective III	ECDS0074	M	H	M	H	H	Entrepreneurship
16		ECIA0071	H	M	H	L		Skill Development
17	Prog. Specific Elective IV	ECPM0069	L	H	H	H		Skill Development
18		ECMS0077	M	H	H			Employability
19	Lab3	ECRS6047	M	M	H	H	M	
20	Lab4	ECCN6048	M	M	H	H	M	
21	Project	ECMI6051	M	M	H	H	H	
22	Audit 2 (MOOCs)	EDCI0100					M	
23	Prog. Specific Elective V	ECAI0096	M	M	H	H	L	
2		ECOT0097	M	H	H	H		
25		ECRS0098	M	H	H	H		
26	Open Elective	Bioinformatics	H	H				
27	Dissertation (Phase I & II)	ECDI6059	M	M	H	H	H	

MAPPING of COURSES to PO/PSOs (M.Tech – VLSI and Embedded System)

Sl. No.	Course Type	COURSE	PO1	PO2	PO3	PO4	PO5	Remarks
1	Core 1	ECAP0053	H	H	H	L		Employability
2	Core 2	ECMA0067	M	M	H	M		Employability
3	Core	ECRM0042	L			M	H	
4	Audit 1	EGRW0015				L	M	
5	Prog. Specific Elective I	ECPP0068	M	H	H			
6		ECAA0057		H	H	M		Employability
7	Prog. Specific Elective II	ECWM0061	M	H		M		Employability
8		ECDV0054	M	H	H	M	L	Employability
9	Lab1	ECAP6041	M	H	H	H	M	
10	Lab2	ECMA6044	M	H	H	H	M	
11	Core 3	ECDS0074	M	H	H			Employability
12	Core 4	ECSA0078	M	M	H	M	L	Employability
13	Prog. Specific Elective III	ECDD0072	H	M	H	L		Skill Development
14		ECIA0071	M	H	M	H	H	Entrepreneurship
15	Prog. Specific Elective IV	ECMT0079	M	H	M			Employability
16		ECBS0080	M	H	H			
17	Lab3	ECDS6049	M	H	H	H	M	
18	Lab4	ECSA6050	M	H	H	H	M	
19	Project	ECMI6051	M	M	H	H	H	
20	Audit 2 (MOOCs)	EDCI0100					M	
21	Prog. Specific Elective V	ECAI0096	M	H	H	H	L	
22		ECNN0099	M	H		H		
23		ECSD0100	M	H	H	H		
24	Open Elective	Bioinformatics	H	H				
25	Dissertation (Phase I & II)	ECDI6059	M	M	H	H	H	

DETAILED SYLLABUS

THEORY COURSES

ECRM0042 RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHT (L-T-P: 2-0-0)

(2 credits-30 hours)

Objective:

This course is designed to help students to identify research problems in various fields. It aims at giving potential researchers the knowledge of effectively analysing and interpreting results and presenting the findings to the scientific and technological community of the world. This course also aims at motivating students to bring about their creative ideas for innovation and establishing research impact in the global for a through intellectual ownership.

Course Outcomes

1. Find research problems in various fields (Remembering).
2. Illustrate the concepts related to patents, trademark and copyright (Understanding).
3. Apply scientific investigations to find solutions for research problems of interest (Applying).
4. Develop technical writing and presentation skills (Applying).
5. Analyze the available literature and compile literature review for knowing the state of the art in the areas of interest (Analyzing/ Creating).
6. Formulate a research problem for a given engineering domain (Creating)

Module I (12 Hours)

Meaning, sources, scope and objective of a research problem; Good research problem criteria and characteristics, errors in selecting a research problem; Research problem solutions– approaches for investigation; Approaches to effective literature studies; Data collection, analysis, interpretation and instrumentation; Plagiarism and ethical practices.

Module II (10 Hours)

Effective writing; Research proposal development and its format; Different report types.

Module III (8 Hours)

a. Nature of intellectual property: Patent, design, trade and copyright; Patenting and development process; Patent grant under PCT and procedure; Geographical indications.
b. Patent rights: Administration of patent systems, scope, information and databases, technology licensing.
c. New developments and case studies.

Suggested Readings

1. Goddard Wayne, Melville Stuart, Research Methodology: An Introduction For Science And Technology Students, Juta & Co. Ltd.
2. Kumar Ranjit, Research Methodology A Step By Step Guide For Beginners, SAGE publications Inc.
3. Halbert J. Debora, Resisting Intellectual Property, CRC press.
4. Menell S. Peter, Lemley A. Mark, Merges P. Robert, Intellectual Property In New Technological Age, Clause 8 Publishing.
5. C.R. Kothari, Research Methodology Methods and Techniques, New Age International

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		L
CO 2	M		H
CO 3	H	L	
CO 4	L	H	M
CO 5	H	M	L
CO6	H	M	L

ECAP0053 ADVANCED DIGITAL SIGNAL PROCESSING (L-T-P: 3-0-0)

(3 Credit-45 hours)

Objective:

This course is intended to make the students learn the essential advanced topics in digital signal processing that are necessary for successful post graduate-level research. The course includes a review of the linear constant-coefficient system properties

covered in an undergraduate DSP course, and then examines a variety of filter structures, time-varying and adaptive systems, fast algorithms, and other topics relevant to the research areas of the students.

Course Outcomes

1. Recall and illustrate theory of different filters and algorithms. (Remembering, Understanding)
2. Choose the best algorithm for adaptive filter design. (Applying)
3. Understand theory of multirate DSP, solve numerical problems and write algorithms. (Understanding, Applying)
4. Analyse theory of prediction and solution of normal equations. (Analysing)
5. Examine applications of DSP at block level. (Analysing)
6. Interpret the utilization of advanced algorithms like LMS, MMSE etc., for designing adaptive filters. (Evaluating)
7. Design the various types of digital filters. (Creating)

Module I (10 Hours)

Overview of DSP: Discrete time signals and Systems. Characterization in time and frequency, LTI System, the Z-transform, DFT, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design & structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, and Parallel all pass realization of IIR, FIR differentiators.

Module II (7 Hours)

Multi rate DSP: Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, polyphase filters, QMF, digital filter banks, Applications in sub-band coding.

Module III (8 Hours)

inear prediction & optimum linear filters: Stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Module IV (8 Hours)

Introduction to adaptive signal processing:Adaptive Filters, FIR adaptive filters: steepest descent adaptive filter, LMS algorithm, Gradient Adaptive Lattice, Minimum mean square criterion, Recursive Least Square algorithm, Applications: noise cancellation, channel equalization, adaptive recursive filters, recursive least squares, Kalman Filter.

Module V (7 Hours)

Estimation of Spectra from Finite-Duration Observations of Signals: Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum Variance Spectral Estimation, Eigen analysis, Algorithms for Spectrum Estimation.

Module VI (5 Hours)

Application of DSP & Multi rate DSP: Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications.

Suggested Readings

1. J. G. Proakis and D. G. Manolakis “Digital signal processing: Principles, Algorithm and Applications”, 4th Edition, Prentice Hall, 2007.
2. N. J. Fliege, “Multirate Digital Signal Processing: Multirate Systems-Filter Banks– Wavelets”, 1st Edition, John Wiley and Sons Ltd, 1999.
3. Bruce W. Suter, “Multirate and Wavelet Signal Processing”, 1st Edition, Academic Press, 1997.
4. M. H. Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley & Sons Inc., 2002.
5. S. Haykin, “Adaptive Filter Theory”, 4th Edition, Prentice Hall, 2001.
6. D. G. Manolakis, V.K. Inglean and S. M. Kogon, “Statistical and Adaptive Signal Processing”, McGraw Hill, 2000.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		M	L		
CO 2			M	H	L	
CO 3		H			M	L
CO 4			H	M	L	
CO 5	M		L			H
CO 6			M	L	H	

ECDV0054 DIGITAL IMAGE AND VIDEO PROCESSING (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective:
This course is intended to give the students an overview of important topics of image and video processing. The course starts with an introduction to the basics of image and video processing such as sampling, aliasing etc. and image transforms like DFT, DCT etc. and then moves on to advanced topics such as image and video restoration, segmentation, compression etc. It also introduces the students to concepts of colour image processing.

Course Outcomes
1. Define key stages of image processing (Remembering)
2. Explain key stages of image processing (Understanding)
3. Implement image enhancement, restoration, data compression techniques (Applying)
4. Compare object recognition tools (Analyzing)
5. Choose image enhancement technique and object recognition tool for specific applications (5, Evaluating)

Module I (10 Hours)
Digital Image and Video Fundamentals: Digital image and video fundamentals and formats, 2-D and 3-D sampling and aliasing, 2-D/3-D filtering, image decimation/interpolation, video sampling and interpolation, Basic image processing operations, Image Transforms. Need for image transforms, DFT, DCT, Walsh, Hadamard transform, Haar transform, Wavelet transform.

Module II (8 Hours)
Image and Video Enhancement and Restoration: Histogram, Point processing, filtering, image restoration, algorithms for 2-D motion estimation, change detection, motion-compensated filtering, frame rate conversion, deinterlacing, video resolution enhancement, Image and Video restoration (recovery).

Module III (10 Hours)
Image and Video Segmentation: Discontinuity based segmentation- Line detection, edge detection, thresholding, Region based segmentation, Scene Change Detection, Spatiotemporal Change Detection, Motion Segmentation, Simultaneous Motion Estimation and Segmentation Semantic Video Object Segmentation, Morphological image processing.

Module IV (7 Hours)
Colour image Processing: Colour fundamentals, Colour models, Conversion of colour models, Pseudo colour image processing, Full Colour processing.

Module V (5 Hours)
Image and Video Compression: Lossless image compression including entropy coding, lossy image compression, video compression techniques, and international standards for image and video compression (JPEG, JPEG 2000, MPEG-2/4, H.264, SVC), Video Quality Assessment.

Module VI (5 Hours)
Object recognition: Image Feature representation and description-boundary representation, boundary descriptors, regional descriptors, feature selection techniques, introduction to classification, supervised and unsupervised learning, Template matching, Bayes classifier.

Suggested Readings
1. Ed. Al Bovik ,"Handbook of Image and Video Processing", 2nd Edition, Academic Press,2000.
2. J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding", 2nd Edition, Academic Press,2011.
3. Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall,2008.
4. M. Tekalp, "Digital Video Processing",2nd Edition, Prentice Hall,2015.
5. S. Shridhar, "Digital Image Processing", 2nd Edition, Oxford UniversityPress, 2016.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	M	M	M	M	M	M
CO 2	M	M	M	M	M	M
CO 3	H	H	H	L	H	L
CO 4	L	L	L	L	L	H
CO 5	H	H	L	L	L	H

ECAU0055 AUDIO PROCESSING (L-T-P: 3-0-0)
(3 credits – 45 hours)

Objective:
This course is intended to introduce the students to the fundamentals of audio processing and then move on to more advanced topics such as LPC, speech coding etc. The course also delves into applications of audio processing such as speech recognition and speaker recognition.

Course Outcomes
1. Define principal characteristics of speech, various speech analysis and synthesis systems (Remembering)
2. Explain principal characteristics of speech, various speech analysis and synthesis systems (Understanding)
3. Implement speech analysis and synthesis systems, speech coding, speech and speaker recognition(Applying)
4. Compare various techniques for speech analysis and synthesis, speech coding, speech and speaker recognition (Analyzing)
5. Choose suitable one amongst various techniques for speech analysis and synthesis, speech coding, speech and speaker recognition (Evaluating)

Module I (8 Hours)
Principle Characteristics of Speech: Linguistic information, Speech and Hearing, Speech production mechanism, Acoustic characteristic of speech Statistical Characteristics of speech. Speech production models, Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model.

Module II (10 Hours)
Speech Analysis and Synthesis Systems: Digitization, Sampling, Quantization and coding, Spectral Analysis, Spectral structure of speech, Autocorrelation and Short Time Fourier transform, Window function, Sound Spectrogram, Mel frequency Cepstral Coefficients, Filter bank and Zero Crossing Analysis, Analysis –by-Synthesis, Pitch Extraction.

Module III (7 Hours)
Linear Predictive Coding Analysis: Principle of LPC analysis, Maximum likelihood spectral estimation, Source parameter estimation from residual signals, LPC Encoder and Decoder, PARCOR analysis and Synthesis, Line Spectral Pairs, LSP analysis and Synthesis.

Module IV (10 Hours)
Speech Coding: Reversible coding, Irreversible coding and Information rate distortion theory, coding in time domain: PCM, ADPCM, Adaptive Predictive coding, coding in Frequency domain: Sub band coding, Adaptive transform coding, Vector Quantization, Code Excited Linear Predictive Coding (CELP).

Module V (5 Hours)
Speech Recognition: Principles of speech recognition, Speech period detection, Spectral distance measure, Structure of word recognition system, Dynamic Time Warping (DTW), Theory and implementation of Hidden Markov Model (HMM).

Module VI (5 Hours)
Speaker recognition: Human and Computer speaker recognition Principles Text dependent and Text Independent speaker recognition systems. Applications of speech Processing.

Suggested Readings
1. Sadaoki Furui, “Digital Speech Processing, Synthesis and Recognition” 2nd Edition, Taylor & Francis, 2000.
2. Rabiner and Schafer, “Digital Processing of Speech Signals”, Pearson Education, 1979.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H	M	L	L	L
CO 2	H	H	M	L	L	L
CO 3	L	H	M	H	H	H
CO 4	L	H	M	H	H	H
CO 5	L	H	M	H	H	H

ECCV0056 COMPUTER VISION (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective:

The course is intended to make an insight into different aspects of Computer Vision and Machine learning, working principles, systems associated and applications.

Course Outcomes

1. Recall the working of camera and explain behavior of various sources, surfaces, shadows, human visual systems etc. (Remembering/ Understanding)
2. Illustrate the image formation models and feature extraction for computer vision. (Understanding)
3. Apply various image analysis operations on the images and videos such as segmentation, counting objects, shape determination, feature extraction etc. (Applying)
4. Analyze algorithms for high level vision analysis such as object detection and classifications using input features and classifiers. (Analyzing)
5. Evaluate the segmentation and motion detection and estimation techniques. (Evaluating)
6. Develop small applications and detect the objects in various applications. (Creating)

Module I (10 Hours)

Image Formation Models: Colour- Generation, Human Perception, Representation, Model for an Image Colour; Camera: Pinhole and Lens Types, geometric Camera model and Camera calibration; Monocular imaging system, Orthographic & Perspective Projection, Binocular imaging systems, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Radiometry, Projections, Transforms- Fourier, Hough and Radon; Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

Module II (8 Hours)

Feature Extraction: Image representations (continuous and discrete), Scene Segmentation and Labeling; Counting Objects; Edge detection, Edge linking, corner detection, texture, binary shape analysis, boundary pattern analysis, circle and ellipse detection, Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges;

Module III (10 Hours)

Shape Representation and Segmentation: Statistical Decision Theory; Pattern Recognition Principles; Clustering Approach- K-Means Clustering; Parametric Approach- Bayes' Classifier; Relaxation Approach; Shape Similarity Based Recognition; Expert System; Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, B-Splines, Least Squares and Eigen Vector Line Fitting, Medial representations, Multi-resolution analysis, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation

Module IV (5 Hours)

Motion Detection and Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Background Subtraction and Modeling, Optical Flow, KLT, Spatio Temporal Analysis, Dynamic Stereo; Motion parameter estimation, Structure from motion, Motion Tracking in Video.

Module V (7 Hours)

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition, Geometric templates from spatial relations, Probabilistic and inferential methods- neural networks, support vector machines; Recognition by relations between templates.

Module VI (5 Hours)

Applications of Computer Vision: Automated Visual Inspection, Inspection of Cereal Grains, Surveillance, In-Vehicle Vision Systems, CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing.

Suggested Readings

1. D. Forsyth and J. Ponce, "Computer Vision - A modern approach", 2nd Edition, Pearson Prentice Hall, 2012
2. Szeliski, Richard, "Computer Vision: Algorithms and Applications", 1st Edition, Springer Verlag London Limited, 2011.
3. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", 2nd Edition, Cambridge University Press, 2004.
4. K. Fukunaga,"Introduction to Statistical Pattern Recognition",2ndEdition, Morgan Kaufmann, 1990.
5. Rafael C. Gonzalez and Richard E. Woods," Digital Image Processing", 3rd Edition, Prentice Hall, 2008.
6. B. K. P. Horn, "Robot Vision", 1st Edition, McGraw-Hill, 1986.
7. E. R. Davies "Computer and Machine Vision: Theory, Algorithms, Practicalities", 4th Edition, Elsevier Inc, 2012.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H			L	M	M
CO 2		H	L			M
CO 3		M	H		L	L
CO 4	L			M	H	M
CO 5				H	M	L
CO 6	M	L	M	M	M	H

ECAA0057 ADVANCED COMPUTER ARCHITECTURE (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective:
The main objective of this course is to introduce the students with the concept of parallelism and pipelining, the design aspects and challenges. After this course students will be able to evaluate the issues in vector and array processors. They will also learn about high performance scalable multithreaded and multiprocessor systems.

Course Outcomes
1. Define the concept of pipelining and parallelism in various computer architectures. (Remembering)
2. Explain pipelining in software and hardware and hazards associated with it. (Understanding)
3. Identify various issues associated with vector and array processors. (Applying)
4. Analyse different types of multiprocessor architectures. (Analysing)
5. Compare the performance of multiprocessors and multithreaded architectures. (Evaluating)
6. Discuss parallel algorithms for multiprocessors. (Creating)

Module I (5 Hours)
Parallel Processing and Pipelining Processing- Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture.

Module II (10 Hours)
Pipeline Architecture-Principles and implementation of Pipelining, Classification of pipelining processors, Design aspect of Arithmetic and Instruction pipelining, Pipelining hazards and resolving techniques, Data buffering techniques, Advanced pipelining techniques, Software pipelining, VLIW (Very Long Instruction Word) processor.

Module III (8 Hours)
Vector and Array Processor- Issues in Vector Processing, Vector performance modeling, SIMD Computer Organization, Static Vs Dynamic network, Parallel Algorithms for Array Processors: Matrix Multiplication.

Module IV (7 Hours)
Multiprocessor Architecture - Loosely and Tightly coupled multiprocessors, Inter Processor communication network, Time shared bus, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency and bus snooping, Massively Parallel Processors (MPP).

Module V (5 Hours)
Multithreaded Architecture- Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions, Parallel Programming Techniques: Message passing program development.

Module VI (10 Hours)
Parallel algorithms for multiprocessors- Classification and performance of parallel algorithms, operating systems for multiprocessors systems, Message passing libraries for parallel programming interface, PVM (in distributed memory system), Message Passing Interfaces (MPI).

Suggested Readings
1. Kai Hwang, Faye A. Briggs, “Computer Architecture and Parallel Processing” McGraw Hill Education, 2012.
2. Kai Hwang, “Advanced Computer Architecture”, McGraw Hill Education, 1993.
3. William Stallings, “Computer Organization and Architecture, Designing for Performance” Prentice Hall, 6th edition, 2006.
4. Kai Hwang, “Scalable Parallel Computing”, McGraw Hill Education, 1998.
5. Harold S. Stone “High-Performance Computer Architecture”, Addison-Wesley, 1993.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				

CO 2	M	H			
CO 3	M		H		
CO 4				H	
CO 5				M	H
CO 6	L		M	L	H

ECSI0058 STATISTICAL INFORMATION PROCESSING (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective
This course is intended to introduce the students to the concepts of information processing. The course starts with the fundamental concepts of random variables and then moves on to random processes, random signal modelling, spectral analysis etc. It also covers concepts of information theory and source coding.

Course Outcomes
1. Define the statistical parameters associated with random variables and random processes. (Remembering)
2. Explain concept of various random signal models like MA, AR, ARMA etc. (Understanding)
3. Identify various hypothesis and methods to estimates parameters in statistical model. (Applying)
4. Inspect concepts of spectral analysis using functions like autocorrelation, periodogram etc.(Analyzing)
5. Evaluate information content, entropy, channel capacity etc. using various source and channel coding techniques (Evaluating)
6. Discuss application of information theory in the area of discrete mathematics (Creating)

Module I (10 Hours)
Review of random variables: Probability Concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebycheff inequality theorem, Central Limit theorem, Discrete & Continuous RandomVariables. Random process: Expectations, Moments, Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and autocovariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

Module II (5 Hours)
Random signal modeling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model & its applications, Linear System with random input , Forward and Backward Predictions, Levinson Durbin Algorithm.

Module III (10 Hours)
Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing. Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio Test ,Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum, Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate , Multiple Parameter Estimation Best Linear Unbiased Estimator, Least-Square Estimation Recursive Least-Square Estimator.

Module IV (5 Hours)
Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic Signals.

Module V (8 Hours)
Information Theory and Source Coding: Introduction, Uncertainty, Information and Entropy, Source coding theorem, Huffman, Shanon-Fano, Arithmetic, Adaptive coding, RLE, LZW Data compaction, LZ-77, LZ-78. Discrete Memory less channels, Mutual information, channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles.

Module VI (7 Hours)
Application of Information Theory: Group, Ring & Field, Vector, GF addition, multiplication rules. Introduction to BCH codes, Primitive elements, Minimal polynomials, Generator polynomials in terms of Minimal polynomials, Some examples of BCH codes, & Decoder, Reed- Solomon codes & Decoder, Implementation of Reed Solomon encoders and decoders.

Suggested Readings
1. Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, McGraw-Hill,2002.

2. D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill,2000.
3. MouradBarkat , "Signal Detection and Estimation", Artech House, 2nd Edition,2005.
4. R G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968.
5. F. J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", New York, North-Holland,1977.
6. Rosen K.H, "Elementary Number Theory", Addison-Wesley, 6th edition, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	H			
CO 3	M		H		
CO 4		M		H	
CO 5	L				H
CO 6	L			M	H

ECVD0059: VOICE AND DATA NETWORKS (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective:

This course is intended to give the students an exposure to the design criteria of voice and data networks. The course starts with network design and performance issues in general, moves on to introducing the students to issues in design of voice and data networks and then gives an extensive idea on voice networks and data networks.

Course Outcomes

1. Define the fundamental concepts of network design and network performance issues, network terminology etc. (Remembering)
2. Explain concepts of voice and data networks. (Understanding)
3. Apply designs of voice and data networks such as link layer design etc. (Applying)
4. Inspect concepts of inter-networking, IP protocol and addressing CIDR, TCP, UDP etc. (Analyzing)
5. Evaluate Queuing models, traffic models, Markov systems etc. (Evaluating)
6. Discuss congestion avoidance, quality of service in packet networks etc. (Creating)

Module I (8 Hours)

Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

Module II (7 Hours)

Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

Module III (8 Hours)

Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

Module IV (7 Hours)

Queuing Models of Networks, Traffic Models, Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols, Aloha System, Carrier Sensing, Examples of Local area networks,

Module V (10 Hours)

Inter-networking, Bridging, Global Internet, IP protocol and addressing, Subnetting, Classless Inter domain Routing (CIDR), IP address lookup, Routing in Internet. End to End Protocols, TCP and UDP, Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit/ Fast Recovery.

Module VI (5 Hours)

Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

Suggested Readings

1. D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall,1992.
2. L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufman, 2011.

3. Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach", 1st Edition, Morgan Kaufman,2004.
4. Walrand,"Communications Network: A First Course", 2nd Edition, McGraw Hill,2002.
5. Leonard Kleinrock, "QueueingSystems,Volume I: Theory", 1st Edition, John Wiley and Sons,1975.
6. Aaron Kershenbaum, "Telecommunication Network Design Algorithms", McGraw Hill, 1993.
7. Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill,1987

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H	H			
CO 3			H	M		
CO 4				H	H	
CO 5				H	H	
CO 6						H

ECVC0060: AUDIO, VIDEO CODING AND COMPRESSION (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

This course is designed to give the students an idea about multimedia systems and processing. The course starts with basic coding techniques such as Huffman coding etc. and transforms such as DCT etc. and then gives an extensive idea on video and audio coding along with their compression systems.

Course Outcomes

1. Define the fundamental concepts of multimedia systems and processing. (Remembering)
2. Outline concepts of lossy and lossless image compression systems, still image compression standards etc. (Understanding)
3. Make use of standards of audio and video coding. (Applying)
4. Analyse motion estimation algorithms. (Analyzing)
5. Evaluate multimedia synchronization, audio-video interleaving video indexing and retrieval etc. (Evaluating)
6. Discuss applications of audio coding, video coding and various compression systems. (Creating)

Module I (5 Hours)

Introduction to Multimedia Systems and Processing, Lossless Image Compression Systems, Huffman Coding, Arithmetic and Lempel-Ziv Coding, Other Coding Techniques.

Module II (10 Hours)

Lossy Image Compression Systems, Theory of Quantization, Delta Modulation and DPCM, Transform Coding & K-L Transforms, Discrete Cosine Transforms, Multi-Resolution Analysis, Theory of Wavelets, Discrete Wavelet Transforms, Still Image Compression Standards: JBIG and JPEG.

Module III (8 Hours)

Video Coding and Motion Estimation: Basic Building Blocks & Temporal Redundancy, Block based motion estimation algorithms, other fast search motion estimation algorithms.

Module IV (5 Hours)

Video Coding Standards: MPEG-1 standards, MPEG-2 Standard, MPEG-4 Standard, H.261, H.263 Standards, H.264 standard.

Module V (7 Hours)

Audio Coding: Basic of Audio Coding, Audio Coding, Transform and Filter banks, Polyphase filter implementation, Format and encoding, Psychoacoustic Models.

Module VI (10 Hours)

Multimedia Synchronization: Basic definitions and requirements, References Model and Specification, Time stamping and pack architecture, Packet architectures and audio-video interleaving, Multimedia Synchronization, Playback continuity. Video Indexing and Retrieval: Basics of content based image retrieval, Video Content Representation, Video Sequence Query Processing.

Suggested Readings

1. Iain E.G. Richardson, "H.264 and MPEG-4 Video Compression", Wiley,2003.

2. Khalid Sayood, “Introduction to Data Compression”, 4th Edition, Morgan Kaufmann, 2012
3. Mohammed Ghanbari, “Standard Codecs: Image Compression to Advanced Video Coding”, 3rd Edition, The Institution of Engineering and Technology, 2011.
4. Julius O. Smith III, “Spectral Audio Signal Processing”, W3K Publishing,2011.
5. Nicolas Moreau, “Tools for Signal Compression: Applications to Speech and Audio Coding”, Wiley, 2011.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H				
CO 2	L	H				
CO 3			H	H	H	
CO 4			H	H	M	
CO 5					H	H
CO 6					H	H

ECWM0061 WIRELESS AND MOBILE COMMUNICATION (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

This course is intended to make the students learn the essential advanced topics in wireless communication. The course starts with an introduction to basics of wireless communication such as cellular concepts and then moves on to important advanced topics related to multiple access techniques, equalizers, fading etc. It also introduces the students to 4G and 5G standards that are relevant topics for today’s times.

Course Outcomes

1. Define the fundamental concepts of cellular communication, multiple access techniques etc. (Remembering)
2. Outline concepts of GSM, GPRS etc. (Understanding)
3. Utilize GSM, CDMA etc. (Applying)
4. Analyse spectral efficiency based on multiple access techniques, equalizers in communication receivers etc. (Analysing)
5. Evaluate path loss, fading, diversity etc. (Evaluating)
6. Discuss 3G, 4G and 5G standards. (Creating)

Module I (10 Hours)

Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment. GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS),2.75 G Standards: EDGE.

Module II (8 Hours)

Spectral efficiency analysis based on multiple access technologies: TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas, Wireless network planning (Link budget and power spectrum calculations).

Module III (10 Hours)

Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.

Module IV (5 Hours)

Equalization, Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

Module V (7 Hours)

Code Division Multiple Accesses: Introduction to CDMA technology, IS 95 system Architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.

Module VI (5 Hours)
Higher Generation Cellular Standards: 3G Standards, evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G.

Suggested Readings
1. V. K. Garg, J. E. Wilkes, "Principle and Application of GSM", Pearson Education, 5thedition,2008.
2. V. K. Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition,2009.
3. T. S. Rappaport, "Wireless Communications Principles and Practice", 2ndedition,PHI, 2002.
4. William C. Y. Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH,1995.
5. Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London, 1997.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L			
CO 2	H		M		L	
CO 3	L			M	H	
CO 4		H	M		L	
CO 5		M	H	H	L	
CO 6				M	M	H

ECSC0062 SATELLITE COMMUNICATION (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective
This course is intended to give the students an exposure to the important concepts of satellite communication. The course starts with fundamental principles of satellite communication and architecture of satellites. It then introduces the students to more advanced topics such as orbital analysis, satellite subsystems, link budget etc.

Course Outcomes
1. Define the brief history of satellite systems and fundamental concepts of satellite communication. (Remembering)
2. Outline concepts of satellite subsystems, modulation and multiple access schemes used in satellite communication etc. (Understanding)
3. Make use of orbital analysis, satellite link budget etc. (Applying)
4. Analyse phenomena in satellite communication such as effect of solar eclipse on satellite, Doppler shift etc. (Analysing)
5. Evaluate subsystems such as AOCS, communication subsystem etc. (Evaluating)
6. Discuss VSAT, DBS-TV etc. (Creating)

Module I (8 Hours)
Architecture of Satellite Communication System: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks.

Module II (10 Hours)
Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal Day.

Module III (10 Hours)
Satellite subsystems: Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication subsystem, power subsystems, antenna sub-system.

Module IV (7 Hours)
Typical Phenomena in Satellite Communication: Effect of Solar Eclipse on satellite, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Module V (5 Hours)
Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.

Module VI (5 Hours)
Modulation and Multiple Access Schemes used in satellite communication, Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO, GPS.

Suggested Readings
1. Timothy Pratt and Others, "Satellite Communications", Wiley India, 2nd edition,2010.
2. S. K. Raman, "Fundamentals of Satellite Communication", PearsonEducation India,2011.
3. Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2009.
4. Dennis Roddy, "Satellite Communication", McGraw Hill, 4th Edition, 2008.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	L		M		
CO 2			H	M	L	
CO 3	L	H	M			
CO4		L		H	M	
CO 5					H	
CO 6				L	M	H

ECWN0063 WIRELESS SENSOR NETWORKS (L-T-P: 3-0-0)
(3 Credits- 45 hours)

Objective
The objective of this course is to make the students to understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology, medium access control protocols and address physical layer issues, sensor management , sensor network middleware, operating systems. Also to learn key routing protocols for sensor networks and main design issues, transport layer protocols for sensor networks, and design requirements

Course Outcomes
1. Recall and illustrate the Concepts, Network Architecture and Applications of Ad-hoc and Wireless Sensor Networks. (Remembering, Understanding)
2. Illustrate the Concepts, Architecture of ad-hoc and sensor networks and MAC layer protocols. (Understanding)
3. Identify the design of routing protocols for ad-hoc and wireless networks. (Applying)
4. Analyse the protocol design issues of Ad-hoc Networks. (Analysing)
5. Elaborate and Evaluate the QOS related performance measurements of ad-hoc and sensor networks. (Evaluating, Creating)

Module I (5 Hours)
Introduction: Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

Module II (8 Hours)
Hardware:Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

Module III (7 Hours)
Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

Module IV (10 Hours)
Overview of sensor network protocols:Sensor network protocols (details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Module V (5 Hours)
Data dissemination and processing: Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

Module VI (10 Hours)
Specialized features: Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

Suggested Readings
1. H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.
2. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, "Wireless Sensor Networks", Springer Verlag, 1st Indian reprint, 2010.
3. F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Indian reprint, 2013.
4. YingshuLi, MyT. Thai, Weili Wu, "Wireless sensor Network and Applications", Springer series on signals and communication technology, 2008.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				L
CO 2		L	M	M	H	H
CO 3		H	L	M	M	M
CO4	L		H	M		M
CO 5			M	L	M	H

ECON0064 OPTICAL NETWORKS (L-T-P: 3-0-0)
(3 Credits- 45 hours)

Objective
This course is intended to give the students an exposure to the design criteria of optical networks. The course starts with fundamentals such as SONET etc. and then deals with practical optical network design issues such as network performance, fault management, optical layer protection schemes etc.

Course Outcomes
1. Define the fundamental concepts of optical networks. (Remembering)
2. Outline concepts of SONET, SDH etc. (Understanding)
3. Utilize WDM network elements, OADM architectures etc. (Applying)
4. Analyse network survivability, WDM network design etc. (Analysing)
5. Evaluate network management functions, optical layer services, interfacing etc. (Evaluating)
6. Discuss concepts of OTDM, PON, AON etc. (Creating)

Module I (5 Hours)
SONET/SDH: Optical transport network, IP, routing and forwarding, multiprotocol label switching.

Module II (8 Hours)
WDM network elements: Optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

Module III (7 Hours)
Control and management: Network management functions, optical layer services and interfacing, performance and fault management, configuration management, optical safety.

Module IV (5 Hours)
Network Survivability: Protection in SONET/SDH & client layer, optical layer protection schemes

Module V (10 Hours)
WDM network design: LTD and RWA problems, dimensioning wavelength routing networks, statistical dimensioning models.

Module VI (10 Hours)
Access networks: Optical time division multiplexing, synchronization, header processing, buffering, burst switching, test beds, Introduction to PON, GPON, AON.

Suggested Readings

1. Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3rd edition,2010.
2. C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design, and Algorithms", PHI, EEE, 2001.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		M	L		
CO 2	H	M	L	M		
CO 3		H	L		M	L
CO 4		H	H		H	
CO 5			H		M	
CO 6			M		L	H

ECCR0065 COGNITIVE RADIO (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

This course will help the students to understand the spectrum scarcity problem and how cognitive radio deals with this problem. It will also deal with the contribution of cognitive radio systems in wireless networks and its architectures that enable the development of the cognitive radio network (both centralized and distributed). After this course students will be able to learn the technologies to allow an efficient use of TVWS for radio communications. It also discusses various cognitive radio standards along with various research challenges for deployment of cognitive radio networks.

Course Outcomes

1. Recall and illustrate the fundamental concepts of cognitive radio networks. (Remembering, Understanding)
2. Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it. (Applying)
3. Examine technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies. (Analysing)
4. Elaborate and evaluate the fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation. (Evaluating, Creating)

Module I (10 Hours)

Introduction: Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Module II (10 Hours)

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

Module III (8 Hours)

Optimization Techniques of Dynamic Spectrum Allocation:Linear programming, convex programming, nonlinear programming, integer programming, dynamic programming, stochastic programming.

Module IV (7 Hours)

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Module V (5 Hours)

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).

Module VI (5 Hours)

Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

Suggested Readings

1. Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.
2. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
3. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.
4. HuseyinArslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.
5. Francisco Rodrigo Porto Cavalcanti, SorenAndersson, "Optimizing Wireless Communication Systems" Springer, 2009.
6. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	M	L	L	
CO 2		H	H	M		L
CO 3		H		H	M	L
CO 4	L	M	H	L	H	H

ECRC0066 RF AND MICROWAVE CIRCUIT DESIGN (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

The objectives of this course are to provide students with RF circuit fundamentals for designing various circuit building blocks in a typical RF transceiver. At the completion of the course, students should appreciate the workings of RF transceivers. They are expected to be able to design key building blocks of RF transceivers, including low-noise amplifiers, standard matching circuits, RF amplifiers, mixers, power amplifiers and RF oscillators.

Course Outcomes

1. Explain the behavior of RF passive components and model active components. (Understanding)
2. Perform transmission line analysis. (Applying, Analysing)
3. Demonstrate use of Smith Chart for high frequency circuit design. (Understanding)
4. Justify the choice/selection of components from the design aspects. (Evaluating)
5. Contribute in the areas of RF circuit design. (Creating)

Module I (8 Hours)

Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

Module II (7 Hours)

Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, the scattering matrix, transmission matrix, Signal flow graph.

Module III (10 Hours)

Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.

Module IV (5 Hours)

Nonlinearity And Time Variance in Microwave Circuits: Inter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.

Module V (10 Hours)

Microwave Semiconductor Devices And Modeling: PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.

Module VI (5 Hours)

Amplifiers Design: Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

Suggested Readings

1. Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior
2. Design", AuthorHouse, 2009.

3. D.M.Pozar, " Microwave engineering" ,Wiley, 4th edition, 2011.
4. R.Ludwig and P.Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.
5. G.D. Vendelin, A.M. Pavoi, U. L. Rohde, "Microwave Circuit Design Using Linear And Non Linear Techniques", John Wiley 1990.
6. S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	H	L		L
CO 2	H	M	L			
CO 3	H	H	M	M		L
CO4		M	H	H	L	M
CO 5	L	L	M	M	H	H

ECMA0067 MICROCONTROLLERS AND APPLICATIONS (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

The course helps to develop an in-depth understanding of the operation of microcontrollers, assembly language programming and microcontroller interfacing techniques. The students will be able to design and implement microcontroller based systems in both hardware and software and can apply this knowledge to more advanced structures.

Course Outcomes

1. Define various terminologies related to microprocessor and microcontrollers. (Remembering)
2. Compare between microprocessor and microcontroller and to explain the internal organization of 8051 microcontroller and PIC16C61 microcontroller. (Understanding)
3. Apply 8051 microcontroller to solve real life problems. (Applying)
4. Analyze the performance of 8051 microcontroller and to design and develop 8051 based system. (Analyzing)
5. Explain the fundamentals of PIC microcontroller. (Understanding)

Module I (7 hours)

Introduction: History of Microcontrollers and Microprocessors. Differences between Microcontrollers and Microprocessors, Introduction to MPU of different categories- such as Microcontroller-8051, AVR, PIC, etc., their specific features, advantages.

Module II (10 hours)

Microcontroller 8051: Introduction; MCS-51 Architecture; Registers, I/O Ports, Memory organization.

Module III (12 hours)

Assembly Language Microcontroller 8051: Instructions, Addressing modes, Arithmetical, Logical, Jumps, Loops and Call etc., Interrupts Timers/ Counters and Serial Communications.

Module IV (8 hours)

Application of MCS-51: Interfacing 7-segment display, LCD, Key board, ADC etc. Development of instrumentation system such as temperature, pressure, flow, frequency, pulse width, voltage, rpm, pH etc. monitoring. Generation of PWM wave, Data-logger, alarm enunciators, PID controller, programmable controller and interlock control.

Module V (8 hours)

Introduction to PIC microcontrollers: Architecture, Mid-Range instruction Set, Power Input and Decoupling, Reset, Watchdog Timer, System Clock/Oscillators.

Suggested Readings

1. M. A. Mazidi and J. G. Mazidi, the 8051 Microcontroller and Embedded Systems
2. A V Deshmukh, Microcontrollers: Theory and Applications
3. Subrata Ghoshal, 8051 Microcontroller-Internals, Instructions, Programming and Interfacing, Pearson
4. Md Ali Mazidi, Rolin D. Mc-Kindly and Janice Gillistie, the 8051 Microcontroller and Embedded System Using Assembly and C
5. Lyla B. Das, Embedded Systems-An Integrated Approach, Pearson
6. Relevant Data Sheets

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M	L		
CO 2		H	M	M	
CO 3			H	M	
CO 4		L	M	H	
CO 5					H

ECPP0068 PARALLEL PROCESSING (L-T-P: 3-0-0)
(3 Credits- 45 hours)

Objective
The objective of this course is to expose the students to the concept of parallel processing and pipelining. In this course students are introduced to the limitations of different architectures of computer. After this course students will be able to Analyse the performance parameters for different architectures.

Course Outcomes
1. Define parallel processing and pipeling, multiprocessor architecture, multithreaded architectures and multithreaded processors (Remembering)
2. Explain parallel processing and pipeling, multiprocessor architecture, multithreaded architectures and multithreaded processors (Understanding)
3. Implement parallel programming techniques (Applying)
4. Compare various parallel processing and pipelining techniques, multiprocessor architecture, multithreaded architectures and multithreaded processors and various operating systems for multiprocessors. (Analyzing)
5. Choose suitable one amongst various parallel processing and pipeling techniques, multiprocessor architecture, multithreaded architectures and multithreaded processors and various operating systems for multiprocessors (Evaluating)

Module I (5 hours)
Overview of Parallel Processing and Pipelining, Performance analysis, Scalability

Module II (10 hours)
Principles and implementation of Pipelining, Classification of pipelining processors, Advanced pipelining techniques, Software pipelining

Module III (10 hours)
VLIW processors, Case study: Superscalar Architecture- Pentium, Intel Itanium Processor, Ultra SPARC, MIPS on FPGA, Vector and Array Processor, FFT Multiprocessor Architecture

Module IV (5 hours)
Multithreaded Architecture, Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions

Module V (10 hours)
Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing, Shared Memory Programming, Data Parallel Programming, Parallel Software Issues

Module VI (5 hours)
Operating systems for multiprocessors systems, Customizing applications on parallel processing platforms

Suggested Readings
1. Kai Hwang, Faye A. Briggs, “Computer Architecture and Parallel Processing”, MGH International Edition
2. Kai Hwang, “Advanced Computer Architecture”, TMH
3. V. Rajaraman, L. Sivaram Murthy, “Parallel Computers”, PHI.
4. William Stallings, “Computer Organization and Architecture, Designing for performance” Prentice Hall, Sixth edition

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	L	H	H	M	L
CO 2	H	L	H	H	M	L
CO 3	M	M	L	L	H	L

CO 4	H	L	H	H	M	H
CO 5	H	L	H	H	M	H

ECPM0069 PATTERN RECOGNITION AND MACHINE LEARNING (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective
The course is intended to make an insight into different statistical models for pattern recognition problems. This course includes different statistical models, linear regression models, different machine learning tools like Neural Network, Fuzzy Logic and different clustering techniques.

Course Outcomes
1. Define various terminologies used in probability theory and statistics, Linear models, neural networks, linear discriminant functions (Remembering)
2. Explain various terminologies used in probability theory and statistics, Linear models, neural networks, linear discriminant functions, unsupervised learning methods (Understanding)
3. Implement various Linear models, neural networks, linear discriminant functions, unsupervised learning methods (Applying)
4. Compare various Linear models, neural networks, linear discriminant functions, unsupervised learning methods (Analyzing)
5. Choose suitable one amongst various neural networks, linear discriminant functions, unsupervised learning methods for specific application (Evaluating)

Module I (10 Hours)
Introduction to Pattern Recognition: Problems, applications, design cycle, learning and adaptation, examples, Probability distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis

Module II (5 Hours)
Linear models: Linear Models for Regression, linear regression, logistic regression Linear Models for classification

Module III (10 Hours)
Neural Network: Perceptron, multi-layer perceptron, back propagation algorithm, error surfaces, practical techniques for improving back propagation, additional networks and training methods, Adaboost, Deep Learning

Module IV (8 Hours)
Linear discriminant functions: Decision surfaces, two-category, multi-category, minimum squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

Module V (7 Hours)
Algorithm independent machine learning: Lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers.

Module VI (5 Hours)
Unsupervised learning and clustering: k-means clustering, fuzzy k-means clustering, hierarchical clustering.

Suggested Readings
1. Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2nd Edition John Wiley & Sons, 2001.
2. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, “The Elements of Statistical Learning”, 2nd Edition, Springer, 2009.
3. C. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H	H	H	L	L
CO 2	H	H	H	H	L	H
CO 3	L	H	H	H	M	H
CO 4	L	H	H	H	M	H
CO 5	M	L	H	H	M	H

ECDE0070 DETECTION AND ESTIMATION THEORY (L-T-P: 3-0-0)

(3 Credits- 45 Hours)

Objective

The objective of the course is to familiarize the students with mathematical understanding of signal detection and estimation. This course also intends to use various approaches to formulate and solve problems for signal detection and parameter estimation from noisy signals.

Course Outcomes

1. Explain of data computing algorithms like PCA, SVD etc. (Understanding)
2. Identify various measures of random processes associated with LTI system. (Applying)
3. Analyse the concepts of random processes in detection and estimation theory. (Analysing))
4. Discuss the design of different types of filters like Kalman and Weiner. (Creating)

Module I (5 Hours)

Review of Vector Spaces: Vectors and matrices: notation and properties, orthogonality and linear independence, bases, distance properties, matrix operations, Eigenvalues and eigenvectors.

Module II (7 Hours)

Properties of Symmetric Matrices: Diagonalization of symmetric matrices, symmetric positive definite and semi definite matrices, principal component analysis (PCA), singular value decomposition.

Module III (10 Hours)

Stochastic Processes: Time average and moments, ergodicity, power spectral density, covariance matrices, response of LTI system to random process, cyclostationary process, and spectral factorization.

Module IV (10 Hours)

Detection Theory: Detection in white Gaussian noise, correlator and matched filter interpretation, Bayes' criterion of signal detection, MAP, LMS, entropy detectors, detection in colored Gaussian noise, Karhunen-Loeve expansions and whitening filters.

Module V (5 Hours)

Estimation Theory: Minimum variance estimators, Cramer-Rao lower bound, examples of linear models, system identification, Markov classification, clustering algorithms.

Module VI (8 Hours)

Topics in Kalman and Weiner Filtering: Discrete time Wiener-Hopf equation, error variance computation, causal discrete time Wiener filter, discrete Kalman filter, extended Kalman filter. Specialized Topics in Estimation: Spectral estimation methods like MUSIC, ESPIRIT, DOA Estimation.

Suggested Readings

1. Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory", Prentice Hall, 1993
2. Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume II: Detection Theory", 1st Edition, Prentice Hall, 1998
3. Thomas Kailath, BabakHassibi, Ali H. Sayed, "Linear Estimation", Prentice Hall, 2000.
4. H. Vincent Poor, "An Introduction to Signal Detection and Estimation", 2nd Edition, Springer, 1998.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H				
CO 2		L	H			
CO 3	M			H	H	
CO 4				L	M	H

ECIA0071 IOT AND APPLICATIONS (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

The main objective of this course is to introduce the students with the concept of IOT and M2M. In this course they will study IOT architecture and applications in various fields along with the security and privacy issues in IOT.

Course Outcomes

1. Choose recent technologies related to IOT and Web technologies. (Understanding)
2. Illustrate the concept of IOT, M2M Security and privacy issues in IOT. (Understanding)
3. Apply the concept of IOT architecture and Web technologies. (Applying)
4. Analyze IOT architecture and applications in various fields. (Analyzing)

Module I (10 Hours)
IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Module II (8 Hours)
M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT ValueChains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Module III (7 Hours)
IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Module IV (10 Hours)
IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Module V (5 Hours)
Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues

Module VI (5 Hours)
Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

Suggested Readings
1. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014
2. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
3. CunoPfister, “Getting Started with the Internet of Things”, OReilly Media, 2011

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	M	L		M
CO 2		M			M	M
CO 3			L	L		L
CO4	M		M	H	L	

ECDD0072 DIGITAL DESIGN AND VERIFICATION (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective
The objective of the course is to familiarize the students with Front end design and verification techniques and create reusable test environments. This course also intends to perform verification of increasingly complex designs more efficiently and effectively.

Course Outcomes
1. Define combinational, sequential logic design and PLDs. (Remembering)
2. Explain the design methodology of HDL (VHDL/Verilog). (Understanding)

3. Explain the architecture of PLDs. (Understanding)
4. Apply HDL coding techniques for various combinational and sequential circuit design. (Applying)
5. Compare different circuit designs for speed, power and noise optimization. (Analysing)
6. Verify increasingly complex designs more efficiently and effectively. (Evaluating)
7. Use EDA tools like Xilinx, Cadence, Mentor Graphics for various electronic design. (Creating)

Module I (10 Hours)
Revision of basic Digital systems: Combinational Circuits, Sequential Circuits, Logic families. Synchronous FSM and asynchronous design, Metastability, Clock distribution and issues, basic building blocks like PWM module, prefetch unit, programmable counter, FIFO, Booth's multiplier, ALU, Barrel shifter etc.

Module II (8 Hours)
Verilog/VHDL Comparisons and Guidelines, Verilog: HDL fundamentals, simulation, and testbench design, Examples of Verilog codes for combinational and sequential logic, Verilog AMS

Module III (7 Hours)
System Verilog and Verification: Verification guidelines, Data types, procedural statements and routines, connecting the test bench and design, Assertions, Basic OOP concepts, Randomization, Introduction to basic scripting language: Perl, Tcl/Tk

Module IV (8 Hours)
Current challenges in physical design: Roots of challenges, Delays: Wire load models Generic PD flow, Challenges in PD flow at different steps, SI Challenge - Noise & Crosstalk, IR Drop, Process effects: Process Antenna Effect & Electromigration.

Module V (7 Hours)
Programmable Logic Devices: Introduction, Evolution: PROM, PLA, PAL, Architecture of PAL's, Applications, Programming PLD's, FPGA with technology: Antifuse, SRAM, EPROM, MUX, FPGA structures, and ASIC Design Flows, Programmable Interconnections, Coarse grained reconfigurable devices.

Module VI (5 Hours)
IP and Prototyping: IP in various forms: RTL Source code, Encrypted Source code, Soft IP, Netlist, Physical IP, and Use of external hard IP during prototyping, Case studies, and Speed issues. Testing of logic circuits: Fault models, BIST, JTAG interface.

Suggested Readings
1. Douglas Smith, "HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog", Doone publications, 1998.
2. Samir Palnitkar, "Verilog HDL: A guide to Digital Design and Synthesis", Prentice Hall, 2nd Edition, 2003.
3. Doug Amos, Austin Lesea, Rene Richter, "FPGA based Prototyping Methodology Manual", Synopsys Press, 2011.
4. Christophe Bobda, "Introduction to Reconfigurable Computing, Architectures, Algorithms and Applications", Springer, 2007.
5. Janick Bergeron, "Writing Testbenches: Functional Verification of HDL Models", Second Edition, Springer, 2003.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L		H	
CO 2	M	H		L		
CO 3	M	M		L	H	
CO4	M	H	H	M	L	
CO 5	L	M	M	H		L
CO 6			M	H	H	
CO 7			L	L	M	H

ECBS0073 BIOMEDICAL SIGNAL PROCESSING (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective
The course will help to develop an in-depth understanding of different types of biomedical signals. The students will be able to identify and Analyse different biomedical signals.

Course Outcomes

1. Define the fundamentals of biomedical signals. (Remembering)
2. Interpret the various types of biomedical signals. (Understanding)
3. Experiment with various types of biomedical signals using various technological tool. (Applying)
4. Analyze and assess biomedical signals using various technological tool. (Analyzing)

Module I (5 hours)
Acquisition, Generation of Bio-signals, Origin of bio-signals, Types of bio-signals, Study of diagnostically significant bio-signal parameters

Module II (5 hours)
Electrodes for bio-physiological sensing and conditioning, Electrode-electrolyte interface, polarization, electrode skin interface and motion artefact, biomaterial used for electrode, Types of electrodes (body surface, internal, array of electrodes, microelectrodes), Practical aspects of using electrodes, Acquisition of bio-signals (signal conditioning) and Signal conversion (ADC's DAC's) Processing, Digital filtering

Module III (7 hours)
Biomedical signal processing by Fourier analysis, Biomedical signal processing by wavelet (time- frequency) analysis, Analysis (Computation of signal parameters that are diagnostically significant)

Module IV (9 hours)
Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals, Coherent treatment of various biomedical signal processing methods and applications.

Module V (8 hours)
Principal component analysis, Correlation and regression, Analysis of chaotic signals Application areas of Bio–Signals analysis Multiresolution analysis (MRA) and wavelets, Principal component analysis(PCA), Independent component analysis(ICA)

Module VI (6 hours)
Pattern classification–supervised and unsupervised classification, Neural networks, Support vector Machines, Hidden Markov models. Examples of biomedical signal classification examples

Suggested Readings
1. W. J. Tompkins, "Biomedical Digital Signal Processing", Prentice Hall, 1993.
2. Eugene N Bruce, "Biomedical Signal Processing and Signal Modeling", John Wiley & Son's publication, 2001.
3. Myer Kutz, "Biomedical Engineering and Design Handbook, Volume I", McGraw Hill, 2009.
4. D C Reddy, "Biomedical Signal Processing", McGraw Hill, 2005.
5. Katarzyn J. Blinowska, JaroslawZygarewicz, "Practical Biomedical Signal Analysis Using MATLAB", 1st Edition, CRC Press, 2011.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H	M	L		
CO 3			H	M	M	M
CO 4				H	H	M

ECDS0074 DSP ARCHITECTURE (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective
The objective of the course is to familiarize the students with architecture of various DSP hardware. It aims to equip the students with ability to design, programming (assembly and C), and testing code using Code Composer Studio environment and other tools at an intermediate to advanced level that will serve them well towards tackling various problems in this discipline.

Course Outcomes
1. Recall, illustrate and summarize the DSP Architecture. (Remembering, Understanding)
2. Make use of TMS320C6X family DSP processor. (Applying)
3. Explain and solve signal processing problems with the help of FPGA based DSP system. (Understanding, Applying)
4. Develop DSP based Assembly Language Programming. (Creating)
5. Examine and explain complete design of DSP system. (Analyzing, Evaluating)

Module I (10 Hours)
Programmable DSP Hardware: Processing Architectures (von Neumann, Harvard), DSP core Algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating Point Computations, Special Architectures Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

Module II (15 Hours)
Structural and Architectural Considerations: Parallelism in DSP processing, Texas Instruments TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors: TMS320C1X and TMS320C2X Family,TMS320C25 –Internal Architecture, Arithmetic and Logic Unit, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit-reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

Module III (10 Hours)
VLIW Architecture: Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Replacement of MAC Moduleby ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed C and Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.

Module IV (5 Hours)
Application of DSPs for signal processing, communication and multimedia. Multi-core DSPs: Introduction to Multi-core computing and applicability for DSP hardware.

Module V (5 Hours)
FPGA based DSP Systems: Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor.

Suggested Readings
1. M. Sasikumar, D. Shikhare, Ravi Prakash, “Introduction to Parallel Processing”, 1st Edition, PHI, 2006.
2. Fayez Gebali, “Algorithms and Parallel Computing”,1st Edition, John Wiley & Sons, 2011
3. Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff McDonald,“Parallel Programming in OpenMP”, 1st Edition, Morgan Kaufman,2000.
4. Ann Melnichuk,Long Talk, “Multicore Embedded systems”, 1st Edition, CRC Press,2010.
5. Wayne Wolf, “High Performance Embedded Computing: Architectures, Applications and Methodologies”, 1st Edition, Morgan Kaufman, 2006.
6. E.S.Gopi, “Algorithmic Collections for Digital Signal Processing Applications Using MATLAB”, 1st Edition, Springer Netherlands,2007.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M	M		L
CO 2		H	M	L	
CO 3			L	M	H
CO 4			H	M	L
CO 5	M	M	L	H	H

ECRS0075: ANTENNAS AND RADIATING SYSTEMS (L-T-P: 3-0-0)
(3 Credits- 45 hours)

Objective
The objective of this course is to introduce students with the concept of antennas, their principle of operation, analysis and their applications. It will also cover the theory of wave propagation over ground, through the troposphere and ionosphere; diversity principles; propagation effects in microwave systems, satellite, space, and radar links.

Course Outcomes
1. Compute the far field distance, radiation pattern and gain of an antenna for given current distribution. (Applying)
2. Compute the array factor for an array of identical antennas. (Applying)
3. Estimate the input impedance, efficiency and ease of match for antennas. (Evaluating)
4. Design antennas and antenna arrays for various desired radiation pattern characteristics. (Creating)

Module I (10 Hours)
Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Array antennas Reflector antennas, Lens antennas, Radiation Mechanism, Current distribution on thin wire antenna. Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friis Transmission equation, Antenna Temperature.

Module II (8 Hours)
Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects. Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non-uniform current.

Module III (7 Hours)
LinearArrays: Two element array, N Element array: Uniform Amplitude and spacing, Broadside and End fire array, Super directivity, Planar array, Design consideration.

Module IV (8 Hours)
Aperture Antennas: Huygen's Field Equivalence principle, radiation equations, Rectangular Aperture, Circular Aperture. Horn Antennas: E-Plane, H-plane Sectoral horns, Pyramidal and Conical horns.

Module V (7 Hours)
Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis, Rectangular Patch, Circular Patch.

Module VI (5 Hours)
Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introduction to MIMO.

Suggested Readings
1. Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 4th edition, 2016.
2. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas for All Applications", Tata McGraw-Hill, 2002.
3. R.C.Johnson and H.Jasik, "Antenna Engineering handbook", Mc-Graw Hill, 1984.
4. I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L	L		
CO 2		M	H	L	L	
CO 3	M	H	H	M		L
CO 4	M	L		H	H	

ECCN0076 ADVANCED COMMUNICATION NETWORK (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective
The main objective of the course is to familiarize the students with concepts in communication networking. This course is intended to teach the students about various protocols in communication networking. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in this discipline.

Course Outcomes
1. Definition of basic taxonomy and terminology of the computer networking area. (Remembering)
2. Understand advanced concepts in Communication Networking. (Understanding)
3. Understand the mechanisms in Quality of Service in networking. (Understanding)
4. Apply the basic concepts to build efficient networks. (Applying)
5. Analyse the network from layers of OSI and TCP/IP model perspective. (Analysing)
6. Evaluate and measure the performance issues in different networks. (Evaluating)
7. Design and develop protocols for Communication Networks. (Creating)

Module I (8 Hours)
Overview of Internet-Concepts, challenges and history. Overview of -ATM. TCP/IP Congestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.

Module II (10 Hours)
Real Time Communications over Internet. Adaptive applications. Latency and throughput issues. Integrated Services Model (intServ). Resource reservation in Internet. RSVP; Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP).Leaky bucket algorithm and its properties.

Module III (10 Hours)
Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms. High speed scheduler design. Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic.; Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of active queue management.

Module IV (7 Hours)
IP address lookup-challenges. Packet classification algorithms and Flow Identification- Grid of Tries, Cross producting and controlled prefix expansion algorithms.

Module V (5 Hours)
Admission control in Internet. Concept of Effective bandwidth. Measurement based admission control. Differentiated Services in Internet (DiffServ). DiffServ architecture and framework.

Module VI (5 Hours)
IPV4, IPV6, IP tunnelling, IP switching and MPLS, Overview of IP over ATM and its evolution to IP switching. MPLS architecture and framework. MPLS Protocols. Traffic engineering issues in MPLS.

Suggested Readings
1. Jean Wairand and Pravin Varaiya, “High Performance Communications Networks”, 2nd edition, 2000.
2. Jean Le Boudec and Patrick Thiran, “Network Calculus A Theory of Deterministic Queueing Systems for the Internet”, Springer Veriag, 2001.
3. Zhang Wang, “Internet QoS”, Morgan Kaufman, 2001.
4. Anurag Kumar, D. Manjunath and Joy Kuri, “Communication Networking: An Analytical Approach”, Morgan Kaufman Publishers, 2004.
5. George Kesidis, “ATM Network Performance”, Kluwer Academic, Research Papers, 2005.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2			H	M	M	M
CO 3		H				
CO 4						H
CO 5	H					M
CO 6					H	M
CO 7						H

ECMS0077 MIMO SYSTEM (L-T-P: 3-0-0)
(3 Credits- 45 hours)

Objective
This course covers the fundamentals of Multiple input multiple output (MIMO) antenna based wireless communication systems. This course covers important concepts of MIMO communication such as capacity computation, error probability analysis, transmitter and receiver design, multi-user communication, etc. After completion of the course the participants will be able to apply the methods for performance analysis and design of advanced wireless communication systems.

Course Outcomes
1. Explain channel modelling and propagation, MIMO Capacity, space-time coding, MIMO receivers, MIMO for multi-carrier systems (e.g. MIMO-OFDM), multi-user communications, multi-user MIMO. (Understanding)
2. Illustrate, Analyse and interpret the cooperative and coordinated multi-cell MIMO and MIMO in 4G (LTE, LTE-Advanced, WiMAX). (Understanding, Analysing, Evaluating)
3. Perform Mathematical modelling and analysis of MIMO systems. (Creating)

Module I (5 Hours)
Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems.

Module II (10 Hours)
Diversity, exploiting multipath diversity, transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation

Module III (10 Hours)
The generic MIMO problem, Singular Value Decomposition, Eigenvalues and eigenvectors, Equalising MIMO systems, Disadvantages of equalising MIMO systems, Predistortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of precoding and combining, Channel state information.

Module IV (8 Hours)
Codebooks for MIMO, Beam forming, Beam forming principles, increased spectrum efficiency, Interference cancellation, Switched beam former, Adaptive beam former, Narrowband beam former, Wideband beam former

Module V (7 Hours)
Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatial multiplexing, Pre- coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre- coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models

Module VI (5 Hours)
Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

Suggested Readings
1. Claude Oestges, Bruno Clerckx, “MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design”,Academic Press, 1st edition, 2010.
2. Mohinder Janakiraman, “Space - Time Codes and MIMO Systems”, Artech House Publishers, 2004.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H	H	M	M	
CO 2		L	M	H	H	L
CO 3	L	M	M	M	L	H

ECSA0078 EMBEDDED SYSTEMS AND APPLICATIONS (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective
The objective of this course is to expose the students to the features of advanced microcontrollers such as PIC and AVR. In this course students are introduced to the architecture, programming and interfacing of all these microcontrollers. Industrial applications of these microcontrollers are also introduced in this course.

Course Outcomes
1. Define various terminologies related to PIC and AVR microcontroller. (Remembering)
2. Explain the internal organization of PIC and AVR microcontroller. (Understanding)
3. Apply and analyze PIC and AVR microcontroller based system. (Applying)
4. Design and develop PIC and AVR microcontroller based system. (Creating)

Module I (10 Hours)
PIC Microcontroller: Overview of PIC Microcontrollers, PIC16CXX Series: Architecture, Memory Organization, Registers, Oscillator Connections, Reset Actions, I/O ports, Interrupt, Timers, ADC, Watch Dog timer, Instruction Set

Module II (10 Hours)
PIC16F8XX Series:
a) Architecture, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, ADC, Instruction Set, Capture/Compare/PWM Module, MSSP Module, USART, Watch Dog Timer.
b) Assembly Language Programming using PIC16CXX and PIC16F8XX

Module III (10 Hours)
PIC24FXX Family Microcontroller: Architecture, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, Watch Dog timer, ADC, PWM, Serial Communications, Programming using Embedded C.

Module IV (15 Hours)
AVR Microcontroller:

a. Introduction, History, Importance of AVR, Naming Convention of AVR, Mega AVR Series.
b. ATMega8 Microcontroller: Architecture, Pin Diagram, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, ADC, Watch Dog timer.
c. ATMega16 Microcontroller: Architecture, Pin Diagram, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, ADC, Watch Dog timer.
d. Programming using ATMega8 and ATMega16.

Suggested Readings

1. V. Deshmukh, Microcontroller: Theory and Applications, TMG, 1st Edition
2. Md. Ali Mazidi, Rolin D. Mckinlay, Danny Causey, PIC Microcontroller and Embedded Systems: Using Assembly and C, Pearson, 1st Edition
3. Md. Ali Mazidi, SarmadNaimi, SepehrNaimi, The AVR Microcontroller and Embedded Systems: Using Assembly and C, Pearson, 1st Edition
4. Relevant Data Sheets

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2		H	M	L
CO 3		M	H	L
CO 4			M	H

ECMT0079 MEMORY TECHNOLOGIES (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective
The course helps to develop an in-depth understanding of the various memory types. The students will be able to learn. After this course students will be able to design semiconductor memory circuits and subsystems. They can also identify various fault models, modes and mechanisms in semiconductor memories and their testing procedures.

Course Outcomes

1. Define various memory architecture. (Remembering)
2. Explain memory circuits and subsystems. (Understanding)
3. Apply various fault models, modes and mechanisms in semiconductor memories and their testing procedures. (Applying)
4. Analyse advanced memory technologies. (Analysing)
5. Assess various high density memory packing technologies. (Evaluating)
6. Discuss memory testing and reliability issues and start of the art memory chip design. (Creating)

Module I (10 hours)
Random Access Memory Technologies, Static Random Access Memories (SRAMs), SRAM Cell Structures, MOS SRAM Architecture, MOS SRAM Cell and Peripheral Circuit, Bipolar SRAM, Advanced SRAM Architectures, Application Specific SRAMs.

Module II (5 hours)
DRAMs, MOS DRAM Cell, BiCMOS DRAM, Error Failures in DRAM, Advanced DRAM Design and Architecture, Application Specific DRAMs. SRAM and DRAM Memory controllers.

Module III (5 hours)
Non-Volatile Memories, Masked ROMs, PROMs, Bipolar & CMOS PROM, EEPROMs, Floating Gate EPROM Cell, OTP EPROM, EEPROMs, Non-volatile SRAM, Flash Memories

Module IV (10 hours)

Semiconductor Memory Reliability and Radiation Effects, General Reliability Issues, RAM Failure Modes and Mechanism, Non-volatile Memory, Radiation Effects, SEP, Radiation Hardening Techniques. Process and Design Issues, Radiation Hardened Memory Characteristics, Radiation Hardness Assurance and Testing

Module V (10 hours)

Advanced Memory Technologies and High-density Memory Packing Technologies,Ferroelectric Random Access Memories (FRAMs), Gallium Arsenide (GaAs) FRAMs, Analog Memories, MagnetoResistive Random Access Memories (MRAMs), Experimental Memory Devices

Module VI (5 hours)

Memory Hybrids (2D & 3D), Memory Stacks, Memory Testing and Reliability Issues, Memory Cards, High Density Memory Packaging

Suggested Readings

1. Ashok K Sharma, “Advanced Semiconductor Memories: Architectures, Designs and Applications”, Wiley Interscience
2. KiyooItoh, “VLSI memory chip design”, Springer International Edition
3. Ashok K Sharma,” Semiconductor Memories: Technology, Testing and Reliability, PHI

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	M			
CO 2	L	H	H	L		
CO 3		M	H	L		
CO 4			M	H		
C0 5				L	H	
C0 6				L	M	H

ECBS0080 COMMUNICATION BUSES AND INTERFACES (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

This main objective of this course is to introduce the students with the concept of various communication buses. After this course students will be able to develop APIs for configuration, reading and writing data onto serial bus and can also design and develop peripherals that can be interfaced to desired serial bus

Course Outcomes

1. Define various terminologies related to communication buses. (Remembering)
2. Compare various communication buses. (Understanding)
3. Explain the architecture of various communication buses. (Understanding)
4. Apply and analyze the concept of various communication buses. (Applying/ Analyzing)

Module I (8 hours)

Serial Busses, Physical interface, Data and Control signals, features

Module II (8 hours)

Limitations and applications of RS232, RS485, I2C, SPI

Module III (8 hours)

CAN - Architecture, Data transmission, Layers, Frame formats, applications

Module IV (8 hours)

PCI - Revisions, Configuration space, Hardware protocols, applications

Module V (8 hours)

USB - Transfer types, enumeration, Descriptor types and contents, Device driver

Module VI (5 hours)

Data Streaming Serial Communication Protocol, Serial Front Panel Data Port (SFPDP) using fiber optic and copper cable

Suggested Readings

1. Jan Axelson, “Serial Port Complete - COM Ports, USB Virtual Com Ports, and Ports for Embedded Systems”, Lakeview Research, 2nd Edition
2. Jan Axelson, “USB Complete”, Penram Publications
3. Mike Jackson, Ravi Budruk, “PCI Express Technology”, Mindshare Press
4. Wilfried Voss, “A Comprehensible Guide to Controller Area Network”, Copperhill Media Corporation, 2nd Edition, 2005.
5. Serial Front Panel Draft Standard VITA 17.1 – 200x
6. Technical references onwww.can-cia.org; www.pcisig.com; www.usb.org

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	L				
CO 2		H	M	M	M	
CO 3			H	H	H	
CO 4			L	L	L	H

ECAI0096 ARTIFICIAL INTELLIGENCE (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

The main objective of the course is to familiarize the students with concepts of Artificial Intelligence, search techniques and knowledge representation issues. This course also aims to equip the students with knowledge of fuzzy logic and its uses for artificial intelligence, game playing and natural language processing.

Course Outcomes

1. Define Artificial Intelligence and different techniques of Artificial Intelligence. (Remembering)
2. Relate components of a Planning system, AI in solutions that require problem solving, inference, perception, knowledge representation, learning ANN and Fuzzy logic. (Understanding)
3. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation,

learning, ANN and Fuzzy logic (Applying)

4. Analyze the different approaches to AI in solutions that require problem solving, inference, perception, knowledge representation, learning, game playing, ANN and Fuzzy logic (Analyzing)

Module I (10 Hours)

What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate- And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

Module II (10 Hours)

Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

Module III (8 Hours)

Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bayes' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory

Module IV (5 Hours)

Fuzzy Logic, Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and- Filler Structures: Conceptual Dependency, Scripts, CYC.

Module V (7 Hours)

Game Playing: Overview, And Example Domain: Overview, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction.

Module VI (5 Hours)

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.

Suggested Readings

1. Elaine Rich and Kevin Knight “Artificial Intelligence”, 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall, 2009.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	M	M	L	L	L	L
CO 2	L	H	H	L	L	L
CO 3		M	H	H	L	L
CO 4	L	M	L	L	M	M

ECOT0097 OPTIMIZATION TECHNIQUES (L-T-P: 3-0-0)

(3 credits – 45 hours)

Objective

The objective of the course is to familiarize the students about various optimization methods and algorithms necessary for solving various optimization problems.

Course Outcomes

1. Define single variable, multivariable and constrained and intelligent optimization techniques and also principles of genetic programming. (Remembering)

2. Illustrate the importance of optimization. (Understanding)
3. Apply basic concepts of mathematics to formulate an optimization problem.(Applying)
4. Analyze and appreciate a variety of performance measures for various optimization problems. (Analysing)
5. Evaluate and measure the performance of an optimization algorithm. (Evaluating)
6. Design algorithms, the repetitive use of which will lead reliably to finding an approximate solution. (Creating)

Module I (7 Hours)
Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers.

Module II (5 Hours)
Linear Programming Problem, Simplex method, Two-phase method, Big-M method, duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.

Module III (8 Hours)
Single Variable Optimization Problems: Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method, Cubic search method.

Module IV (10 Hours)
Multi Variable and Constrained Optimization Technique: Optimality criteria , Direct search Method, Simplex search methods, Hooke-Jeeve‘s pattern search method, Powell‘s conjugate direction method, Gradient based method, Cauchy‘s Steepest descent method, Newton‘s method ,Conjugate gradient method. Kuhn - Tucker conditions, Penalty Function, Concept of Lagrangian multiplier, Complex search method, Random search method.

Module V (8 Hours)
Intelligent Optimization Techniques: Introduction to Intelligent Optimization, Soft Computing, Genetic Algorithm: Types of reproduction operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO) - Graph Grammer Approach – Example Problems

Module VI (7 Hours)
Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

Suggested Readings
1. S. S. Rao, “Engineering Optimisation: Theory and Practice”, Wiley, 2008.
2. K. Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall, 2005.
3. C.J. Ray, “Optimum Design of Mechanical Elements”, Wiley, 2007.
4. R. Saravanan, “Manufacturing Optimization through Intelligent Techniques, Taylor & Francis Publications, 2006.
5. D. E. Goldberg, “Genetic algorithms in Search, Optimization, and Machine learning”, Addison-Wesley Longman Publishing, 1989.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		H	L		
CO 2		L	H	H	M	
CO 3	H		L	M	M	L
CO 4	L		H	M		M
CO 5		M		M	H	H
CO 6		L		H	M	H

ECRS0098: REMOTE SENSING (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective
This course is intended to introduce the students to the concepts of remote sensing. The course starts with the physics used in remote sensing and then gives an idea about the types of platforms and satellites. It also deals with advanced topics such as microwave scatterometry, thermal and hyper spectral remote sensing etc.

Course Outcomes

1. Define the concepts behind the physics of remote sensing. (Remembering)
2. Outline concepts of data acquisition and different platforms such as LANDSAT, SPOT etc. (Understanding)
3. Make use of optical sensors and different types of scanners. (Applying)
4. Analyse different types of RADAR, characteristics of microwave images etc. (Analyzing)
5. Evaluate thermal and hyper spectral remote sensing etc. (Evaluating)
6. Discuss data analysis and data processing techniques. (Creating)

Module I (10 Hours)
Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing, Effects of Atmosphere Scattering, Different types, Absorption, Atmospheric window, Energy interaction with surface features, Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.

Module II (5 Hours)
Data Acquisition: Types of Platforms, Different types of aircrafts, Manned and Unmanned space crafts, sun synchronous and geosynchronous satellites.
Types and characteristics of different platforms: LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD etc.

Module III (10 Hours)
Photographic products, B/W color, color IR film and their characteristics, resolving power of lens and film, Optomechanical electro optical sensors, across track and along track scanners, multispectral scanners and thermal scanners, geometric characteristics of scanner imagery, calibration of thermal scanners.

Module IV (10 Hours)
Scattering System: Microwave scatterometry, types of RADAR, SLAR, resolution, range and azimuth, real aperture and synthetic aperture RADAR. Characteristics of Microwave images: topographic effect, different types of Remote Sensing platforms, airborne and space borne sensors, ERS, JERS, RADARSAT, RISAT, Scatterometer, Altimeter, LiDAR remote sensing, principles, applications.

Module V (5 Hours)
Thermal and Hyper Spectral Remote Sensing: Sensors characteristics, principle of spectroscopy, imaging spectroscopy, field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing, thermal sensors, principles, thermal data processing, applications.

Module VI (5 Hours)
Data Analysis: Resolution, Spatial, Spectral, Radiometric and temporal resolution, signal to noise ratio, data products and their characteristics, visual and digital interpretation, Basic principles of data processing, Radiometric correction, Image enhancement, Image classification, Aerial Laser Terrain Mapping.

Suggested Readings

1. Lillesand.T.M. and Kiefer.R.W ,"Remote Sensing and Image interpretation", 6th Edition, John Wiley & Sons, 2000.
2. John R. Jensen, "Introductory Digital Image Processing: A Remote Sensing Perspective", 2nd Edition, PrenticeHall,1995.
3. Richards, John A., Jia, Xiuping, "Remote Sensing Digital Image Analysis",5th Edition, Springer-Verlag Berlin Heidelberg, 2013.
4. Paul Curran P.J. Principles of Remote Sensing, 1st Edition, Longman Publishing Group, 1984.
5. Charles Elachi, Jakob J. van Zyl, "Introduction to ThePhysicsand Techniques of Remote Sensing", 2nd Edition, Wiley Serie,2006.
6. Sabins, F.F.Jr, "Remote Sensing Principles and Image Interpretation", 3rd Edition, W. H. Freeman & Co,1978.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	L				
CO 2		H	M			
CO 3			H	H		
CO 4			M	H	H	
CO 5					H	H
CO 6						H

ECNN0099: NANOTECHNOLOGY AND NANOELECTRONICS (L-T-P: 3-0-0)
(3 credits – 45 hours)

Objective

This course will introduce the students to Nanotechnology. The course is designed to build up a basic understanding of the nano concepts. It will provide the students the knowledge of synthesis of nanomaterials, their characterization techniques as well as touch upon some applications of nanotechnology. This course will also introduce the students to nano and molecular

Course Outcomes

1. Recognize the concepts underlying this disruptive field of new technology (Remembering)
2. Illustrate the processes involved in making nano components and material. (Understanding)
3. Apply this knowledge for fabrication of new materials and devices in the nanoscale (Application)
4. Analyze new materials and devices in the nanoscale using various characterization tools (Analysis)
5. Evaluate materials for their various properties (Evaluating)
6. Creating solutions for practical problems with appropriate use of nano-materials. (Creating)

Module I (8 Hours)

Basics of Nanotechnology: History, Properties of Nanomaterials, Difference between Bulk and Nanomaterial, Molecular building blocks for nanostructure systems, Forces between atoms and molecules - Particles and grain boundaries – strong Intermolecular forces – Electrostatic and Vander Waals forces between surfaces, Properties of nanomaterials.

Module II (8 Hours)

Physics of nanomaterials: Atomic scale structure of nanoparticles, nanotubes, nanowires, nanodots etc.; electronic and optical characteristic properties of quantum dots, quantum wires and quantum wells; concept of quantum confinement: 0D, 1D and 2D nanostructures; Size effects – Fraction of Surface Atoms – specific Surface Energy and Surface Stress. Nanophotonics, Nanofluidics, Nanothermodynamics, Plasmonics – plasmons and surface plasmons, SPR, Core-shell quantum dots and quantum-dot-quantum wells.

Module III (10 Hours)

Synthesis and Characterization of nanomaterials: Top down approach, Lithography – electron beam and ion beam techniques, Etching – wet and dry etching, Bottom up approach - Solvent based and template based synthesis, other important synthesis methods like CVD, PVD etc.; Doping, Nucleation, Growth and Stability of colloidal nanoparticles, concept of self-assembly. Characterization methods: Transmission electron microscopy (TEM), Scanning electron microscopy (SEM), Atomic force microscopy (AFM), X-ray diffraction spectroscopy (XRD), Optical characterization.

Module IV (12 Hours)

Fundamentals of Nanoelectronics: Quantum particles, Quantum mechanics of electrons, Free and confined electrons, Band theory of solids, Single electron/few electron devices, Coulomb blockade, Semiconductor quantum wells, quantum wires and quantum dots, Nanosensors, Micro and Nano electromechanical systems, Photonic crystals, Nanopiezotronics.

Module V (7 Hours)

Molecular Electronics: Electronic and optoelectronic properties of molecular materials - Electrodes and contacts – functions – molecular electronic devices - elementary circuits using organic molecules- Organic materials based rectifying diode switches – TFTs- OLEDs- OTFTs – logic switches.

Suggested Readings

1. G. L. Hornyak, J. Dutta, H. F. Tibbals, A. Rao Introduction to nanoscience, CRC Press
2. G. L. Hornyak, J. Dutta, H. F. Tibbals, A.Rao Introduction to nanotechnology CRC Press
3. T. Pradeep, Nano: The Essentials McGraw Hill
4. G. W. Hanson, Fundamentals of Nanoelectronics, Pearson
5. D. Maclurcan and N. Radywyl (Eds.) Nanotechnology and Global Sustainability CRC Press
6. E. Lichtfouse, J. Shwarzbauer, D. Robert, Environmental Chemistry for a Sustainable World, Vol.2 Springer Verlag

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M	M	L	L
CO 2		M	H		
CO 3		L	M	H	
CO 4		M	H	M	
CO 5	L	M	H		H
CO 6			M	M	H

ECSD0100 SOC DESIGN (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective
This course will cover the basics of system-on-chip (SoC) design, hardware-software co-specification, co-synthesis, network-on-chip (NoC) systems and system-on-programmable-chip technologies. It provides the advanced knowledge required for system-on-chip design and development, multi-core architectures and embedded systems on a chip. It also involves projects based on FPGA prototyping platform using state-of- the-art synthesis and verification tools and design flows.

Course Outcomes
1. Define System on Chip (SoC) and SoC design methodologies. Also Relate the algorithms used for ASIC construction. (Remembering)
2. Explain the issues involved in ASIC design, including technology choice, design management, tool-flow, verification, debug and test, as well as the impact of technology scaling on ASIC design. (Understanding)
3. Model and specify embedded systems at high levels of abstraction. (Applying)
4. Develop HDL coding techniques for minimization of power consumption, Fault tolerant designs. (Applying)
5. Examine high performance algorithms available for ASICs. (Analysing)
6. Develop examples of applications and systems developed using a co-design approach. (Creating)

Module I (7 Hours)
ASIC: Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP) concepts.

Module II (8 Hours)
NISC: NISC Control Words methodology, NISC Applications and Advantages, Architecture Description Languages (ADL) for design and verification of Application Specific Instruction set Processors (ASIP), No-Instruction-Set-computer (NISC)- design flow, modeling NISC architectures and systems, use of Generic Netlist Representation - A formal language for specification, compilation and synthesis of embedded processors.

Module III (8 Hours)
Simulation: Different simulation modes, behavioural, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors, Low power FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

Module IV (7 Hours)
Low power SoC design / Digital system: Design synergy, Low power system perspective- power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling (DCFS), building block optimization, building block memory, power down techniques, power consumption verification.

Module V (10 Hours)
Synthesis: Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report analysis Single core and Multi core systems, dark silicon issues, HDL coding techniques for minimization of power consumption, Fault tolerant designs

Module VI (5 Hours)
Case study for overview of cellular phone design with emphasis on area optimization, speed improvement and power minimization.

Suggested Readings
1. Hubert Kaeslin, “Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication”, Cambridge University Press, 2008.
2. B. Al Hashimi, “System on chip-Next generation electronics”, The IET, 2006
3. RochitRajsuman, “System-on- a-chip: Design and test”, Advantest America R & D Center, 2000
4. P Mishra and N Dutt, “Processor Description Languages”, Morgan Kaufmann, 2008
5. Michael J. Flynn and Wayne Luk, “Computer System Design: System-on-Chip”, Wiley, 2011

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		H	M	L	

CO 2	H	M		L		
CO 3		M		H	L	H
CO 4		H	M		H	
CO 5	H		M	L		H

ECBI0129 BIOINFORMATICS

(L:T:P: 3:0:0) (3 credit – 45 hours)

Objective

The objective of the course is to introduce students to the rapidly evolving field of bioinformatics. It will help the students to gain knowledge about various biological databases that provides information about biomolecules. It will also give in depth understanding of various techniques used in bioinformatics.

Course Outcomes

1. Recall the biological concepts. (Remembering)
2. Explain the fundamentals of bioinformatics. (Understanding)
3. Apply various techniques used in bioinformatics. (Applying)
4. Analyse and compare various aspects of bioinformatics. (Analysing)
5. Predict protein structure that helps in drug discovery. (Creating)

Module I (10 hours)

Introduction to bioinformatics and computational biology, Scope of bioinformatics, relation of bioinformatics with molecular biology, Fundamental concepts of biology such as nucleotide, amino acids, proteins, different structure of proteins, DNA, DNA Sequences, Cell, Chromosomes, Gene, Mutation, Genetic Polymorphism

Module II (15 hours)

The form of biological information, Introduction to Biological Databases: Nucleic Acid Databases (NCBI, EMBL, DDBJ,), Protein databases (Primary, Composite and Secondary), Specialized Genome Databases (SGD, TIGR), Structure Databases (CATH, SCOPE and PDBsum), Tools: FASTA, BLAST, BLAT, RASMOL

Module III (10 hours)

DNA sequence analysis, Sequence Based Parameters, DNA sequencing as a diagnostic tool

Module IV (10 hours)

a. Protein Structure and Function, Sequence Alignment, Protein Sequence Analysis, Protein Secondary Structure Prediction, Recent advancement in bioinformatics
b. Introduction to various bioinformatics Softwares: Acua, INCA, Anaconda, PAST3, CodonW
c. DNA Computing

Suggested Readings

1. Arthur M. Lesk, Introduction to Bioinformatics, Fifth Edition, Oxford
2. Jin Xiong, Essential Bioinformatics, First Edition, Cambridge University Press
3. David W. Mount, Bioinformatics: Sequence and Genome Analysis, First Edition, CBS
4. Relevant e resources

Mapping of COs to Syllabus

Course Outcomes	**Module 1**	**Module 2**	**Module 3**	**Module 4**
CO 1	H	L		
CO 2		H		
CO 3		M	H	
CO 4			M	H
CO 5			L	H

LABORATORY COURSES

ECAP6041: ADVANCED DIGITAL SIGNAL PROCESSING LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

1. Find and demonstrate the particular methodology to be adopted for writing the various programs in MATLAB. (Remembering - Understanding)
2. Apply important mathematical skills in writing MATLAB programs for DSP. (Applying)
3. Examine the advance topics of digital signal processing in MATLAB. (Analyzing)

List of Experiments:

1. Basic Signal Representation
2. Different operations on discrete time signals
3. Linear and Circular convolution
4. Correlation Auto And Cross
5. Stability Using Hurwitz Routh Criteria
6. Sampling FFT Of Input Sequence
7. Butterworth Low pass And High pass Filter Design
8. Chebychev Type I, II Filter
9. State Space Matrix from Differential Equation
10. Normal Equation Using Levinson Durbin
11. Decimation And Interpolation Using Rational Factors
12. Maximally Decimated Analysis DFT Filter
13. Cascade Digital IIR Filter Realization
14. Convolution And M Fold Decimation & PSD Estimator
15. Estimation Of PSD
16. Inverse Z Transform
17. Group Delay Calculation
18. Separation Of T/F
19. Parallel Realization of IIR filter

ECDV6042: DIGITAL IMAGE AND VIDEO PROCESSING LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

1. Perform basic gray and colour image processing operations as well as various image procession algorithms. (Applying)
2. Perform basic video processing algorithm and to calculate various features of image. (Applying)

List of Experiments:

1. Perform basic operations on images like addition, subtraction etc.
2. Plot the histogram of an image and perform histogram equalization
3. Implement segmentation algorithms
4. Perform video enhancement
5. Perform video segmentation
6. Perform image compression using lossy technique
7. Perform image compression using lossless technique
8. Perform image restoration
9. Convert a colour model into another
10. Calculate boundary features of an image
11. Calculate regional features of an image

12. Detect an object in an image/video using template matching/Bayes classifier

ECWM6043: WIRELESS AND MOBILE COMMUNICATION LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

1. Define the fundamental concepts of cellular communication like frequency reuse, cell splitting etc. (Remembering)
2. Outline concepts of GSM and CDMA architecture, network concepts etc. (Understanding)
3. Utilize GSM handset for various signalling techniques. (Applying)
4. Analyse transmitter and receiver sections in mobile handset, different modulation techniques etc. (Analysing)
5. Evaluate AT commands in 3G network. (Evaluating)
6. Discuss features of 3G communication systems such as transmission of voice and video calls, SMS etc. (Creating)

List of Experiments:

1. Understanding Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, multipath environment, Coverage and Capacity issues using communication software.
2. Knowing GSM and CDMA architecture, network concepts, call management, call setup, call release, Security and Power Control, Handoff Process and types, Rake Receiver etc.
3. Study of GSM handset for various signaling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
4. To study transmitters and receiver sections in mobile handsets and measure frequency band signal and GMSK modulating signal.
5. To study various GSM AT Commands their use and developing new applications using it.
6. Understating of 3G Communication System with features like; transmission of voice and video calls, SMS, MMS, TCP/IP, HTTP, GPS and File system by AT Commands in 3G network.
7. Study of DSSS technique for CDMA, observe effect of variation of types of PN codes, chip rate, spreading factor, processing gain on performance.
8. To learn and develop concepts of Software Radio in a real time environment by studying the building blocks like Baseband and RF section, convolution encoder, Interleaver and De- Interleaver.
9. To study and Analyse different modulation techniques in time and frequency domain using SDR kit.

ECMA6044: MICROCONTROLLER AND APPLICATIONS LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

1. Apply the concept of 8051 microcontroller to write program using assembly language and embedded C language. (Applying)
2. Design systems using 8051 microcontroller. (Creating)

List of Experiments:

1. Introduction to various simulators used for 8051 microcontroller
2. Assembly language programming of 8051 microcontroller for arithmetic operations
3. Assembly language programming of 8051 microcontroller for logical operations
4. Introduction to development board of 8051 microcontroller
5. Interfacing of LED with 8051 microcontroller
6. Interfacing of Seven segment display with 8051 microcontroller
7. Interfacing of LCD interfacing with 8051 microcontroller
8. Interfacing of Keyboard with 8051 microcontroller
9. Interfacing of ADC with 8051 microcontroller
10. Assignment based on above mentioned experiments.

ECPM6045: PATTERN RECOGNITION & MACHINE LEARNING LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcome

1. Implement various tools such as maximum likelihood algorithm, Bayes classifier, linear regression, deep learning algorithm, linear discriminant algorithm,unsupervised learning. (Applying)

2. Design classifier using perceptron rule, feed forward back-propagation and delta rule, SVM. (Creating)

List of Experiments:

1. Implement maximum likelihood algorithm
2. Implement Bayes classifier
3. Implement linear regression
4. Design a classifier using perceptron rule
5. Design a classifier using feed-forward back-propagation and delta rule algorithms
6. Implement deep learning algorithm
7. Implement linear discriminant algorithm
8. Design a two class classifier using SVM
9. Design a multiclass classifier using SVM
10. Perform unsupervised learning

ECDE6046: DETECTION AND ESTIMATION THEORY LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

1. Identify methods for detection and estimation of signals in white and non-white Gaussian noise. (Applying)
2. Analyse Signals and noise models. (Analysing)
3. Design optimal and suboptimal detection and estimation algorithms under realistic conditions. (Creating)

List of Experiments:

1. Simulate signal and noise models models.
2. Simulate spatially separated target Signal in the presence of Additive Correlated White Noise
3. Simulate spatially separated target Signal in the presence of Additive Uncorrelated White Noise
4. Simulate spatially separated target Signal in the presence of Additive Correlated Colored Noise
5. Detect Constant amplitude Signal in AWGN
6. Detect Time varying Known Signals in AWGN
7. Detect Unknown Signals in AWGN
8. Compare performance comparison of the Estimation techniques - MLE, MMSE, Bayes Estimator, MAP Estimator, Expectation Maximization (EM) algorithm
9. Performance comparison of conventional Energy Detectors and Coherent Matched Filter Techniques

ECRS6047: ANTENNAS AND RADIATING SYSTEMS LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcome

1. Definition of basic taxonomy and terminology of the computer networking area. (Remembering)
2. Understand and build the skills of subnetting and routing mechanisms. (Understanding)
3. Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation. (Understanding)
4. Apply mathematical foundations to solve computational problems in computer networking. (Applying)
5. Analyse performance of various communication protocols. (Analysing)
6. Compare routing algorithms. (Evaluating)
7. Design and develop protocols for Communication Networks and practice packet/file transmission between nodes. (Creating)

List of Experiments:

1. Simulation of half wave dipole antenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.
3. Simulation of quarter wave, full wave antenna and comparison of their parameters.
4. Simulation of monopole antenna with and without ground plane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.
6. Simulation of a half wave dipole antenna array.
7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.

8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.
9. Case study.

ECCN6048: ADVANCED COMMUNICATION NETWORKS LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

1. Definition of basic taxonomy and terminology of the computer networking area. (Remembering)
2. Understand and build the skills of subnetting and routing mechanisms. (Understanding)
3. Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation. (Understanding)
4. Apply mathematical foundations to solve computational problems in computer networking. (Applying)
5. Analyse performance of various communication protocols. (Analysing)
6. Compare routing algorithms. (Evaluating)
7. Design and develop protocols for Communication Networks and practice packet/file transmission between nodes. (Creating)

List of Experiments:

1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.
2. Linux Network Configuration.
3. Configuring NIC's IP Address.
4. Determining IP Address and MAC Address using if-config command.
5. Changing IP Address using if-config.
6. Static IP Address and Configuration by Editing.
7. Determining IP Address using DHCP.
8. Configuring Hostname in /etc/hosts file.
9. Design TCP iterative Client and Server application to reverse the given input sentence.
10. Design a TCP concurrent Server to convert a given text into upper case using a multiplexing system called "select".
11. Design UDP Client Server to transfer a file.
12. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.
13. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.
14. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.
15. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.
16. Signaling and QoS of labeled paths using RSVP in MPLS.
17. Find shortest paths through the provider network for RSVP and BGP.
18. Understand configuration, forwarding tables, and debugging of MPLS.

ECDS6049: DSP ARCHITECTURE LAB

(L-T-P:0-0-4) (2 credits)

Course Outcomes

1. Recall and demonstrate the Code Composer Studio. (1-Remembering, 2-Understanding)
2. Develop the interfacing between MATLAB and Code Composer Studio (3-Applying, 6-Creating)
3. Simplify and explain the real time DSP problems with the help of DSP processor. (4-Analyzing, 5-Evaluating)

List of Experiments:

1. Introduction to Code Composer Studio-I
2. Introduction to Code Composer Studio-II
3. Introduction to the Addressing Modes

4. FFT and Bit Reversal Operation
5. FFT and its Applications
6. Audio Codec and its Applications
7. Real Time Data Exchange
8. FIR filtering by interfacing Matlab with Code Composer Studio
9. Introduction to Interrupts
10. Digital communication using Binary Phase Shift Keying

ECSA6050: EMBEDDED SYSTEMS AND APPLICATIONS LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

1. Perform various experiments using PIC and AVR microcontroller. (Applying)
2. Relate different peripheral devices with PIC and AVR microcontroller. (Analysing)
3. Evaluate the performance of various microcontroller based embedded systems (Evaluating)

List of Experiments:

1. Introduction to MPLAB and Embedded C.
2. LED interfacing with PIC Microcontroller
3. 7 Segment display interfacing with PIC Microcontroller
4. LCD interfacing with PIC Microcontroller
5. Keyboard interfacing with PIC Microcontroller
6. ADC and DAC interfacing with PIC Microcontroller
7. Serial Communication using PIC Microcontroller
8. Timer using PIC Microcontroller
9. Interrupt using PIC Microcontroller
10. Basic programming using AVR Microcontroller
11. Data Acquisition using LabView
12. Interfacing of Microcontroller with LabVIEW

ECMI6051: MINI PROJECT

(L-T-P: 0-0-4) (2 credits)

Objective

The Mini Project work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminars should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of a report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by the Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

Course Outcomes

1. Choose various topics for self-learning (Remembering)
2. Explain different problems and recent trends related to the topic (Understanding)
3. Apply the knowledge to find out the solution of the problems related to the topic (Applying)
4. Compare various real life problems related to the topic (Analysing)
5. Evaluate various design problems related to the topic (Evaluating)
6. Develop oral and written communication skills to present and defend their work in front of technically qualified audience (Creating)

ECDI6059: DISSERTATION PHASE–I

(L-T-P: 0-0-20) (10 credits)

Objectives

During this phase the student will start a research project applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester

Course Outcomes

1. Select a project of interest. (Remembering)
2. Defend the topic of interest for continuing work, by doing initial studies on it. (Understanding)
3. Prepare a working methodology for the project for its successful completion.(Applying)
4. Design and experiment on the selected project. (Analysing)
5. Devise tools and methods for experimenting and troubleshooting for getting expected outcomes. (Evaluating)
6. Explain, justify and defend the project work by presenting the work and writing a report. (Creating)

ECDI6060: DISSERTATION PHASE–II

(L-T-P: 0-0-32) (16 credits)

Objective

During this phase the student will carry forward and complete the work that they have started in Phase I. It is expected that the student will publish at least one research paper in a well-known journal to augment their work during this phase. Published papers will carry extra weightage during evaluation. The mode and components of evaluation and the weightages attached to them shall be published by the Department at the beginning of the semester.

Course Outcomes

1. Define the problem encountered in Phase-I. (Remembering)
2. Explain the working model of the proposed work. (Understanding)
3. Apply mathematical skills and how these skills are important in engineering. (Applying)
4. Contrast different problems encountered in designing a system. (Analysing)
5. Interpret knowhow on the topic selected for the project. (Evaluating)
6. Contrast on limitations of the system designed. (Creating)

VALUE ADDED COURSES

ECES6064: ELECTRONIC DISPLAY SYSTEM

(L-T-P: 2-0-0) (2 credits – 30 hours)

Objective

The objective of this course is to introduce the students to opto-electronic devices that are used to make advance display units. This course will also provide an exposure to interfacing of these display devices based on LED.

Course Outcomes

1. Explain and experiment with LED based display system. (Understanding - Applying)
2. Make use of Embedded Systems and its related applications. (Applying)
3. Design electronic displays. (Creating)

Module I (10 hours)

Fundamentals of LED: Introduction to PN Junction Diode, Construction and working of LED, Types of LED, Advantage, Disadvantage and Applications, 7 segment display, LED Dot Matrix Display, Tricolor LED – Construction and Working, LCD. Fundamentals of Microcontroller: 8051 Microcontroller, Basic and Advanced Microcontroller Boards.

Module II (20 hours)

Glowing of various patterns in LED using microcontroller, Microcontroller based up counter and down counter design using LED and 7 segment displays, Displaying of Names in different format using LCD, designing of rolling display using LED and LCD. Implementation of display devices in projects.

Suggested Readings

1. Electronic Devices and Circuits Theory, Boylestead and Nashelsky, 9th Edition, Prentice Hall India, 2007.

2. Electronic Devices and Circuits, Salivahanan et al., 2nd Edition, Tata McGraw Hill, New Delhi, 2008.
3. The 8051 Microcontroller And Embedded Systems Using Assembly And C, Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay,Pearson
4. Microcontrollers : Theory and Applications, A V Deshmukh, Tata McGraw-Hill Education

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	M
CO 2	H	H
CO 3	H	H

ECNA6065: NANOTECHNOLOGY and APPLICATIONS

(L-T-P: 2-0-0) (2 credits – 30 hours)

Objective

This course will introduce the students to Nanotechnology. The course is designed to build up a basic understanding of the nano concepts. It will provide the students the knowledge of synthesis of nanomaterials, their characterization techniques as well as touch upon some applications of nanotechnology.

Course Outcomes

1. Define various terms such as nanotechnology, nanoelectronics, nanoscience etc. (Remembering)
2. Explain the operations of various characterization tools. (Understanding)
3. Apply the synthesis process to fabricate various nanostructures. (Applying)
4. Analyze various nanostructures. (Analysing)
5. Evaluate nanomaterials using characterization techniques. (Evaluating)

Module I (17 hours)

Introduction to Nanotechnology, Basics of Material science and Nanoscience, Poor Man's Nanotechnology, Introduction to Characterization Techniques-I, Synthesis of nanomaterials, ImageJ, Origin and Lab Rules, Nano electronics: Novel device fabrication and characterization.

Module II (13 hours)

Introduction to Characterization Techniques – II, Optical properties of nanomaterials, Nano Bioscience, Issues of Nanotechnology, Characterization results, Applications of Nanotechnology.

Suggested Readings

1. G. L. Hornyak, J. Dutta, H. F. Tibbals, A. Rao Introduction to nanoscience, CRC Press
2. G. L. Hornyak, J. Dutta, H. F. Tibbals, A.Rao Introduction to nanotechnology CRC Press
3. T. Pradeep, Nano: The Essentials McGraw Hill
4. G. W. Hanson, Fundamentals of Nanoelectronics, Pearson
5. D. Maclurcan and N. Radywyl (Eds.) Nanotechnology and Global Sustainability CRC Press
6. E. Lichtfouse, J. Shwarzbauer, D. Robert, Environmental Chemistry for a Sustainable World, Vol.2 Springer Verlag

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	M
CO 2	H	M
CO 3	H	M
CO 4	M	H
CO 5	M	H

SCHOOL OF TECHNOLOGY
DEPARTMENT OF COMPUTER APPLICATIONS
MASTER OF COMPUTER APPLICATIONS (MCA)

VISION

Imparting knowledge of Computer Applications, to mould individuals into IT professionals, researchers and entrepreneurs who are innovative, versatile and committed to society.

MISSION

To prepare students for professional career and higher studies by providing conducive teaching, learning and research environment.

- To produce skilled individuals and entrepreneurs in emerging areas of technologies by academia-industry collaboration.
- To instill in individuals a sense of commitment to work for the betterment of society using technology.

PROGRAMME – MASTER OF COMPUTER APPLICATIONS (MCA)

PROGRAM OUTCOMES – MCA

PO 1: Computational Knowledge: Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models from defined problems and requirements.

PO 2: Problem Analysis: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

PO 3: Design /Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex Computing problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

PO 6: Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

PO 7: Life-long Learning: Recognise the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO 8: Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 9: Communication Efficacy: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO 10: Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

PO 11: Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO 12: Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PROGRAM SPECIFIC OUTCOMES – MCA

PSO 1: Develop a comprehensive understanding and proficiency in advanced programming, computer networks, database management, distributed applications, software engineering, and entrepreneurship, enabling the effective design, development, and management of software systems.

PSO 2: Ability to work with latest tools and technologies in the field of computer applications, such as cyber security, data science and artificial intelligence and pursue careers in IT industry, research and development, teaching and allied areas.

LIST OF COURSES -MCA

Mapping Code	Course Name
1.1	Mathematical Foundation for Computer Science
1.2	Theory of Computation
1.3	Operating Systems
1.4	Data Structures and Algorithms
1.5	Programming Through Java
1.6	Operating Systems Lab
1.7	Data Structures and Algorithms Lab
1.8	Programming Through Java Lab
2.1	Software Engineering
2.2	Data Communication and Computer Networks
2.3	Advanced Database Management Systems
2.4	Internet Technology and Applications
2.5	Sensor Networks and Internet of Things
2.6	Data Communication and Computer Networks Lab
2.7	Internet Technology and Applications Lab
2.8	Advanced Database Management Systems Lab
2.9	Constitution of India
3.1	Cyber Law and IT Security
3.2	Machine Learning
3.3	Enterprise Resource Planning
3.4	Research Methodology and IPR
3.5	Elective I *Specialization I: Artificial Intelligence* OR *Specialization II: Data Science*
3.6	Elective II *Specialization I: Artificial Intelligence* OR *Specialization II: Data Science*
3.7	Machine Learning Lab
3.8	Minor Project - MCA
3.9	Communication Skills
3.10	Entrepreneurship
4.1	Major Project - MCA
4.2	Elective III

MAPPING of COURSES to PO/PSOs –MCA

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1.1	H	M		L											L
1.2	H	M		L									M		L
1.3		L	H		M								H		
1.4	M	H	M										H		L
1.5	M		H		H								H		M
1.6		L	H		M								H		
1.7	M	H	M										H		L
1.8	M		H		H								H		M
2.1			H					M					H		M
2.2	H		M		M							L		L	M
2.3	H		M		M							L		L	M
2.4			H						L			M		L	H
2.5	M		H		H					M		M			H
2.6	H		M		M							L		L	M
2.7			H						L			M		L	H
2.8	H		M		M							L		L	M

2.9										M				M	
3.1						H	M			L				H	
3.2	H		M		M							L	M		H
3.3					H			M				L	M		
3.4					M		L					H			H
3.5	H	M		M	L									M	H
3.6	H	M		M	L									M	H
3.7	H		M		M							L	M		H
3.8	M	L	H		H		M	M			M	H	H	M	M
3.9									H	M	L			M	
3.10										M	L	H			
4.1	M	L	H		H		M	M			M	H	H	M	M
4.2	L		M			M		H	L						M

THEORY COURSES

CAOS0016: OPERATING SYSTEMS

(4 credits – 60 hours)

Objective

The main objective of this course is to introduce the students to a layer of software called Operating Systems, whose job is to manage all the devices of a computer system and provide user programs with a simple interface to the hardware. This course will familiarize the students with the concepts of processes, memory management, file management, Input/Output management and the potential problem of deadlocks. The students will also learn about the Linux operating system, which is a full-blown Unix clone and is fast gaining popularity worldwide.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Elaborate what operating systems are, what they do and how they are designed and constructed. (Creating)
2. Define process concepts like process scheduling, inter-process communication, process synchronization and concurrency. (Remembering)
3. Explain different memory management schemes, relate various approaches to memory management and effectiveness of a particular algorithm. (Understanding)
4. Identify different page replacement algorithms to solve problems. (Applying)
5. Determine the concepts learned with case studies of Linux and Windows. (Evaluating)

Module I: Concepts, Processes and Threads (14 Hours)

Operating system as an Extended Machine and as a Resource Manager, Operating system concepts (Files, Deadlocks, Memory Management, Input/Output, Processes, The Shell, Security), The evolution of Operating Systems (Serial Processing, Simple Batch Systems, Multiprogrammed Batch Systems, Mainframe Operating Systems, Server Operating Systems, Time Sharing Systems, Multiprocessor Operating Systems, Real-Time Systems, Embedded Operating Systems, Smart Card Operating), System Calls (Process Management, File Management, Directory management), Introduction to Processes (The Process Model, Process Creation, Process Termination, Process Hierarchies, Process States, Implementation of Processes, Process Control Block), Threads (The Thread Model, Thread Usage, Implementing Threads(In User Space and Kernel), Scheduler Activation, Pop Up Threads, Interprocess Communication (Race conditions, Critical Sections, Mutual Exclusion with Busy Waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message Passing), Classical IPC problems (The Dining Philosophers Problem, The Sleeping Barber Problem), Process Scheduling (Scheduling in Batch Systems, Scheduling in Batch Systems, Scheduling in Interactive Systems, Scheduling in Real-Time Systems, Thread Scheduling)

Module II: Deadlocks and Memory Management (14 Hours)

a. Resources, Deadlock (Conditions for Deadlock, Deadlock modeling), Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention
b. Memory management without swapping or paging (Monoprogramming without swapping or paging, Multiprogramming with fixed partitions, Relocation and Protection), Swapping, Virtual Memory (Paging, Page Tables), Page Replacement Algorithms (Not-recently-used, First in first out, Second Chance page replacement algorithm, The Clock Page Replacement Algorithm, Least Recently used page replacement algorithm, The Working Set Page Replacement Algorithm, Modeling Paging Algorithms (Belady's Anomaly, Stack Algorithms, Predicting page fault rates), Design issues for Paging Systems, Implementation issues, Segmentation (Implementation of pure segmentation, Segmentation with Paging: MULTICS)

Module III: Input/output and File Systems (16 Hours)

a. Principles of I/O hardware (I/O devices, Device Controllers, Direct memory access), Principles of I/O software, I/O Software Layers, Disks (Disk hardware, disk formatting, disk arm scheduling algorithms, Error handling, Track-at-a-time caching, RAM disks) Clocks (Clock hardware, Clock software), Terminals (Terminal hardware, Input software, Output software)
b. Files (File Naming, File structure, File types, File access, File attributes, File operations, Memory mapped files), Directories, File System layout (Implementing files, Implementing directories, Shared files), Security (The security environment, Generic Security Attacks, Design Principles For Security, User Authentication), Protection mechanisms (Protection Domains, Access Control Lists, Capabilities, Multilevel Security, Covert Channels), Type of File Systems (FAT, VFAT, FAT32, NTFS)

Module IV: Introduction to Linux OS design – Case study (16 Hours)

Overview of Unix, Processes in Unix (Fundamental Concepts, Process Management System Calls in Unix, Implementation of Processes in Unix), Memory Management in Unix, Input/Output in Unix, The Unix File System, Security in Unix

Suggested Readings

1. Andrew S Tanenbaum, Modern Operating Systems , (Second Ed.), Prentice Hall of India, New Delhi,
2. William Stallings, Operating Systems, Fourth Edition, Prentice Hall of India, New Delhi.
3. Silberschatz, Galvin, Operating System Concepts, Fifth Edition, John Wiley and Sons (Asia) Pte.
4. HM Deitel, Operating Systems, Second Edition, Pearson Education.
5. Pramod Chandra P. Bhatt, An Introduction to Operating Systems Concept, Prentice Hall of India.
6. Maurice J. Bach, The Design of the Unix Operating System, Prentice Hall of India, New Delhi.
7. Kernighan and Pike, The Unix Programming Environment, Prentice Hall of India, New Delhi.

Mapping of COs with Syllabus

Course Outcomes	Module1	Module2	Module3	Module4
CO1	H	M	L	
CO2	M	H	L	
CO3	M	H	M	
CO4		M	H	
CO5		L	H	M

CAPJ0018: PROGRAMMING THROUGH JAVA

(4 credits–60 hours)

Objective

The course is designed to impart the knowledge and skill required to solve real world problems using an object-oriented approach utilizing Java language constructs. This course covers the two main parts of Java i.e. Java Language and Java Library (JDK 5). After completion of the course, a student is expected to be able to

- Do Object Oriented Programming using Java
- Implement Exception handling and Multithreading in Java.
- Create Java I/O Applications and Applets.
- Set up a GUI using Swing components
- Do Network Programming in Java.
- Access relational databases from the Java program and use Java Beans and Servlets.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Recall the various features of Object Oriented programming by utilizing the JAVA language construct. (Remembering)
2. Explain the standard library, scope and lifetime of a variable and various control statements used in JAVA programs. (Understanding)
3. Interpret the concept of classes and object in JAVA and apply exception handling to solve various exceptions (Applying)
4. Contrast the different type of inheritance and polymorphism and Analyse it in resolving various problems (Analysing)
5. Select the appropriate GUI and will be able to justify their decision to use a particular GUI by evaluating the required parameters depending on the domain and requirement. (Evaluating)
6. Develop algorithms based on the knowledge they have gained to design cost effective and user friendly applications. (Creating)

Module I: Core Java Programming (14 Hours)

a. Java Overview: Genesis, Java Philosophy, Java and Internet, Object-Oriented Programming features, Java Applet and Application, Java Environment and Java Development Kit (JDK) and Java Standard Library (JSL),
b. Java language fundamentals: The scope and lifetime of variable, Type conversion and casting, Control statements, Arrays
c. Classes and objects: The this keyword, Garbage collection, Overloading constructor, Using object as parameters, Argument passing, Returning objects, Recursion, Introducing Access control (public, private and protected), static, final, nested classes, String class, Command- line argument

Module II: Inheritance, Exception handling, Multithread and Applets (12 Hours)

a. Inheritance: Member access and inheritance, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance, the Object class; Packages, Interface, classpath
b. Exception handling: Fundamentals, Exception types, Java's built-in exceptions, user defined exceptions.
c. Multithreaded Programming: The Java thread model (thread priorities, synchronization and inter-thread communication); Deadlock, Thread Group
d. I/O Basics: Streams, the stream classes, the predefined streams, Reading console input, writing console output, the

transient and volatile modifiers, using instance of native methods

Module III String handling, Utility classes, java.lang and java.io (12 Hours)

a. String handling: String constructors, methods for character extraction, string searching and comparison, data conversion using valueof (), String Buffer.
b. Exploring java. lang: Simple type wrappers, System class, class Class, Math functions
c. The utility classes: Vector, Stack, Hash Table, String Tokenizer, Bit set, Date, Calendar, Gregorian Calendar, Random, Observable
d. Input/Output - Exploring java.io: The java.io classes and interface, File class and methods for creating, renaming, listing and deleting files and directories, I/O stream classes (File Input Sream, File Output Stream, Buffered Input Stream, Buffered Output Stream, Push Back Input Stream, Input Stream Reader, Buffered Reader, Buffered Writer, Print Stream, Random Access File)

Module IV: Networking, Images, Applet class and Swing (12 Hours)

a. Networking: Socket overview, Stream Sockets, Datagram sockets, Manipulating URLs, Establishing a simple Server/Client using Stream Sockets, Connectionless Client/Server Interaction with Datagrams
b. Images: File formats, image fundamentals, creating, loading and displaying images, ImageObserver, MediaTracker
c. The Applet class: applet architecture, passing parameters to applets, getDocumentBase, getCodeBase, and showDocument, AppletContext and AudioClip interfaces, Graphics class and methods for drawing lines, rectangles, polygons and ovals
    I. Swing: Component and Container classes, Layout managers (Flow Layout, Grid Layout, Border Layout), Handling events, Adapter classes, Anonymous inner classes
    II. Swing GUI components: JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollBar, JScrollPane, JToolTip, JPanel, JFrame
    III. Menus: JmenuBar, JMenu, JMenuItem, JSeparator

Module V: Java Beans, JDBC, Java Servlets (10 Hours)

a. Java Beans: Introducing JavaBeans Concepts and Bean Development Kit (BDK), Using the Bean Box, Writing a simple Bean, Bean Properties (simple properties), Manipulating events in the Bean Box
b. Java database connectivity (JDBC): Introduction to JDBC, type of JDBC connectivity, Establishing database connections, Accessing relational database from Java programs

Suggested Readings

1. Deitel, H. M.; P. J. Deitel, Java : How To Program (Sixth Edition), New Delhi: Prentice-Hall India, 2005
2. Schildt, H., The Complete Reference Java 2 (Fifth Edition), New Delhi: Tata McGraw-Hill, 2005
3. Moss, K., Java Servlets (Second Edition), New Delhi: Tata McGraw-Hill
4. Russel, Java Programming for the absolute Beginner , New Delhi: Prentice-Hall India
5. Hanagan D., Java Examples in a Nutshell (Third Edition), New Delhi: O' Reilly, 2001

Mapping of COs with Syllabus

Course Outcome	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	M		
CO2	H	H	M		
CO3	H				
CO4		H			
CO5				H	H
CO6			M	M	M

CASE0019: SOFTWARE ENGINEERING

(4 credits–60 hours)

Objective

The field of software engineering aims to find answers to the many problems that software development projects are likely to meet when constructing large software systems. The objective of this paper is to make students aware of the problems incurred by large-scale software development and the solutions proposed. It covers a framework for studying and evaluating software tools, and stresses the importance of theory in the development of software.

COURSE / LEARNING OUTCOMES

CO1: Demonstrate understanding of fundamental software engineering principles and methodologies by explaining core concepts such as software development life cycle, agile methodologies, and software project management. (Understanding)

CO2: Apply software engineering techniques and tools to design and develop software solutions by implementing design patterns, writing test cases, and using version control systems. (Applying)

CO3: Analyze software requirements and specifications to identify potential risks, resource needs by conducting requirement analysis, feasibility studies, and risk assessments. (Analysing)

CO4: Create comprehensive software project plans and design documentation that address software requirements and constraints by developing detailed project plans, system architectures, and design documents. (Creating)

Module I (10 Hours)

a. The Product and The Process: The Product - Evolving Role of Software, Software (Characteristics, Components and Applications;
b. The Process – Software Engineering A Layered Technology, The Software Process, Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Process Models (The Incremental Model, The Spiral Model, The Component Assembly Model, The Concurrent Development Model), The Formal Methods Model, Fourth Generation Techniques;
c. Project Management Concepts – The Management Spectrum (People, the Problem, the Process and the Project);
d. Software Process and Project Metrics – Measures, Metrics and Indicators, Metrics in the Process and Project Domains, Software Measurement, Reconciling Different Metrics Approaches, Metrics for Software Quality;
e. Software Project Planning – Observation on Estimating, Project Planning Objectives, Software Scope, Resources, Project Estimation Technique – Empirical estimation techniques (Expert Judgement Technique, Delphi Cost Estimation), Heuristic estimation techniques (COCOMO Model), Halstead Software Science (An Analytical Technique), The Make-Buy Decision;

Module II (10 Hours)

a. Project Scheduling and Tracking - Basic Concepts, The Relationship between People and Effort, Defining a Task set for the Software Project, Selecting Software Engineering Tasks, Defining a Task Network, Scheduling, The Project Plan;
b. Software Projects Risks, Quality Assurance and Configuration Management: RiskManagement- Reactive Vs. Proactive Risk Strategies, Software Risk, Risk Identification, Risk Projection, Risk (Mitigation, Monitoring and Management), Safety Risks and Hazards, The RMMM Plan;
c. Software Quality Assurance - Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Statistical Quality Assurance, Software Reliability, The SQA Plan, The ISO 9000 Quality Standards;
d. Software Configuration Management - Software Configuration Management, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting;
e. System Engineering - Computer Based Systems, Product Engineering

Module III (20 Hours)

a. Analysis and Design: Analysis Concepts and Principles - Requirements Analysis, Communication Techniques, Analysis Principles, Software Prototyping, Specification, Specification Review;
b. Analysis Modeling- The Elements of the Analysis Model, Data Modeling, Functional Modeling and Information Flow, Behavioral Modeling, the Mechanics of Structured Analysis, the Data Dictionary;
c. Design Concepts and Principles - Software Design and Software Engineering, the Design Process, Design Principles, Design Concepts, Effective Modular Design, Design Heuristic for Effective Modularity, the Design Model, Design Documentation;
d. Design Methods - Data Design, Architectural Design, the Architectural Design Process, Architectural Design Optimization, Interface Design, Human-Computer Interface Design, Interface Design Guidelines, Procedural Design;
e. Design For Real Time systems - Real Time Systems;
f. Case studies on diagram - Use case, Class, Activity, Sequence

Module IV (10 Hours)

a. Software Testing: Software Testing Methods - Software Testing Fundamentals, Test Case Design, White Box Testing, Basis Path Testing, Control Structure Testing, Black Box Testing, Testing for Specialized Environments;
b. Software Testing Strategies - A Strategic Approach to Software Testing, Strategic Issues, Unit Testing, Integration Testing, Validation Testing, System Testing, The Art of Debugging;
c. Technical Metrics For Software - Software Quality, A Framework For Technical Software Metrics, Metrics for the Analysis Model, Metrics for the Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Maintenance

Module V (10 Hours)

a. Object Oriented Software Engineering: Object Oriented Concepts and Principles - The Object Oriented Paradigm, Object Oriented Concepts, Identifying the Elements of an Object Model, Management of Object Oriented Software Projects
b. Object Oriented Analysis - Object Oriented Analysis, Domain Analysis, Generic Components of the Object Oriented Analysis Model, the OOA Process, the Object Relationship Model, the Object Behavior Model
c. Object Oriented Design - Design for Object Oriented Systems, The Generic Components of the OO Design Model, The

Systems Design Process, The Object Design Process, Design Patterns, Object Oriented Programming

d. Advanced Topics in Software Engineering: Cleanroom Software Engineering- The Cleanroom Approach, Functional Specification, Design Refinement and Verification, Cleanroom Testing
e. Software Reuse - Management Issues, the Reuse Process, Domain Engineering, Building Reusable Components, Classifying and Retrieving Components, Economics of Software Reuse
f. Reengineering - Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering, Economics of Reengineering
g. Computer Aided Software Engineering - Case Definition, Building Blocks of Case, Taxonomy of Case Tools, Integrated Case Environments, the Integration Architecture, the Case Repository

Suggested Readings

1. Roger S. Pressman, Software Engineering A Practitioner's Approach, Fourth Edition, Tata McGraw Hill.
2. Rajib Mall, Fundamentals of Software Engineering, Second Edition, Prentice Hall of India Private Limited.
3. Ian Sommerville, Software Engineering, Sixth Edition, Addison Wesley, Pearson Education.
4. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals Of Software Engineering, Second Edition, Prentice Hall of India Private Limited, New Delhi, 2002.
5. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, Modern Systems Analysis and Design, Second Edition, Pearson Education.
6. Richard E Fairley, Software Engineering Concepts, Tata McGraw Hill Publishing Company Limited, New Delhi, 1997.
7. Hans Van Vilet, Software Engineering Principles and Practice, Second Edition, John Wiley and Sons, Ltd.

Mapping of COs with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	M	M
CO2	L	H	H	M	M
CO3	L	M	H	H	H
CO4	L	L	H	H	H

CAIT0022: INTERNET TECHNOLOGY AND APPLICATIONS

(4 credits – 60 hours)

Objective

The objective of the course is to familiarize the students with a discussion on Internet and its growth. It also provides the students a study on the basic services provided by the Internet. A familiarization on the markup languages, scripting languages and web application development are also being discussed to make the student competent to design websites. It has been taken into consideration that this paper assumes that the students must know well in advance about the various protocols of the Internet and the knowledge of HTML and databases.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Recall and examine the growth of Internet and identify the history behind it. (Remembering)
2. Identify and differentiate the various services provided by the internet. (Understanding)
3. Experiment with various mark-up languages and scripting languages. (Applying)
4. Analyse and design a website of their own and can also identify the faults in the design. (Analysing)
5. Develop and create a website of their own. (Creating)
6. Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (Evaluating)

Module I: Introduction to Internet (10 Hours)

History of the Internet; History of the World Wide Web; W3C (World Wide Web Consortium); Levels of Internet Connectivity (Dial-up, Leased Line, DSL, VSAT); Requirements for Internet connectivity; Use of Browsers; Different types of browsers (IE, Opera, Netscape, Firefox); Search engines; FTP; Electronic Mail; Instant Messaging; DHCP; DNS; HTTP; URL; Proxy Servers.

Module II: Internet Markup Languages (12 Hours)

a. XHTML: What is XHTML? Components of XHTML; Elements of XHTML (Headers, Paragraphs,
b. Linking, Images, Special Characters, Lists, Tables, Forms, Framesets)
c. Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation Service; Use of CSS (Positioning Elements, Backgrounds, Text flow)
d. XML: What is XML? Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Vocabularies; Document Object Model (DOM and its methods); Extensible Style Sheet Language (XSL)

Module III: Web servers, Databases and Scripting Languages (18 Hours)

a. Web servers: What is a web server; HTTP Request Types; System Architecture of a Web server; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Apache Web Server.
b. Databases: Introduction to each one of the following: SQL, MYSQL, DBI
c. Scripting Languages: Javascript: Operators, Data Types, Control Structures, Functions, Arrays, String Manipulation. JQuery, ASP.NET. Introduction to Perl and CGI (Common Gateway Interface). JSP: Introduction; JSP Overview; Scripting; Standard Actions; Directives
d. Java Servlets: Servlet overview and architecture, Servlet Interface and Servlet life cycle, HttpServlet Class, HttpServletRequest Interface, HttpServletResponse Interface, Handling HTTP get Requests, deploying a web application, Handling HTTP get requests containing data, Handling HTTP post requests.

Module IV: Web Application Development Using PHP (20 Hours)

a. Web Site Design Considerations: Using Logical Design: Planning your website, drawing a map, using a top-down approach, flexibility, other web design metaphors. Creating templates. Creating a Compatible Design: Designing for different color depths, resolutions, different browser considerations, accommodating limited bandwidth. Validating your work.
b. PHP: Introduction to PHP; Data Types; Control Structures; Functions; Strings; Arrays; Querying Web Databases using PHP; Writing to Web Databases; Errors, Debugging and Deployment; Reporting in PHP; Validation Techniques in PHP.

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
2. Hugh E. Williams and David Lane, PHP and MySQL, 2nd Edition, O'Reilly, Shroff Publishers and Distributors Pvt. Ltd.
3. Moss, K., Java Servlets (Second Edition), New Delhi: Tata McGraw-Hill
4. Internet Complete, 2nd Edition, BPB Publications, New Delhi
5. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H			
CO 3			H	
CO 4		M		H
CO 5		M		H
CO 6		M		H

CAEP0024: ENTERPRISE RESOURCE PLANNING

(4 credits–60 hours)

Objective

To help the student understand the conceptual elements of ERP and its theory and implementation. This is especially poignant in view of large number of organizations implementing ERP applications in recent years. The student will appreciate the impact that ERP brings into the daily operations of firms with respect to their productivity, integration, communication, etc.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Recall the conceptual elements of ERP. (Remembering)
2. Demonstrate the Influence of ERP in Large Organizations. (Understanding)
3. Identify the impact of ERP into the daily operations of firms with respect to their productivity, integration, communication etc. (Applying)
4. Analyse the practical side of ERP implementation with different vendors. (Analysing)
5. Discuss and evaluate the best practices of ERP with various case studies and real time examples. (Creating, Evaluating)

Module I: ERP Basics (15 hours)

a. Evolution and structure of ERP, ERP concepts, growth of the ERP market, conceptual model of ERP, 2-tier and 3-tier architecture, elements in ERP architecture, advantages/benefits of ERP, overview of an enterprise, integrated management information, business modeling, integrated data model
b. ERP and related technologies: Business Process Reengineering (BPR), Management Information Systems (MIS), Decision Support Systems (DSS), Data Warehousing, Data Mining, Online Analytical Processing (OLAP), Supply Chain Management.

Module II: ERP Modules (15 hours)
Item types in ERP, Manufacturing, distribution and Financial requirements, item control module in ERP, Finance module, Manufacturing and Production Planning module, Sales and Distribution module, Plant Maintenance module, Quality Management module, Materials Management module, Capital Requirement Planning module, Purchase Control module, Human Resources modules; concept of Bill of materials, concept of formula management.

Module III: Profiling ERP Vendors (10 hours)
a. SAP AG: R/3 –, overview of R/3 system, R/3 modules, R/3 and the internet
b. BAAN: Baan ERP modules, Baan ERP Tools
c. Oracle: Oracle modules – Financials, Human Resources, Projects, Manufacturing, Supply chain.
d. PeopleSoft: Accounting and control, Treasury Management, Performance Management, Sales and Logistics, Procurement.

Module IV: ERP Implementation Lifecycle (10 hours)
Elements of implementation methodology, Pre-evaluation Screening, Package evaluation, project planning phase, Gap Analysis, Business Process Re-engineering, configuration, Implementation team training, testing, product migration and support, Problems in ERP implementation, cost of ERP.

Module V Best Practices in ERP (10 hours)
a. Concept of Best Practices, concept of Customer Order Decoupling Point(CODP), Demand Management – Sales and Operations Planning, ERP scenario in India, future directions in ERP.
b. Case studies should also be introduced to highlight situations where ERP projects are implemented, and the success stories/benefits/difficulties of these implementations.

Suggested Readings
1. O'Leary, Daniel E, Enterprise Resource Planning Systems: systems, life cycle, electronic commerce and risk, Cambridge University Press.
2. Alexis Leon, Enterprise Resource Planning, 14th reprint, Tata McGraw Hill, New Delhi 2005
3. Rahul V Altekar, Enterprise Resource Planning (Theory and Practice), Prentice Hall India, New Delhi 2004
4. Alexis Leon, ERP Demystified, Tata McGraw Hill Pub. Co. Ltd, 2000
5. Kent Sandoe, Enterprise Integration, John Wiley and Sons
6. Garg and Venkitakrishnan, Enterprise Resource Planning : Concepts and Practice, 2nd edition, Prentice Hall India
7. Garg and Venkitakrishnan, ERPWARE: ERP Implementation Framework, Prentice Hall India
8. ERP – Concepts and Cases, ICFAI University Press, 2004

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		M	H		
CO 3		H	M		
CO 4		L		H	
CO5					H

CAPA0030: PRINCIPLES OF ARTIFICIAL INTELLIGENCE

(4 credits – 60 hours)

Objective
Artificial Intelligence has embraced the larger scientific goal of constructing information- processing theory of intelligence. If such a science of intelligence could be developed, it could guide the design of intelligent machines as well as explicate intelligent behaviour as it occurs in humans and other animals. This paper describes the fundamental AI ideas that underlie many of the AI applications and provides a base for understanding natural intelligence.

Module I: General Issues and Overview of AI (12 Hours)
Introduction to AI: The AI problems, the underlying assumption, AI techniques, the level of the model, criteria for success, AI applications. Problem solving, search and control strategies: defining the problem as a state space search, production systems, control strategies, breadth-first search, depth-first search, problem characteristics, production system characteristics, issues in the design of search programs.

Module II: Search Strategies for AI Production Systems (16 Hours)
Heuristic search techniques: generate-and-test, hill climbing, simple hill climbing, steepest- ascent hill climbing simulated annealing, best-first search, OR-graphs, the A* algorithm, problem reduction, AND-OR graphs, the AO* algorithm, constraint satisfaction, means-end analysis. game playing: overview, the minimax search procedure, adding alpha-beta cutoffs, additional

refinements, iterative deepening.

Module III: Knowledge Representation (16 Hours)
Knowledge representation issues: representations and mappings, representing simple facts in logic, knowledge representation attributes, computable functions and predicates, resolution, conversion to clause form, the basics of resolution, resolution in propositional logic, procedural vs. declarative knowledge, logic programming, forward vs. backward reasoning, matching, control knowledge. statistical reasoning: probability and Bayes' theorem, certainty factors and rule-based systems, Bayesian networks, Dempster-Shafer theory, basic notions and concepts of fuzzy sets, fuzzy set operations, information - based characterization of fuzzy sets, fuzzy relations and their calculus.

Module IV: Advanced AI (16 Hours)
Natural language processing: overview, morphological analysis, syntactic analysis, semantic analysis, discourse integration, pragmatic analysis, parsing techniques, top-down parsing, bottom- up parsing, augmented transition networks (ATN). Learning: rote learning, learning by taking advice, learning by induction, explanation-based learning. Expert system: representing and using domain knowledge, expert system shells, explanation, knowledge acquisition.

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:
1. Recall and identify the need of incorporating human intelligence into machine and define the basic terms related to the concept of knowledge and representation, learning and reasoning, communication and language processing. (Remembering)
2. Define problem state space, design algorithms to solve problems, generalized schema for knowledge interpretation and planning and language processing. (Understanding)
3. Compute and demonstrate the problem in terms of state space and apply different AI algorithms to solve problems and construct logic to represent knowledge in the computational domain and also to interpret the natural language. (Applying)
4. Compare and analyse the performance of algorithms based on problem domain. (Analysing)
5. design and create new intelligent algorithms for application development by integrating experience based learning. (Creating)
6. Judge and assess the algorithms based on completeness, optimality, and space and time complexity for solving a problem in an intelligent manner. (Evaluating)

Suggested Readings
1. Rich, E.; K. Knight, Artificial Intelligence, (Second Edition), New Delhi: Tata McGraw-Hill, 1997
2. Nilson, N. J., Principles of Artificial Intelligence, New Delhi: Narosa Publishing House, 2002
3. Pedrycz, W.; F. Gomide, An Introduction to Fuzzy Sets: Analysis and Design, New Delhi: Prentice- Hall India, 2004.
2. Winston, P. H., Artificial Intelligence, New Delhi: Pearson Education Asia, 2002
3. Charniak, E.; D. McDermott, Introduction to Artificial Intelligence, New Delhi: Pearson Education, 2002
4. Russell, S.; P. Norvig, Artificial Intelligence: A Modern Approach (Second Edition), New Jersey: Prentice-Hall, 2003

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	L
CO 2	M	H	L	
CO 3	L	M	H	
CO 4		H	M	M
CO 5			H	M
CO 6		M	M	H

CACL0033: CYBERLAW and IT SECURITY (4-0-0)
(4 credits – 60 hours)

COURSE/LEARNING OUTCOMES:
1. Apply fundamental concepts of Information Security threats and vulnerabilities to adopt right security measures and design real time scenarios. (Applying)
2. Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation. (Analyzing)
3. Analyze and evaluate the cyber security needs of an individual/organization. (Analyzing, Evaluating)
4. Design operational and strategic cyber security strategies and policies. (Creating)
5. Analyze various types of cybercrime and formulate procedures for real world cybercrime Investigations. (Analyzing)

Module I: (12 hours)
Object and Scope of the IT Act - Genesis, Object, Scope of the Act. Encryption -Symmetric Cryptography, Asymmetric Cryptography, RSA Algorithm, Public Key Encryption

Module II: (14 hours)
Digital Signature- Technology behind Digital Signature, creating a Digital Signature, Verifying a Digital Signature, Digital Signature and PKI, Digital Signature and the Law. E-Governance and IT Act 2000- Legal recognition of electronic records, Legal recognition of digital signature, Use of electronic records and digital signatures in Government and its agencies, Certifying Authorities. Need of Certifying Authority and Power. Appointment, function of Controller. Who can be a Certifying Authority? Digital Signature Certifications. Generation, Suspension and Revocation of Digital Signature Certificate.

Module III: (12 hours)
Domain Name Disputes and Trademark Law: Concept of Domain Names, New Concepts in Trademark, Jurisprudence, Cyber-squatting, Reverse Hijacking, Meta tags, Framing, Spamming, Jurisdiction in Trademark Dispute

Module IV: (12 hours)
Cyber Regulations Appellate Tribunal: Establishment & Composition of Appellate Tribunal, Powers of Adjudicating officer to Award Compensation, Powers of Adjudicating officer to impose Penalty.

Module V: (10 hours)
The Cyber Crimes (S-65 to S-74): Tampering with Computer Source Documents(S-65), Hacking with Computer System(S-66), Publishing of Information Which is Obscene in Electronic Form(s-67), Offences: Breach of Confidentiality & Privacy (S-72), Offences: Related to Digital Signature Certificate (S-73 & S-74)

Suggested Readings

1. Farooq Ahmad, Cyber Law in India, Pioneer Books
2. Vakul Sharma, Information Technology Law and Practice, Universal Law Publishing Co. Pvt. Ltd.
3. Suresh T Vishwanathan, The Indian Cyber Law, Bharat Law house New Delhi.
4. P.M. Bakshi and R.K.Suri, Hand book of Cyber and E-commerce Laws, Bharat Law house New Delhi.
5. Rodney D. Ryder, Guide to Cyber Laws, Wadhwa and Company Nagpur.
6. The Information Technology Act, 2000, Bare Act, Professional Book Publishers, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		M
CO 4				H	M
CO 5				M	H

CAMF0043: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

(4 Credits)

Objective

- To introduce the concepts of mathematical logic.
- To introduce the concepts of sets, relations, and functions and relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.
- To perform the operations associated with sets, functions, and relations.
- To understand combinatorics and apply in solving problems.
- To use Graph Theory for solving problems

COURSE/LEARNING OUTCOMES

1. Ability to apply mathematical logic to solve problems (Remembering, Understand)
2. Recall some basic concept of set theory and understand the concept of graph theory and Group theory. (Remembering)
3. Interpret logic sentence in terms of predicates, quantifiers, and logical Connectives (Understanding)
4. For a given a discrete problem, classify its algebraic structure (Analyzing)
5. Derive the solution of a problem using deductive logic and prove the solution based on logical inference (Applying)
6. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra (Evaluating)
7. Develop the given problem as graph networks and solve with techniques of graph theory. (Creating)

Module I (13 hours)

Mathematical Logic: Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, Logical equivalence: The Laws of logic, Logical Implication, Normal forms, Quantifiers, universal quantifiers. Predicates: Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof of contradiction.

Module II (20 hours)

Set theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Matrix representation of relations and partial ordered sets, representation of relations by Graphs; Lattices as Partially Ordered Sets, Boolean algebra; Functions. Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids; Groups, Congruence Relation and Quotient Structures, permutation groups, Lagrange's Theorem; Normal subgroups. Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. (Definition, basic properties and examples)

Module III (12 hours)

Elementary Combinatorics: Basics of counting, Combinations & Permutations with repetitions, Constrained repetitions, Binomial Coefficients, Binomial and Multinomial theorem, Pigeonhole Principle, principles of Inclusion – Exclusion.

Module IV (15 hours)

Graph Theory: Basic Concepts, Sub graphs, Multi graphs Representation of Graphs, Isomorphism, Paths and Circuits, Traversing a Graph, DFS, BFS, Eulerian and Hamiltonian graphs, Shortest path algorithms, Planar Graphs, Chromatic Numbers. Tree and Spanning Trees. Applications of Graph Theory.

Suggested Readings

1. Discrete Mathematical Structures with Applications to Computer Science by J. P. Tremblay and R Manohar, Tata McGraw-Hill Publications, 1997.
2. Graph Theory by Narsingh Deo, Prentice-Hall of India publications, 2004.
3. Discrete Mathematical Structures, Theory and Applications. D.S. Malik, Thomson Learning, I Edn
4. Discrete Mathematics for Computer Science, Haggard, Thomson Learning, I Edn
5. Discrete Mathematics and Its Applications by Kenneth H Rosen. Tata McGraw-Hill Publications
6. Mathematical foundation of Computer Science by Y. N Sings. New Age international Publishers
7. Bernard Kolman, Robert. C.Busby & Sharon Ross, "Discrete Mathematical structures" Prentice Hall of India,2001.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3	H			
CO 4		H		
CO 5		H		
CO 6		H	M	
CO 7				H

CADA0044: DATA STRUCTURES AND ALGORITHMS

(4 Credits – 60 Hours)

Objectives

- To introduce first level topics covering basics in algorithms and data structures.
- To enable students to choose appropriate data structures, understand the ADT/libraries, and use of it to design algorithms for a specific problem.
- To understand the necessary mathematical abstraction to solve problems.
- To apply important algorithmic design paradigms and methods of analysis.

COURSE/LEARNING OUTCOMES

At the end of the course, students would be able to:

1. Know the formal definition of algorithms, importance of analysis of an algorithm and get familiar with different types of problem and their solutions. (Remembering and Understanding)
2. Choose appropriate data structure as applied to specified problem definition. (Applying)
3. Understand different design strategies such as brute force, divide-and-conquer, dynamic programming, greedy technique and backtracking used for the design of algorithms. (Understanding)
4. To design and analyse algorithms for given problems. (Applying)
5. Compare and analyse different design strategies and assess an algorithm in terms of correctness, computation cost and memory space used. (Analysing and Evaluating) .

6. Design new algorithms for given problems by using most appropriate algorithmic strategy considering the problem domain. (Creating)

Module I (14 Hours)
Introduction to Algorithms, Fundamentals Stages of Problem Solving, and Classification of Algorithms - Based on Implementation, Based on Design, Based on Area of Specialization, Based on Tractability, Basics of Algorithms Analysis, Asymptotic Analysis, Mathematical Analysis of Iterative and Recursive Algorithms, Empirical Analysis of Algorithms, Models of Computations - RAM model, Turing Machine.

Module II (12 Hours)
Data Structures: Abstract Data Types (ADTs), Stacks, Queues, Circular Queues, Implementation of Stacks using Queues, Implementation of Queues using Stacks, Priority Queues, Heaps, Linked Lists, Search and Update Operations on Varieties of Linked Lists, Graphs, Binary Trees, Tree Traversals, Binary Search Trees (BSTs), AVL Trees, Red Black Trees, Splay Trees, B-Trees, Disjoint Sets.

Module III (12 Hours)
Analysis of Sorting and Searching Algorithms: The sorting problem, Brute Force Approach - Sequential Search, Bubble Sort, Selection Sort, Decrease-and-Conquer Approach - Insertion Sort, Binary Search, Divide-and-Conquer Approach - Quick Sort, Merge Sort, Transform-and-Conquer Approach - Heap Sort, Linear Sorting Algorithms - Counting Sort, Radix Sort, Bucket Sort, Hashing - Hash Function, Collisions in Hashing, Separate Chaining, Open Addressing, Analysis of Search Operations.

Module IV (14 Hours)
Graph Algorithms: Graphs and their Representations, Graph Traversal Techniques - Breadth First Search (BFS) and Depth First Search (DFS), Minimum Spanning Trees (MST), Greedy Techniques - Prim's and Kruskal's algorithms for MST, Dijkstra's Algorithm for Single Source Shortest Paths, Dynamic Programming - Warshall's Algorithm for finding Transitive Closure of a Graph, Floydd's Algorithm for All-Pairs Shortest Paths Problem.
Algorithmic Design Techniques: Greedy Algorithms - Coin Change Problem, Scheduling Problem, Knapsack Problem, Huffman Trees, Divide-and-Conquer Approach - Strassen Matrix Multiplication, Closest-pair Problem, Tiling Problem, Dynamic Programming – Longest Common Subsequence (LCS) problem, Optimal Binary Search Trees, Travelling Salesperson Problem, Chain matrix multiplication.

Module V (8 Hours)
Tractable and Intractable Problems: Computability of Algorithms, Computability Classes – P, NP, NP-Complete, NP-Hard.
Basics of Backtracking, Branch-and-bound methodologies for Algorithm design, Approximation algorithms, Randomized algorithms.

Suggested Readings
1. Mark Allen Weiss, Data Structure and Algorithm Analysis in C++, Fourth Edition, Pearson, 2014.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford University Press, 2014.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, The MIT Press, 2009.
4. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, 2008.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4			H	H	
CO 5		M	M	H	
CO 6					H

CACC0045: DATA COMMUNICATION AND COMPUTER NETWORKS

(4 credits)

Objective
This course introduces students to computer networks and concentrates on building a firm foundation for understanding Data Communications and Computer Networks. It deals with the Data link layer, the Network layer, the Transport layer and the Application Layer. This course also introduces the concepts of network security and cryptography.

Module I: Digital Communications

Signals, noise, Nyquist rate, Shannon capacity; Analog transmission: modulation techniques, FDM; Digital transmission: PCM, TDM, line coding, xDSL,; Transmission media: Guided (twisted pair, coaxial, fiber optic) and unguided media; Local area networks: Ethernet, Fast Ethernet, introduction to Gigabit Ethernet and WLANs; Repeater, Hubs, Bridges, Switches, Router and Gateway.

Module II: Media Access Control and Data Link Layer
Data Link Layer Fundamentals: Framing, Error Control, Flow Control, Error Detection and Correction; Data link protocols: Stop-&-Wait ARQ, Go-Back-NARQ, Selective Repeat ARQ, Piggybacking
Multiple Access Protocols: Advantages of Multiple-Access Sharing of Channel Resource, Pure ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA), CSMA with Collision Detection (CSMA/CD), Asynchronous Transfer Mode (ATM)

Module III: Network Layer
IPv4 Addresses: Address space, Notations, Classful addressing, classless addressing, NAT; IPv6 Addresses: advantages, structure, address space, packet format, extension header; Transition from IPv4 to IPv6; Address Mapping, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols.

Module IV: Transport Layer and Application Layer
Process to Process Delivery: Client Server paradigm, Connectionless vs Connection Oriented Service, Services provided to upper layers, Transport Service primitives. UDP: Introduction, User Datagram, Checksum, UDP operations, use of UDP, Remote Procedure call TCP: Introduction, TCP Service Model, TCP Protocol, segment header, Connection Establishment and release, Transmission Policy, Congestion Control, Timer Management, Wireless TCP and UDP . Application Layer: Domain Name System, Simple Mail Transfer Protocol (SMTP), POP3, IMAP, File Transfer Protocol (FTP) Network Security: Cryptography, Symmetric Key Algorithms, Public Key Algorithms, Digital Signatures, Communication Security, Web Security

COURSE/LEARNING OUTCOMES:
At the end of the course the students will be able to:
1. Understand and explain Data Communications System and its components (Understand, Explain)
2. Understand and identify different networking terminologies and network architecture. Design issues in network and network transition. (understand)
3. Students would be able to distinguish between IPV4 and IPV6 network together with MAC layer transmission and modulation schemes. (Analyze)
4. Students would be able to understand and analyze what type of network to implement and decide what protocols to configure(Analyze)
5. Students would be able to know why different layers are embodied with different protocols and different network architecture for different network needs. (Evaluate)
6. Have a basic knowledge of the use of cryptography and network security; (Apply)

Suggested Readings
1. Andrew S. Tenenbaum, Computer Networks (Fourth Ed.), Prentice Hall of India, 2002
2. W Richard Stevens, UNIX Network Programming – Volume I (2nd Ed.), Prentice Hall of India, 2002
3. William Stallings, Data and Computer Communications (Sixth Ed.), Prentice Hall of India, 2000
4. Fred Halsall, Data Communication, Computer Networks and Opens Systems, (4th Ed.), Pearson Education, 2000
5. William Stallings, Cryptography and Networking Security - Principles and Practice, Pearson

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4		M	M	M
CO 5			H	M
CO 6				H

CADM0046: ADVANCED DATABASE MANAGEMENT SYSTEMS
(4 Credits - 60 hours)

Objective
The objective of this course is to introduce the basic conceptual background necessary to design and develop simple database systems. The course stresses on database modeling and design, physical file storage techniques and SQL query language

facilities provided by database management systems. The course also presents some advanced database management concepts like query processing and optimization, transaction processing, concurrency control, recovery and security issues in database management systems.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Explain the core terms, concepts, and tools of relational database management systems (Understanding)
2. Understand Normalization and Design ER-diagrams and corresponding schema diagrams for handling database projects (Creating)
3. Recall and identify the techniques used by a DBMS to process, optimize and execute high level queries. (Remembering)
4. Describe fundamentals of transaction processing system, including ACID properties of a transaction. (Understanding)
5. Illustrate concurrency control & analyze several concurrency control techniques for ensuring serializability, locking, timestamping. (Analysing)
6. Discuss some of the techniques that can be used for database recovery from failures and summarize the control measure for securing databases against a variety of threats. (Understanding)

Module I: Introduction (3 Hours)

Introduction: Introduction to databases, characteristics of the database approach, database users and designers, role of a DBA, advantages of using a DBMS, data models, schemas, instances, DBMS architecture (Three-Schema Architecture), Database systems- Network, Hierarchical, Relational, Data Independence

Module II: Relational Data Model and ER Models (12 Hours)

Relational Model: Domains, Attributes, Tuple and Relation; Super keys Candidate keys and Primary keys for the Relations. Relational Constraints: Domain Constraint, Key Constraint, Integrity Constraint.

Relational Algebra: basic relational algebra operations-SELECT, PROJECT, UNION, INTERSECTION, SET DIFFERENCE, Cartesian PRODUCT, JOIN, Aggregate functions.

Entity Relationship (ER) Model: Entities, Attributes, Relationships. More about Entities and Relationships, E-R Diagram, Conversion of E-R Diagram to Relational Database, Case Study.

Module III: Functional Dependencies and Normalization (10 Hours)

Functional Dependencies, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Multivalued Dependencies.

Module IV: Data Storage, Indexing, Query Processing and Query Optimization (11 Hours)

Overview of physical storage media, Magnetic Disks, RAID, File Organization: Fixed-length records, variable-length records. Organization of records in Files - Heap Files, Sequential File, Hashed Files. Indexing: Types of Single-level Ordered Indexes (Primary Indexes, Clustering Indexes, Secondary Indexes), Multilevel Indexes, Multilevel indexing using B tree and B+ tree, Indexing on multiple keys. Query Processing: Overview of query processing, Algorithms for query processing, Query Optimization

Module V: Transaction Processing and Concurrency Control (14 Hours)

Transaction Processing: Transaction, ACID properties of transaction, transaction states, schedules, serializability, tests for serializability, recoverability, transaction definition in SQL. Concurrency Control: Concurrent execution of transaction, Lock-based techniques for concurrency control, Graph-based protocol, Timestamp based protocol, Deadlock, Deadlock prevention methods, Deadlock detection Deadlock recovery.

Module VI: Recovery and Security (10 Hours)

Recovery system: Types of failure, types of storage, recovery and Atomicity, Log-based recovery, shadow paging, recovery with concurrent transactions, buffer management, logical undo logging, transaction rollback, checkpoints, restart recovery, fuzzy checkpointing.

Security: Security and Integrity-security violations, authorization and views, granting of privileges, security specifications in SQL, encryption, and statistical databases.

Suggested Readings

1. Silberschatz, HF Korth, S Sudarshan, Database System Concepts, Tata- McGraw Hill, 1997.
2. R Elmasri, SB Navathe, Fundamentals of Database Systems, Addisson, Wesley (Third Edition) 2000
3. DM Kroenke, Database Processing: Fundamentals, Design and Implementation, Prentice-Hall of India, (Eighth Edition) 2002.
4. GW Hansen, JV Hansen, Database Management and Design, Prentice-Hall of India, (2nd Edition) 2001.

5. Thomas M Connolly, Carolyn E Begg, Database Systems, A Practical Approach to Design, Implementation and Management, Addison Wesley Longman Ltd. 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M	M	M	M	M
CO 2		H	H			
CO 3				H		
CO 4					H	
CO 5					H	
CO 6						H

CATC0048: THEORY OF COMPUTATION

(4 credits – 60 hours)

Objective

The objective of the Theory of Computation is to introduce and study abstract, mathematical models of computation (such as finite state, pushdown and Turing machines), and to use the abstract machine models to study the ability to solve computational problems. At the complete course students will be able to use regular expressions effectively and appropriately, construct derivations and parse trees, write simple programs for a Turing machine, understand the equivalence of grammars, languages and automata and translate between grammars, languages and automata.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. Define basic terminology like Deterministic and Non deterministic automata, Pushdown Automata, Parse Tree, Regular Languages, Turing Machines etc. (Remembering)
2. Make use of techniques, components and tools of a typical automated machine and apply it in designing new machines (Applying)
3. Design deterministic and non-deterministic context-free grammars and understand their capabilities and limits. (Creating)
4. Design deterministic and non-deterministic pushdown automata and Turing Machine. (Creating)
5. Demonstrate the understanding of complexity classes and current unsolved problems in theoretical computer science. (Understanding).

Module I Theory of Automata (15 Hours)

Definition of an Automaton, Description of a Finite Automaton, Transition Systems, Properties of Transition Functions, Acceptability of a String by a Finite Automaton, Nondeterministic Finite State Machines, The Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata.

Module II Formal Languages, Regular Sets and Regular Grammars (15 Hours)

Definition of formal languages, Chomsky Classification of Languages, Languages and Their Relation, Recursive and Recursively Enumerable Sets, Operations on Languages, Languages and Automata; Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma for Regular Sets, Application of Pumping Lemma, Regular Sets and Regular Grammars.

Module III Context-free Languages (15 Hours)

Context-free Languages and Derivation tree, Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars, Pumping Lemma for Context-free Languages, Decision Algorithms for Context-free Languages.

Module IV Pushdown Automata Turing Machines and Linear Bounded Automata (15 Hours)

Basic Definitions, Acceptance by PDA, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata; Turing machine Model, Representation of Turing Machine, Language Acceptability by Turing Machines, Design of Turing Machines, Universal Turing Machine and Other Modification, The Model of Linear Bounded Automaton, Turing Machines and Type 0 Grammars, Linear Bounded Automata and Languages, Halting Problem of Turing Machines, NP-Completeness.

Suggested Readings

1. K.L.P. Mishra, N. Chandrasekaran, Theory of Computer Science, BPB Publication, Prentice-Hall of India, Second Edition.
2. H.R. Lewis and C.H.Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall of India.
3. H.E. Hopcraft and J.D. Ullamn, Introduction to Automata Theory, Languages and Computation, Narosa Publications.
4. J.C. Martin, Introduction to Languages and the Theory of Automata, Tata McGraw-Hill.
2. C.H. Papadimitriou, Computation Complexity, Addison-Wesley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	M	M	M
CO2	M	M	M	M
CO3			H	
CO4				H
CO5			M	H

CAML0049: MACHINE LEARNING

(4-0-0) (4 Credits – 60 Hours)

COURSE/LEARNING OUTCOMES:

1. Learn mathematical principles used in learning algorithms and relate them to learning principles. (Understanding)
2. Construct and classify learning algorithms used in different problems. (Applying)
3. Know what and how to perform pre-processing to make dataset ready for learning algorithms(Analysing)
4. Create learning models and evaluate the effect of it in a given problem domain. (Evaluation)

Module I: (15 hours)

Mathematical Foundations of Machine Learning: Linear Algebra-Linear equations & vector spaces,matrix decomposition: determinant, Eigen values, singular value decomposition, matrix approximation, Calculus: Differentiation & partial differentiation, gradient of matrices, Probability & Distributions: Discrete and Continous probabilities, Gaussian distribution, Continous optimization:Gradient descent, Lagrange Multiplier.

Module II: (10 hours)

Learning: supervised and unsupervised learning,necessary of supervised learning, KNN,regression models,Naive Bayes' classifier, decision trees,random forest classifier, SVM:linear, non-linear.

Module III: (11 hours)

Data preprocessing & Scaling: Different kinds of preprocessing, Data transformations, Scaling: training data & testing data, Types of unsupervised learning, dimensionality reduction, clustering: k-Means, Fuzzy C -Means, DBSCAN, Comparing and evaluating clustering.

Module IV: (13 hours)

Neural Network: Biological to Artificial neurons, Logical computations with neurons, perceptron, MLP & backpropagation, Tuning neural network hyperparameters, vanishing and exploding gradient problems,momentum optimization:AdaGrad, Adam optimization, Regularization: L1 & L2, Convolutional property of neural network.

Module V: (11 hours)

Deep learning: Convolutional Neural Network: AlexNet, GoogleNet, ResNet, RNN: Training a RNN, deep RNN, LSTM cell, Auto encoders: stacked auto encoders, sparse auto encoder.

Suggested readings:

1. Hands-On Machine Learning with Scikit-Learn & TensorFLow. Second edition, Aurelien Geron,2017, O' Reilly Media.
2. Machine Learning-An Algorithmic Perspective, second edition, Stephen marshland,2015, CRC Press.
3. Deep Learning, John D. Kelleher,2019, Massachusetts Institute of Technology(MIT).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	M		
CO 3			H	M	
CO 4				H	H

CAHC0050: HUMAN COMPUTER INTERACTION (HCI)

(4-0-0) (4 Credits – 60 Hours)

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

1. Learn the basic physiological, perceptual, and cognitive components of human learning and memory and gain theoretical knowledge of the fundamental aspects of designing and implementing user interfaces (Remembering)

2. Explain the HCI implications for designing various applications such as multimedia/apps/ ecommerce/ e-learning Web sites. (Understanding)
3. Design effective HCI for individuals. (Applying)
4. Analyze the quality of user interface (Analyzing)
5. Assess the importance of user feedback. (Evaluating)
6. Develop meaningful user interface. (Creating)

Module I: Introduction to HCI And History (10 Hours)
What is HCI? Historical evolution of the field. Human brain and computer: The Human sensation and perception–Human Memory – Reasoning and problem solving; The computer and its I/O Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms- Problems and challenges.

Module II: Design and Software Process (22 Hours)
Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Design Evaluation Techniques – Experimental evaluation and Empirical Methods: Hypothesis testing, Choosing participants and sample size, Variables: independent and dependent measures, Types of experimental designs, Data analysis.

Module III: Models and Theories (9 Hours)
Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and Collaboration models-Hypertext, Multimedia and WWW. Design Case studies: Multi-Key press Hindi Text Input Method on a Mobile Phone, Employment Information System for unorganized construction workers on a Mobile Phone.

Module IV: Mobile HCI (7 Hours)
Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile
Design, Tools.

Module V: Brain-Computer Interaction (BCI) and Neuroprosthetics/Sensory substitution (12 HOURS)
What is BCI? BCI and brain plasticity-Neuroergonomics and Neurocognitive Engineering-Medical applications of BCI: Neuroprosthetics, Commercial Applications of BCI, Ethical implications of these interfaces, Neuroprosthetics vs. sensory substitution, Most sensory substitution devices compensate for loss of vision: discussion of visual to tactile and visual to auditory devices, Components of sensory substitution devices, Underlying theories and why it works?

Suggested Readings:

1. "Human Computer Interaction", 3rd Edition , Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, 2004, Pearson Education.
2. "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th Edition, Shneiderman, Plaisant, Cohen, and Jacobs, 2009, Addison Wesley.
3. "Introduction to Human Factors Engineering", 2nd Edition, Wickens, Lee, Liu, and Gordon-Becker, 2004, Pearson.
4. "Human Computer Interaction", Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T., 1994, Addison-Wesley.
5. "Designing the User Interface", B. Shneiderman; 2000, Addison Wesley(Indian Reprint).
6. "Mobile Design and Development", First Edition, Brian Fling, 2009, O'Reilly Media Inc.
7. "Designing Web Interfaces", First Edition, Bill Scott and Theresa Neil, 2009, O'Reilly.

Mapping of Course outcomes

Course outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	L			H
CO 2	L	H	M	M	L
CO 3		H	H	M	
CO 4		H	H	L	
CO 5		M	H	H	
CO 6			H	H	M

CABI0051: BIOINFORMATICS

(4-0-0) (4 Credits – 60 Hours)

Course Outcomes:
1. Relate the different mathematical principles that are necessary in sequence analysis and searching. (Remembering).
2. Explain the different protein structure and use algorithm models for alignment analysis. (Understanding)

3. Design phylogenetic tree for discovering pattern in sequence analysis. (Creating)
4. Analyze , predict and model protein structure and assess the structures.(Evaluating)

Module I: (16 hours)
Introduction to bioinformatics, opportunity and challenges in bioinformatics, protein sequence, analyzing protein sequences, analyzing DNA sequences, palindromes in DNA sequences, coding DNA sequences, RNA structures and sticky strands, pubmed, Expasy, Assessment of structure prediction, protein engineering.

Module II: (15 hours)
Genome organization, picking out genes in genomes, genome of homosapiens, database indexing, nucleic acid sequence database,genome database, protein sequence database, database of protein families, structures, protein identification resource, sequence alignments and dotplots, sequence similarity quantification, scoring schemes, dynamic programming for optimal pairwise alignment, multiple sequence alignment, editing and publishing alignments.

Module III: (14 hours)
phylogenetic tree, taxonomic relationships, clustering and cladistic methods, ancestral sequences and its reconstruction, evolution and varying rates of evolution, preparing data for phylogenetic tree, BLAST search, building the tree specific to a problem, phylip and open source tools for generating tree, maximum likelihood tree.

Module IV: (15 hours)
Folding and protein stability, sidechains, denaturation in relation to protein stability, coiled-coiled proteins, helical model, structural elements and superposition, mustang, dali, protein structure evolution, SCOP classification, prediction of protein structure and modeling, assessment of structure prediction, secondary structure and prediction, homology modeling and fold recognition. Three dimensional profiles to assess quality of structures.

Suggested readings:
1. Bioinformatics for dummies, second edition, Jean-Michel, Cedric Notredame, 2007, Wiley publishing
2. Introduction to bioinformatics, fourth edition, Arthur M. Lesk,2014, Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		M
CO 3			H	
CO 4				H

CADL0052: DEEP LEARNING

(4-0-0) (4 Credits – 60 Hours)

Course Outcomes:
1. Recall the various deep learning related terms, tools, and technologies (Remembering)
2. Compare and contrast the various types of neural networks (Analysing)
3. Test, explore and estimate all the parameters for neural networks. (Evaluating)
4. Illustrate the various deep unsupervised learning techniques for solving specific real-world problems. (Understanding)
5. Experiment how to deploy neural network algorithm to solve real-world problems. (Applying)

Module I: Basics of Deep Learning (14 Hours)
Introduction: Basics of Artificial Intelligence, Machine learning, and Deep learning; History and Capabilities of Deep Learning, Deep Learning primitives – Soft Max Function, Sigmoid, Tanh and ReLU Neurons, Functions and Gradient Descent, Linear/Logistic regression, Vectorizing Logistic regression,
Neural Network: Basic concepts of artificial neurons, single and multi-layer perceptrons, perceptron learning algorithm, perceptron convergence theorem, gradient descent and backpropagation algorithm, the vanishing gradient problem, gradient descent, regularization, dropout

Module II: Types of Neural Networks (18 Hours)
Convolutional Neural Networks (CNN): Introduction to CNN, CNN Architectures, Convolution / pooling layers, Correlation, Filtering, CNN architectures, Detection and Segmentation, Advanced CNNs for computer vision
Advanced Deep Architectures: Recurrent Neural Networks, Long Short-Term Memory Units (LSTM), Gated Recurrent Unit (GRU), Encoder Decoder architectures, Generative Adversarial Networks (GANs)

Module III: (10 Hours)

Deep Unsupervised Learning: Autoencoders (standard, sparse, denoising, contractive, etc), Variational Autoencoders, clustering learning, Adversarial Generative Networks, Learn-from-data model, Autoencoder and DBM Attention and memory models, Maximum Entropy Distributions, Unsupervised learning of visual representations from image patches and locality, Unsupervised Learning of Visual Representations using Videos

Module IV: Deep Learning in Practice (18 Hours)
Deep Learning for Computer Vision: Introduction to convnets, training a convnet on small datasets, using a pretrained convnet, Applying Deep Learning for Object detection, face recognition, and automatic image classification
Deep Learning for Natural Language Processing (NLP): Introduction to NLP, Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning, Named Entity Recognition, Opinion Mining using Recurrent Neural Networks, Parsing and Sentiment Analysis using Recursive Neural Networks, Sentence Classification using Convolutional Neural Networks

Suggested Readings
1. Nielsen, Michael A. *Neural networks and deep learning*. Vol. 25. San Francisco, CA: Determination press, 2015.
2. Goodfellow, Ian, et al. *Deep learning*. Vol. 1. No. 2. Cambridge: MIT press, 2016.
3. Deng, Li, and Yang Liu, eds. *Deep learning in natural language processing*. Springer, 2018.
4. Wani, M. Arif, et al. *Advances in deep learning*. Springer, 2020.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3	L	H		M
CO 4			H	
CO 5		M		H

CASC0053: SOFT COMPUTING

(4-0-0) (4 Credits – 60 Hours)

Course/Learning Outcomes
At the end of the course, students would be able to:
1. Identify and describe soft computing techniques and their roles in the development of smart machines. (Remembering and Understanding)
2. Apply fuzzy logic and reasoning to deal with uncertainty and solve various problems. (Applying)
3. Analyze the architecture and algorithms of Neural networks to meet the challenges of soft computing problems. (Analyzing)
4. Analyze genetic algorithms to combinatorial optimization problems. (Analyzing)
5. Evaluate and compare solutions to a given problem using various soft computing approaches. (Evaluating and Creating)
6. Effectively use existing software tools to solve real problems using a soft computing approach. (Applying)

Module I (6 Hours)
Introduction to Soft Computing, Characteristics of Soft Computing, Soft Computing Versus Hard Computing, Soft Computing Constituents, Applications of Soft Computing techniques, Evolutionary Computing, Machine Learning Basics.

Module II (11 Hours)
Fuzzy Logic: Introduction to Fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, Rules, Propositions, Implications and Inferences, Fuzzification and Defuzzification, Fuzzy ogic controller, Fuzzy Expert Systems, Fuzzy Decision Making, Applications of Fuzzy logic.

Module III (15 Hours)
Neural Networks: Biological neurons and its working, Introduction to Artificial Neural Network, Artificial Neural Networks Versus Biological Neural Networks, Activation functions, ANN architectures : McCulloch & Pitts model, Perceptron, ADALINE, MADALINE, Activation functions, Supervised Learning: Introduction, Neuron as a simple computing element, The perceptron, Backpropagation Networks: Architecture, Multilayer Perceptron, Back propagation learning-input layer, Radial Basis Function Networks. The Hopfield Network, Unsupervised Learning Neural Networks: Hebbian Learning, Self-Organizing Computational Maps: Kohonen Network, Applications of ANNs.

Module IV (13 Hours)
Genetic Algorithms: Introduction to Genetic Algorithm (GA), Working Principle, Difference between traditional algorithms and GA, Phases of Genetic Algorithm, Basic GA framework and different GA Architectures, Convergence of GA, Applications of GA

case studies. Introduction to genetic programming-basic concepts.

Module V (15 Hours)
Deep Learning: Basics of Deep Learning, Convolutional Neural Network, Recurrent Neural Network. Matlab/Python Lib: Study of Neural Network Toolbox and fuzzy logic toolbox, Simple implementation of ANN and fuzzy logic.

Suggested Readings

1. R. Rajasekaran and G. A Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, Prentice Hall of India. 2003.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley, 2011.
3. N.P.Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press. 2005.
4. Simon O. Haykin, Neural Networks and Learning Machines, Pearson, 2009.
5. MATLAB Toolkit Manual.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	
CO 5	M		M		M
CO 6					M

CADS0054: DATA SCIENCE
(4-0-0) (4 Credits – 60 Hours)

Course/Learning Outcomes:
At the end of this course, students will demonstrate the ability to
1. Understand the basic concepts and technologies related to Data Science. (Understanding)
2. Obtain, clean/process, and transform data and analyze the transformed data using an ethically responsible approach (Applying and Analyzing)
3. Relate which tools and methodologies can be applied to solve data science tasks. (Remembering)
4. Integrate Data Science capabilities into the formation of a situation analysis (Evaluating)
5. Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges (Creating)
6. Interpret data findings effectively to any audience, orally, visually, and in written formats. (Understanding)

Module I: Introduction to Data Science, Preprocessing, and Data Visualization (14 Hours)
Introduction to Data Science: Why Learn Data Science, Data Analytics Life Cycle, Types of Data Analysis, Types of Jobs in Data Analytics, Data Science Tools, Fundamentals Areas of Study in Data Science
Data Preprocessing: Introduction to Data Preprocessing, Data Types and Forms, Possible Data Error Types, Various Data Preprocessing Operations - Data Cleaning, Data Integration, Data Transformation, Data Reduction, and Data Discretization
Data Plotting and Visualization: Introduction to Data Visualization, Visual Encoding, Data Visualization Libraries, Basic Data Visualization Tools (Histograms, Bar Charts, Scatter Plots, Line Charts, Area Plots, Pie Charts, Donut Charts); Specialized Data Visualization Tools (Box Plots, Bubble Plots, Violin Plots, Heat Map, Dendogram, Radar Chart, Venn Diagram, 3D Scatter Plots), Advanced Data Visualization Tools (Wordclouds, Chord Diagram, Waffle Charts, Choropleth Map, Bubble Map), Data Visualization Types

Module II: Statistical Data Analysis and Machine Learning (18 Hours)
Statistical Data Analysis: Role of Statistics in Data Science, Kinds of Statistics, Descriptive Statistics (Measures of Frequency, Central Tendency, Dispersion, and Position), Inferential Statistics, Parametric vs Non-Parametric Hypothesis Testing, Probability Theory, Four Perspectives on Probability, Bayesian Probability, Probability Distribution
Machine Learning for Data Science: Overview of Machine Learning, Supervised Machine Learning - Regression Methods (linear, polynomial, and logistic), Classification Methods (KNN Classification, Support Vector Machine (SVM) Classification, and Decision Tree Classification); Unsupervised Machine Learning - Clustering Methods (Fuzzy c-means Clustering and Principle Component Analysis (PCA) Clustering), Association Analysis - Apriori Algorithm and FP-Growth Analysis, Introduction to Reinforcement Learning

Module III: Time-Series Analysis and Deep Learning (12 Hours)

Time-Series Analysis: Overview of Time-Series Analysis, Components of Time-Series, Time-Series Forecasting Models using Stochastic Models (AR, MA, ARMA and ARIMA), Time-Series Forecasting using Support Vector Machines Based Models
Deep Learning for Data Science: Introduction to TensorFlow, Pytorch, Deep Learning Primitives, Convolutional Neural Network (Softmax, ReLU, Sigmoid or Logistic Activation function, and Pooling), TensorFlow and CNN, AutoEncoder (Convolutional Autoencoder and Sparse Autoencoder)

Module IV: Social Media Analytics, Business Analytics, and Big Data Analytics (16 Hours)
Social Media Analytics: Overview of Social Media Analytics, Seven Layers of Social Media Analytics, Social Network Analysis (Link Prediction, Community Detection, and Influence Maximization), Text Analytics/Mining (Text Categorization, Document or Text Summarization, and Sentiment Analysis), Trend Analytics
Business Analytics: An Overview of Business Analytics, The Business Analytics Life Cycle, Basic Tools Used in Business Analytics, Financial Analytics, Market Analytics, Customer Analytics, and Employee Analytics
Big Data Analytics: An Overview of Big Data, Hadoop, Hadoop Distributed File System, Interacting with HDFS from Python Applications, Introduction to Snake, Pig and Spark

Suggested Readings
1. J. Grus, Data Science from Scratch: First Principles with Python, O'Reilly, 2nd Edition, 2019
2. Silberschatz, H. F. Korth, S Sudarshan, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, 1st Edition, Dreamtech, 2016
3. C. Neil, R. Schutt, Doing Data Science: Straight Talk from the Frontline, O'Reilly, 1st Edition, 2019.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H			
CO 3		H	M	M
CO 4			M	M

CAVS0055: DATA VISUALIZATION FOR DATA SCIENCE

(4-0-0) (4 Credits – 60 Hours)

Course/Learning Outcomes
1. Learn what data visualization is, how it's used, and how computers display information. Also explore different types of visualization and how humans perceive information. (Remembering)
2. Apply principles of design and colour to make visualizations more engaging and effective. (Applying).
3. Learn how to visualize graphs that depict relationships between data items. (Understanding)
4. Designing your own visualization system for large datasets and dashboards. (Creating)
5. Create and interpret the visualization from the data set, and apply techniques from user-interface design to create an effective visualization system. (Creating, Evaluating)

Module I: (12 hours)
Introduction to Data Visualization: Overview of Visualization, Defining data visualization; Visualization workflow: describing data visualization workflow, process in practice; Data representation: chart types: categorical, hierarchical, relational, temporal & spatial.

Module II: (15 hours)
Visualization Tools: 2-D: bar charts, clustered bar charts, dot plots, connected dot plots, pictograms, proportional shape charts, bubble charts, radar charts, polar charts, Range chart, Box-and-whisker plots, univariate scatter plots, histograms word cloud, pie chart, waffle chart, stacked bar chart, back-to-back bar chart, all relevant 2-D charts. 3-D: surfaces, contours, hidden surfaces, pm3d coloring, 3D mapping; multi-dimensional data visualization; manifold visualization; graph data visualization; Annotation; Word Clouds, Seaborn and Regression Plots.

Module III: (12 hours)
Visualization of Numerical Data**:** Data, Mapping, Charts, Glyphs, Parallel Coordinates, Stacked Graphs, Tufte's Design Rules.

Module IV: (10 hours)
Visualization of Non-Numerical Data**:** Graphs and Networks**,** Embedding Planar Graphs**,** Graph Visualization**,** Creating Maps and Visualizing Geospatial Data, Introduction to Folium, Maps with Markers, Choropleth Maps, Tree Maps**,** Principal Component Analysis**,** Multidimensional Scaling**,** Packing.

Module V: (11 hours)

The Visualization Dashboard: Introduction, Visualization Systems, the Information Visualization, Database Visualization, Visualization System Design.

Suggested Readings

1. Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016
2. Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	M		
CO 3			M	M	
CO 4				H	
CO 5					H

CABD0056: BIG DATA MANAGEMENT

(4-0-0) (4 Credits – 60 Hours)

COURSE / LEARNIG OUTCOMES:

1. List the components of Hadoop and Hadoop Ecosystem. (Remembering)
2. Understanding of big data basics and problems over big data. (Understanding)
3. Identify Big Data and its Business Implications. (Applying)
4. Make use of Hadoop and MapReduce programming to tackle big data problems. (Applying)
5. Demonstrate Machine Learning Techniques using R/Python. (Understanding)

Module I (12 Hours)

Introduction to Big Data and Hadoop Types of Digital Data: Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Ecosystem, IBM Big Data Strategy, Introduction to Infosphere Big, Insights and Big Sheets.

Module II (12 Hours)

HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

Module III (10 Hours)

Map Reduce: Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Module IV (14 Hours)

Hadoop Ecosystem: Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. HBase : HBasics, Concepts, Clients, Example, HBase Versus RDBMS.

Module V (12 Hours)

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Introduction to Big Data Analytics with BigR.

Suggested Readings

1. Hadoop: The Definitive Guide, Third Edition, Tom White, 2012, O'reily Media.
2. Big Data Analytics, Seema Acharya, Subhasini Chellappan, 2015, Wiley.
3. Machine Learning (in Python and R), First Edition, J. P. Mueller, L. Massaron, 2016, Wiley.

Mapping of Course Outcomes:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H			H	
CO 2	H	M			
CO 3			M	H	
CO 4			H	H	
CO 5				M	H

CAWA0057: WEB ANALYTICS AND DEVELOPMENT

(4-0-0) (4 Credits – 60 Hours)

Course Outcomes:

1. Recall the various Web Analytics--related terms, tools, and technologies (Remembering)
2. Illustrate the various web data capturing procedures and the various important web metrics (Understanding)
3. Experiment how to deploy web intelligence to improve the outcomes of marketing or business plan. (Applying)
4. Compare and contrast the various web analytics tools (Analysing)
5. Analyze, test, and judge results based on search analytics, competitive intelligence analytics and Google analytics. (Analyzing, Evaluating)

Module I: Basic Concepts of web Analytics and Web Data Collection (14 Hours)

Introduction: Web Analytics – brief history, evolution, importance and need; advantages and limitations of web analytics, site references, Basic Terms - keywords and key phrases, onsite web, offsite web, visit characterization terms, content characterization terms, conversion metrics; Web analytics platform

Data Collection: Clickstream Data - Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.

Module II: Web Data Capturing and Web Metrics (16 Hours)

Capturing data: Web logs, data capture, Type and size of data, Innovation, Integration, selecting optimal web analytic tool, Understanding click stream data quality, identifying unique page definition, Using cookies, Link coding issues

Web Metrics: Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non-ecommerce sites): Improving bounce rates, optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI.

Module III: Search Analytics and Qualitative Analysis of Web Data (12 Hours)

Search Analytics: Performing Internal Search Site Analytics, Search engine optimization, Measuring SEO Efforts, Analyzing Pay per Click effectiveness,

Qualitative Analysis: Essence of customer eccentricity, Heuristic evaluations, Site Visits: Conducting a site visit, Benefits of site visits; Surveys - Website surveys, Post-visit surveys, creating and running a survey, Benefits of surveys .

Module IV: Web Analytics Tools, Competitive Intelligence and Google Analytics (18 Hours)

Web Analytics tools: Click Stream Analysis, A/B testing, Online Surveys

Competitive Intelligence (CI) analysis: CI data sources, Toolbar data, Panel data, ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities.

Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.

Suggested Readings

1. Kaushik, Avinash. Web Analytics: An Hour a Day. United States, Wiley, 2007.
2. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed
3. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. 1st ed.
4. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			L
CO 2		H		
CO 3		L	H	M
CO 4				H
CO 5			H	H

CASI0058: SENSOR NETWORK AND INTERNET AND INTERNET OF THINGS

(3 Credits – 45 Hours)

Objective

This course will introduce the students to the Internet of Things(IoT) and basic structure of communication protocols in sensor networks. The course is designed to build up basic understanding of how to set up an application specific IoT network with

better orientation and representation of sensor nodes.

COURSE/LEARNING OUTCOMES:

CO1: Utilize IoT concepts, hardware knowledge, and device platforms like Arduino, Raspberry Pi, and WSNs to design and develop effective networks, addressing real-world challenges.**(Applying)**

CO2: Assess sensor protocols and network architectures to optimize communication efficiency and evaluate the suitability of different protocols for specific IoT applications. (**Analyzing**)

CO3: Critically evaluate the reliability, scalability, and security of IoT systems, and make informed decisions on protocol selection and energy preservation techniques. (**Evaluating**)

CO4: Integrate knowledge and skills to design, test, and deploy complete IoT systems, demonstrating proficiency in prototyping, programming, and data analysis for domain-specific applications. **(Creating)**

Module I: Introduction to IOT (10 Hours)

Definitions and Characteristics of IoT, Historical Evolution of IoT: Predecessors of IoT-Wireless Sensor Networks, Machine-to-Machine Communications, IoT versus M2M; Impact of IOT in various industries, IoT Hardware Technologies - Microcontrollers, Sensors, Actuators, RFID; Types of sensors and actuators; IoT Device Platforms - Arduino, Raspberry Pi, IOT Reference Architecture: Main Design Objectives of IOT, Layers of IoT Reference Architecture, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views; IoT Data Management and Compute Stack, Edge, Fog, and Cloud computing. Emerging Trends and Technologies, IOT value chain.

Module II: IoT Communication Model and Protocols (10 hours)

Communication Models: Request-Response, Publisher-Subscriber, Push-Pull, Exclusive Pair; Key protocols Key Protocols in IoT: Physical and Data Link Layer Protocols-IEEE 802.11 (Wi-Fi), IEEE 802.15.4, ZigBee, RFID, Bluetooth and Bluetooth Low Energy (BLE), Z-Wave, LoRa and LoRaWAN; Network Layer Protocols- IPv4 and IPv6, RPL, 6LoWPAN; Transport Layer Protocols-TCP, UDP; Application Layer Protocols: MQTT, CoAP, HTTP/HTTPS, WebSockets, AMQP, DDS, XMPP

Security Challenges in IoT Communication: Encryption and Authentication Techniques- Symmetric and asymmetric protocols, authentication protocol- Digital Signatures, Secure Communication Protocols- MQTT with TLS/SSL, CoAP with DTLS, HTTPS, AMQP with SASL, AMQP with SASL.

Module III: IoT Development with Arduino and Raspberry Pi (12 Hours)

IOT with Arduino: Overview of Arduino, Hands-on Experience with Arduino (Firmware development & RTOS)Setting up Arduino IDE and development environment, General Purpose I/O (GPIO) programming with Arduino, Interfacing sensors with Arduino, Serial communication interfaces: RS-232/485, I2C, SPI

IoT with Raspberry PI: Overview of Raspberry Pi, Setting up Raspberry PI SD Card, Raspberry PI booting up & Initialization; General Purpose I/O(GPIO), Serial Communication Interfaces: RS-232/485, Synchronous Peripheral Interfaces: I2C, SPI; Sensors Interfacing with Raspberry PI Domain-specific applications of IoT: Home automation, Industry applications, Surveillance, applications, Other IoT applications.

Module IV. **Wireless Sensor Networks & Protocols (13 Hours)**

Key definitions of sensor networks, Advantages of sensor Networks, Wireless Sensor Networks Applications, Unique constraints and challenges, Driving Applications.

Single node architecture: hardware and software components of a sensor node, Energy Consumption of Sensor Nodes, WSN Network architecture: Design Principles for WSNs- Gateway Concepts, Need for gateway, data relaying and aggregation strategies, Classification of sensor nodes in WSN based on behaviour, network topologies in WSN, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs. WSN Operating Systems-Operating System Design Issues - Examples of Operating Systems – Introduction to Tiny OS, Mate , MagnetOS , MANTIS etc.

Overview of sensor network protocols: Sensor network protocols : Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Specialized features: Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

Suggested Readings

1. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley, 2013.

2. Qusay F. Hassan, Internet of Things A to Z: Technologies and Applications, Wiley-Blackwell, 2018.
3. Peter Waher, Mastering Internet of Things: Design and Create Your Own IoT Applications Using Raspberry Pi 3, Packt Publishing, 2018.
4. Kazem Sohraby, Minoli Daniel and Znati Taieb, Wireless sensor networks: technology, protocols, and applications. John Wiley & Sons, 2007.
5. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice (Wireless Communications and Mobile Computing), Wiley-Blackwell, 2010.

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	H	M
CO2		M		H
CO3		H		M
CO4			H	

ECRM0042 RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHT (L-T-P: 2-0-0)

(2 credits-30 hours)

Objective:

This course is designed to help students to identify research problems in various fields. It aims at giving potential researchers the knowledge of effectively analysing and interpreting results and presenting the findings to the scientific and technological community of the world. This course also aims at motivating students to bring about their creative ideas for innovation and establishing research impact in the global for a through intellectual ownership.

Course Outcomes

1. Find research problems in various fields (Remembering).
2. Illustrate the concepts related to patents, trademark and copyright (Understanding).
3. Apply scientific investigations to find solutions for research problems of interest (Applying).
4. Develop technical writing and presentation skills (Applying).
5. Analyze the available literature and compile literature review for knowing the state of the art in the areas of interest (Analyzing/ Creating).
6. Formulate a research problem for a given engineering domain (Creating)

Module I (12 Hours)

Meaning, sources, scope and objective of a research problem; Good research problem criteria and characteristics, errors in selecting a research problem; Research problem solutions– approaches for investigation; Approaches to effective literature studies; Data collection, analysis, interpretation and instrumentation; Plagiarism and ethical practices.

Module II (10 Hours)

Effective writing; Research proposal development and its format; Different report types.

Module III (8 Hours)

a. Nature of intellectual property: Patent, design, trade and copyright; Patenting and development process; Patent grant under PCT and procedure; Geographical indications.
b. Patent rights: Administration of patent systems, scope, information and databases, technology licensing.
c. New developments and case studies.

Suggested Readings

1. Goddard Wayne, Melville Stuart, Research Methodology: An Introduction For Science And Technology Students, Juta & Co. Ltd.
2. Kumar Ranjit, Research Methodology A Step By Step Guide For Beginners, SAGE publications Inc.
3. Halbert J. Debora, Resisting Intellectual Property, CRC press.
4. Menell S. Peter, Lemley A. Mark, Merges P. Robert, Intellectual Property In New Technological Age, Clause 8 Publishing.
5. C.R. Kothari, Research Methodology Methods and Techniques, New Age International

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		L

CO 2	M		H
CO 3	H	L	
CO 4	L	H	M
CO 5	H	M	L
CO6	H	M	L

EGEH0111: ENGLISH (2 Credits- 30 hours) (L-T-P: 2-0-0)

Objective: *The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.*

Module I: Vocabulary Building (6 hours)

1. The concept of Word Formation
2. Root words from foreign languages and their use in English
3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
4. Synonyms, antonyms, and standard abbreviations.

Module II: Basic Writing Skills (6 hours)

a) Sentence Structures
b) Use of phrases and clauses in sentences
c) Importance of proper punctuation
d) Creating coherence
e) Organizing principles of paragraphs in documents
f) Techniques for writing precisely

Module III: Identifying Common Errors in Writing (5 hours)

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

Module IV: Nature and Style of sensible Writing (6 hours)

Describing, Defining, Classifying, providing examples or evidence, Writing introduction and conclusion

Module V: Writing Practices (7 hours)

Comprehension, Précis Writing, Essay Writing

Suggested Readings

1. *Practical English Usage*. Michael Swan. OUP. 1995.
2. *Remedial English Grammar*. F.T. Wood. Macmillan.2007
3. *On Writing Well.* William Zinsser. Harper Resource Book. 2001
4. *Study Writing*. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

LABORATORY COURSES

CAOS6012: OPERATING SYSTEMS LAB

(2 credits)

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

1. Recall and label the basic commands in Linux. (Remembering)
2. Classify system calls, library functions calls to write on standard output device. (Understanding)
3. Experiment with shell programs. (Applying)
4. Construct programs on process scheduling, page replacement algorithms. (Creating)
5. Evaluate free space management using programs. (Evaluating)

Module1

Introduction to Linux

File System (Types of file, Filename, parent-child relationship, absolute and relative pathname, file and directory permissions) Introduction to vi editor (start vi, the three modes, create, save and open a text file, positioning by character, positioning by line, positioning by word, positioning in the word, positioning on a numbered line, inserting text, deleting text), Simple Linux commands, Shell Programming

Module2:

Semaphores, Shared Memory and Message Queues: Semaphore (Binary semaphore, Linux Semaphore Facilities, Using Semaphores), Shared Memory, Message Queues

Module3:

Processes and Signals : Process Structure, Starting a new Process, Replacing a Process Image, Duplicating a Process Image, Waiting for a process, Zombie Processes, Terminating a Process, Signals (Signal handling, Sending signals, Signal interface, Signals sets).

Module4:

POSIX Threads: Creating threads, Simultaneous execution of threads, Synchronization and Critical sections, Synchronization with Semaphores, Synchronization with Mutexes, Thread Attributes, Cancelling a thread.

Inter-Process Communication: Pipes, Process Pipes, and The Pipe Call, Parent and Child processes, FIFOs (Accessing a FIFO, opening a FIFO, Reading and Writing FIFO).

Mapping of COs with Syllabus:

Course Outcomes	Module1	Module2	Module3	Module4
CO1	H	M		
CO2		H	M	
CO3		M	H	L
CO4	L	M	H	
CO5		L	M	H

CAPJ6014: PROGRAMMING THROUGH JAVA LAB

(2 credits)

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

1. List various GUI and thus will be able to select the suitable GUI to resolve a given problem. (Remembering)
2. Distinguish among the various utility class like vector, stack, Hash Table, String Tokenizer, etc. (Understanding)
3. Apply their knowledge to solve practical problems like reading from a dataset, writing into a file and develop games using JAVA program. (Applying)
4. Evaluate the performance of various swing GUI components and design various applications using Swings depending on the domain and requirement. (Evaluating)

At the end of the experiments, students will be able to

1. Program to illustrate class, objects and constructors
2. Program to implement overloading, overriding, polymorphism etc
3. Program to implement the usage of packages
4. Program to create our own exception
5. Program for handling file operation

6. Implement the concept of thread programming
7. Program to implement Generic class and generic methods
8. Program for event-driven paradigm in Java
9. Program that uses Menu driven Application
10. Program to implement JDBC in GUI and Console Application
11. Socket programming to implement communications
12. Develop a multi-threaded GUI application of your choice.

E-resource for learning
Java, www.spoken-tutorial.org

Mapping of COs with Syllabus:

Course Outcomes	1,2,3,4,5	6,7	8,9,10,11,12
CO1		M	H
CO2	H		
CO3		M	H
CO4	M	M	H

CAIT6017: INTERNET TECHNOLOGY AND APPLICATIONS LAB

(2 credits)

COURSE / LEARNING OUTCOMES
At the end of this course students will be able to:

1. Utilise and experiment with mark-up languages such as XHTML and style sheets such as CSS to design static web pages. (Applying)
2. Design and validate a website and can also identify the faults in the design. (Analysing)
3. Create and develop a web application using various available frameworks and scripting languages such as JavaScript and PHP. (Creating)
4. Validate and examine a dynamic web application using database handling and various other services and deploy them after proper validation (Evaluating and creating)

Module I

a. XHTML: Components of XHTML; Elements of XHTML (Headers, Linking, Images, Special Characters, Lists, Tables, Forms, Framesets)
b. Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation Service; Use of CSS (Positioning Elements, Backgrounds, Text flow)
c. Web Site Design Considerations: Using Logical Design: Planning your website, drawing a map, using a top-down approach, flexibility, other web design metaphors. Creating templates. Creating a Compatible Design: Designing for different color depths, resolutions, different browser considerations, accommodating limited bandwidth. Validating your work.

Module II

a. Web servers: HTTP Request Types; System Architecture of a Web server; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Apache Web Server. b) Databases: Introduction to each one of the following: SQL, MYSQL, DBI
b. Scripting Languages: JavaScript: Operators, Data Types, Control Structures, Functions, Arrays, String Manipulation. VBScript Introduction to Perl and CGI (Common Gateway Interface).
c. PHP: Introduction to PHP; Data Types; Control Structures; Functions; Strings; Arrays; Querying Web Databases using PHP; Writing to Web Databases; Errors, Debugging and Deployment.

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 2nd Edition, Prentice Hall of India Pvt. Ltd. , New Delhi
2. Hugh E. Williams and David Lane, PHP and MySQL, 2nd Edition, O'Reilly, Shroff Publishers and Distributors Pvt. Ltd.
3. Internet Complete, 2nd Edition, BPB Publications. , New Delhi
4. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

Mapping of COs to Syllabus

Course Outcomes	**Module 1**	**Module 2**
CO 1	H	
CO 2	H	
CO 3	L	H
CO 4		H

CADA6033: DATA STRUCTURES AND ALGORITHM LAB

(2 Credits)

Objectives

1. To introduce first level topics covering basics in algorithms and data structures.
2. To enable students to choose appropriate data structures, understand the ADT/libraries, and use of it to design algorithms for a specific problem.
3. To understand the necessary mathematical abstraction to solve problems.
4. To apply important algorithmic design paradigms and methods of analysis.

COURSE/LEARNING OUTCOMES

At the end of the course, students would be able to:

1. Get introduced to existing algorithms and how to analyse them using graph notation. (Remembering)
2. Demonstrate the existing standard algorithms. (Understanding)
3. Apply existing algorithms in developing different applications. (Applying)
4. Analyse the time complexity of standard algorithms. (Analysing and Evaluating)
5. Create efficient applications by using the right algorithm depending on input pattern and size. (Creating).

List of Programs

1. Implement the linear search and binary search algorithm to search for a given element e from a list of n numbers. Analyze the algorithms.
2. Prove that the Bubble Sort algorithm has time complexity of $O(n^2)$ by showing the graph notation.
3. Prove that the Selection Sort algorithm has time complexity of $O(n^2)$ by showing the graph notation.
4. Implement the Insertion Sort algorithm and analyse the algorithm using the graph notation.
5. Implement the Divide-and-Conquer technique and analyze the algorithm showing the graph notation.
6. Implement the Greedy Programming technique and analyze the algorithm showing graph notation.
7. Implement the Dynamic Programming technique and analyze the algorithm showing graph notation.
8. Design a small file compressor and decompressor by using Huffman coding technique.

Suggested Readings

1. Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, The Design and Analysis of Computer Algorithms. Addision Wesley, 2001. (Modules I, II, III and IV)
2. Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, Data Structures and Algorithms.. Addision Wesley, 2000. (Modules I and V)
3. Thomas H Corman, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, 2nd PHI, 2004
4. V Manbar, Introduction to Algorithms - A Creative Approach, Addision Wesley, 2000.
5. Ellis Harwitz, Sartaz Sahani, Fundamentals of Computer Algorithms.. ,Computer Science Press, 2000.
6. Peter Linz, An Introduction to Formal Languages and Automata. Narosa Publishing House 2001

Mapping of COs with Syllabus

Course Outcomes	1	2	3	4	5	6	7	8
CO1	H	H	H	H				
CO2	H	H	H	H				
CO3					H	H	H	
CO4	H	H	H					
CO5								H

CACC6034: DATA COMMUNICATION AND COMPUTER NETWORKS LAB

(2 Credits)

Objective

Network programming involves writing programs that communicate with other programs across a computer network. Most operating systems provide pre-compiled programs that communicate across a network. This course envisages providing an introduction to such networking programming, whereby students will learn to write their own network programs. At the end of this course in network programming, the students are expected to have elementary ideas about the socket programming and their usage in setting up TCP and UDP communications.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

1. List various network related commands. They will get introduced to socket programming in TCP and UDP environments. (Remembering)

2. Illustrate the functions used in TCP and UDP client server communication. (Understanding)
3. Apply their knowledge of socket programming to perform various types of communications, address conversions and so on. (Applying)
4. Analyze the efficiency of TCP and UDP client –server communication. (Analysing)
5. Design and evaluate code for conducting chat or communication between client and server in UDP environment. (Creating, Evaluating)

Module I

a. Introduction to Network Programming: Introduction to Sockets; Address Structure – IPv4, IPv6; Value-Result Arguments; Byte Order Functions; Byte Manipulation Functions; inet_aton, inet_addr, inet_ntoa, inet_pton, inet_ntop, readn, written, readline, isfdtype functions
b. Elementary TCP Sockets: Introduction; socket, connect, bind, listen, accept, fork, exec, close, getsockname, getpeername functions; TCP Client Server example; signal, sigaction, wait, waitpid functions; Connection Termination; SIGPIPE signal
c. i/O Multiplexing: I/O models; select function; Batch input; shutdown, pselect, poll functions; Example – TCP Echo Server.
d. Socket Options: getsockopt, setsockopt, fcult, ioclt functions; Socket status – generic socket options
e. Elementary UDP Sockets: Introduction; recvfrom, sendto functions; UDP Examples; connect function with UDP; UDP socket receive buffer; Example – UDP Echo Server

Module II

a. Elementary Name and Address Conversion: Introduction; gethostbyname function; RES_USE_INET6 resolver option; gethostbyaddr, uname, gethostname, getservbyname, getservbyport functions.
b. IPv4 and IPv6 Interoperability: Introduction; IPv4 Client - IPv6 Server, IPv6 Client – IPv4Server; IPv6 Address Testing Macros, IPV6_ADDRFORM.
c. Advanced Name and Address Conversions: Introduction; getaddrinfo, gai_strerror, freeaddrinfo, getnameinfo functions; Reentrant functions.
d. Daemon Processes: Introduction; syslogd daemon; syslog, daemon_init functions; inetd daemon; daemon_inetd function.

Suggested Readings

1. W Richard Stevens, UNIX Network Programming – Volume I, Second Edition, Prentice Hall of India Pvt. Ltd., 2002
2. Douglas E Comer, Internetworking with TCP/IP: Principles, Protocols, and Architectures Volume I, Fourth Edition, Prentice Hall of India Pvt. Ltd.
3. Douglas E Comer, David L Stevens, Internetworking with TCP/IP: Design, Implementation, and Internals – Volume II, Third Edition, Prentice Hall of India Pvt. Ltd.
4. Douglas E Comer, David L Stevens, Internetworking with TCP/IP: Client Server Programming and Applications – Volume III, Second Edition, Prentice Hall of India Pvt. Ltd.

Mapping of COs with Syllabus

Course Outcomes	Module I	Module II
CO1	H	M
CO2	H	M
CO3	H	
CO4	H	
CO5		H

CADM6035: ADVANCED DATABASE MANAGEMENT SYSTEMS LAB

(2 Credits)

Objectives:

1. Learn to create and use a database
2. Be familiarized with a query language.
3. Have hands on experience on DDL Commands
4. Have a good understanding of DML Commands and DCL commands
5. Familiarize advanced SQL queries.
6. Be Exposed to different applications

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

1. Identify basic SQL operations and fetch results with respect to specific requirement. (Remembering/Evaluating)
2. Describe PL/SQL program structure like conditional constructs, iterative construct, and exception handling. (Understanding)
3. Use different program structures and apply them to solve problems. (Applying)

4. Apply and analyze PL/SQL procedures, functions, packages, triggers to practice assignments. (Analysing)
5. Create applications using Oracle forms and Oracle report. (Creating)

Module I: Query handling with SQL in Oracle

a. Creation, altering and dropping of tables and inserting rows into a table (use of constraints while creating tables) examples using SELECT command.Queries using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT, Constraints.
b. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.Queries implementing various joins (left,right,full). Implementation of complex queries: nested queries,sub queries.
c. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions

Module II: PL/SQL Programming

a. Language fundamentals - PL/SQL block structure, character set, identifiers, literals, delimiters, comments, data types in PL/SQL
b. Program Structure - Conditional constructs, Iterative constructs, Exception handling
c. SQL in PL/SQL- DML and Transaction Management (Commit and Rollback), Data Retrieval, Cursors (Explicit and Implicit), error handling with Cursors
b. d) Procedures, Functions, packages, Triggers- creating and managing functions, procedures, packages and triggers
a. Built-in functions - String functions (ascii, chr, concat, greatest, instr, least, length, lower, lpad, ltrim, replace, rpad, rtrim, substr, trim, upper) Numeric functions (bitand, ceil, exp, floor, ln, mod, power, round, sign, sqrt, trunk) , Date and time functions (add_months, current_date, current_timestamp, last_day, months_between, next_day, round, sysdate, systimestamp, trunk) Conversion functions (to_number, to_char, cast, to_date, to_timestamp)

Module II: Forms Builder and Reports Builder

Components of application development in Oracle Forms (Form modules, menus, PL/SQL libraries, Object libraries, Database objects), Features of the Report Builder, defining a data model for a report, specifying the layout of the report using the Oracle Reports Wizard.

Suggested Readings

1. Ivan Bayross, Commercial Application Development Using Oracle Developer 2000 Forms 6i, BPB Publications, 2nd Revised Edition, 2005
2. John Day, Craig Van Slyke, Starting out with Oracle, Dreamtech Press, 2004
3. Steven Feuerstein, Oracle PL/SQL Programming, O'Reilly Publications, 3rd Edition.

Mapping of COs with Syllabus

Course Outcomes	Module I	Module II
CO1	H	M
CO2	M	H
CO3	M	H
CO4	M	H
CO5	M	H

CAML6036: MACHINE LEARNING LAB

(0-0-2) (2 Credits – 30 Hours)

COURSE/LEARNING OUTCOMES:

1. Explain the implementation procedures for the machine learning algorithms. (Understanding)
2. Design Java/Python programs for various Learning algorithms. (Creating)
3. Apply appropriate data sets to the Machine Learning algorithms. (Applying)
4. Identify and apply Machine Learning algorithms to solve real world problems (Applying)

Experiments:

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

5. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
6. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Suggested Readings:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems – 2nd edition, Aurelien Geron, O'Reilly.
2. Building Machine Learning Systems with Python, Willi Richert and Luis Pedro Coelho, Packt Publishing.

Mapping of COs with Syllabus

Course Outcomes	1	2	3	4	5	6	7	8	9
CO1	H	H	H						
CO2	M	M	M	M	M	M	M	M	M
CO3				H	H	H	H	H	H
CO4	M	M	M	M	M	M	M	M	M

CAMN6038: MINOR PROJECT – MCA (5 CREDITS)

***Objective**: The objective of the Minor project is to consolidate the concepts and practices that were learned during the course and to serve as a record of competence. It should enable a student to apply concretely in a small package the concepts gained from Software Engineering.*

COURSE / LEARNING OUTCOMES

At the end of this Minor Project students will be able to:

CO1: Recall and distinguish client end programming from a server end programming, web based application from a smart phone based application, approach to an application based project from a research based project. (Remembering, Understanding)

CO2: Identify different API and development environment tools for building the project, research terminologies for research-based projects. (Applying)

CO3: Apply the knowledge of programming to develop application specific but not limited to Web, Android, IoT etc., for research-based projects the different algorithm design techniques. (Applying)

CO4: Analyse the advantage and limitation of different development languages, APIs, platforms, algorithms. (Analysing)

CO5: Create applications to meet real time needs (Creating)

CO6: Judge the efficiency of the project using various evaluation parameters and testing methodologies, efficiency of the algorithm for research-based complexity measure. (Evaluating)

E-resource for learning

LaTeX, www.spoken-tutorial.org

CAMP6039: MAJOR PROJECT – MCA

(18 Credits)

Objective

The primary objective of the Major Project is to enable students to have a thorough understanding of the theoretical principles learnt in earlier five semesters through a prolonged practical experience. The major project is oriented towards developing requisite skills, knowledge of latest technologies and an entrepreneurial attitude in a student which are needed to make an effective start as a computer/IT professional.

COURSE / LEARNING OUTCOMES

At the end of Major Project students will be able to:

CO1: Apply programming knowledge and requirement analysis to develop solutions for Web, Android, IoT, etc. Applying algorithm design, classification, and clustering techniques for research projects, including detailed project planning and resource allocation. (**Applying**)

CO2: Analyze the pros and cons of various development languages, APIs, platforms, and algorithms. Conduct feasibility studies and risk analysis to inform tool and technique selection. (**Analyzing**)

CO3: Create applications to meet real-time needs with comprehensive project plans that include requirement analysis, risk management, and feasibility assessments. Design novel or hybrid research techniques for research projects. (**Creating**)

CO4: Evaluate project efficiency using evaluation parameters, testing methodologies, and continuous requirement validation. Assess algorithm complexity for research projects and ensure deliverables meet objectives through risk assessment and feasibility study. (**Evaluating**)

VALUE ADDED COURSES

CARP6051: ROBOTIC PROCESS AUTOMATION

(30 Hours)

COURSE/ LEARNING OUTCOMES

1. Explain the RPA Developer enablement journey and an introduce to the role. (Understanding)
2. Explain the three constructs that are fundamental in any software process: variables, arguments and control flow. (Understanding)
3. Address what selectors are, the UI Explorer, the Property Explorer, Selector types, where to use them and how to fine-tune Selectors when encountering difficult situations. (Remembering)
4. Creating UI input and output actions. (Creating)
5. Learn about the many email tasks that can be automated to help you save valuable time. Cover an essential aspect of development, identifying and solving bugs in your projects and learn about how to get automation production-ready: how to anticipate, detect and resolve errors in your workflows. (Applying)

Module I: (8 Hours)

RPA Overview: Overview of Robotic Process Automation (RPA), Benefits of RPA in industries and business processes, Introduction to the RPA Developer Role, Variables, Data Types and Control Flow, Version Control, Data Manipulation, Excel and Data Tables, Selectors.

Module II: (22 Hours)

Bot Building: UI Automation, Introduction to Logging in Studio, IMDB Movie Rating, Contact Details, RPA Challenge.

Amazon Data Scraping, Recording Demo.

Calculate Client Hash, PDF Automation, Error and Exception Handling, Debugging.

Email Automation, Connecting Robot to Orchestrator, Publishing workflow to Orchestrator, Orchestrator Demos.

Suggested Readings

1. The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems by Tom Taulli, Publisher: Apress
2. Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the Leading RPA Tool – UiPath by Alok Mani Tripathi, Publisher: Packt Publishing; 1st edition
3. Robotic Process Automation Projects: Build Real-world RPA Solutions Using UiPath and Automation Anywhere by Arun Kumar Asokan and Nandan Mullakara, Publisher: Packt Publishing Limited

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO1	H	
CO2	H	
CO3		H
CO4		H
CO5		H

CABC6052: BLOCKCHAIN

(30 Hours)

COURSE/ LEARNING OUTCOMES

1. To understand what Blockchain is and why it is used. (Remembering)
2. To be able to explain the different components involved within Blockchain. (Understanding)
3. To know when and why you may want to use Blockchain within your environment. (Remembering)

Module I: (7 Hours)

Introduction to Blockchain Technology and its Importance; Evolution of the Blockchain Technology,

Module II: (7 Hours)

Elements of a Blockchain, Basic Crypto Primitives – Cryptographic Hash, Digital Signature

Module III: (16 Hours)

Blockchain Consensus I – Permissionless Models, Blockchain Consensus II – Permissioned Models, Smart Contract Hands On I – Ethereum Smart Contracts (Permissionless Model), Blockchain Applications

Suggested Readings

1. Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020,
2. Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials
3. Ethereum Development Resources - https://ethereum.org/en/developers

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H		
CO2	M	H	
CO3		M	H

CAAW6053: ADVANCED WEB APPLICATION DEVELOPMENT TECHNIQUES

(30 Hours)

COURSE/ LEARNING OUTCOMES

1. Explain the JavaScript and an introduce to the role in client server architecture.(Understanding)
2. Explain the importance of data validation and understand the process of data sanitization. (Understanding)
3. Address the threat handling mechanism while development. (Remembering)
4. Creating User interface, service design pattern, and remote connection. (Creating)
5. Learn about the recent trend in web development architecture based on micro service design pattern. Cover an overview of recent trend in management of load balancing and service scalability. (Applying)

Module I: (18 Hours)

JavaScript Overview: Form events, Client Side Validation (Length check, Numeric field check, Alphanumeric field check, Empty Field, special character, password format, All field entry check), Server Side validation (Data sanitization), SQL Injection, Overview of session management, Cross site scripting, URL validation, Importance of Asynchronous JavaScript and XML (Ajax), loading page content using AJAX, Database connection, Back end data update using AJAX.

Module II: (12 Hours)

Micro Service Applicability: Micro Service design pattern, Overview of Service Oriented Architecture, Principles of Web Service, SOAP / RESTful Web Service, Overview of Containerization: Kubernetes with Docker.

Suggested Readings

1. Beginning JavaScript with DOM Scripting and Ajax – Russ Ferguson and Christian Heilmann, Publisher: Apress ; 2nd edition
2. Ajax programming for the absolute beginner, Jerry Lee Ford, Jr. Publisher: Course Technology, 1st Edition
3. Kubernetes Microservices with Docker by Deepak Vohra, Publisher: Apress, 1st Edition

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO1	M	
CO2	M	
CO3		M
CO4		H
CO5		H

CASL0200: SERVICE LEARNING

(2 Credits)

Objective

The objective of this course is to understanding of the theory and practice of community university engagement. The students provide an insight on the theme of Social Responsibility of Higher Education Institution and to introduce community based participatory research and the tools to facilitate engaged research.

COURSE/LEARNING OUTCOMES

At the end of this course, students will demonstrate the ability to

1. Define and explain the understanding of Community-University Engagement (CUE) and outline CUE in relation to higher education policy in India. (Remembering)
2. Analyze and identify the social responsibility of higher education institutions to facilitate engaged teaching, research & service. (Analyzing)
3. Determine the various methods and tools on Community-Based Participatory Research (CBPR). (Evaluating)
4. Evaluate how Higher education institutions can undertake community engagement post COVID-19. (Evaluating)
5. Design a plan for the engagement of students with the community through engaged teaching, research and service. (Creating)

Module I: Community University Engagement (CUE) (7 Hours)

History and Role of Community University Engagement (CUE) in Indian Higher Education Policy, Fostering Social Responsibility by Higher Education, Current status and possible interventions, Recent initiatives related to CUE, Principles of community engagement and its principles, Forms of community engagement

Module II: Social Responsibility of HEIs. (8 Hours)

Understanding Social Responsibility of HEIs – Engaged Teaching, Research & Service, Community Engaged teaching and research, community-based participatory research, practice-based learning, Community service, Reforming Existing and developing new courses, Engaged service on educating students to become active citizens, Effective Methods and Tools for Engaging Community in Research

Module III: Community Based Participatory Research (CBPR) (8 Hours)

Understanding Community Based Participatory Research (CBPR), Engaged research, Knowledge and research, Development and use of CBPR, Building Partnerships in Research, data collection and Analysis Multi modal, Knowledge sharing and Mobilisation, Practical challenges, littered dignity, Solutions for sustainable livelihoods, Capacities of panchayats and small nagarpalikas for disaster preparedness

Module IV: Service Learning-based Assignments (7 Hours)

Carrying out group assignments on service-learning for community university engagement

Sample use cases:

Digitally literate the unemployed youth/women/rural area-based students to train them to learn the basics of computer and digital transactions

Identify an area of need in the nearby community and design a project related to it addressing their social well-being.

Build awareness in the community about various social and ethical issues in Information Technology.

Launch digital campaign to raise awareness around – Personal hygiene and cleanliness, metal health, environment, food and nutrition.

Suggested Readings

1. W. James Jacob, Stewart E. Sutin, John C. Weidman, John L. Yeager, “Community Engagement in Higher Education: Policy Reforms and Practice”, Springer, 2015.
2. David Coghlan, Mary Brydon-Miller, “The SAGE Encyclopedia of Action Research”, SAGE, 2014.
3. Kronick, Robert F., “Emerging Perspectives on Community Schools and the Engaged University”, IGI Global,2019
4. Tami L. Moore, “Community-University Engagement: A Process for Building Democratic Communities”, John Wiley & Sons, 2014.
5. Marshall Welch, “Engaging Higher Education: Purpose, Platforms, and Programs for Community Engagement”, Stylus Publishing, 2016.
6. Barbara Jacoby, “Building Partnerships for Service-Learning”, John Wiley & Sons, 2003.
7. Becca Berkey, Emily A. Eddins, Patrick M. Green, Cara Meixner, “Reconceptualizing Faculty Development in Service-Learning/Community Engagement: Exploring Intersections, Frameworks, and Models of Practice”, Stylus Publishing, 2018.

AUDIT COURSES

EGCS0110: COMMUNICATION SKILLS (Audit Course)

***Objective**: The objective of this audit course is to prepare students to be effective in their career in the corporate world where they will use their professional expertise. This course enables students*

- *To understand the difference between hard skills and soft skills*
- *To learn the importance of communication skills as part of the soft skills,*
- *To be familiar with the various features of effective communication, which includes verbal, non-verbal, written communication and body language.*

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: *Recognise* the difference between hard and soft skills
CO 2: *Understand* the importance of communication skills
CO 3: *Analyse* features of effective communication
CO 4: *Apply* the soft skills in the corporate world

CMES0023: ENTREPRENEURSHIP (AUDIT COURSE)

***Objective**: The objective of the course is to introduce students to the concept of entrepreneurship, entrepreneurial skills and their use in a variety of situations. The students are examined on the personal skills to help them define entrepreneurial opportunity and are taught to develop a criteria to judge a situation to develop into a venture, plan and prepare business plans considering the market, technical, financial and legal requirements.*
The various topics that are generally covered in the course are:

- *Meaning of entrepreneur and entrepreneurship and its relation with problem - solving, characteristics of an entrepreneur, factors influencing entrepreneurship*
- *Identify and explain entrepreneurial opportunities, generating a list of entrepreneurial opportunities in a number of commercial and non-commercial situations*
- *Preliminary Project appraisal methods - Selecting the right opportunity, market*
- *Survey and research, techno-economic feasibility, financial feasibility- sources of finance – identify various sources of capital, ways to access the capital. Legal environment – identify the types of the regulatory systems and predict their effects on the creation of the entrepreneurial venture, role of government and government agencies.*
- *Creating the business model – business plan preparation.*
- *Recognize and assess the expected life of a venture, break-even analysis, recognize the common causes of failure of business ventures, how to deal with seven business crisis- planning for survival and growth.*

SCHOOL OF COMMERCE AND MANAGEMENT

SCHOOL OF COMMERCE AND MANAGEMENT

DEPARTMENT OF COMMERCE

MASTER OF COMMERCE

Course Structure of MASTER OF COMMERCE

SEMESTER I				
Type of Course/Category	**Course Code**	**Course Name**	**Credits T-L-P**	**Page**
Core Course (Theory)	CMOT0041	Organizational Theory and Behavior	4-0-0	1231
Core Course(Theory)	CMBD0042	Business Statistics and Decisions	4-0-0	1232
Core Course(Theory)	CMFY0043	Financial Statement Analysis	4-0-0	1233
Core Course (Theory)	CMMG0044	Managerial Economics	4-0-0	1233
Core Course (Theory)	CMAG0045	Cost and Management Accounting	4-0-0	1234
Total Credits			**20**	
SEMESTER II				
Core Course (Theory)	CMRC0046	Research Methodology In Commerce	4-0-0	1235
Core Course (Theory)	CMBE0047	Business Environment	3-0-0	1236
Core Course (Theory)	CMBL0048	Business Law	3-0-0	1237
Core Course (Theory)	CMFI0049	Corporate Finance	4-0-0	1238
Core Course (Theory)	CMPG0050	Principles of Marketing	4-0-0	1239
Core Course (Theory)	CMBS0051	International Business	4-0-0	1240
Total Credits			**22**	
SEMESTER III				
Core Course (Theory)	CMSH0052	Strategic Human Resource Management	4-0-0	1241
Core Course (Theory)	CMCR0053	Consumer Behaviour	4-0-0	1242
Project Work	CMDS6006	Dissertation - I	4-0-0	1255
Specialisation:	CMTM0054	Corporate Tax Management	4-0-0	1243
Accounting and Taxation(Theory)	CMAF0055	Accounting Theory and Financial Reporting	4-0-0	1244
Specialisation:	CMCR0056	Advance Corporate Finance	4-0-0	1245
Finance and Investment(Theory)	CMBK0057	Investment Banking	4-0-0	1246
Specialisation:	CMIG0058	International Marketing	4-0-0	1246
Management(Theory)	CMBC0059	Business Ethics and Corporate Governance	4-0-0	1247
Total Credits			**20**	
SEMESTER IV				
Core Course (Theory)	CMEM0060	Entrepreneurship Management and E-Commerce	4-0-0	1248
Project Work	CMDS6007	Dissertation – II	6-0-0	1256
Specialisation:	CMMD0061	Modern Accounting	4-0-0	1249
Accounting and Taxation(Theory)	CMAV0062	Advanced Accounting	4-0-0	1251
Specialisation:	CMFI063	Financial Institution Management	4-0-0	1252
Finance and Investment(Theory)	CMPN0064	Portfolio Management	4-0-0	1252
Specialisation:	CMIL0065	Management of Industrial Laws	4-0-0	1254
Management(Theory)	CMSM0066	Supply Chain Management	4-0-0	1254
	CMSP0067	Security Analysis And Portfolio Management	5-0-0	1252
Total Credits			**18**	
Total Programme Credits			**80**	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

DEPARTMENT OF COMMERCE

MASTER OF COMMERCE

(Specialisations in Accounting and Taxation, Finance and Investment and Management)

PROGRAMME OUTCOMES (POs)

PO 1: **Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communicatio**n: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Ethical and responsible citizen:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them. : Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO 6: **Leadership, Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: **Knowledge of Commerce:** To accustom the students with conventional as well as contemporary areas in the discipline of Commerce. To inculcate the knowledge of business and the techniques of managing the business with special focus on accounting and taxation, finance and investment and management

PSO 2: **Research, Innovation and Advancements:** To serve industry and society with contemporary knowledge and skills in the area of Commerce and Management and the ability to create new knowledge which can be added on to the existing knowledge on emerging fields and to pursue advanced education in the domain of Commerce

PSO 3: **Entrepreneurial Ability:** To enable them to start their own business by enhancing the horizon of knowledge in various field of commerce through teamwork, effective communication, ethical decision-making ability

LIST OF COURSES IN MCOM

COURSES
1.1 Organizational Theory & Behavior
1.2 Business Statistics & Decisions
1.3 Financial Statement Analysis
1.4 Managerial Economics
1.5 Cost & Management Accounting
2.1 Research Methodology iIn Commerce
2.2 Business Environment
2.3 Business Law
2.4 Corporate Finance
2.5 Principles of Marketing
2.6 International Business
3.1 Strategic Human Resource Management
3.2 Consumer Behaviour
3.3 Dissertation – I
COURSES
3.4 (A) Corporate Tax Management
3.5 (A) Accounting Theory and Financial Reporting
3.4 (F) Advance Corporate Finance
3.5 (F) Investment Banking
3.4 (M) International Marketing
3.5 (M) Business Ethics and Corporate Governance

4.1 Entrepreneurship Management and E-Commerce
4.2 Dissertation – II
4.3 (A) Modern Accounting
4.3 (A) Advanced Accounting
4.4 (F) Financial Institution Management
4.4 (F) Portfolio Management
4.4 (M) Management of Industrial Laws
4.4 (M) Supply Chain Management

MAPPING OF COURSES WITH POS/PSOS

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1.1	L	L	M	L	L		L		M
1.2		H	M	M					H
1.3	H	L	M		M		H	M	M
1.4		L	M		L	H			
1.5	H	L	M	M	M		M	H	M
2.1	H	H	H	M	M		H		H
2.2	M		M		L		H		L
2.3	M		M	M	H		M		
2.4	H	M	H	H	M		L	M	H
2.5	M	M	M	M		L	M		M
2.6	H	M			H		H		L
3.1	M			M		M	M		L
3.2	M	H	H		M	L	M		M
3.3	M	H	H	H		L	H	L	H
3.4 (A)	H		M	M	M		H	M	M
3.5 (A)	H	H	M				H	H	M
3.4 (F)	M		M	H		L	M	H	H
3.5 (F)	H	H	H			L	H	M	H
3.4 (M)	H	M	M		H	M	H		L
3.5 (M)	M	L				H	H	L	
4.1	H	L	L		H	H	H		L
4.2	M	H	H	H		L	H	L	H
4.3 (A)	H	L	M	M		L	H	H	M
4.3 (A)	H	H	M	M		L	H	H	H
4.4 (F)	H	L	L	H		H	H	H	H
4.4 (F)	H	L	M	H		L	H	M	H
4.4 (M)	H	L	H	L		H	H		H
4.4 (M)	H		L	M	L	M	H		

DETAILED SYLLABUS

CMOT0041: ORGANISATIONAL THEORY AND BEHAVIOUR (4 CREDITS– 60 HOURS)

***Objective**: The objective of this paper is to provide the students an insight into the principles of organizational behaviour and its relation to other activities in an organization, and to introduce the students to the techniques of organisational behaviour used as a management tool.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO 1: Define the concepts of Organisational Behaviour in the global context (Remembering)
CO 2: Explain the Cognitive processes of organizational behavior and its application in workplace (Understanding)
CO 3: Develop models of group dynamics, leadership theories, power & politics in terms of its application in workplace (Applying)
CO 4: Analyse the importance of communication and decision making techniques for improving productivity of employees (Analysing)
CO 5: Determine and develop models of Organizational culture, work stress and Conflict & negotiation in various workplace settings (Evaluating and Creating)

Module I: Introduction to Organizational Behaviour (8 Hours)

Defining Organisational Behaviour, historical background: the Hawthorne Studies; early development, conceptual development; the nature of people; theoretical frameworks; explaining and predicting behaviour; OB in the global context.

Module II: Cognitive processes of organizational behavior (12 Hours)

Nature and importance of Perception and attribution; perception and individual decision making; values, nature and dimensions of attitudes and job satisfaction; personality; aptitude; interests; learning; intelligence, motivation - theories of motivation.

Module III: Group Dynamics (14 Hours)

a) Understanding group dynamics, types of groups, group goals, group cohesiveness, group pressure and norms, teamwork; group structure - formal leadership, roles and norms; group member resources - abilities, personality, characteristics, stages in group development.
b) Leadership Theories - trait, behavioural, contingency, attributional, charismatic, transactional vs. transformational.
c) Power and politics: Contrasting leadership and power; power in groups; power tactics; politics-power in action.

Module IV: Communication and Decision Making (12 Hours)

Role of communication; Communication media and technology, communication networks - formal vs. informal; barriers to effective communication; communication skills; feedback information; persuasion in communication; active listening; participative decision-making techniques; groups vs. the individual; groupthink and group shift; the decision-making process

Module V: Organizational culture and Work Stress (14 Hours)

a) Definition of organizational culture; cultural typologies; organizational culture vs. national culture; functions of culture; formation of cultures; potential sources of stress - environmental factors, organizational factors; individual differences - perception, job experience, social support, locus of control, hostility; Stress – the emergence of stress, causes of stress; stress consequences - physiological symptoms, psychological symptoms, behavioural symptoms, stress management strategies : individual approaches, organizational approaches.
b) Conflict and negotiation: Definition of conflict; the conflict process; conflict in intergroup relations; creating functional conflicts; bargaining strategies; role of personality traits on negotiation; third party negotiations; intergroup relations and factors affecting intergroup relations.

Suggested Readings

1. Luthans Fred, Organisational Behaviour, 10th Edition, McGraw Hill India, 2005
2. Robbins Stephen P, Organizational Behaviour, 11th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004
3. Gilmer, Industrial Psychology, McGraw Hill.
4. Ghiselle and Brown, Personnel and Industrial Psychology, McGraw Hill.
5. Davis Keith, Human Relations at Work, Tata McGraw Hill.
6. Leavitt, Managerial Psychology, University of Chicago Press.
7. Bass B M , Leadership Psychology and Organizational Behaviour, Harper International.
8. Litterer, Analysis of Organizations, John Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L			
CO 2		M	L	L
CO 3	M	M	M	
CO 4		H	H	M
CO 5				H

CMBD0042: BUSINESS STATISTICS AND DECISIONS (4 CREDITS-60 HOURS)

***Objective**: The objective of this course is to familiarize students with the applications of statistical techniques in business decisions. This purpose of this course is to provide students with statistical tools needed by managers. The course emphasizes understanding the process associated with statistical decisions, defining and formulating problems, Analysing the data, and using the results in decision making.*

COURSE/LEARNING OUTCOMES

After learning this course, the students will be able to:

CO 1: Find the techniques for decision-making under uncertainty.(Remembering)
CO 2: Demonstrate understanding of statistical thinking and data analysis. (Understanding)
CO 3: Apply methods of Correlation, Regression and also use Time based data. (Applying)
CO 4: Analyse from theoretical and practical perspectives, decision making concepts and processes in business settings. (Analysing)
CO 5: Estimate different kinds of Statistical methods like Mean, Median, Mode, Standard Deviation, Index Number. (Evaluating)
CO 6: Combine research concepts and methods in a business setting. (Creating)

Part A: BUSINESS STATISTICS

Module I: Uni-variate Analysis (15 hours)

Measures of Central Tendency including Arithmetic mean, Geometric mean and Harmonic mean: properties and applications; Mode and Median. Partition values - quartiles, deciles, and percentiles. Measures of Variation: absolute and relative. Range, quartile deviation and mean deviation; Variance and Standard deviation: calculation and properties.

Module II: Bi-variate Analysis (10 hours)

Simple Linear Correlation Analysis: Meaning, and measurement. Karl Pearson's coefficient and Spearman's rank correlation. Simple Linear Regression Analysis: Regression equations and estimation. Relationship between correlation and regression coefficients.

Module III: Time-based Data: Index Numbers and Time Series Analysis(15 hours)

Meaning and uses of index numbers; Construction of index numbers: Aggregative and average of relatives – simple and weighted, Tests of adequacy of index numbers, Construction of consumer price indices.

Components of time series; additive and multiplicative models; Trend analysis: Finding trend by moving average method and Fitting of linear trend line using principle of least squares.

Part B: BUSINESS DECISION

Module IV (10 hours)

Course introduction. Introduction to Evidence Based Management. Introduction to measurement theory and statistical inference. Simple decision tools; Rational choice, limited rationality and biases; Modern test theory. Rapid evidence assessment. Academic Survey design and testing.

Module V (10 hours)

Multiple-person decision making. Exploratory data analysis; Forecasting; roadmaps Optimisation; Big data, inference and dimension reduction. Forecasting, roadmaps.

Suggested Readings

1. Sharma J. K., Business Statistics, Pearson Education.
2. Gupta S.C., Fundamentals of Statistics, Himalaya Publishing House.
3. Gupta S.P. and Gupta A, Elementary Statistics, Sultan Chand and Sons, New Delhi.
4. Levin R and Rubin David S, Statistics for Management, Prentice Hall of India, New Delhi.
5. Spiegel M.R., Theory and Problems of Statistics, Schaum's Outlines Series, McGraw Hill Publishing

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	L	M			
CO 2	M	H	M		
CO 3			M	H	H

CMFY0043: FINANCIAL STATEMENT ANALYSIS (4 credits – 60 hours)

***Objective**: The course introduces the knowledge of decision makers information about a business enterprise for use in decision-making and to evaluate the economic situation of the firm and predicting its future course based on the financial statements.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO 1: Define the role of standard setters and regulators in Financial Reporting (Remembering).
CO 2: Illustrate the information provided by Balance Sheet, Income Statement and Cash Flow Statement (Understanding)
CO 3: Identify and compare cash flow classifications of operating, investing and financing activities (Applying)
CO 4: Analysing the link between Income statement, Balance Sheet and Cash Flow Statement (Analysing)
CO 5: Criticise rations used to analyse a company's liquidity, profitability, solvency and efficiency (Evaluating)
CO 6: Build a strong base on financial statement analysis (Creating)

Module I: Introduction to Financial Statement Analysis (10 hours)

Scope of Financial Statement Analysis; Financial Statements and other information sources; Financial Statement Analysis Framework; Classification of Business Activities; Financial Reporting Standards; Regulatory Authorities; International Financial Reporting Standards Framework (IFRS); Comparison of IFRS with other Reporting Standards.

Module II: Analysis of Income Statement (15 hours)

Components and format of Income Statement; Revenue Recognition; Expense Recognition; Non- recurring and Non-operating items; Earnings Per Share(EPS) : Simple Vs complex capital structure, Basic EPS, Diluted EPS; Analysis of Income Statement: Common size analysis, Income Statement Ratios.Case Study I

Module III: Balance Sheet (10 hours)

Components and format of Balance Sheet; Measurement Bases of Assets and Liabilities; Equity: Components, Statement of Changes in Shareholders Equity; Uses and Analysis of Balance Sheet: Common size analysis, Balance Sheet Ratios.Case Study II

Module IV: Cash Flow Statement (15 hours)

Components and format of Cash Flow Statement; Linkages and Preparation: Cash Flow Statement with Income Statement and Balance Sheet, Preparation of Cash Flow Statement, Conversion from Indirect to Direct method; Cash Flow Statement Analysis: Evaluation of Sources and Uses of Cash, Common size analysis, Free Cash Flow to Firm and Free Cash Flow to Equity, Cash Flow Ratios.Case Study III

Module V: Financial Statement Analysis Techniques (10 hours)

Financial Analysis Process; Analysis tools and techniques; Common Ratios: Activity Ratios, Liquidity Ratios, Solvency Ratios, Profitability Ratios; Integrated Financial Ratio Analysis.Case Study IV

Suggested Readings

1. Thomas R. Robinson and Elaine Henry: International Financial Statement Analysis, Wiley.
2. Charles H. Gibson:Financial Statement Analysis, Cengage.
3. Subramanyam K R and Wild John J. :Financial Statement Analysis, McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	L	L		M	
CO 2	M	H	H		
CO 3		M			H
CO 4			H		
CO 5			M		H
CO 6	M	H	H	H	

CMMG0044: MANAGERIAL ECONOMICS (4 CREDITS-60 HOURS)

***Objective**: The objective of the course is to acquaint students with the basic principles of micro and macroeconomics for developing the understanding of theory of the firm, markets and the macro environment. This will help them in managerial decision making processes.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO 1: Understand the scope of managerial economics.
CO 2: State the difference between demand and supply.
CO 3: Outline the determinants of supply and estimate elasticity of supply.
CO 4: Summarize the concept of production function and relate it with economies and diseconomies of scale.
CO 5: Explain the various kinds of production functions.
CO 6: Estimate cost of production of firms.
CO 7: Summarize and evaluate fiscal policy and monetary policy to control inflation.
CO 8: Describe Balance of Payments and its various components.
CO 9: Outline various Open macro-economic concepts

Module I: Managerial Economics (10 Hours)

Introduction to Managerial Economics; Economic factors influencing decisions, Functions Role and Responsibilities of Managerial Economist; Principles in Managerial decision analysis; Micro-Macro Economics, Paradox of Micro Economics, Distinction between Micro and Macro Economics.

Module II: Demand Analysis (10 Hours)

Theories in Demand, Derivation of demand, types, Environment influencing demand; Elasticity of Demand; Advertising or promotional Elasticity; Demand forecasting ; Demand forecasting for new products, Demand Estimation for consumer durables and non-consumer durables.

Module III: Production And Cost Analysis (15 Hours)

Production Function; Law of variable proportions, Production with two variable inputs; Cost Analysis: concept, importance, types – Real opportunity, Money, Fixed, variable, Direct, indirect, Explicit, implicit, past, feature, controllable and uncontrollable, Escapable, inescapable, urgent, potable cost, Replacement and Historical cost, Total Average and Marginal cost in short Run – and Long Run curve; Revenue - Concepts, definition, types-Total, Average, Marginal and relationship with AR and MR

Module IV: Market Structure (13 Hours)

Concept, meaning and classification of Market; Perfect competition-features and price determination; Monopoly – definition, features, types and price determination; Monopolistic competition-meaning, concept, types, price determination and defects; Pricing - types, cost pulls, going rate, Intuitive, Imitative, Marginal cost, Pioneering, Transfer pricing; Price discrimination – Definition, Concept, meaning, types, conditions, Dumping and socio – economic consideration in pricing; Firm objectives, staff, sales and growth Maximization.

Module V: Business Cycle (13 Hours)

Business cycle–cobweb, Hick's Samuelson Theories of Trade cycle; Measures to control Business Cycle; Inflation; Deflation; Economic effects on production distribution and employment, remedies demand full v/s cost push Inflation; Monetary and fiscal policies objectives, role and impact on economic development, Concept of sustainable development, consumption and its inclusive growth.

Suggested Readings

1. Koutsyiannis, A., Modern Microeconomics, Macmillan Press Ltd.
2. Varian, Micro-Economic Analysis , Norton
3. Pindyck Robert S., Daniel L. Rubinfeld and Prem L. Mehta, Micro Economics, Pearson Education Asia, New Delhi.
4. Branson William H., Macro Economics Theory and Policy, First East – West Press.
5. Dornbusch, R. and S. Fischer Macro Economics , Publisher Tata McGraw Hill.
6. Oliver Blanchard ,Macro Economics, Pearson Education, LPE.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	L		
CO 2	M	M	H	
CO 3		H	M	M
CO 4			M	H

CMAG0045: COST AND MANAGEMENT ACCOUNTING (4 CREDITS-60 HOURS)

Objectives:

- *To understand the different concepts of cost, costing and cost accounting and their practical application in real world scenarios.*

- *To provide in-depth knowledge of the detailed procedure and documentation involved in cost ascertainment systems.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: Define the meaning of cost, costing and cost accounting. (Remembering)
CO2: Illustrate the application of management accounting. (Understanding)
CO3: Identify the detailed procedure and documentation involved in the cost ascertainment system. (Applying)
CO4: Compare profit maximization and wealth maximization as an objective to financial management. (Analysing)
CO5: Interpret the effective techniques for inventory control. (Evaluating)
CO6: Estimate cost of production under different situations. (Creating)

Module I: Introduction to Cost and Management Accounting (10 Hours)

Concepts of Costs; Classifications and Elements of Cost; Cost Centre and Cost Unit; Methods and Techniques of Costing; Installation of a Costing System.

Module II: Management Accounting (10 Hours)

Tools and Techniques of Management Accounting; Relationship of Cost Accounting, Financial Accounting, Management Accounting and Financial Management; Conflicts in Profit Vs Value Maximisation Principle; Role of Management Accountant in Decision Making.

Module III: Material Cost (10 Hours)

Materials Control – Concept and Techniques; Stock Verification; Methods of Pricing of Material: FIFO, LIFO, Simple Average, Weighted Average; Inventory Management: Techniques of fixing of minimum, maximum and reorder levels, Economic Order Quantity, ABC Analysis ; Stock Verification and Perpetual Inventory.

Module IV: Activity Based Costing (Abc) And Cost Records (10 Hours)

ABC Vs Traditional Costing; Uses and Limitations; Cost Ledgers – Integrated Accounts and Non- Integrated Accounts; Reconciliation of Cost and Financial Accounts.

Module V: Costing Systems (20 Hours)

Unit and Output Costing; Job Costing: Job Cost Cards, Collecting Direct Costs; Batch Costing: Features and Applications; Contract Costing: Features, Distinction between Job and Contract Costing, Contract Accounts, Accounting for Material, Accounting for Plant Used in a Contract; Process Costing: Features, Applications and Types of Process Costing; Joint Products, By-Products; Service Costing: Features and Applications; Unit Costing and Multiple Costing.

Suggested Readings

1. Arora, M. N., “Cost and Management Accounting”, Vikash Publishing House, New Delhi.
2. Zad, N. S., “ Cost and Management Accounting”, Taxman, New Delhi.
3. Aggarwal, P., “Cost and Management Accounting”, Bharat Law House, New Delhi.
4. Banarjee, H., “Cost and Management Accounting”, Prentice Hall India Pvt, Ltd, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	L	M		L	
CO 2	L	L			
CO 3			M	M	M
CO 4			H		
CO 5					H

CMRC0046: RESEARCH METHODOLOGY IN COMMERCE (4 CREDITS-60 HOURS)

***Objective**: This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: Define and tell why research and its methodology are important. (Remembering)
CO2: Explain the use of methodology in understanding the process of research. (Understanding)
CO3: Identify the sources of data and apply various data collecting techniques. (Applying)

CO4: Classify, analyse and draw inferences from Data. (Analysing)
CO5: Justify the use of various methods in evaluating data. (Evaluating)
CO6: Design methodology specific to the study under consideration. (Creating)

Module I: Introduction to research (10 Hours)

Concept, objectives, types of research, approaches to research-qualitative and quantitative research, case study research, research methodology.

Module II Research Design (10 hours)

Defining and developing a Research Problem, how to approach. Types of research and research design.

Module III Survey design & Measurement (20 hours)

Survey design & Measurement: Survey Design- Variables, design of research instruments and data preparation - Validity & Reliability, Best Practices.
Measurement & Scaling Types, Sampling – sample size and techniques.

Module IV Research Analytics (15 hours)

Research Analytics: Hypotheses testing, Correlation and Regression overview and intro to SPSS, MS-Excel, Factor analysis, Cluster Analysis, MS-Excel

Module V Research Report writing(15 hours)

Best practices, References and Bibliography, Ethics in Research.

1. Kothari C.R , Research Methodology: Methods and Techniques, New Age International,
2. Srivastava, S. C. : Foundation of Social Research and Economics Techniques, Himalaya Publishing House, 1990.
3. Sharma H.D. and Mukherji S. P: Research Methods in Economics and Business, New York : The Macmillan Company, 1992.
4. Saunders M , Philip Lewis and Adrian Thornhill, Research Methodology for business students, Pearson Education
5. Michael V.P, Research Methodology in Management, Himalaya Publishing House

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M		M	
CO 2	M	H	H		
CO 3		M			H

CMBE0047: BUSINESS ENVIRONMENT (3 CREDITS– 45 HOURS)

***Objective**: To apply relevant knowledge, skills and exercise professional judgement in understanding the macro environment in which a business organisation operates. The course would also make the students capable of analysing and understanding policies of the government implemented from time to time and assess their impact on business.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:
CO1: Define economic systems in depth (Remembering)
CO2: Outline how an entity operates in a business environment (Understanding)
CO3: Identify the role of Public and Private sector in the business environment (Applying)
CO4: Examine the trade environment in details (Analysing)
CO5: Explain the impacts of Government policy on the economic environment (Evaluating)
CO6: Elaborate the various trade blocs and the role of WTO (Creating)

Module I: Business Environment (9 classes)

Concept, Components and importance of Indian Business Environment; Types of Business Environment-Cultural, social, political, technological, economic and legal environment; scanning techniques of environmental forecasting.

Module II: Economic trends (9 hours)

Economic reforms in India –Liberalization, privatization and globalization; Competitive Strength of Indian industry; Impact of liberalization policy on different sectors; Foreign Investments policy in India.

Module III: Multinational Corporations (8 classes)

Multinational corporations and their participation in India; strategies of multinational corporations;competitive strengths policies and performance.

Module IV: Business Ethics and Social Responsibilities (9 classes)

Business ethics and social responsibilities; relationship between business and society; Corporate power social accountability; Ethical issues and values in business; Corporate Social policies - issues and challenges; Ecological and environmental issues.

Module V: Economic Development of North Eastern Region (10 classes)

Special package for economic development of the north eastern region; DONER and its role in economic development, infrastructure and industry; North East Industrial Policy- promotional measures for cross-border trade, Role of NEC and NEDFI. Problems and prospects of the industry in Assam, Brief study of the tea industry, paper industry, food processing industry, silk industry and bell metal industry; tourism industry.

Suggested Readings

1. Wheelen, Concepts of Strategic Management and Business policy, Pearson Education, New Delhi.
2. Islam Swabera & Kharkongor; Business Environment, Taxman's Publication, New Delhi.
3. Misra S.K., Puri V.K.; Indian Economy, Himalaya Publishing House, Mumbai.
4. Deepashree, Indian Economy, Tata McGraw Hill, New Delhi.
5. Dutta Rnddar and Sundaram KPM , S. Chand & Co. Ltd., New Delhi.
6. Agarwal A.N., Indian Economy, New Delhi.
7. Kazhmi Azhar, Business Policy,
8. Gupta, Liberalisation - its impact on Indian Economy, Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	L	M	H		
CO 2	M	M	M		
CO 3		L		H	H
CO 4			M	M	H

CMBL0048: BUSINESS LAW (3 CREDITS- 45 HOURS)

***Objectives**: The objectives of this course is to enable students to have a detailed understanding of the Indian Contract Act, 1872, The Special Contract Act and The Sales Contract Act. The course also aims at giving the students in depth knowledge about the Negotiable Instruments Act 1881.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: Relate with the legal environment that is influencing business functioning. (Remembering)
CO2: Illustrate a proper perspective about legal environment for better decision making. (Understanding)
CO3: Identify the legal provisions in the formation of a company and partnership. (Applying)
CO4: Examine the validity of any contract as per the law. (Analysing)
CO5: Interpret the uses and application of the various negotiable instruments. (Evaluating)
CO6: Formulate a valid contract with all legal provisions and conditions. (Creating)

Module I: The Indian Contract Act, 1872

a) Proposal- its communication, acceptance and revocation; Agreement vis-à-vis contract, void agreement & voidable contract
b) Consideration – essential elements, exception to rule- No consideration no contract; privity of contract and consideration
c) Capacity to contract; Free consent – coercion, undue influence, misrepresentation, fraud; Mistake – of fact and of law
d) Legality of object – agreements opposed to public policy and in restraint of marriage, trade & legal proceedings; Contingent contracts
e) Performance of contract–liability of joint promisor; Consequences of breach of contract–liquidated damages and penalty

Module II: Special contracts (10)

a) Law of Indemnity and Guarantee (Ss.124-125, Ss-126-129,132-147)
b) Law of Bailment and pledge (Ss. (Secs 148, 152-154,162, 172,178,178A and 179)
c) Law of Agency (S. 182-185& 201-209only)

Module III: The Sale of Goods Act 1930 (10)

a) Introduction, Definitions (Sec-2), Formalities of the contract of sale (Ss. 4-10),

Distinction between 'sale' and 'agreement of sell, Distinction between 'sale and hire-purchase agreement'

b) Conditions and Warranties (sec 11-17)
c) Transfer of property as between the seller and the buyer (sec-18-26)
d) Rights of an unpaid seller (Secs-45-54)

Module IV: The Negotiable Instruments Act, 1881 - As Amended by The Negotiable Instruments(Amendment and Miscellaneous Provisions) Act, 2002

a) Notes, Bills and Cheques-Promissory notes, Bills of exchange and cheques (Demand drafts, payment orders etc.);Drawer, Drawee, Acceptor, Holder, Holder in due course, payment in due course
b) Endorsement-Endorsement in blank and endorsement in full, conversion of endorsement in blank into endorsement in full and its effects
c) Negotiation; Presentment-At sight, on presentment, after sight, presentment for payment; Maturity-Calculating its period; Noting and protest-Protest for better security; Presumption as to negotiable instruments-and estoppel; Cross Cheques-Cheques crossed generally and specially;Of penalties in case of Dishonour of certain cheques for insufficiency of funds etc.; Offences by companies

Suggested Readings

1. Majumdar A.K. & Kapoor G.K., Company Law & Practice, Taxmann Publication
2. Gupta Vijay, K.C. Garg ,Company Law, Kalyani Publishers
3. Auter, Company Law- Singh, Eastern Book Company, Lucknow.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		
CO 3			H	H

CMFI0049: CORPORATE FINANCE (4 CREDITS – 60 HOURS)

***Objectives**: The main objective of the course is to provide the conceptual background for corporate financial analysis from the point of corporate value creation. The course develops a theoretical framework for understanding and analysing major financial problems of modern firms in the market environment.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: Explain the basic tools and concepts necessary to understand modern financial theory and its application in corporations. (Understanding)
CO2: Apply capital budgeting tools for evaluating investments. (Applying)
CO3: Analyse the relationship between capital structure, risk and shareholder value using the Modigliani Miller Theorems. (Analysing)

Module I: Introduction to Corporate Finance (15 hours)

Objective of Corporate Finance; Role of finance manager in corporations; types of firms; stock markets; financial institutions; Financial Statement Analysis: Balance Sheet analysis, Income Statement analysis, Cash Flow statement; Case Study - Enron

Module II: Investment Decisions (10 hours)

Net Present Value (NPV) rule; Payback rule; Accounting rate of return method; Profitability index; Internal Rate of Return (IRR) rule; Modified Internal Rate of Return; Choosing between projects; Capital Budgeting process; Forecasting Incremental Earnings; Break even Analysis; Scenario analysis; Options in Capital Budgeting – Delay, Expand, Abandon

Module III: Stock Valuation (20 hours)

Models of Stock Valuation; Dividend Discount Model; Discounted Cash Flow Model; Comparable Companies Analysis; Systematic Risk vs Equity Risk; Measuring Systematic risks; Beta; Capital Asset Pricing Model (CAPM); Cost of Capital: Weighted Average Cost of Capital (WACC), Cost of Debt, Cost of preference share and cost of retained earing and using WACC to value a project.

Module IV: Long Term Financing (15 hours)

Equity financing for Private Companies; Initial Public Offerings (IPO); Case Study – Google's IPO; Debt Financing: Private Debt and Public Debt, Bond Covenants, Repayment Provisions; Capital Structure: Capital Structure Choices, Capital Structure in Perfect Capital Markets, Modigliani and Miller (MM) Model, Debt and Taxes.

Suggested Readings

1. Berk and DeMarzo : Corporate Finance, Pearson.
2. Brealey, Richard/ Myers, Stewart C. / Allen, Franklin :Principles of Corporate Finance, McGraw Hill.
3. Aswath Damodaran : Investment Valuation, John Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			M
CO 2		M	H	
CO 3	M		M	
CO 4		H		
CO 5				H

CMPG0050: PRINCIPLES OF MARKETING (4 CREDITS – 60 HOURS)

***Objective**: To apply relevant knowledge, skills and exercise professional judgement in selecting and applying marketing principles and concepts in different business contexts and to contribute to the evaluation of the performance of an organisation and its strategic and operational development.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO 1: Define and explain marketing mix models in workplace and contribute to organisational growth (Remembering and Understanding)
CO 2: Assess the impact of product and brand management decisions on organizational performance (Applying)
CO 3: Examine the effectiveness of pricing and promotion decisions (Analysing)
CO 4: Determine appropriate distribution and retailing strategies in improving organisational performance (Evaluating)
CO 5: Elaborate the Rural Marketing initiatives and Developments in Marketing (Creating)

Module I: Introduction to Marketing (12 classes)

Marketing in the Twenty-First Century; marketing in economic development process; Meaning of Marketing, Concept of Marketing, New Terminology of Marketing Concept, Holistic Concept of marketing, , Marketing Objectives; Marketing Environment; Marketing Mix; Elements of Marketing Mix, Product Mix, Price Mix, Promotion/Communication Mix, Place Mix/ Distribution Mix; Significance of Marketing Mix; Factors Affecting Marketing Mix; Growth & Future of marketing in India.

Module II: Product, and Product Brand Management (12 hours)

Definition, Features, Characteristics and Classification of Product; ; Dimension of Product Concept, Product Life Cycle definitions, Stages of the Product Life Cycle; Types of New Products; Challenges to New Product Development; Steps in the Development of the New Product; Introduction, Objectives, Problems and Process of Test Marketing; Introduction to Product Brand, Definition of Product Branding, Purpose of Branding, Features of Good Brands, Significance and Importance of Branding, Brand equity, Brand loyalty.

Module III: Pricing and Promotion Decision (12 Classes)

a) Pricing Decisions; Concept of Price; Significance of Pricing; Factors Affecting Pricing Decisions; Major Pricing Methods; Pricing Policies and Strategies; Geographical Pricing, Product Line Pricing, Discounts and Rebates.
b) Meaning and Nature of Promotion, Importance of Promotion, Communication Process, Concept of Integrated Marketing Communication, Meaning of Promotion Mix, Elements of Promotion Mix (Methods of Promotion), Factors Influencing Promotion Mix Decisions, Promotion Mix Strategies, Communication Planning and Control.

Module IV: Distribution (12 Classes)

a) Channels of Distribution: Meaning of a Channel of Distribution, Importance of Channels of Distribution, Types of Distribution Channels, Choice of a Channel of Distribution, Functions of Distribution Middlemen, Distribution Strategies, Wholesaling.
b) Meaning of Physical Distribution, Importance of Physical Distribution, Elements of Physical Distribution, Marketing Logistics Decisions.

Suggested Readings

1. Gupta C.B., Principles of Marketing, Sultan Chand & Sons.
2. Kotler Philip , Marketing Management, Pearson Education, New Delhi.
3. Sherlekar S. A., Marketing Management, Himalaya Publishing House, Mumbai.
4. Kumar A & Meenakshi, Marketing Management, Vikas Publishing House, New Delhi.
5. Saxena R, Marketing, Himalaya Publishing House, Mumbai.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L			
CO 2		M	L	L
CO 3	M	M	M	
CO 4		H	H	M
CO 5				H

CMBS0051: INTERNATIONAL BUSINESS (4 CREDITS – 60 HOURS)

***Objective**: This course provides an overview of the environment, concepts, and basic differences involved in international business.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO 1: Describe the foundation of international business.
CO 2: Describe international organizations and multinational corporations.
CO 3: Define forms of foreign involvement.
CO 4: Discuss international trade theory.

Module I: Introduction to Global Business (15 hours)

Global Business: Scope, Global Linkages today; Culture and Global Business: Elements of culture, Training Challenge; Global Trade and Investment Theory: Mercantilism, Classical Trade Theory, Factor Proportion Theory, International Trade and Product cycle theory, Theory of International Investments; Structure of Indian Foreign Trade: Composition & direction; EXIM Bank; Exit Policy of India; Regulation and Promotion of Foreign Trade.

Module II: Global Financial Markets (15 hours)

Foreign exchange markets; Fixed and Floating Foreign exchange rates; Significant monetary events; Exchange rates, interest rates and economic policy; Economic Integration; Government Trade Policies.

Module III: Global Business Environment (15 hours)

Private International Law; Public International Law; Risk to Global Business; Doctrine of Sovereign Immunity; Doctrine of Eminent Domain; Labour Law Differences; Theoretical foundations of International Business; Balance of Payments; International Liquidity; International Economic; Accounting and Tax differences; Multinational Corporations; Foreign Direct Investment.

Module IV: International Finance (15 hours)

Financing exports and imports; International Capital and Cash Management; Capital Structure: International Dimensions; International Capital Markets; International Banking and Security Markets; IMF; World Bank; IFC; ITA; ADB; WTO.

Suggested Readings

1. Joshi Rakesh Mohan: International Business, Oxford University Press.
2. Cherunilam F: International Business: Text and Cases, PHI Learning.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	M		H
CO 2	M		M	
CO 3		M	H	M
CO 4		H	M	H

CMSH0052: STRATEGIC HUMAN RESOURCE MANAGEMENT (4 CREDITS – 60 HOURS)

***Objective**: The objective of this course is to develop within the students the understanding of the student with relevant concepts, roles and challenges related to strategic human resource management practices in the workplace and design the requisite skills to be competent contributors in the organization's strategic decision-making process and make them competent to for various managerial and administrative positions in different organizations.*

COURSE/ LEARNING OUTCOMES:

After learning this course, the students will be able to:

CO 1: Define the hierarchy of strategy, classify between traditional HR and strategic HR. (Remembering)
CO 2: Explain the factors behind the emergence of strategic human resource management (Understanding)
CO 3: Choose the aims of strategic HRM, interpret the various approaches to strategic HRM and identify the barriers in

implementing HR strategies (Applying)

CO 4: Analyse the concept of HR strategies, explain the approaches of developing HR strategies and analyse the ways in which HR strategies can be implemented (Analysing)

CO 5: Analyse the strategic role of the HR director, determine the strategic role of the HR specialists and design the new mandate for HR

CO 6: Evaluate the various approaches to motivation, develop the retention strategy and flexibility strategy that should be adopted by an organisation (Creating)

Module I: Introduction to Strategic Human Resource Management (12 hours)

Introduction, Strategy, Hierarchy of Strategy, Corporate Level Strategy, Business Level Strategy, Functional Level Strategy, Strategic HRM, Emergence of Strategic Human Resource Management (SHRM), The Evolutionary Stages of Strategic HRM, Difference Between Traditional HR and Strategic HR, Case study

Module II: Concepts of Strategic Human Resource Management (12 hours)

Introduction, Trends in Strategic Human Resource Management, HR Practitioners Role, Human Resource as Competitive Advantage, Aims of Strategic HRM, Approaches to Strategic HRM, Formulation of HR Strategies, The Classical Sequential Approach, The Empirical Need-based Approach, Achieving Strategic Fit, Problems in Achieving Strategic Fit, Benefits of Strategic HRM, Barriers to Strategic HRM, Case study

Module III: Human Resource Strategies and its Implementation (12 hours)

Introduction, HR Strategies, Types of HR Strategies, Overarching Strategies, Specific HR Strategies, Criteria for an Effective HR Strategy, Developing HR Strategies, Methodology for Formulating HR Strategies, Setting Out the Strategy, conducting a Strategic Review, Implementing HR Strategies Barriers to the Implementation of HR Strategies, Overcoming the Barriers, Case study

Module IV: Roles in Strategic Human Resource Management (12 hours)

The Strategic Role of Top Management, The Strategic Role of Front-line Management, The Strategic Role of the HR Director, The Strategic Role of the HR Specialists, The New Mandate for HR, The Specific Strategic Roles of HR, Business Partner, The Innovation Role, The Change Manager Role, The Implementer Role, Case study

Module V: Challenges in Strategic Human Resource Management (12 hours)

Introduction, The Challenges of Workplace Diversity, The Management of Workplace Diversity, Managing Diverse Workforce in an Organisation, Planning a Mentoring Program, Organising Talents Strategically, Retention Strategy, Talent Management Strategy and its components, Approaches to Human Resource Planning, Managing Executive Information Systems, Challenges for HR Managers, HRM Strategic Challenges, Case study

Suggested Readings

1. Deb Tapomoy , Strategic Approach to Human Resource Management Concept, Tools and Application, Atlantic Publishers & Distributors Pvt Ltd.
2. Nayantara Padhi, Strategic Human Resources Management: Theory and Practice, Atlantic Publishers and Distributors Pvt. Ltd; 1 edition
3. Mello Jeffrey A., Strategic Management of Human Resources, Cengage Learning, 3rd edition
4. Sharma A, Khandekar A, Strategic Human Resource Management – An Indian Perspective, SAGE Publications
5. Schuler, R. S., & Jackson, S. E., 2009, Strategic Human Resource Management.2nd ed., Wiley-India
6. Sharma, A and Khandekar, A., 2006, Strategic Human Resource Management: an Indian perspective.1st ed., Response Books.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L			
CO 2		M	L	L
CO 3	M	M	M	
CO 4		H	H	M
CO 5				H

CMCR0053: CONSUMER BEHAVIOUR (4 CREDITS – 60 HOURS)

***Objective**: The objective of this course is that the students should be able to understand the different concepts of consumer behaviour, implications of motivation, personality, perception, learning in marketing, role of social and cultural settings on*

consumer behaviour and consumer buying process and will make them competent for taking responsible positions in the area of marketing in different organizations.

COURSE/ LEARNING OUTCOMES:

After learning this course, the students will be able to:

CO1: Define the consumer behaviour, relate the various marketing implications select the learning principles in marketing, find the influence of culture and subculture on consumer behaviour and define the stages of consumer buying process (Remembering)

CO2: Explain the models of consumer decision process, interpret the concepts of motivation, personality and perception with reference to consumer buying behaviour, relate the concept of conditioning in consumer buying (Understanding)

CO3: Apply the factors influencing consumer behaviour in developing marketing strategies, identify the impact of personality and perception on marketing strategies, choose the important aspects of information processing theory, make use of social stratification to develop marketing strategy, identify purchase decision and post purchase behaviour in varied marketing situations (Applying)

CO4: Analyse market segmentation and segmentation of consumer markets, classify the types of brand personality, analyse the split-brain theory, compare the various types group influence on consumer behaviour and analyse traditional and contemporary models of consumer behaviour (Analysing)

CO5: Assess the positioning strategies on buying behaviour, determine the relationship between personality and self image, evaluate the relationship between traditional and contemporary models of consumer behaviour (Evaluating)

CO6: Discuss the types of research methods, Elaborate the measures of consumer learning and design strategies for influencing family purchasing decision-making and the consumption related roles (Creating)

Module I: Contemporary Dimensions of Consumer Behaviour (12 hours)

Consumer Behaviour, Consumer Decision-Making, Models of Consumer Decision –Making, Types of Consumer Buying Behaviour, Factors influencing Consumer Behaviour, Market Segmentation, Segmentation of Consumer markets, Positioning, Differentiation and Marketing Mix, Marketing Research;Consumer Research Process, Types of Research Methods.

Module II: Marketing implications of Motivation, Personality and Perception (12 hours)

Motivation and its Marketing Implications, Personality and its Marketing Implications, Brand Personality, Personality and self Image, The Concept of Perception, Perception and its Impact on Marketing strategies

Module III: Application of Learning Principles in Marketing (12 hours)

Consumer Learning, Concept of Conditioning, Important Aspects of Information Processing Theory, Split-Brain Theory, Measures of Consumer Learning

Module IV: Implications Social and Cultural Settings on Consumer Behaviour (12 hours)

Influence of culture and Subculture on Consumer Behaviour, Influence of Social Class on Consumer Behaviour, Social Stratification and Marketing Strategy, Group Influence on Consumer Behaviour, Household and Family Influence on Consumer Behaviour, Socialisation of family Members, Family Purchasing Decision-Making and Consumption Related Roles, family Life Cycle.

Module V: Consumer Buying Process (12 hours)

Stages of Consumer Buying Process, Purchase Decision and Post Purchase Behaviour, Traditional and Contemporary Models of Consumer Behaviour; Case study

Suggested Readings

1. Blackwell, Roger D, Paul W Miniard and James F Engel, Consumer Behaviour, Thomson Learning Inc.,2002.
2. Duhan S.N., GarimaSahni N.K. , Consumer Behaviour, 1st edition, 2016, Kalyani Publishers
3. Loudon, David l., and Albert J. Della Bitta, Consumer Behaviour, Tata McGraw Hill, New Delhi
4. Schiffman, Leon G., and Leslie kanuk, Consumer Behaviour, Prentice Hall, New Delhi
5. Schiffman, Kanuk L L., S Ramesh Kumar, Consumer Behaviour, 10th edition, Pearson
6. Dheeraj Sinha, Consumer India Inside the Indian Mind and Wallet, 2011, Jain Book Depot

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L			
CO 2		M	L	L
CO 3	M	M	M	
CO 4		H	H	M

CO 5				H

SPECIALISATION: ACCOUNTING AND TAXATION

CMTM0054: CORPORATE TAX MANAGEMENT (4 CREDITS-60 HOURS)

***Objectives**:*

- *To familiarize students with corporate tax planning.*
- *To cram the process of computation of tax for companies.*
- *To identify the process of business reorganization in terms of tax planning*

COURSE/LEARNING OUTCOMES

At the end of the course the students will be able to:

CO1: Define the concept of tax management. (Remembering)
CO2: Compare between tax planning and tax management. (Understanding)
CO3: Identify the tax planning process of companies. (Applying)
CO4: Analyse various tax incentive plans for corporate sector. (Analysing)
CO5: Measure tax planning in case of amalgamation or de-merger. (Evaluating)
CO6: Adapt the concept of limited liability partnership. (Creating)

Module I: Introduction of Tax Planning and Management: (5 Hours)

Tax planning, tax management, tax evasion and tax avoidance; Nature and scope of tax planning and tax management in the corporate sector.

Module II: Assessment of Companies' Tax Management: (15 Hours)

Residential Status and incidence of tax, Computation of corporate tax: Carry forward and set off of losses in the case of certain companies under Sec. 79 of Income-tax Act, 1961; various deductions available to corporate assess.

Module III: Tax Computation of Companies (15 Hours)

Computation of taxable income of companies;Computation of amount of corporate tax liability; Minimum Alternate Tax; Tax on distributed profits of domestic companies; Tax on income distributed to unit holders.

Module IV: Tax Planning a Specific Tax Management Decisions (10 Hours)

Implications of Tax concessions and incentives for corporate decisions in respect of setting up a new business, location of business and nature of business.

Module V: Business Reorganisation (15 Hours)

Tax Planning in respect of amalgamation or de-merger of companies ,Slump sale, conversion of a firm into a company; Conversion of sole proprietorship into company, Conversion of company into limited liability partnership.

Suggested Readings

1. Srinivas, E.A, Corporate Tax Planning, Tata McGraw Hill, New Delhi.
2. Singhania,Vinod. K,Taxmann's Direct Taxes, Law & Practice, Taxman, New Delhi.
3. Ahuja. Girish & Gupta, Ravi, Bharat's Professional Approach to Direct Taxes, Law & Practice, BharatLaw House Pvt. Ltd., New Delhi.
4. Bhagmati Prasad, Direct Taxes and Laws and Practice, WishwaPrakashan, New Delhi

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M		M	
CO 2	M	H	H		
CO 3		M			H
CO 4			H		

CMAF0055: ACCOUNTING THEORY AND FINANCIAL REPORTING (4 CREDITS-60 HOURS)

***Objectives**:*

- *To provide knowledge about the notion of accounting theory.*
- *To enable students to learn the reporting aspect of specific accounting standards.*
- *To identify the key issues in corporate financial reporting.*

COURSE/LEARNING OUTCOMES

At the end of the course the students will be able to:

CO1: Define the concept of accounting theory.(Remembering)
CO2: Compare various accounting standards (AS). (Understanding)
CO3: Apply the knowledge of IFRSs.(Applying)
CO4: Analyse the FASB and IASB. (Analysing)
CO5: Assess the issues in corporate reporting. (Evaluating)
CO6: Adapt the thought of segment reporting. .(Creating)

Module I: Accounting Theory (15 Hours)
Nature; Classifications of Accounting Theory; Different Approaches toTheory Construction; Factors Influencing Accounting Environment; Measurement in Accounting; Accounting Principles: Generally Accepted Accounting Principles; Indian Accounting Standards.

Module II: Reporting of Explicit Accounting Standards (10 Hours)
AS-1: Disclosure of Accounting Principles; AS-6: Depreciation accounting; AS-9: Revenue Recognition; AS-27: Financial Reporting of Interests in Joint Ventures; AS-29: Provisions, Contingent Liabilities and Contingent Assets.

Module II: Financial Reporting (10 Hours)
Nature, Objectives and Benefits; General purpose and Specific Purpose Report; Qualitative Characteristics of Accounting Information; Conceptual Framework: Financial Accounting Standards Board (FASB)International Accounting Standards Board (IASB).

Module III: International Financial Reporting Standards (Ifrss) (15 Hours)
Role of International Accounting Standards Board (IASB); Arguments for Global Convergence; Required Disclosure as per International Financial Reporting Standards; Achievements of International Accounting Standards Board(IASB)and Obstacles in Convergence;Difference between International Financial Reporting Standards(IFRSs) and Indian Accounting Standards; US GAAP.

Module IV: Issues in Corporate Financial Reporting (10 Hours)
Accounting for Changing Prices; Segment Reporting; Interim Reporting; Foreign Currency Translation

Suggested Readings
1. Porwal, L.S, Accounting Theory, McGraw Hill Education (India) Ltd. New Delhi
2. Lal,Jawahar,Accounting Theory and Practice, Himalaya Publishing House, New Delhi.
3. Das, Arjun &Saxena, Vishal, Accounting Theory & Practice, Navyug Publications; 2nd edition, Uttar Pradesh.
4. Evans, Thomas G., Accounting Theory, South-Western, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			L
CO 2	M	H		M	
CO 3			H		
CO 4				H	
CO 5					H

SPECIALISATION: FINANCE AND INVESTMENT

CMCR0056: ADVANCED CORPORATE FINANCE (4 CREDITS – 60 HOURS)

***Objectives**: The objective of this course is to equip students with the background to act as finance managers in organizations. This course develops a theoretical framework for understanding and Analysing major financial problems of modern firms in the market environment.*

COURSE/LEARNING OUTCOMES
After learning this course, the students will be able to:
CO1: Apply the concept of Time Value of Money for valuation of cash flows. (Applying)
CO2: Explain the determinants of interest rates. (Understanding)
CO3: Illustrate the features of debt securities. (Understanding)
CO4: Build a valuation model for bonds. (Applying)
CO5: Explain Capital structure choices and its impact on the firm. (Understanding)
CO6: Explain the rationale and process of a Mergers and Acquisition deal. (Understanding)

Module I: Interest Rates and Valuation of Cash Flows (15 hours)

Introduction to Time Value of Money; Converting cash across time; Timelines; Finding the present value of a stream of cash flows; Finding the future value of a stream of cash flows; Perpetuity; Annuities – Present Value and Future Value; Growing Cash flows – Growing perpetuity and growing annuity; Determinants of Interest rates; Yield curves.

Module II: Bonds (20 hours)
Features of debt securities – Indenture and covenants, Maturity, Par Value; Coupon rates; Embedded options bonds; Risk associated with bonds – Interest rate risk, Yield Curve risk, Call and prepayment risk, Credit risk, Liquidity risk, Sovereign risk; Yield spreads; Valuation of Bonds; Measurement of Interest rate risk.

Module III: Capital Structure and Payout Policy (15 hours)
Capital Structure choices – Across industries and within industries; Leverage and firm value; Effect of leverage on risk and return; Homemade leverage; Leverage and cost of capital; Costs of Bankruptcy and financial distress – Direct and Indirect costs; Tradeoff theory of Optimal Capital Structure; Dividend versus share repurchase in perfect capital markets; Payout versus retention of cash; Signaling with payout policy; Dividends, splits and spin offs.

Module IV: Mergers and Acquisitions (10 hours)
Background and trends; Rationale of a mergers and acquisition (M&A) deal; Steps in M&A deal; Takeover defences – Poison pills, Staggered Boards, White Knight, Golden Parachutes; Value added in a takeover.

Suggested Readings

1. Berk and DeMarzo: Corporate Finance, Pearson.
2. Brealey, Richard/ Myers, Stewart C. / Allen, Franklin: Principles of Corporate Finance, McGraw Hill.
3. AswathDamodaran: Investment Valuation, John Wiley.
4. Ross, Westerfield, Jordan: Fundamentals of Corporate Finance, McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		H
CO 3		M	M	
CO 4			H	

CMBK0057: INVESTMENT BANKING (4 CREDITS – 60 HOURS)

***Objectives**: The objective of this course is to acquaint students with the various models of equity valuation. Students are expected to be proficient in the use of Microsoft excel for conducting a comparable company analysis and discounted cash flow valuation of a publicly traded company.*
process. (Understanding)

Module I: Comparable Companies Analysis (15 hours)
Comparable companies analysis steps; Selecting the universe of comparable companies; Identifying key characteristics of target; Spread key statistics, ratios and trading multiples; Benchmarking comparable companies; Valuation implied by EV/EBITDA; Valuation implied by P/E; Pros and cons of comparable analysis.

Case study I: Valuation of a publicly listed company using comparable company analysis.

Module II: Discounted Cash Flow Analysis I (15 hours)
Summary of Discounted Cash Flow (DCF) analysis steps; Studying the target, Determination of key performance drivers; Financial statement analysis for valuation; Estimation of growth; Models for estimation of Cost of Equity – Capital Asset Pricing Model and Fama-French model.

Case study II: Valuation of a publicly traded company using Discounted Cash Flow model.

Module III: Discounted Cash Flow Analysis II(15 hours)
Estimation of cost of debt; Determination of Weighted Average Cost of Capital; Projection of Free Cash Flow; Determining Terminal Value- Exit Multiple method and Perpetuity growth method; Calculation of present value; Determination of Valuation; Pros and cons of DCF analysis.

Case study II (contd.): Valuation of a publicly traded company using Discounted Cash Flow model.

Module IV: Leveraged Buyouts(15 hours)
Meaning and objective of Leveraged Buyout (LBO); Rationale of LBOs in modern finance; Key participants; Characteristics of a strong LBO candidate; Economics of LBO; Exit and Monetizing strategies; LBO financing.

Suggested Readings

1. Rosenbaum and Pearl: Investment Banking, Wiley Finance.
2. E. Soubeiga: Mastering Financial Models, McGraw Hill.
3. J. Tija: Building Financial Models, McGraw Hill.
4. PratapGiri S: Investment Banking, McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	M	H	
CO 2	M	M	M	L
CO 3		H	M	M
CO 4		M	H	H

SPECIALIZATION: MANAGEMENT

CMIG0058: INTERNATIONAL MARKETING (4 CREDITS – 60 HOURS)

***Objective**: To familiarize the students with the concept and issues of international marketing and enable them to be able to analyse the foreign market environment and develop international marketing strategies for a business firm.*

COURSE/ LEARNING OUTCOMES

After learning this course, the students will be able to:

CO1: Define international marketing (Remembering)
CO2: Explain International Product Planning and Pricing decisions (Understanding)
CO3: Identify the traditional to modern channel structures, Intermediaries (Applying)
CO4: Analyse the international distribution decisions in terms of issues and planning (Analysing)
CO5: Evaluate the different aspects of international promotional strategies (Evaluating)
CO6: Elaborate the trends associated with international marketing in the present context (Creating)

Module I: Introduction: Introduction to International Business (14 hours)

An overview; International marketing management process, International marketing information system. International Marketing Environment: Influence of physical, economic, socio - cultural, political and legal environments on international marketing decisions; International marketing information system. International Market Segmentation, Selection and Positioning; International market entry strategies – Exporting, licensing, contract manufacturing, joint venture, setting -up of wholly owned subsidiaries abroad.

Module II: International Product Planning and Pricing decisions (14 hours)

Major Product decisions-product design, labeling, packaging, branding and product support services; Product standardization vs. adaptation; Managing product line; International trade product life cycle; New product development. Pricing decisions for International Markets: Factors affecting international price determination; International pricing process and policies; Delivery terms and currency for export price quotations; Transfer pricing; Counter trade as a pricing tool- types and problems of counter trading.

Module III: International Distribution Decisions (12 hours)

Distribution channel- from traditional to modern channel structures, Intermediaries for international markets-their roles and functions; Alternative middlemen choices, Factors affecting choice of channels; Locating, selecting and motivating channel members; International distribution logistics- Issues and Planning.

Module IV: International Promotion Strategies (12 hours)

Communications across countries-complexities and issues; Country -of-origin effect; Sales promotions in international markets, trade fairs and exhibitions, International public relations, International Advertising decisions, Personal selling and sales management; Developing international promotion campaign.

Module V: Emerging trends in International Marketing (8 hours)

International Marketing through Internet; Ecological concerns and international marketing ethics.

Suggested Readings

1. Cateora, Philip R, Grahm John L and Prashant Salwan, International Marketing, Tata Mc Graw Hill
2. Czinkota, Michael R. and Illka A. Ronkainon, International Marketing, Cengage Learning
3. International Marketing, P K Vasudeva, 4th edition, 2010, Excel Books , New Delhi.
4. Jain, Subash C., International Marketing, South-Western.
5. Keegan, Warran J and Mark C Green, Global Marketing, Pearson

6. Kotabe, Masaaki and Kristiaan Helsen, Global Marketing Management, John Wiley and Sons.
7. Onkvist, Sak and John J.Shaw, International Marketing; Analysis and Strategy, Psychology Press.
8. Rajagopal, International Marketing, Vikas Publishing House.
9. Terpstra, Vern; Foley, James and Ravi Sarathy, International Marketing, Naper Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L			
CO 2		M	L	L
CO 3		M	M	
CO 4	M		H	M
CO 5				H

CMBC0059: BUSINESS ETHICS AND CORPORATE GOVERNANCE (4 CREDITS-60 HOURS)

***Objective**: This paper aims at providing the students the understanding of ethical issues related to business and good governance necessary for long term survival of business.*

COURSE/LEARNING OUTCOMES

After learning the course the students will be able to:

CO1: Define business ethics. (Remembering)
CO2: Distinguish between ethical and unethical behavior at workplace. (Understanding)
CO3: Elaborate the various theories on ethics in practice. (Applying)
CO4: Evaluate legal and economic aspects of ethics in business. (Analysing)
CO5: Interpret the accountability hierarchy from a corporate governance perspective. (Understanding)
CO6: Design issues involved in addressing litigation risks in corporate governance and regulatory contexts. (Creating)
CO7: Examine ethical theories and frameworks to Analyse ethical dilemmas in business and resolve practical problems. (Analysing)
CO8: Identify different stakeholders and understand why they may hold differing perspectives on ethical issues. (Applying)

Module I: Introduction (9 hours)

Definition & nature of business ethics, characteristics, ethical theories; causes of unethical behavior;ethical abuses; work ethics; code of conduct; public good.

Module II: Ethics Theory and Beyond (13 hours)

Management of ethics - ethics analysis [Hosmer-model]; ethical dilemma; ethics in practice, ethics for managers; role and function of ethical managers- comparative ethical behavior of managers; code of ethics; competitiveness, organizational size, profitability and ethics; cost of ethics in corporate ethics evaluation; business and ecological / environmental issues in the Indian context and case studies.

Module III: Legal Aspects of Ethics (10 hours)

Political – legal environment; provisions of the Indian constitution pertaining to business; political setup – major characteristics and their implications for business; prominent features of MRTP &FERA; social – cultural environment and their impact on business operations, salient features fIndian culture and values.

Module IV: Environmental Ethics (10 hours)

Economic environment; philosophy of economic growth and its implications for business, main features of economic planning with respect to business; industrial policy and framework of government contract over business; role of chamber of commerce and confederation of Indian industries.

Module V: Corporate Social Responsibility and Governance (15 hours)

Definition, evolution and need for CSR; theoretical perspectives; corporate citizenship; business practices; strategies for CSR; challenges and implementation; evolution of corporate governance; governance practices and regulation; structure and development of boards; role of capital market and government; governance ratings; future of governance- innovative practices; case studies with lessons learnt

Suggested Readings

1. Sherlekar S.A. , Ethics in Management, Himalaya Publishing House.
2. William B. Werther and David B. Chandler, Strategic corporate social responsibility, Sage Publications Inc.
3. Robert A.G. Monks and Nell Minow, Corporate governance, John Wiley and Sons.
4. Shaw W.H., Business Ethics, Cengage Learning.
5. Beeslory, Michel and Evens, Corporate Social Responsibility, Taylor and Francis.

6. Kotler Philip and Lee Nancy, Corporate social responsibility: doing the most good for company and your cause, Wiley.
7. Banerjee Subhabrata Bobby , Corporate social responsibility: the good, the bad and the ugly,
8. Edward Elgar Publishing.
9. Kumar Satheesh , Corporate governance, Oxford University, Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L			
CO 2		M	L	L
CO 3			M	M
CO 4		M		H
CO 5	M		H	

CMEM0060: ENTREPRENEURSHIP MANAGEMENT AND E-COMMERCE (4 CREDITS- 60 HOURS)

***Objective**: The students develop and can systematically apply an entrepreneurial way of thinking that will allow them to identify and create business opportunities that may be commercialized successfully.*

COURSE/LEARNING OUTCOMES

CO1: Define entrepreneurship, its features and ability to discern distinct entrepreneurial traits (Remembering)
CO2: Illustrate the parameters to assess opportunities and constraints for new business ideas (Understanding)
CO3: Demonstrate the systematic process to select and screen a business idea(Understanding)
CO4: Choose the entrepreneurship as a career objective (Applying)
CO5: Analysing the legal framework to set up new ventures (Analysing)
CO6: Find the meaning and Concept of E-Commerce; Business Model for E Commerce (Remembering)
CO7: Discuss the entrepreneurial prospects in e-commerce (Creative)

Module I (15 Hours) Entrepreneurship Development Perspective

a) Entrepreneurship: Definition, Concept, Growth and role. The Entrepreneur : Types, characteristics, theories of entrepreneurial class, Urges and importance of Entrepreneurship Stimulates; Seed Beds of Entrepreneurship, Influencing Factors; Problems(Operational and Non Operational) and Obstacles. Entrepreneurial Management. Role of socio economic environment.

b) Skills for a New Class of Entrepreneurs; The Ideal Entrepreneurs; The Entrepreneurship Audit; Identification of opportunities by an Entrepreneur; The steps to identify the project/ ventures; Process of converting business opportunities into reality; Feasibility Report and analysis; Process of setting up a small scale industry/unit.

Module II (15 Hours) Creation Entrepreneurial Venture

Promotion of a venture, External Environment Analysis; Economic, Social, Technological and competition; Legal Framework for establishing and fund raising Venture Capital: Sources and Documents required, SWOC Analysis.

Module III (15 Hours) Promotion and Development of Entrepreneurship

Exports and entrepreneurs. Balanced Regional Development and Entrepreneurs, relevant Acts for Entrepreneurs (An overview only); Foreign Exchange and Entrepreneurs; Micro and small enterprises; Recent Initiatives taken by the government to revitalize the Entrepreneurship. NPSD – National Policy for Skill Development and Entrepreneurship 2015, Institutions in aid of Entrepreneurship Development – The National institute for Entrepreneurship and small business development, District Industry Centre (DIC), National Alliance of young Entrepreneurs.

Module IV (15 Hours)

a) Introduction to E-commerce: Meaning and Concept of E-Commerce; Business Model for E Commerce; Sales and Marketing Cycle; Features of E Commerce; Element of E-Commerce; Benefits and Limitations of E-Commerce; Types of E-Commerce

System; B2B, B2C, C2C, C2B, B2G andG2C.

b) Electronic Payment systems : Features of an ideal electronic payment system; Types of an Electronic Payment System, Credit Cards, Debit Cards, Smart Cards, E-Money, E Check and Electronic fund transfer (EFT). Need of security in E Commerce; Essential security requirements for safe electronic payments; Security Schemes for an Electronic Payment Systems, Encryption, Digital Signature, Security Certificates; internet security Protocol, SSL, HTTP,SET.

Suggested Readings

1. Entrepreneurship Development Institute of India, "Handbook for New Entrepreneurs", Oxford University Press.
2. Patel V. G., "When the Going Gets Tough – Strategic responses to Business Crisis", Tata McGraw Hill Publishing Company Limited.
3. Desai Vasant, "Small scale industries and entrepreneurship", Himalayan Publishing House.
4. Desai Vasant, "Management of small scale industries", Himalayan Publishing House.
5. Bolton William, "The University Handbook on Enterprise Development", Columbus.
6. Desai Vasant, "Management of small scale industries", Himalayan Publishing House.
7. Gupta Sarika, E-Commerce, Publisher: Khanna Books
8. Joseph P. T., E-Commerce, An Indian Perspective, Prentice Hall India Pvt., Limited

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	M		
CO 2		M	H	
CO 3			M	H
CO 4		L	M	H

SPECIALISATION: ACCOUNTING AND TAXATION

CMMD0061: MODERN ACCOUNTING (4 CREDITS-60 HOURS)

***Objectives**:*

- *To provide knowledge about the various concepts of accounting.*
- *To learn the application of various accounting concepts.*
- *To categorize the key areas of modern accounting.*

COURSE/LEARNING OUTCOMES

At the end of the course the students will be able to:

CO1: Define the concept of modern accounting. (Remembering)
CO2: Compare various systems of modern accounting. (Understanding)
CO3: Apply the knowledge of environmental accounting. (Applying)
CO4: Analyse behavioural accounting. (Analysing)
CO5: Assess the challenges in social accounting. (Evaluating)
CO6: Adapt the thought of forensic accounting. (Creating)

Module I: Introduction to Modern Accounting (10 Hours)

Various concepts of modern accounting: inflation accounting, environmental accounting, social accounting, forensic accounting and behavioural accounting; its application, process and its scope.

Module II: Inflation Accounting (10 Hours)

Meaning; techniques of inflation accounting; determination of value of assets and liabilities under inflation accounting; accounts preparation under inflation accounting.

Module III: Social and Environmental Accounting (10 Hours)

Meaning; purpose of social accounting; scope & objectives of social accounting; benefits & challenges of social accounting; accounting under social accounting, Meaning; functions of environmental accounting; valuation process under environmental accounting, methods of evaluation under environmental accounting; accounts preparation under environmental accounting.

Module IV: Forensic Accounting (10 Hours)

Meaning;branches of forensic accounting; activities under forensic accounting; procedure of forensic accounting; stages of forensic accounting; application and consequences of forensic accounting.

Module V: Behavioural Accounting (10 Hours)

Meaning; process of behavioural accounting; application of behavioural accounting; techniques of behavioural accounting; influence of accounting information on behaviour.

Module VI:
Definition and objectives of HRA, Evolution and historical development, Importance and relevance in modern business, Methods of Human Resource Valuation- Cost-based methods (historical cost, replacement cost), Economic value methods (present value of future earnings, opportunity cost) Behavioral approaches to valuation, Human Capital Reporting Standards and Guidelines Global standards (e.g., International Accounting Standards - IAS) Reporting guidelines for human capital

Suggested Readings

1. Lal, Jawahar, Accounting Theory and Practice, Himalaya Publishing House, New Delhi
2. Pedneault, Stephen, Forensic Accounting and Fraud Investigation for Non–Experts, John Wiley & Sons; 3rd edition , New Delhi.
3. Pahuja, Shuchi, Environmental Accounting & Reporting: Theory, Law & Empirical Evidence, New Century Publications, New Delhi.
4. Hellmann, Andreas, Behavioural Accounting, Routledge; 1 edition, New Delhi.
5. Rao, P.M., Corporate Social Accounting and Reporting, Deep & Deep Publications Pvt.ltd , Delhi.

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M		M	
CO 2	M	H	H		
CO 3		M			H

CMAV0062: ADVANCED ACCOUNTING (4 Credits- 60 hours)

***Objective**: The objective of this course is to provide advanced knowledge in the field of accounting. It stresses on specialised accounting processes followed in specific organisations. This course also gives insight into various modern concepts of Accounting.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: Define the recent concepts of accounting (Remembering)
CO2: Explain the various modes of liquidation of companies (Understanding))
CO3: Compare the accounting techniques followed under general and special processes and determine insurance claims from loss of profit and stock (Analysing and Applying)
CO4: Construct financial statements of insurance and banking companies (Creating)

Module I: Conceptual Framework (10 credits)
Capital Maintenance Adjustments, Recognition of the elements of Financial Statements, Concept of Capital and Capital Maintenance, GAAP and Accounting Standards in India, Compliance Requirements of Accounting Standards in India, Applicability of Accounting Standards in India, Applicability of Indian Accounting Standards (IND-AS)

Module II: Accounts of Banking Companies (15 credits)
Accounting of Banking Companies: Nature, Features of Banking Companies, Banking Regulation Act, 1949, Rebate on Bills Discounted, Income recognition, Statutory books to be maintained, special features of Bank bookkeeping, Preparation and presentation of Financial Statements of Banks, Advances and its classification, provisions to be made against advances.

Module III: Accounts of Insurance Companies and Insurance Claims (15 credits)
Accounting of Insurance Companies: Meaning of Insurance Business, Accounts of Life insurance company – Revenue Account, Profit and Loss Account and Balance Sheet, Ascertainment of profit under Life insurance business, Accounts of general insurance business – Revenue Account, Profit and Loss Account and Balance Sheet.
Insurance Claims: Average clause, indemnity period, procedure of ascertaining loss of stock and loss of profit, Ascertainment of claims against loss of stock and loss of profit.

Module IV: Investment Accounts and Liquidation of a company (15 credits)
Investment Account: Meaning, features, concept of cum-interest, ex-interest, cum-dividend, ex- dividend, Accounting for fixed interest learning securities and variable earning securities, bonus shares and right shares, Intercompany investment.
Winding up of a company: Meaning, winding up by National Company law Tribunal, Modes of Winding up, preferential payments, Preparation of Statement of Affairs, Liquidator's Final statement of Account.

Module V: Inflation and Government Accounting (5 credits)

Government Accounting: Meaning, features and Objectives of Government Accounting; difference between commercial accounting and Government Accounting; General Principles of Government Accounting; System of financial administration and financial control in India; Accounts keeping of the government; Classification of Accounts in Government Accounting, Accounting for Human Resources in an Organisation.

Suggested Readings

1. JawaharLal, Financial Accounting, S Chand
2. Hanif & Mukherjee Advanced Accounting, McGraw Hill Education.
3. Dam B. B., Advanced Accounting, Capital Publishing Company
4. Khan M. Y., Advanced AccountingM.C. Shukla, Advanced Accounting, S Chand & Co.
5. Maheshwari S. N. Advanced Accounting, Vikas Publishing.

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2			M	M	
CO 3			H		
CO 4				H	H

SPECIALISATION: FINANCE AND INVESTMENT

CMFI0063: FINANCIAL INSTITUTIONS MANAGEMENT (4 CREDITS – 60 HOURS)

***Objectives**: The objective of this course is to impart the knowledge of the banking, finance and insurance industry to the students. The student will be able to articulate the operations of each of this industry; understand the various potential conflicts of interests and analyse the regulatory structure of the industry.*

COURSE/LEARNING OUTCOMES

After learning this course, the students will be able to:

CO1: Explain the operations of the banking industry. (Understanding)
CO2: Analyse the potential conflicts of interest in the banking industry. (Analysing)
CO3: Explain the operations of the Insurance industry. (Understanding)
CO4: Explain the operations of the financial services industry. (Understanding)
CO5: Outline the risks in the financial industry. (Understanding)
CO6: Analyse the regulatory framework in the banking and financial industry. (Analysing)

Module I: Banking (15 hours)

Commercial Banking; Capital requirements of Banks; Merchant Banking; Investment Banking; Securities trading; Potential conflicts of Interests in Banking; Large Banks and their implications; Risks in Banking. Case study: 2008 financial crisis

Module II: Insurance companies (15 hours)

Life insurance companies: size, structure, composition of industry, recent trends and regulations; Property-casualty insurance: size, structure, composition of industry, recent trends and regulation; Health insurance; Moral hazard and adverse selection; risks in insurance industry.

Module III: Financial services industry (15 hours)

Mutual funds: size, structure, composition of industry, types, objectives, costs, recent trends and regulations; Hedge funds: types of hedge funds, fees in hedge funds industry, offshore hedge funds, and regulation of hedge funds.

Module IV: Risk and regulation (15 hours)

Interest rate risk; Market risk; Credit risk; Off balance sheet risk; Foreign exchange risk; Sovereign risk; Technology and Operational risk; Liquidity risk; Insolvency risk; Liability and liquidity management; Deposit insurance; Basel norms: rationale, Basel I, Basel II, Basel III; Dodd-Frank Act.

Suggested Readings

1. John C Hull: Risk Management and Financial Institutions, Wiley Finance Series.
2. Saunders: Financial Institutions Management, McGraw Hill.
3. Kohn: Financial Institutions and Markets, Oxford University Press.

4. Frank J Fabozzi, Franco Modigliami: Capital Markets – Institutions and Instruments, PHI Learning.

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	M	L	
CO 2		H		
CO 3	H			M
CO 4				H
CO 5			H	

CMSP0067: SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT
Credit 5 (60 hours)

This course provides a broad overview of investment management, focusing on the application of finance theory to the issue faced by portfolio managers and investors in general and to provide conceptual foundation for the purpose of undertaking Investment analysis for securities as well as portfolios

Objectives:

1. Gain knowledge and insights on the functioning of Financial Market.
2. Develop tools and skills for security analysis.
3. Develop tools and approaches to help navigate the complexities and challenges in Financial Market.

COURSE OUTCOMES:

CO1: Remembering: Remembering the key terms/concepts in the field of investments.
CO2: Understanding: To provide a theoretical and practical background in the field of investments.
CO2: Understanding: Understand both the mechanics and operations of financial markets
CO3: Applying: Application of models used in valuation of equity and portfolio management.
CO4: Analysing: Fundamental and technical evaluation of securities in equity and bond markets.

Module I Introduction (10 hours)

Investment alternatives and their evaluation: Risk and Return- measurement of risk and return, Risk in a contemporary mode- beta, CAPM, Fixed income securities, Stock market and indices, Index calculation, Bond Market and Government Securities.

Module II Security analysis II (20 hours)

Evaluation of Fixed income securities, Evaluation of equities- Fundamental analysis: Concept of intrinsic and market value, economy, industry and company analysis. Technical analysis: chart pattern, price actions, determining support and resistance, break outs and break downs, working on tools. Valuation of shares based on: Earnings, Dividend and Net assets, CAPM, Valuation of bonds and bond yields. – Working with analytics - Beta, covariance, variance and standard deviation, correlation and regression.

Module III Portfolio Management (15 hours)
Portfolio Management – Risks and Returns: Concept of portfolio and portfolio management, concept of risk, optimal portfolio- portfolio diversification, mechanics of diversification. Working with efficient frontier, capital market line and indifference curve on a hypothetical portfolio.

Module IV Financial Derivatives (15 hours)
Financial Derivatives: Futures, Options, Portfolios of futures and options synthetics, Exotics and Financially engineered products.

CO mapping:

Outcome	Module I	Module II	Module III	Module IV
CO1	M	M	M	M

CO2	H	H	H	M
CO3	M	M	H	H
CO4	H	H	H	M

Suggested readings:

1. Damodaran, A., Damodaran on Valuation – Security Analysis for Investment and Corporate Finance, 2nd Edition, Wiley India, 2008.
2. Fischer, D.E. and Jordan, R., Security Analysis and Portfolio Management, 6th Edition, Pearson Education, 1995.
3. Graham, B., and Dodd, D.L., Security Analysis, 6th Edition, Tata McGraw-Hill Education, 2008.
4. Kevin, S., Security Analysis and Portfolio Management, PHI Learning, 2009.
5. Khatri, D.K., Security Analysis and Portfolio Management, Macmillan Publishers India, 2010.
6. Ranganathan, M. and Madhumati, R., Security Analysis and Portfolio Management, 2 nd Edition, Pearson, 2012.
7. Reily, F. and Brown, K.C., Analysis of Investments and Portfolio Management, 10th Edition, Cengage Learning, 2012.

CMIL0065: MANAGEMENT OF INDUSTRIAL LAWS (4 CREDITS- 60HOURS)

***Objective**: The objective of this course is to make the students aware of the legal aspects of management. Every industrial concern is set to follow certain terms and guidelines and the management has to take due care about it. This course will give a detailed idea about the various industrial laws and its provisions.*

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: Define the terms commonly used in industrial laws (Remembering)
CO2: Explain the various provisions of labour laws (Understanding)
CO3: Identify the factors essential for management of labour unions (Applying)
CO4: Analyse the different theories of Trade Unionism.(Analysing)
CO5: Assess the impact of economic changes upon labour management (Evaluating)
CO6: Develop a model of business management abiding by all industrial laws (Creating)

Module I: Introduction to Labour Laws (15 credits)

Origin and Development, Objectives and Principles of Labour Laws, Development of Labour Laws in India, Concept of Industrial Relations- Importance, Scope & Aspects of Industrial Relations, Factor Affecting Industrial Relations, Different approaches/perspectives of Industrial Relations, Industrial conflict, unfair labour practices, concept of Labour welfare & activities of labour welfare officer, Political influence on trade unions, Workers Education, Role of trade union in the changed economic scenario.

Module II: Regulatory framework for management of industries (15 credits)

Trade Union Act, 1926, The Industrial Employment (Standing Orders) Act, 1946, Factories Act, 1948, Payment of Bonus Act, 1956, Payment of Wages Act, 1936: scope, objectives and important provisions

Module III: Dispute and settlement (15 credits)

Industrial Disputes Act, 1947: Industrial Disputes, Development of Industrial Disputes Legislations in India, Mechanisms for settlement of Industrial Disputes, Constitutional and Statutory Framework in India, unions and technological changes, Industrial relation system, Instruments of economic coercion, discipline, domestic enquiry grievance procedure and disciplinary action, Principle of natural justice.

Modu:le IV Prevention and legal regulations regarding labour management (15 credits)

Machinery for prevention of industrial disputes, Welfare Officer works committees, Joint Management Council, Ethical Codes, Methods of setting Industrial Disputes, Arbitration Adjudication, Tripartite and Bipartite Machinery, Collective Bargaining, workers' participation in management, Labour management and cooperation, Industrial relations and related legislations with special reference to industrial disputes Act, 1947, labour welfare and social security, Lok Adalat as a body to conduct mediation. Case studies

Suggested Readings

1. Goswami G V , Labour Industrial Laws, Central Law Agency.
2. Pillai K M , Labour and Industrial Law, Allahabad Law Agency
3. Mishra S N , Labour and Industrial Laws, Central Law PublicationsS
4. Singh BD , Labour Law for Managers, Excel Books, New Delhi,
5. Pai GB , Labour Law in India, Butterworth's India, New Delhi
6. Srivastava SC, Industrial Relations and Labour Laws, Vikas Publishing House.

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV

CO 1	L	M	H	H
CO 2	M	M	H	
CO 3		H	M	H
CO 4		L	M	H

CMSM0066: SUPPLY CHAIN MANAGEMENT AND LOGISTICS (4 CREDITS – 60 HOURS)

Objective*: The objective of this paper is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for an international firm.*

COURSE/LEARNING OUTCOMES

After learning the course, the students will be able to:

CO1: Define the process of supply chain management. (Remembering)

CO2: Demonstrate operational purchasing methods and techniques on supplier management and supply in specific business contexts. (Understanding)

CO3: Explain the strategic importance of logistics elements and describe how they affect supply chain management. (Understanding)

CO4: Apply sales and operations planning, MRP and lean manufacturing concepts. (Applying)

CO5: Analyse the creation of new value in the supply chain for customers, society and the environment. (Analysing)

Module I: Basic Framework (9 hours)

Concept of supply chain management (SCM); SCM and trade Logistics; Business view of SCM; Push and pull of SCM; Decision phases; Impellers and drivers in SCM Process views of SCM, planning and operations; Supply chain modeling; Role of Relationship marketing in SCM; managing relationships with suppliers and customers; Designing strategic distribution network; Factors influencing distribution network.

Module II: Supply Chain and Information Management Systems (13 hours)

Purchasing Process- Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle;Supplier selection and evaluation; Vendor development; Importance of information management; Distribution and sharing of information; Information Technology as a platform for effective and efficient supply chain management.

Module III: Logistic System (10 hours)

Concept, objectives and scope of logistics; System elements; Inbound and Outbound logistics. Reverse inventory, Value added role of logistics, Logistics interface with manufacturer and marketing, Packing, Marking, Just in time concept; Third party logistic outsourcing–challenges and future directions.

Module IV: Transportation (16 hours)

Importance of effective transportation system; Service choices and their characteristics; inter- modal services; Transport cost characteristics and rate fixation; Carrier selection determinants and decision; Structure of Shipping: World seaborne trade; international shipping - characteristics and structure;Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Charter, party agreement; Development in sea transportation-Unitization, containerisation, inter and multimodal transport; CFC and ICD; Indian shipping – growth, policy and problems; Ports and port trust; International Air transport: International set up for air transport: Freight rates; India's exports and imports by air – Problems and prospects;Carriage of Goods by sea, sea and combined transport.

Module V: Warehousing and Inventory Management (12 hours)

Warehousing And Marketing Strategy;Objectives and functions of warehousing; Warehouse Strategies; Material handling equipment and material mobility Warehousing evaluation and requirements.

Inventory management-inventory categories, EOQ, LT, ICC; Inventory levels; Material planning and sourcing of procurement; Methods of cost reduction.

Suggested Readings

1. Ballau, R.H., Business Logistics Management, Prentice Hall,Englewood Cliffs.
2. Bes, J., Chartering Practices.
3. Bes, J., Dictionary of Shipping and chartering Practices.
4. Christopher, M., Logistics and Supply Chain Management, Prentice Hall.
5. ICAO Journal, New York., various issues.
6. Indian Shipping and Transport, Mumbai, Various issues.
7. Murphy, Paul R. and Donald F. Wood, Contemporary Logistics, Prentice Hall.
8. Marks, Daniel, Shipping Cartels.
9. Shapiro, R., Logistics Strategy: Cases and Concepts, West Publishing, St. Paul.
10. Coughlan, A.,Anderson, E. and Louis W. Stern, Marketing Channels, Prentice Hall.
11. The Marine Times, Mumbai, various issues.

12. John J Coyle, C. John and Langley,Brian J Gibs, Logistics approach to Supply Chain Management, Cengage Learning.
13. Burt, Dobler and Starling, World Class Supply Management, Tata McGraw Hill.
14. Bowersor, Donald J and David J Closs, Logistics management and Integrated Supply Chain Management, Tata McGraw Hill

Mapping of Course Outcomes

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L			
CO 2		M	L	L
CO 3			M	M
CO 4		M		H
CO 5	M		H	

CMDS6006: DISSERTATION-I (RESEARCH SOFTWARE) (4 CREDITS- 60 HOURS)

***Objective**: The objective of the course would be to educate the students about the various dimensions of a research based project work. The students will also be taught about the application of statistical tools through SPSS.*

This phase of the Dissertation will comprise of the following:

1. **Synopsis**: Submission of a write up on a specific area/topic of study (10hours)
2. **Review of Literature**: Submission of a specified number of reviews to respective guide (15 hours)
3. **Research Methodology**: Lecture based on the topic of study. (10 hours)
4. **Referencing Style**: Lecture on referencing style to be followed while submitting report (5 hours)
5. Training on application of Statistical software used in research (20hours)
6. **Submission of Progress Report after completion of Phase I**: Report should comprise of Introduction, Review of Literature, Research Methodology and References.

EVALUATION:

A diary will be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester. Evaluation at Phase I will be done by the respective guide based on timely submission of part-work and quality of work as follows:

Synopsis (30marks)
Review of Literature (30marks)
Research Methodology (30marks)
Referencing (10marks)

CMDS6007: DISSERTATION-II (6 credits - 75 hours)

***Objective**: The objective of the course would be to develop analytical skills among the students for solving any research queries. The students will also be taught about the preparation of a project report.*

This phase of the Dissertation will comprise of the following:

1. **Field Work**: Collection of data and validation with the respective guide (30 hours)
2. **Analysis of Data**: Analysis and presentation of the data collected though application of various statistical tools though SPSS and other statistical software packages. (10 hours)
3. Test of Plagiarism.
4. **Submission of Project Report**: Submission of the complete report in continuation from Phase I.
5. Presentation of work using PPT and Viva Voce Examination.

EVALUATION:

Evaluation at Phase II will be done by a panel comprising of an external and internal expert along with the respective guide based on quality of work as follows:

Report (50marks)
Presentation (30marks)
Viva-Voce (10marks)

Suggested Reading

1. Singh, J.K.Venture Capital Financing in India. Dhanpat Rai and Company,NewDelhi.
2. Annual Reports of Major Financial Institutions in India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	
CO 5					H

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES
DEPARTMENT OF CHEMISTRY
MASTER OF SCIENCE IN CHEMISTRY – MSc Chemistry

SEMESTER I				
Type of Course/ Category	**Course Code**	**Course Name**	**Credits L-T-P**	**Page**
Theory/DC	CHIC0003	Fundamentals of Inorganic Chemistry	4-0-0	1266
Theory/DC	CHOC0004	Fundamentals of Organic Chemistry	4-0-0	1267
Theory/DC	CHPC0005	Fundamentals of Physical Chemistry	4-0-0	1268
Theory/DC	CHQT0029	Introduction to Quantum Chemistry and Group Theory	4-0-0	1286
Lab/DC	CHIQ6002	Inorganic Qualitative and Quantitative Analyses and Preparations - Lab	0-0-3	1290
Audit Course	CHSL0200	Elements of Service Learning	NC	1288
Value Added Course	CHPC6137	Petroleum Chemistry	NC	1292
Total Credits			**19**	
SEMESTER II				
Theory/DC	CHIR0007	Advanced Inorganic Chemistry I	4-0-0	1269
Theory/DC	CHOG0008	Advanced Organic Chemistry I	4-0-0	1270
Theory/DC	CHAP0009	Advanced Physical Chemistry I	4-0-0	1271
Theory/DC	CHFY0030	Fundamentals of Spectroscopy	4-0-0	1287
Theory/DC	CHGC0011	Introduction to Green and Environmental Chemistry	3-0-0	1272
Lab/DC	CHEQ6003	Experimental Physical Chemistry - Lab	0-0-3	1290
Value Added Course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	1292
Total Credits			**22**	
SEMESTER III				
Theory/DC	CHAI0012	Advanced Inorganic Chemistry II	4-0-0	1272
Theory/DC	CHAO0013	Advanced Organic Chemistry II	4-0-0	1274
Theory/DC	CHAP0014	Advanced Physical Chemistry II	4-0-0	1274
Theory/DC	CHSP0015	Special Topics in Biochemistry	3-0-0	1275
Theory/DC	CHAP0031	Applied Spectroscopy	3-0-0	1288
Theory/DC	CHRM0017	Research Methodology for Chemistry	3-0-0	1276
Lab/DC	CHQA6004	Organic Qualitative Analysis and Synthesis Lab	3-0-0	1291
Value Added Course	CHPC6137	Petroleum Chemistry	NC	1292
Total Credits			**24**	
SEMESTER IV				
Theory/ DE	CHMC0018	Materials Chemistry	3-0-0	1277
Theory/ DE	CHCC0019	Computational Chemistry	3-0-0	1278
Theory/ DE	CHFC0020	Food Chemistry	3-0-0	1279
Theory/ DE	CHIC0021	Industrial Chemistry	3-0-0	1280
Theory/ DE	CHMD0022	Medicinal Chemistry	3-0-0	1281
Specialization I: Inorganic Chemistry				
Theory/ DE	CHOC0027	Organometallic Chemistry	3-0-0	1284
Theory/ DE	CHIP0028	Inorganic Rings, Clusters and Polymers	3-0-0	1285
Specialization II: Physical Chemistry				
Theory/ DE	CHRC0023	Recent Advances in Catalysis	3-0-0	1281
Theory/ DE	CHBC0032	Biophysical Chemistry	3-0-0	1282
Specialization III: Organic Chemistry				

Theory/ DE	CHHC0025	Heterocyclic Chemistry	3-0-0	1283
Theory/ DE	CHNP0026	Natural Products Chemistry	3-0-0	1284
Project/DC	CHRP6005	Research Project	12	1291
Value Added Course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	1292
Audit Course	EDCI0200	Constitution of India	NC	
Total Credits			**21**	
Total Programme Credits			**86**	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

DEPARTMENT OF MATHEMATICS
MASTER OF SCIENCE IN MATHEMATICS – MSc Mathematics

SEMESTER I				
Type of course/ Category	**Course Code**	**Course Name**	**Credits L-T-P**	**Page**
DC	MARA0014	Real Analysis	4-0-0	1297
DC	MALA0015	Linear Algebra	4-0-0	1297
DC	MAAB0016	Abstract Algebra	4-0-0	1298
DC	MADE0017	Differential Equations	4-0-0	1299
DC	MAMT0018	Mathematical Methods I	4-0-0	1299
Mandatory Course	MASL0200	Community Engagement and Service Learning	NC	1327
Value Added Course	MAFG0154	Fractal Geometry and Applications	NC	1325
Value Added Course	MACM6004	Computational Skill Development: MATHEMATICA		1330
Total Credits			20	
SEMESTER II				
DC	MATF0019	Topology and Functional Analysis	4-0-0	1300
DC	MACA0020	Complex Analysis	4-0-0	1301
DC	MAMP0021	Measure Theory and Probability Theory	4-0-0	1301
DC	MAMD0022	Mathematical Methods II	4-0-0	1302
DC	MACL0023	Classical Mechanics	4-0-0	1303
Mandatory	EDCI0200	Constitution of India	NC	
Value Added Course	MAML0152	Essential Mathematics for Machine Learning	NC	1327
Value Added Course	MACS6005	Computational Mathematics with SAGE MATH		1331
Total Credits			20	
SEMESTER III				
DC	MADS0030	Discrete Mathematics	4-0-0	1304
DC	MACP0031	Computer Programming in C	2-0-0	1304
DC	MACP6002	Computer Programming in C Lab	0-0-1	1329
DC	MARM0032	Research Methodology for Mathematical Sciences	3-0-0	1305
DC	MARS6001	Research Seminar	2-0-0	1329
	Specialization I: Theoretical			
DE	MAFA0033	Field theory & commutative Algebra	4-0-0	1306
DE	MANT0034	Number Theory		1307
DE	MAML0035	Mathematical Logic		1307
DE	MAFS0036	Fuzzy sets and Applications		1308
	Specialization II: Applicable			
DE	MAFD0037	Fluid Dynamics I	4-0-0	1309
DE	MARC0038	Riemannian Geometry & Tensor Calculus		1309
DE	MADS0059	Dynamical Systems and Chaos		1320
DE	MACO0060	Convex Optimization		1321
DE	MANS0039	Numerical solution of PDE	4-0-0	1310
	Specialization III: Computational			

DE	MACN0040	Computational Number Theory	4-0-0	1311
DE	MASC0041	Scientific Computing		1311
DE	MASF0042	Special Functions		1312
DE	MAGT0061	Introduction to Game Theory		1321
Value Added Course	MACM6004	Computational Skill Development: MATHEMATICA		1330
Total Credits			20	
SEMESTER IV				
Specialization I: Theoretical				
DE	MAAS0046	Advanced Analysis	4-0-0	1313
DE	MAGY0047	Graph Theory	4-0-0	1313
DE	MACA0048	Multivariable calculus	4-0-0	1314
DE	MAAY0049	Algebraic Number Theory	4-0-0	1315
	MAAN0062	Algebraic Geometry	4-0-0	1322
Specialization II: Applicable				
DE	MAFL0050	Fluid Dynamics II	4-0-0	1315
DE	MACM0051	Continuum Mechanics	4-0-0	1316
DE	MATR0052	Theory of Relativity	4-0-0	1317
DE	MANO0063	Numerical Optimization	4-0-0	1323
DE	MAPD0065	Plasma Dynamics	4-0-0	1324
Specialization III: Computational				
DE	MADN0054	Design and Algorithms Analysis	4-0-0	1318
DE	MAML0064	Machine Learning	4-0-0	1323
DE	MAFE0053	Finite Elements Methods	4-0-0	1318
DE	MAIC0055	Introduction to Cryptography	4-0-0	1319
Project DC	MARP6003	Research Project	8	1330
Value Added Course	MAMR0153	Statistical Methods & Software in Research	3-0-0	1326
Value Added Course	MACS6005	Computational Mathematics with SAGEMATH		1331
Total Credits			20	
Total Programme Credits			80	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

DEPARTMENT OF PHYSICS
MASTER OF SCIENCE IN PHYSICS - MSc Physics

Semester I				
Type of Course/ Category	**Course Code**	**Course Name**	**Credits**	**Page**
Theory/DC	PSCM0020	Classical Mechanics	4	1335
Theory/DC	PSQM0021	Quantum Mechanics I	4	1335
Theory/DC	PSMP0055	Mathematical Physics-I	4	1353
Theory/DC	PSEL0049	Electronics I	4	1348
Theory/DC	PSPL6009	Physics Laboratory I	4	1356
Mandatory	PSPS0200	Physics and Service Learning		1354
Value Added Course	PSCP6120	Computational Physics using PYTHON	2-0-0	1361
Total Credits			**20**	
Semester II				
Theory/DC	PSQM0024	Quantum Mechanics II	4	1336
Theory/DC	PSMP0056	Mathematical Physics -II	4	1354
Theory/DC	PSED0026	Electrodynamics	4	1338
Theory/DC	PSNP0050	Nanophysics I	4	1349
Theory/DC	PSPL6003	Physics Laboratory II	4	1356
Total Credits			**20**	
Semester III				
Theory/DC	PSCP0025	Condensed Matter Physics	4	1337
Theory/DC	PSNP0054	Nuclear and Particle Physics	4	1352
Theory/DC	PSRM0051	Research Methodology	2	1350
Theory/DC	PSCN0030	Computer Oriented Numerical Methods	2	1339
Theory/DC	PSCN6010	Computer Oriented Numerical Methods Laboratory	4	1357
Theory/DC	PSPP6017	Project Phase I	2	1361
	Specialisation: High Energy Physics			
Theory/DE	PSHP0052	High Energy Physics I	4	1351
	Specialisation: Astrophysics			
Theory/DE	PSPL0036	Plasma Physics I	4	1341
	Specialisation: Plasma Physics			
Theory/DE	PSPL0036	Plasma Physics I	4	1341
	Specialisation: Electronics			
Theory/DE	PSEC0037	Electronics II	4	1342
	Specialisation: Nanophysics			
Theory/DE	PSNS0041	Nanophysics II	4	1343
Mandatory	EDCI0200	Constitution of India		
Total Credits			**23**	
Semester IV				
Theory/DC	PSSM0034	Statistical Mechanics	4	1340
Theory/DC	PSAM0028	Atomic and Molecular Physics	4	1363
Theory/DC	PSPR6018	Project Phase II	3	1361
Theory/DC	PSST6016	Study Tour	P/NP	
	Specialisation: High Energy Physics			
Theory/DE	PSEP0053	High Energy Physics II	4	1351

Theory/DE	PSGR0044	General Theory of Relativity and Cosmology	4	1344
	Specialisation: Astrophysics			
Theory/DE	PSAR0045	Astrophysics	4	1345
Theory/DE	PSGR0044	General Theory of Relativity and Cosmology	4	1344
	Specialisation: Plasma Physics			
Theory/DE	PSPM0046	Plasma Physics II	4	1345
Theory/DE	PSPM6013	Plasma Physics Laboratory	4	1365
	Specialisation: Electronics			
Theory/DE	PSER0047	Electronics III	4	1346
Theory/DE	PSEL6014	Electronics Laboratory	4	1359
	Specialisation: Nanophysics			
Theory/DE	PSNY0048	Nanophysics III	4	1347
Theory/DE	PSNY6015	Nanophysics Laboratory	4	1360
Total Credits			19	
Total Programme Credits			81	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES
DETAILED SYLLABUS
DEPARTMENT OF CHEMISTRY

VISION:

To produce competent chemistry graduates through dedicated teaching in classrooms, through labs and research, who can contribute meaningfully to society while fulfilling their ambitions in academia, research or industry.

MISSION:

The objective of the department is to provide dedicated guidance and support to students to equip them with a sound understanding of the fundamentals of chemistry

- to enable them to explore the diverse and hitherto unexplored resources of the north-eastern region
- to make significant contributions to fundamental and socially relevant research in the frontiers ofchemistry
- to help them generate their ideas and provide them the knowhow to convert them into reality

PROGRAM OUTCOMES – MSC PROGRAMME

PO 1: **Critical Thinking**: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO 2: **Knowledge Skil**l: Equip the student with skills to analyse problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems , rather than replicate curriculum content knowledge .

PO 3: **Scientific Communication Skills**: Imbibe effective scientific and / or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.

PO 4: **Ethics**: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned .Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective , unbiased and truthful actions in all aspects .

PO 5: **Enlightened Citizenship**: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges

PO 6: **Analytical Reasoning**: Ability to evaluate the reliability and relevance of evidence;identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO 7: **Multicultural Competence**: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is , "welcoming for allstudents" .

PO 8: **Lifelong Learning**: Ability to think, acquire knowledge and skills through logical reasoning and to inculcatethe habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/reskilling .

PO 9: **Leadership Qualities**: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.

PO 10: **Research Skills**: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations , problem solving and interpretation

PROGRAMME SPECIFIC OUTCOMES FOR MSC CHEMISTRY

PSO 1: **Scientific Problem solving skills:** Deep knowledge of the topic which can develop the problem solving skills using chemical principles.

PSO 2: **Analytical skills:** Develop analytical skills such as synthesizing, separating, characterizing chemical compounds and chemical reaction with the help of sophisticated instruments.

PSO 3: **Research ski**lls: Develop research skills through dissertation/Project work in different fields of chemistrysuch as organic, nanoscience, analytical, physical etc.

PSO 4: **Learning skills on life processes:** Acquire advanced level of knowledge in natural products as well asbiological system

from the chemistry point of view.

COURSES OFFERED IN MSC CHEMISTRY

Sl. No.	Course Name
1.1	Fundamentals of Inorganic Chemistry
1.2	Fundamentals of Organic Chemistry
1.3	Fundamentals of Physical Chemistry
1.4	Introduction to Quantum Chemistry and Group Theory
1.5	Inorganic Qualitative and Quantitative Analyses and Preparations - Lab
1.6	Value Added Course
2.1	Advanced Inorganic Chemistry I
2.2	Advanced Organic Chemistry I
2.3	Advanced Physical Chemistry I
2.4	Fundamentals of Spectroscopy
2.5	Introduction to Green and Environmental Chemistry
2.6	Experimental Physical Chemistry - Lab
2.7	Service learning
2.8	Value Added Course
3.1	Advanced Inorganic Chemistry II
3.3	Advanced Organic Chemistry II
3.3	Advanced Physical Chemistry II
3.4	Special Topics in Biochemistry
3.5	Applied Spectroscopy
3.6	Research Methodology for Chemistry
3.7	Organic Qualitative Analysis and Synthesis Lab
3.8	Value Added Course
4.1.1	Materials Chemistry
4.1.2	Computational Chemistry
4.1.3	Food Chemistry
4.1.4	Industrial Chemistry
4.1.5	Medicinal Chemistry
4.2.1	Organometallic Chemistry
4.2.2	Inorganic Rings, Clusters and Polymers
4.3.1	Recent Advances in Catalysis
4.3.2	Biophysical Chemistry
4.4.1	Heterocyclic Chemistry
4.4.2	Natural Products Chemistry
4.5	Research Project
4.6	Value Added Course

MSC Chemistry- Mapping of Courses to PO/PSO

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO2	PSO3	PSO4
1.1	H	H	H	M		H		H			H		L	
1.2	H	H	H			H		H			H		L	
1.3	H	H	H			H		H			H		L	
1.4	H	H	H			H		H			H		L	
1.5	H	M	H	H		H		M		M	H	H	H	
1.6		L				M		M	M	H	M	H	M	
2.1	H	H	H	M		H		H			H		L	
2.2	H	H	H	M		H		H			H		L	
2.3	H	H	H	M		H		H			H		L	
2.4	H	H	H	M		H		H		L	H	L	M	
2.5	H	M	H	M	M	M		H			M	L	L	
2.6	H	M	H	H		H		M		M	H	H	H	
2.7	M	M	H	L	H		H	H	H		L		L	
2.8		L				M		M	M	H	M	H	M	
3.1	H	H	H	M		H		H			H		L	M
3.2	H	H	H	M		H		H			H		L	M
3.3	H	H	H	M		H		H			H		L	L
3.4	H	H	H	M		H		H			H		L	H
3.5	H	H	H	H		H		H		M	H	L	H	L
3.6	H	H	H	H	L	H		H		H	M		H	
3.7	H	M	H	M		H		M		M	H	H	M	
3.8		L				M		M	M	H	M	H	M	
4.1.1	H	H	H	M		H		H			M		M	
4.1.2	H	H	H	M		H		H			M	M	M	
4.1.3	H	H	H	M		H		H			M		M	L
4.1.4	H	H	H	M		H		H			M		M	
4.1.5	H	H	H	M		H		H			M		M	L
4.2.1	H	H	H	M		H		H		M	M		H	
4.2.2	H	H	H	M		H		H		M	M		H	
4.3.1	H	H	H	M		H		H		M	M		H	

4.3.2	H	H	H	M		H		H		M	M		H	H
4.4.1	H	H	H	M		H		H		M	M		H	H
4.4.2	H	H	H	M		H		H		M	M		H	H
4. 5	H	H	H	H	M	H		H		H	M	H	H	M
4.6		L				M		M	M	H	M	H	M	

THEORY COURSES

CHIC0003: Fundamentals of Inorganic Chemistry

(4-0-0)

Course Outcomes

CO 1: Recall the fundamental concepts associated with hard and soft acids and bases. (Remembering)
CO 2: Explain the general characteristics and applications of coordination compounds. (Understanding)
CO 3: Make use of the electronic spectra to understand the electronic transition in coordination complexes. (Applying)
CO 4: Analyse the Metal-ligand bonding in transition metal complexes. (Analysing)
CO 5: Explain the Magnetic properties of transition metal complexes. (Evaluating)
CO 6: Design complexes of transition metal and predict their electronic and magnetic properties. (Creating)

Module I: Concepts of Acids and bases (10 lectures)

Hard and soft acid-base concept, non-aqueous solvents, redox chemistry.

Module II: Transition Metal Chemistry (8 lectures)

Descriptive chemistry of transition metals including lanthanides and actinides, coordination chemistry - coordination number and geometry, isomerism, thermodynamic stability - successive and overall stability constants, Irving-William series, chelate and macrocyclic effects.

Module III: Bonding in Inorganic and Coordination Compounds (20 lectures)

VBT (hybridization), CFT and their limitations, ligand field theory, d-orbital wave functions, d-orbital splitting in octahedral, square planar, square pyramidal, trigonal bipyramidal, and tetrahedral complexes; Jahn-Teller distortion, CFSE for d1 to d10 systems, pairing energy, low-spin and high-spin complexes and molecular orbital (MO) theory of selected octahedral, tetrahedral complexes and other geometries, Walsh Diagram.

Module IV: Electronic Spectra of Transition Metal Complexes (12 lectures)

d-d transition, charge transfer transition, color, intensity and origin of spectra, interpretation, term symbols and splitting of terms different geometries, selection rules for electronic transitions, correlation, Tanabe-Sugano and Orgel diagrams, calculation of Dq, B and C, nephelauxetic ratio.

Module V: Magnetic Properties of Transition Metal Complexes (10 lectures)

Magnetic properties of free ions, types of magnetic behavior: dia-, para-, ferro- and antiferro-magnetism, temperature independent paramagnetism, magnetic susceptibility - Van Vleck equation, experimental measurement, magnetic moment - orbital contribution, quenching of contribution, effect of spin orbit coupling, spin crossover, temperature dependence of magnetic susceptibility, exchange coupling effects, magnetic properties of second and third transition series and lanthanides.

Suggested Readings

1. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter and R. L. Keiter, Pearson Education.
2. Ligand Field theory and its Applications, B. N. Figgis and M. A. Hitchman, Wiley India.
3. Inorganic Chemistry, G. L. Miessler and D. Tarr, Pearson Education.
4. Inorganic Chemistry, P.W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Oxford UniversityPress.
5. Fundamental Concepts of Inorganic Chemistry, Vols. 1-7, A. K. Das and M. Das, CBS Publishers and Distributors.
6. Essentials of Nuclear Chemistry, H. J. Arnikar, Wiley Eastern, New Delhi.
7. Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Wiley.
8. Inorganic Chemistry, C. E. Housecroft and A. G. Sharpe, Prentice Hall.
9. Chemical Applications of Group Theory, F. A. Cotton, Wiley.
10. Lanthanide and Actinide Chemistry, S. A. Cotton, John Wiley.
11. Nuclear and Radiochemistry, G. Fridlander, J.W. Kennedy, E. S. Macias and J. M. Miller, John Wiley, New York.
12. Inorganic Chemistry, M. Weller, F. Armstrong, J. Rourke and T. Overton, Oxford University Press.
13. Elements of Magnetochemistry, R. L. Dutta and A. Syamal, Affiliated East-West Press Pvt. Ltd.-New Delhi.
14. Magnetism and Transition Metal Complexes, F. E. Mabbs and D. J. Machin, Dover Pub. Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	M	L	
CO 3				H	
CO 4			H		
CO 5		L			H

CO 6				H	M

CHOC0004: Fundamentals of Organic Chemistry
(4-0-0)

Course Outcomes
CO 1: Recall various concepts associated with the kinetics of organic reaction mechanisms. (Remembering)
CO 2: Explain the generation and application of different reaction intermediates in organic synthesis. (Understanding)
CO 3: Analyse Point group of organic molecules and their connection with optical activity. (Analysing)
CO 4: Determine the absolute or relative configuration of chiral organic molecules and design asymmetric synthesis. (Evaluating)
CO 5: Predict the stereochemistry of the product of different reactions. (Creating)

Module I: Kinetics and Energetics of Reaction Mechanism (15 lectures)
Transition state theory of reaction rates - kinetics and thermodynamics of activation, reaction profiles for multistep reactions, Hammond postulate, Curtin-Hammett Principle, kinetic and thermodynamic control, Linear free energy relationships (LFER), Hammett equation - substituent and reaction constants, the Taft treatment of polar and steric effects in aliphatic compounds, kinetic isotope effects in organic reactions, effects of conformation on reactivity, stereoelectronic effects, neighbouring group participation, anomeric effect.

Module II: Reaction Mechanisms and Intermediates (Structure and Reactivity) - I (15 lectures)
a. Carbanions: enolates and enamines, kinetic and thermodynamic enolates, lithium and boron enolates in Aldol and Michael reactions, alkylation and acylation of enolates, name reactions under carbanion chemistry - Claisen, Dieckmann, Knoevenegal, Stobbe, Darzen, Acyloin condensations, Shapiro reaction, Julia olefination, Brook rearrangement, Sakurai reaction, Henry reaction, Kulinkovich reaction, Nef reaction, Baylis-Hillman reaction.
b. Ylids: Chemistry of phosphorous and sulfur ylids - Wittig and related reactions, Peterson olefination.
c. Carbocations: structure and stability of carbocations, classical and non-classical carbocations, neighbouring group participation and rearrangements including Wagner-Meerwein, pinacol-pinacolone, semi-pinacol rearrangement, C-C bond formation involving carbocations, oxymercuration, halolactonisation, Tishchenko reaction, Ritter reaction, Prins reaction.

Module III: Reaction Mechanisms and Intermediates (Structure and Reactivity) – II (15 lectures)
a. Carbenes and Nitrenes: Structure of carbenes, generation of carbenes, addition and insertion reactions, rearrangement reactions of carbenes such as Wolff rearrangement, generation and reactions of ylids by carbenoid decomposition (existence of O and N based ylids), Structure of nitrene, generation and reactions of nitrene and related electron deficient nitrogen intermediates, Curtius, Hoffmann, Schmidt, Beckmann rearrangement, structure and reactivity of benzynes.
b. Radicals: Generation of radical intermediates and its addition to alkenes, alkynes (inter &intramolecular) for C-C bond formation and Baldwin's rules, name reactions involving radical intermediates such as Barton deoxygenation and decarboxylation, Mc Murry coupling.

Module IV: Stereochemistry (15 lectures)
a. Classification of organic molecules into different Point Groups, R and S, E and Z nomenclature in C, N, S, P containing compounds, concept of absolute and relative configuration, chirality in molecules devoid of chiral centres - allenes, spiranes and biphenyls.
b. Concepts of stereogenic centres – chirotopic and achirotopic centres, homotopic and heterotopic ligands and faces, optical purity and enantiomeric excess, conformation of acyclic organic molecules, cyclohexane and decalins.
c. Dynamic stereochemistry, stereoselective synthesis, classification of stereoselective synthesis, diastereoselective, enantioselective and double stereo-differentiating reactions, nucleophilic addition to aldehyde and acyclic ketones, Prelog's rule, nucleophilic addition to cyclic ketones.
d. Enantioselective synthesis, use of chiral reagent, chiral catalyst and chiral auxiliary, stereospecific and stereoselective reactions.

Suggested Readings
1. Advanced Organic Chemistry, Part A and B, F. A. Cary and R. I. Sundberg, Springer.
2. Stereoelectronic Effects, A. J. Kirby, OUP.
3. Modern methods of Organic Synthesis, W. Carruthers and I. Coldham, Cambridge University Press.
4. Mechanism and Theory in Organic Chemistry, T. H. Lowry and K. S. Richardson.
5. Organic Chemistry, J. Clayden, N. Greeves and S. Warren.
6. Modern Physical Organic Chemistry, E. V. Anslyn and D. A. Dougherty, University Science Books.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	H	
CO 3				H
CO 4				H
CO 5		H	H	L

CHPC0005: Fundamentals of Physical Chemistry

(4-0-0)

Course Outcomes

CO 1: Explain the laws of thermodynamics. (Understanding)
CO 2: Explain the methods to determine the properties of polymers. (Understanding)
CO 3: Explain the various terms involved in data analysis. (Understanding)
CO 4: Apply the laws of thermodynamics and kinetics of polymerization to solve problems. (Applying)
CO 5: Distinguish between different types of systems, polymers and various statistical parameters. (Analysing).
CO 6: Calculate the sizes of polymer molecules and analyses the results of different chemical experiments from thestatistical point of view. (Evaluating)

Module I: Equilibrium and Non-Equilibrium Thermodynamics (22 lectures)

a. Laws of thermodynamics, state and path functions and their applications, Maxwell 's relations, spontaneity and equilibria, Le Chatelier principle.
b. Non-ideal system - thermodynamics of real gases and gas mixtures, fugacity and its determination, non-ideal solutions, activity and activity coefficient, different scales of activity coefficient, electronic activity coefficients.
c. Phase equilibrium - thermodynamic criteria of phase equilibrium, Gibbs phase rule and its application to three component systems- triangular plots - water-acetic acid-chloroform system and ammonium chloride-ammonium sulphate-water system.
d. Non-equilibrium thermodynamics - forced flows and entropy of production, coupled flows and phenomenological relations, Onsager reciprocal relations, thermodynamic effects-Seebeck, Peltier and Thomson effects.

Module II: Statistical Thermodynamics (22 lectures)

a. Statistical mechanics of systems independent particles - Maxwell Boltzmann distribution, entropy and probability, calculation of thermodynamic properties for independent particles, molecular partition functions, evaluation of translational, rotational and vibrational and nuclear partition functions.
b. Thermodynamic properties of monatomic and diatomic gases (Suckur Tetrode equation), calculation of partition functions, thermodynamic function, principles of equipartition, heat capacities (Einstein model and Debye modification), residual entropy, equilibrium constant.

Module III: Polymer Chemistry (8 lectures)

Molecular weight of polymers, determination of molecular weight, kinetics of polymerization reaction, copolymerization, average dimension of polymer molecules, size exclusion chromatography.

Module IV: Sampling and Data Analysis (8 lectures)

Sampling of solid, liquid and gaseous samples, mean and standard deviation, absolute and relative errors, linear regression, covariance and correlation coefficient.

Suggested Readings

1. Physical Chemistry, P. Atkins and J. Paula, Oxford University Press.
2. Physical chemistry, I. R. Levine, Mcgraw Hill Education.
3. Physical Chemistry: A Molecular Approach, D. A. McQuarrie and J. D. Simon, Viva Student Edition.
4. Physical Chemistry, R. S. Berry, S. A. Rice and J. Ross, Oxford University Press.
5. Statistical Mechanics, D. A. McQuarrie, University Science Books, California.
6. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas and B. Sivasankar, Pearson.
7. Polymer Science, V. R. Gowarikar, N. V. Viwanathan and J. Sreedhar, New age International Publishers.
8. Principles of Polymerization, G. Odian, Willy Student Edition.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M			

CO 2	M		M	
CO 3				H
CO 4	M	H	M	
CO 5		H	M	
CO 6			H	

CHIR0007: Advanced Inorganic Chemistry I
(4-0-0)

Course Outcomes
CO 1: Recall the concepts of organometallic chemistry. (Remembering)
CO 2: Illustrate the photochemistry of different inorganic compounds. (Understanding)
CO 3: Select the inorganic compounds for their suitable analytical and industrial use. (Applying)
CO 4: Analyse the structure, bonding and synthesis of some inorganic compounds. (Analysing)
CO 5: Explain the bonding in solid-state chemistry. (Evaluating)
CO 6: Discuss the mechanism of Inorganic reactions. (Creating)

Module I: Descriptive Inorganic Chemistry (20 lectures)
a. Structure and bonding in polyhedral boranes and carboranes, styx notation, Wade's rules, electron count in polyhedral boranes, synthesis of polyhedral boranes, isolobal analogy, boron halides, phosphine-boranes, boron heterocycles, borazine.
b. Silanes, silicon halides, silicates, silicones, silanols, zeolites, germanium, tin and lead organyls, silenes, germenes, stannenes, phosphorous halides, phosphazenes, sulphur halides, structural features and reactivity of S-N heterocycles.
c. Synthesis and reactivity of organo-lithium, beryllium and magnesium compounds, calixarines, cryptands and crown ethers in complexation chemistry.
d. Preparation and reactivity of aluminium organyls, carbalumination, hydro alumination, chemistry of Ga (I) and In (I), reduction of Al, Ga and In organyls, Metal organic framework structures (MOFs).

Module II: Introduction to Solid State Chemistry (10 lectures)
Structure of simple solids – metals, alloys and compounds; common structure types; synthesis of solid state compounds - ceramic method, microwave synthesis, sol-gel, precursor method, hydrothermal synthesis, CVD and intercalation; characterization of solids, bonding in solids – free-electron and molecular orbital theory; bands in solid state compounds, properties of solids – optical, magnetic and electrical properties of solids.

Module III: Organometallic Chemistry (15 lectures)
a. Valence electron count (16/18 electron rules), synthesis, structure, bonding and reactivity of mono and polynuclear
b. metal carbonyls, substituted metal carbonyls, vibrational spectra of metal carbonyls, metal-metal bonding.
c. Types of M-C bonds, synthesis and reactivity of metal alkyls, carbenes, alkenes, alkynes, and arene complexes, metallocenes and bent metallocenes, isolobal analogy.
d. Reactions of organometallic complexes: Substitution, oxidative addition, reductive elimination, insertion and de insertion, catalysis, hydrogenation, hydroformylation, Monsanto process, Wacker process, alkene polymerization.

Module IV: Mechanism of Inorganic Reactions (10 lectures)
Substitution in octahedral and square planar complexes, lability, trans-effect, conjugate base mechanism, racemisation, electron transfer reactions - inertness and lability, inner sphere and outer sphere mechanism, Marcus theory, solid state reactions – topotactic and epitactic mechanisms.

Module V: Inorganic Photochemistry (5 lectures)
Photosubstitution and photoredox reactions of chromium, cobalt and ruthenium compounds, Ligand field and charge transfer state (Thexi and DOSENCO states), cis-trans isomerization, photocatalysis and solar energy conservation by ruthenium complexes.

Suggested Readings
1. Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Wiley.
2. Chemistry of elements, N. N. Greenwood and E. A. Earnshaw, Butterworth-Heinemann.
3. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter and R. L. Keiter, PearsonEducation.
4. Inorganic.Chemistry, G. L. Miessler and D. Tarr, Pearson Education.
5. Inorganic Chemistry, P.W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Oxford UniversityPress.
6. Concepts and Models of Inorganic Chemistry, B. E. Douglas, D. H. McDaniel and J. J. Alexander, John Wiley.
7. Inorganic Chemistry, G. Wulfsberg, University Science Books.
8. Solid State Chemistry: An Introduction, L. Smart, E. Moore, Nelson Thorns Ltd.

9. Fundamental Concepts of Inorganic Chemistry, A. K. Das and M. Das, CBS Publishers and Distributors.
10. Organometallic Chemistry of the Transition Metals, R. H. Crabtree, John Wiley.
11. Mechanisms of Inorganic Reactions, F. Basalo and R. G. Pearson, John Wiley

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1			H		
CO 2					H
CO 3	L	L	M		
CO 4	H			L	
CO 5		H			
CO 6				H	

CHOG0008: Advanced Organic Chemistry-I

Course Outcomes

CO 1: Recall nucleophilic and electrophilic substitution reactions and the factors related to the rate of these reactions. (Remembering)
CO 2: Explain the stereo chemical aspects and mechanism of elimination reactions. (Understanding)
CO 3: Apply the practical utility of metal and metal-free oxidising agents in organic synthesis. (Applying)
CO 4: Compare various kinds of reducing agents in chemo selective and stereo selective synthesis. (Analysing)
CO 5: Select name reactions for constructing compounds having industrial and academic importance. (Evaluating)

Module I (15 lectures)

a. **Nucleophilic Substitution**: S_N1, S_N2 and related mechanisms; Factors influencing reaction rates; Neighboring group participation by π- and σ-bond; Anchimeric assistance; Aromatic Nucleophilic Substitution: The SNAr, S_N1, benzyne and SR_N1 mechanisms. Reactivity; effect of substrate structure, leaving group and attacking nucleophile; The S_Ni mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinyl carbon. Aromaticity, antiaromaticity and homoaromaticity.

b. **Electrophilic Substitution**: Aliphatic: Bimolecular mechanisms: SE1, SE2 and SEi. The SE1mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity. Aromatic: The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems.

Module II (15 lectures)

a. **Elimination reactions**: Mechanism and stereochemistry of different types of elimination reactions; Effects of substrate structure, attacking base, leaving group and medium; Formation of other double bonds (C=N, C=O) and triple bonds by elimination reactions; Mechanism and orientation in pyrolytic elimination.

b. **Miscellaneous Reactions:** Biginelli reaction, Passerini reaction, Nazarov cyclisation, Pd-catalyzed reactions, Vilsmeier Hack reaction, Ugi reaction, Robbinson annulations, Mitsonobu reaction, Appel reaction, Favoriskii rearrangement.

Module III: Oxidation Reactions (15 lectures)

Metal and non-metal based oxidations (Cr, Mn, Al, Ag, Os, Ru, Se, DMSO, hypervalent iodine), reagents (Fremy's salt, silver carbonate, peroxides/per-acids), Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation, Sharpless asymmetric dihydroxylation, Baeyer-Villiger oxidation, Wacker oxidation, hydroboration-oxidation, Prevost reaction and Woodward modification.

Module IV: Reduction Reactions (15 lectures)

Catalytic hydrogenation (Pd/Pt/Rh/Ni), Wilkinson catalyst, Noyori asymmetric hydrogenation, metal based reductions using Li/Na/Ca in liquid ammonia, Sodium, Magnesium, Zinc, Titanium and Samarium (Birch, Pinacol formation, McMurry, Acyloin formation, dehalogenation and deoxygenations), Hydride transfer reagents from Group III and Group IV in reductions ($NaBH_4$triacetoxyborohydride, L-selectride, K-selectride, Luche reduction, $LiAlH_4$, DIBAL-H, and Red-Al, Trialkylsilanes and Trialkylstannane, Meerwein-Pondorff-Verley reduction), stereo/enantioselective reductions (Chiral Boranes, Corey-Bakshi-Shibata).

Suggested Readings

1. Advanced Organic Chemistry, Part A and B, F. A. Cary and R. I. Sundberg, Springer.
2. Organic Synthesis, M. B. Smith, Academic Press.
3. Modern Methods of Organic Synthesis, W. Carruthers and I. Coldham, Cambridge University Press.
4. Organic Chemistry, J. Clayden, N. Greeves and S. Warren. Oxford University Press.
5. Organic Chemistry, S. H. Pine, McGraw-Hill Bool.

6. Advanced Organic Chemistry: Reactions, Mechanisms and Structure (4th edn.), J. March, Wiley Student Edition, John Wiley & Sons Asia Pte. Ltd.
7. Modern Synthetic Reaction, H. O. House, W. A. Benjamin Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H
CO 5	L	H	H	H

CHAP0009: Advanced Physical Chemistry I

(4-0-0)

Course Outcomes

CO 1: Recall the kinetics of different types of chemical reactions. (Remembering)
CO 2: Explain the interactions of ionic species with solvent molecules. (Understanding)
CO 3: Apply the knowledge of chemical kinetics to some important types of reactions. (Applying)
CO 4: Analyse the application of electrochemistry in different fields. (Analysing)
CO 5: Calculate the rate of different types of chemical reactions. (Evaluating)

Module I: Chemical Kinetics (15 lectures)

Theories of unimolecular reactions: Lindemann theory, drawbacks of Lindemann theory- Hinshelwood modification, RRK theory, Slaters treatment, RRKM theory. Steady state approximation and its applications, oscillating reactions, chemical chaos, Belousov-Zhabotinski reaction, straight chain reactions - hydrogen-halogen reactions, alkane pyrolysis, Branching- chain reactions - the hydrogen-oxygen reaction, explosion limits, Enzyme catalyzed reactions, Michaelis-Menten mechanism- Lineweaver-Burk and Eadie plots, enzyme inhibiton.

Module II: Study of Fast Reactions (5 lectures)

Stopped flow technique, temperature and pressure jump methods, NMR studies in fast reactions, shock tube kinetics, relaxation kinetics, Linearized rate equation, relaxation time in single step fast reactions, determination of relaxation time.

Module III: Molecular Reaction Dynamics (15 lectures)

Collisions of real molecules- trajectory calculations, Laser techniques, reactions in molecular beam, reaction dynamics, estimation of activation energy and calculation of potential energy surface- the transition state theory (TST) of bimolecular gaseous reactions, statistical and thermodynamic formulations. Comparison between TST and hard sphere collision theory, theory of unimolecular reactions- Lindemann theory and its limitations, kinetics of reactions in solution-diffusion controlled and chemically controlled reactions, TST of reactions in solution- Bronsted and Bjerrum equation, effect of ionic strength, kinetic salt effect.

Module IV: Electrochemistry - I (10 lectures)

a. Ion-solvent interaction- the Born model, Thermodynamic parameters of ion solvent interactions- structural treatment, the ion-dipole model-its modifications, ion-quadrupole and ion-induced dipole interactions.
b. Primary solution- determination of hydration number, compressibility method and viscosity-mobility method, Debye-Huckel theory of ion-ion interactions, derivation, validity and limitations, extended Debye-Huckel-Onsager equation, random walk model of ionic Diffusion-Einstein Smoluchowski reaction.

Module V: Electrochemistry – II (15 lectures)

a. **Theories of Electrical Interface:** Electrocapillary phenomena - Lippmann equation, electron transfer at interfaces, polarizable, non-polarizable and non-polarisable interfaces, Butler-Volmer equation, Tafel plot.
b. **Electro-analytical Techniques:** Potential step methods, potential sweep methods, Polarography and Pulse voltammetry, controlled current techniques, techniques based on impedance.
c. **Systems for Electro-Chemical Energy Storage and Conversion**: Types of Batteries, Lead- acid batteries, Nickel-cadmium batteries and Li-ion batteries, electrical double layer capacitor, pseudo-capacitor, fuel cells.

Suggested Readings

1. Physical Chemistry, P. Atkins and J. Paula, Oxford University Press, Oxford.
2. Physical chemistry, I. R. Levine, Mcgraw Hill Education.
3. Chemical Kinetics, K. J. Laidler, Pearson.
4. Modern Electrochemistry Part 1, 2A and 2B, J. O. Bockris and A. K. N. Reddy, Springer.
5. Electrochemical Methods Fundamentals and Applications, J. Bard and L. R. Faulkner, Willy India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2				H	M
CO 3	H	M	M		
CO 4				L	H
CO 5	M	M			

CHGC0011: An Introduction to Environmental and Green Chemistry

Course Outcomes

CO 1: Recall the basic concepts of green chemistry. (Remembering)
CO 2: Explain the principles of green chemistry, green reaction conditions, renewable sources of energy etc.(Understanding)
CO 3: Apply the concept of green chemistry in the applied research field. (Applying)
CO 4: Analyse and solve the problems related to the environment. (Analysing)
CO 5: Identify the causes of environmental degradation and find solutions for its protection. (Applying)

Module I: Environmental pollution (15 lectures)

Chemistry and environmental pollution: Chemical hazards, chemical disasters, Water pollution, air pollution and soil pollution; agricultural pollution, pollution by plastics; environmental biochemistry, toxicological chemistry, e-pollution and nuclear hazard.Environmental analysis: Analysis of water and wastewater, solid-wastes and air pollution.

Module II: Environmental protection (10 lectures)

Environmental protection: pollution prevention, green chemistry, biodegradation, water and wastewater purification – removal of arsenic, iron, fluoride, etc.; air purification, waste minimization, industrial and municipal waste treatment and soil remediation.

Module III: Principles and concepts of Green Chemistry (10 lectures)

Green chemistry: Principles of green chemistry, development of green chemistry; atom economy reactions – rearrangement reactions, addition reactions; atom uneconomic reactions–sublimation, elimination; toxicity measures, need of green chemistry in day-to-day life.

Module IV: Emerging Green Technology and alternative energy sources (10 lectures)

Design for energy efficiency, photochemical reactions – advantages, disadvantages; microwave technology in chemistry - microwave heating, microwave assisted reactions, ultrasound assisted reactions, reactions in organic liquids, reactions in aqueous media, electrochemical synthesis- examples. Supercritical solvents, ionic liquids, green catalyst, auto-exhaust catalyst and clean technology. Real world examples.

Suggested Readings

1. Environmental Chemistry, S. E. Manahan, CRC Press, Boca Raton.
2. Green Chemistry: Theory and Practice, P. T. Anastas and J. C. Warner, Oxford University Press.
3. Environmental Chemistry, J. W. Moore and E. A. Moore, Academic Press, London.
4. Green Chemistry: An Introductory Text, M. Lancaster, RSC.
5. Handbook of Environmental Chemistry, O. Hutzinger, Springer-Verlag.
6. M. C. Cann and M. E. Connelly, Real World Cases in Green Chemistry, ACS.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1			H	M
CO 2			H	H
CO 3			M	H
CO 4	H	H		
CO 5	H	H		

CHAI0012: Advanced Inorganic Chemistry II

(4-0-0)

Course Outcomes

1. Recall the concepts of analytical techniques used in inorganic analysis. (Remembering)
2. Illustrate the role of metal ions in the function of biological macromolecules. (Understanding)
3. Apply the special Analytical Techniques for the characterization of inorganic compounds. (Applying)

4. Analyse the principles and application of Nuclear and Radiochemistry. (Analysing)
5. Explain the nature of supramolecular interactions. (Evaluating)
6. Develop a fundamental knowledge of nanomaterials. (Creating)

Module I: Special Analytical Techniques (25 lectures)

a. Principles and applications of Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS/EDX), Transmission Electron Microscopy (TEM), Selected Area (Electron) Diffraction (SAED), Thermal methods of analysis – thermogravimetric analysis (TGA), Differential Thermal Analysis (DTA), Differential Thermogravimetry (DTG), Differential Scanning Calorimetry (DSC), Powder X-ray Diffraction, Single crystal X-ray diffraction.

b. Principles and applications of atomic absorption spectroscopy, atomic emission spectroscopy, Infrared and Raman Spectroscopy, Magnetic Resonance Spectroscopy- Electron Spin Resonance (ESR) of d^1 and d^9 transition metal ions in cubic and tetragonal ligand fields, applications of ^{31}P, ^{19}F, ^{119}Sn and ^{195}Pt nuclear magnetic resonance (NMR) spectroscopy.

Module II: Bioinorganic Chemistry (15 lectures)

Role of metal ions in biology and their toxic effects; Iron management in biological systems– siderophores, ferritin and transferrin; Dioxygen storage and transport – structure of myoglobin and haemoglobin, cooperativity of O_2 binding in haemoglobin, Bohr effect and Hill coefficients; Electron transfer proteins (structure and function) - Fe-S proteins, cytochromes and plastocyanines; Structure of nitrogenase and its role in di-nitrogen fixation; Structure and function of vitamin B_{12} and mechanism of 1,2-shift reaction; Inorganic therapeutics - chelate therapy, metal based drugs.

Module III: Introduction to Supramolecular Chemistry (5 lectures)

Supramolecular chemistry: Definition, supramolecular host-guest compounds, macrocyclic effect, nature of supramolecular interactions.

Module IV: Introduction to Nanomaterials (5 lectures)

Fabrication of nanomaterials – top-down and bottom-up approaches; solution-based synthesis of nanoparticles; other methods of nanomaterial synthesis – brief overview. Carbon fullerenes and nanotubes. Applications of nanoparticles.

Module V: Nuclear and Radiochemistry (10 lectures)

Radioactive decay and equilibrium. Mass defect and binding energy, packing fraction, stability of nucleus, neutron-proton ratio, Artificial radioactivity. Nuclear reactions; Q value, cross sections, types of reactions, Chemical effects of nuclear transformations; fission and fusion, fission products and fission yields. Radioactive techniques; nuclear reactors, separation of isotopes; tracer technique, neutron activation analysis, counting techniques such as G.M. ionization and proportional counter. Application of radio-isotopes in agriculture, medicine and industry. Radiocarbon dating**.**

Suggested Readings

1. Fundamentals of Light Microscopy and Electronic Imaging, D. B. Murphy and M. W. Davidson, Wiley.
2. Transmission Electron Microscopy a Textbook for Materials Science, D. B. Williams, C. B. Carter, Springer.
3. Principles of Biochemistry, D. Nelson, A. L. Lehninger and M. M. Cox, W. H. Freeman & Co.
4. Biochemistry, R. H. Abeles, P. A. Frey and W. P. Jencks, Jones and Bartlett Publishers, Boston
5. Fundamentals of Biochemistry: Life at the Molecular Level, D. Voet, J. G. Voet and C. W. Pratt.
6. Bioinorganic Chemistry, I. Bertini, H. B. Gray, S. J. Lippard and J. S. Valentine, Viva books Pvt. Ltd.
7. Inorganic Biochemistry: An introduction, J. A. Cowan, Wiley.
8. Supramolecular chemistry, J. W. Steed and J. L. Atwood, John Wiley
9. Supramolecular Chemistry: Concepts and Perspectives, J. M. Lehn, Wiley-VCH.
10. Nanostructures and Nanomaterials: Synthesis, Properties and Applications, C. G. Zhong, Imperial College Press.
11. Nuclear and Radiochemistry, G. Friedlander, J.W. Kennedy, E. S. Macias and J. M. Miller, John Wiley, New York.
12. Perspectives in Supramolecular Chemistry and Molecular Recognition, G. R. Desiraju, Wiley.
13. Nanotechnology: A Gentle Introduction to the Next Big Idea, M. Ratner and D. Ratner, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				
CO 2		H			
CO 3	H				
CO 4					H
CO 5			H		
CO 6				H	

CHAO0013: Advanced Organic Chemistry-II

(4-0-0)

Course Outcomes

CO 1: Recall the principles of organic photochemistry, pericyclic reactions. (Remembering)
CO 2: Explain the theories related to pericyclic reactions. (Understanding)
CO 3: Apply the knowledge of different reactions in research and industrial field. (Applying)
CO 4: Analyse the problems related to photochemistry and synthetic strategy. (Analysing)
CO 5: Demonstrate different theories in pericyclic reaction and photochemistry to check the feasibility of chemicalreactions. (Understanding)

Module I: Organic Photochemistry (15 lectures)

a. Introduction to organic photochemical-photophysical processes, chemiluminescence, photosensitization.
b. Photochemistry of carbonyl compounds - α-cleavage, β-cleavage, intramolecular H-abstraction, addition to π-systems-Paterno-Buchi reaction, electron transfer reactions, Photochemistry of olefins – photo stereomutation of cis-trans isomers, optical pumping, cycloaddition, photochemistry of conjugated polyenes. Photochemistry of enones, photo-rearrangement reactions- di-π-methane rearrangement, Photo-rearrangement of cyclohexadienones, Barton rearrangement, singlet oxygen photochemistry.

Module II: Pericyclic Reactions (15 lectures)

Main features of pericyclic reactions; Woodward-Hoffman rules, correlation diagram and FMO approaches; Electrocyclic reactions – conrotatory and disrotatory motions for 4n and 4n+2systems; Cycloadditions – antarafacial and suprafacial additions, [2+2] and [4+2] reactions (hv and Δ), 1,3-dipolar cycloadditions and chelotropic reactions; Sigmatropic[i,j] shifts of C-H and C-C bonds; Sommelet-Hauser, Claisen, thio-Claisen, Cope and aza-Cope rearrangements.

Module III: Introduction to Heterocyclic chemistry (15 lectures)

Nomenclature of heterocyclic compounds. Structure, reactivity, synthesis and reactions Pyridine, quinoline, Isoquinoline, Indole, Benzofuran, Benzothiophene, pyrazole, Imidazole, oxazole, Isoxazole, Thiazole, Isothiazole, pyridazine, pyrimidine and pyrazine.

Module IV: Synthetic Strategies (15 lectures)

Synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, importance of order of events in organic synthesis, one group and two group C-X disconnections, chemo selectivity, reversal of polarity, cyclisation reactions, amine synthesis.

One group C-C disconnections – alcohols and carbonyl compounds, regioselectiviity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

Two group C-C disconnections – Diels-Alder reaction, 1,3-difunctionalised compounds, α, β-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds, Michael addition and Robinsonannelation. Principle of protection of alcohol, amine, carbonyl and carboxyl groups; Common protecting groups.

Suggested Readings

1. Organic Chemistry, J. Clayden, N. Greeves and S. Warren, Oxford University Press.
2. Principles of Organic Synthesis, R. O. C. Norman and J. M. Coxon, Blackie Academic and Professional.
3. Strategies and Tactics in Organic Synthesis 4 & 5, M. Harmata, Academic Press.
4. Modern Heterocyclic Chemistry, L. A. Paquette, John Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		H		
CO 3	M	H	H	L
CO 4	H			H
CO 5	H	H		

CHAP0014: Advanced Physical Chemistry II

(4-0-0)

Course Outcomes

CO 1: Recall the basic structure and properties of solids. (Remembering)
CO 2: Explain the electrical properties in terms of semiconductor, superconductor etc. (Understanding)
CO 3: Interpret the results of problems related to adsorption processes and electro kinetic phenomena of surfaces.(Applying)

CO 4: Analyse the process of surface adsorption and types of different catalysed reactions. (Analysing)
CO 5: Apply the properties of solids to interpret the conducting behaviour of different types of materials. (Applying)

Module I: Solid state (18 lectures)
Structures of solids - crystal planes and Miller indices, Bragg's law and applications, Debye-Scherrer powder method, nanoparticles and nanotechnology, defects in solids, thermodynamics of Schottky and Frenkel defect formation, thin films, Langmuir-Blodget film. Electrical properties of solids, intrinsic and extrinsic semiconductors, doping of semiconductors, p-n junction, super conductors, conducting polymers, organic conductors, molecular electronic devices, nonlinear optical materials, optical reflectance, photoconduction, ionic conductors, Meissner effect, BCS theory.

Module II: Surface Chemistry (22 lectures)
a. Electrical aspects of surface chemistry, Electro kinetic phenomena, the structure of electrical double layer, Zeta potential and colloidal stability, Measurement of zeta potential. Surfactants – definition and classification, micelle formation and determination of critical micelle concentration.
b. Reverse micelle and its application, solubilization, microemulsion.
c. Adsorption of gases on solid surfaces – Langmuir's theory and its limitations. Derivation of BET equation – determination of surface area of an adsorbent, thermodynamics of adsorption processes. Capillary condensation – adsorption in micro pores, Kinetics of heterogeneous catalysis – Langmuir-Hinshelwood model and Eley-Riedel mechanism.

Module III: Catalysis and Photochemistry (20 lectures)
a. Catalysts, classification of catalysts. Characterization of catalysts: Methods of surface analysis, surface area, pore size, void fraction, particle size, mechanical strength, surface chemical composition, surface acidity and reactivity. Rates of homogeneously catalysed reactions, turnover number and frequency.
b. Photochemistry - kinetics of photophysical and photochemical processes, complex photochemical processes.

Suggested Readings
1. Solid State Chemistry and its Applications, A. R. West, John Wiley.
2. Solid State Chemistry, D.K. Chakrabarty, New Age Publishers.
3. New Directions in Solid State Chemistry, C.N. R. Rao and J. Gopala Krishnan.
4. Catalytic Chemistry, B. C. Gates, John Wiley & Sons.
5. Fundamentals of Industrial Catalytic Processes, C. H. Bartholomew and R. J. Furrauto , Wiley Interscience.
6. Surfactants and Interfacial Phenomena, M. J. Rosen, John Wiley.
7. Physical Chemistry, J. P. Atkins, Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	H		
CO 3		H	
CO 4		H	M
CO 5	H		

CHSP0015: Special Topics in Biochemistry
(3-0-0)

Course Outcomes
CO 1: Recall the characteristic, properties of carbohydrates. (Remembering)
CO 2: Explain the synthesis and biosynthesis of different biomolecules. (Understanding)
CO 3: Distinguish between the physical, chemical and biochemical properties of amino acids, proteins, peptides, enzymes etc. (Analysing)
CO 4: Explain the chemistry of nucleic acids. (Understanding)
CO 5: Explain the importance of vitamins for a living being. (understanding)

Module I: Carbohydrates (9 lectures)
Characteristics and properties of carbohydrates – nomenclature and stereochemistry of monosaccharides, typical carbohydrates, sweetening agents; chemistry of monosaccharides – cyclic structures, Haworth and conformational representations, oxidation, determination of ring size, structure of correlations, synthesis, glycosides; Oligosaccharides and Polysaccharides – sucrose and other oligosaccharides, starch, cellulose and other polysaccharides.

Module II: Lipids (9 lectures)
a. Glycerol derivatives- fats and oils, fatty acid biosynthesis, phospholipids, glycolipids, properties of lipid aggregates, micelles, bilayers, liposomes and biological membranes.

b. Steroids – structural characteristics, synthesis and biosynthesis, steroid hormones; prostaglandins – structural characteristics, synthesis and biosynthesis.
c. Pheromones – structure and origin, synthesis.

Module III: Nucleosides, Nucleotides and Nucleic acids (9 lectures)

a. Nucleosides and Nucleotides: The structure of nucleosides, chemistry of nucleosides, nucleotides; sunlight, carbohydrates and energy – photosynthesis, glycolysis and metabolic energy.
b. Nucleic acids: Structure and function of DNA, RNA (m-RNA, t-RNA, r-RNA), an overview of gene expression (replication, transcription and translation), genetic code (origin, Wobble hypothesis and other features), genetic errors, carcinogenesis and recombinant DNA technology.

Module IV: Amino acids, Peptides and Proteins (9 lectures)

a. Amino Acids – structural characteristics, acid-base properties, synthesis.
b. Peptides – amino acid analysis, terminal group analysis, the amino acid sequence, synthesis; I Proteins, enzymes and biosynthesis – the alpha-helix, other secondary and tertiary structural characteristics, enzymes; protein synthesis.

Module V: Vitamins (9 lectures)

Vitamins: Classification; occurrence; chemistry of Vitamins – structure elucidation and synthesis; biochemical functions; deficiency syndromes.

Suggested Readings

1. Organic Chemistry, S. H. Pine, J. B. Hendrickson, D. J. Cram and G. S. Hammond, McGraw Hill.
2. Organic Chemistry, J. Clayden, N. Greeves, S. Warren and P. Wothers, Oxford University Press.
3. Biochemistry, J. M. Berg, J. L. Tymoczco, G. J. Gatto and L. Stryer, W. H. Freeman & Co.
4. Biochemistry, D. Voet and J. G. Voet, John Wiley and Sons Berg.
5. Principles of Biochemistry, D. Nelson, A. L. Lehninger, M. M. Cox, W. H. Freeman & Co.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H		M	M
CO 3				H	
CO 4			H		
CO 5					H

CHRM0017: Research Methodology for Chemistry

(3-0-0)

Course Outcomes

CO 1: Explain the different methods of scientific Research. (Understanding)
CO 2: Explain how to use e-resources for research. (Understanding)
CO 3: Explain the analysis and presentation of data. (Understanding)
CO 4: Apply the knowledge of chemical safety and handle chemicals safely in the lab. (Applying)
CO 5: Construct a proposal for project funding. (Creating)

Mode of Assessment:

Modules I-II will be assessed based on a written examination (2 credits) while Module III will be assessed on the basis of a seminar (1-credit).

Module I: Methods of Scientific Research and Chemical Safety (15 lectures)

a. Print resources, digital resources, information technology and library resources, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving an oral presentation, writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publication of scientific work; writing ethics – avoiding plagiarism.
b. Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals, overview of chemical regulations in India.

Module II: Data Analysis (15 lectures)

The Investigative Approach: Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments.

Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemometrics, Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, r and its abuse. Basic aspects of multiple linear regression analysis.

Module III: Project Proposal Writing (Seminar Module) (15 lectures)

In this module, students will be reviewing scientific articles, writing reports on the papers they have read and finally prepare a research proposal.

Suggested Readings

1. Practical skills in chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A. Jones, Prentice-Hall, Harlow.
2. Data analysis for chemistry, D. B. Hibbert and J. J. Gooding, Oxford University Press.
3. Errors of observation and their treatment, Fourth Ed., J. Topping, Chapman Hall, London.
4. Quantitative chemical analysis, D. C. Harris, Freeman.
5. How to use Excel in analytical chemistry and in general scientific data analysis, R. de Levie, Cambridge Univ. Press.
6. Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.
7. OSU safety manual 1.01.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	H		L
CO 3		H	
CO 4	H		
CO 5			H

CHMC0018: Materials Chemistry

(3-0-0)

Course Outcomes

CO 1: Recall the knowledge of the basic structure of materials. (Remembering).
CO 2: Explain how molecular structure affects the properties of materials. (Understanding)
CO 3: Explain the properties of different materials based on their structures. (Applying)
CO 4: Analyse the application of different types of materials in a different field. (Analysing).
CO 5: Predict and control material properties. (Creating)

Module I: Solid state ionic conductors (11 lectures)

Structure, physico-chemical principles, applications of Ferrous alloys, Fe-C phase transformations in ferrous alloys, non- ferrous alloys, properties and applications of ferrous and non-ferrous alloys, magnetic alloy, metallic glass, ceramics, nano- materials and optical materials.

Module II: Polymeric materials and inorganic Polymers (12 lectures)

a. Molecular shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer typesand their applications, conducting and ferro-electric properties.
b. Polysiloxanes, polysilanes, polyphosphazenes, polymeric sulphur - synthesis, structure, properties and applications,co-ordination polymers and organometallic polymers.

Module III: Liquid crystals and high-temperature superconductors (High-Tc or HTS) materials (12 lectures)

Nomatic, smectic, cholesteric - properties and applications, high Tc materials, defect perovskites, high Tc superconductivity in cuprates, 1-2-3 and 2-1-4 materials, anisotropy, temperature dependence of electrical resistance, optical phonon modes, superconducting state, heat capacity, coherence length, elastic constants, position lifetimes, micro-wave absorption pairing and multi gap structure in high Tc materials, applications of high Tc materials.

Module IV: Organic solids and molecular devices (10 lectures)

a. Conducting organics, organic superconductors, magnetism in organic materials, fullerenes, doped fullerenes as superconductors.
b. Molecular rectifiers and transistors, artificial photosynthetic devices, sensors, clay -polymer and carbon composites, phosphor and laser materials.

Suggested Readings

1. Principles of the Solid State, H. V. Keer, Wiley Eastern.
2. Material Science and Engineering- An Introduction, W. D. Callister, Wiley, New York.
3. Materials Science, K. D. Lever, J. M. Alexender and R. D. Rawlings, J.C. Senderson, ELBS.
4. Inorganic Polymers, J. E. Marck, H. R. Allcock and R. West, Prentice Hall.
5. Solid State Physics, N. W. Ashcroft and N. D. Mermin, Saunders College.
6. Thermotropic Liquid Crystals, G.W. Gray, John Wiley.
7. Handbook oi Liquid Crystals, K. V. Chemie Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H	M	H
CO 2	H		H	
CO 3	M	M		
CO 4	M			H
CO 5		M	M	M

CHCC0019: Computational Chemistry

(3-0-0)

Course Outcomes

CO 1: Recall the programming and some numerical methods in Chemistry. (Remembering)
CO 2: Explain the molecular mechanics methods. (Understanding)
CO 3: Apply QM/MM methods in organic, inorganic and organometallic systems. (Applying)
CO 4: Explain the quantum mechanical methods. (understanding)

Module I: Programming and some numerical methods in chemistry (10 lectures)

Introduction to Linux/UNIX and shell scripts; programming in C /python; Least squares fit; root finding; numerical differentiation; integration and solution of ODE; matrix multiplication, inversion and diagonalization; interpolation; pattern recognition techniques and molecular graphics.

Module II: Molecular Mechanics (MM) Methods (10 lectures)

Basic geometrical description of molecules; force field energy, force field parameterization, differences between force fields, computational considerations, validation of force fields, advantages and limitations of force field methods, transition structure modelling, hybrid force field – electronic structure methods.

Module III: Electronic structure (or Quantum Mechanical, QM) Methods (15 lectures)

Many electron systems, Hartree-Fock method, basis sets, electron correlation and its treatment, basics of density functional theory, DFT based reactivity descriptors. Introduction to popular softwares (like Gaussian, DMol, GAMESS). Applications to simple molecular systems. Monte Carlo and molecular dynamics simulations.

Module IV: Combined QM/MM methods (10 lectures)

Implications of the choice of QM and MM methods; Application of QM/MM methods in organic, inorganic and organometallic systems including bio-organic and bio-inorganic molecules.
Quantitative structure activity relation (QSAR): Early approaches, topological indices, fragmental models; quantum mechanical descriptors.

Suggested Readings

1. Modelling Molecular Structure, A. Hinchcliffe, John Wiley and Sons.
2. Molecular Modeling Basic Principles and Applications, H. D. Holtje, W. Sippl, D. Rognan and G. Folkers , Wiley-VCH.
3. Molecular Modeling: Principles and Applications, A. R. Leach, Pearson Education.
4. Introduction to computational chemistry, F. Jensen, John Wiley and Sons Press.
5. Numerical Recipes in Fortran/C, S. A. Tenkolsky, W. T. Vetterling and P. Flannery, Cambridge University Press.
6. Python programming for the absolute beginner, Course Technology, M. Dawson, CENGAGE learning.
7. C Programing for the absolute beginner, M. Vine, Thomson Course Technology.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2		H		
CO 3		M	M	H

CO 4			H	

CHFC0020: Food Chemistry

(3-0-0)

Course Outcomes

CO 1: Recall the relationship between food, nutrition and health. (Remembering)
CO 2: Explain the nutritional needs during the life cycle and nutritional deficiency and their prevention. (Understanding)
CO 3: Apply the knowledge of food chemistry for entrepreneurial development. (Applying)
CO 4: Explain the sources, functions of major nutritional constituents. (Analysing).
CO 5: Outline the changes in nutrition during cooking, ripening, storage of different categories of food. (understanding)
CO 6: Explain nutritional perspectives of diets. (understanding)

Module I: Basic idea of food and nutrients (2 lectures)

Relationship between food, nutrition and health; functions of food: physiological and social.

Module II: Major nutritional constituents (12 lectures)

Functions, sources, deficiency/excess diseases of the following major nutrients:(a) Carbohydrates; (b) Amino acids and proteins; (c) Lipids, sterols, metabolite; (d) Mineral; (e) Vitamins: A, D, E, K.

Module III: Different categories of food (7 lectures)

Selection, nutritional contribution and changes during Cooking/Ripening/storage of the following categories of food: (a) Cereals; (b) Pulses; (c) Fruits and vegetables; (d) Milk and milk products; (e) Egg, meat, poultry and fish; (f) Fats and oils.

Module IV: Nutritional needs during life cycle (6 lectures)

Body composition, Influence of Nutrition, Physical Activity, Growth and Aging; Maternal Nutrition, Nutritional Requirement during Infancy, Childhood; Diet, Nutrition and Adolescence; Nutrition in the Elderly.

Module V: Prevention and management of deficiencies (6 lectures)

Causes, symptoms, treatments and preventions of the following: Protein-Energy malnutrition among children; Vitamin A deficiency; Iron deficiency; Fluorosis: Over nutrition, obesity, coronary heart diseases, Diabetes (Type I & II); Diet, Nutritionand cancer.

Module VI: Dietary goals & guidelines (10 lectures)

National Perspectives; nutritional perspectives of vegetarian diets; Social Health Issues – Smoking, Alcoholism, DrugAddiction, AIDS and AIDS Control Programs; Food Preservation & Food Additives & Colorants.

Module VII: Entrepreneurship Development (2 lectures)

Scope of Food based items for Entrepreneur Development in North East India & Identification of Resources; Developmentof a Project Plan.

Suggested Readings

1. Fundamentals of Foods, Nutrition and Diet Therapy, S. R. Mudambi and M. V. Rajagopal, New Age International.
2. Nutrition Science, B. Srilakshmi, New Age International.
3. Handbook of Food and Nutrition, M. Swaminathan,BAPPCO.
4. Perspectives of Nutrition, G. M. Wardlaw and J. S. Hanpl, McGraw Hill.
5. Food Science, Nutrition and Food Safety, S. Sari, A. Malhotra, Pearson India Ltd.
6. Nutritive Value of Indian Foods, NIN, ICMR, C. Gopalan, B.V. Rama Sastri and S. C. Balasubramanian.
7. Textbook of Human Nutrition, M. S. Bamji, Oxford & IBH Pub Co Pvt Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H	M	M	M	M		
CO 2				H	H		
CO 3							H
CO 4		H	L				
CO 5				H			
CO 6						H	

CHIC0021: Industrial Chemistry

(3-0-0)

Course Outcomes

CO 1: Recall the origin, importance of elastomers. (Remembering)
CO 2: Recall the classification, limitations of synthetic fibers. (Remembering)
CO 3: Illustrate the classification and utility of fertilizers and pesticides. (Understanding)
CO 4: Compare and Analyse different chemical reactions and procedures adopted in different industries. (Analysing)
CO 5: Evaluate the challenges existing in the tea and sugar industries and suggest ways to overcome them. (Evaluating)
CO 6: Explain the classes, manufacturing of different paints. (Understanding)

Module I: Elastomers (7.5 lectures)

Rubbers: origin, importance, types of rubber, natural rubber, gutta-percha, guayle rubber, balata. Refining of crude rubber, drawbacks of natural rubber, vulcanization, technique of vulcanization. Synthetic rubber, poly butadiene, buna –S or SBR rubber, neoprene, nitrile rubber, butyl rubber, silicone rubber, & poly urethane.

Module II: Synthetic Fibres (5 lectures)

Introduction, natural and artificial fibres characteristics and limitations. Study of following synthetic fibres- Rayon (nitro cellulose) cupra ammonium rayon, acetate rayon, nylon 66, nylon-6, terylene (Dacron) Teflon & Saran.

Module III: Fertilizers and Pesticides (10 lectures)

a. Fertilizers: Plants nutrients, need for fertilizers, qualities of fertilizers, NPK ratio, classification of fertilizers, straight and mixed fertilizers. Nitrogenous fertilizers, manufacture of ammonium nitrate, urea, ammonium sulphate, phosphate fertilizers manufacture of triple phosphate and super phosphate, potassium fertilizers.
b. Pesticides: Introduction, classification, Study of the following types: - Organo chlorine pesticides like DDT, BHC and Aldrin. Organo phosphorous pesticides, malathion& parathion. Rodenticides, fungicides, herbicides, fumigants and repellants (one example each).

Module IV: Sugar and Fermentation Industries (10 lectures)

a. Sugar: Importance of sugar industry, manufacture of raw and refined sugar with flow sheet, estimation of sugar (physical and chemical methods).
b. Fermentation: Definition of fermentation, importance of various fermentation industries, basic requirements for fermentation, steps in fermentation process. Manufacture of alcohol from molasses, distillation, coffee still, preparation of absolute alcohol, various useful fractions and their uses, proof sprit, denatured spirit.

Module V: Tea Industry (7.5 lectures)

Chemical composition - an overview, Polyphenols in tea- Mechanism of theaflavin formation, biochemistry of tea - Biosynthesis of caffeine, Cinnamate, flavonoids, Chemical properties of tea- Polyphenols as Antioxidants.

Module VI: Paints (5 lectures)

Introduction, classification of paints, constituents of paints in brief. Manufacture of paints, qualities of good paint, emulsion paints, paint removers, varnishes enamels, lacquers, thinners in brief.

Suggested Readings

1. Industrial Chemistry, B. K. Sharma, Goel Publishing House Meerut, India.
2. Shreeve's Chemical Process Industries, G. T. Austin, Mc Graw Hill.
3. Organic Chemistry Vol I, I. L. Finar.
4. Organic Chemistry Vol II, I. L. Finar.
5. Introduction to Paint Chemistry and Principles of Technology, J. Bentley and G. P. A. Turner, Springer Science.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H			
CO 4			L	H	H	M
CO 5				H	H	
CO 6						H

CHMD0022: Medicinal Chemistry

(3-0-0)

Course Outcomes

CO 1: Recall the definition of drugs and pro drugs and history of drug development. (Remembering)
CO 2: Explain the mechanisms and theoretical aspects of drug action. (Understanding)
CO 3: Explain the properties and synthetic methods of antibiotics, antiviral, antimalarials etc. (Understanding)
CO 4: Explain the classes of neurotransmitters, drugs affecting cholinergic and adrenergic pathways. (Understanding)
CO 5: Recall about antihistamines, anti-inflammatory drugs, analgesics, anticancer gene therapy etc. (Remembering)

Module I: Introduction and History of Drug Development (5 lectures)

Definition of drug and prodrugs; need of drugs; germ theory of diseases; history of sulpha drugs and their mode of action; antibacterial agents.

Module II: Mechanisms and Theoretical aspects of drug action, drug discovery, design and delivery (10 lectures)

Receptors – two-state model of receptor theory, drug-receptor interaction and Clark's Occupancy Theory; physiological response; drug agonist and antagonist – classification; Need of quantification of drug action; definition of chemotherapeutic index and therapeutic index; factors affecting bioactivity of drugs; pharmacokinetics and pharmacodynamics; QSAR; Lead compounds in drug discovery; importance of SAR and molecular modification; importance of combinatorial library and molecular modelling in drug discovery; drug delivery – controlled drug delivery methods.

Module III: Antibiotics, Antivirals and Antimalarials (15 lectures)

a. General introduction to antibiotics – their sources and classification; causes and concerns of bacterial resistance to antibiotics; definition and need of broad Spectrum Antibiotics. Mechanism of action of lactam antibiotics, non-lactam antibiotics and quinolones.
b. Antivirals – difficulty in developing clinical solutions to viral diseases, introduction to antiviral agents, AIDS –its cause and prevention.
c. Antimalarials – classification of human malaria and plasmodia responsible for human malaria; discovery of quinine and its structure-activity-relationship (SAR), importance of quinine as a lead to the discovery of low cost antimalarials,artemisinin and its derivatives – their SAR and importance in dealing with chloroquine resistant malaria, mode of action.

Module IV: Neurotransmitters (5 lectures)

Classes of neurotransmitters, drugs affecting cholinergic and adrenergic pathways.

Module V: Miscellaneous topics (10 lectures)

Antihistamines, anti-inflammatory drugs, analgesics, anticancer and antihypertensive drugs, gene therapy, anti-sense and anti-gene strategies and drug resistance.

Suggested Readings

1. Medicinal Chemistry: An Introduction, G. Thomas, John Wiley & Sons.
2. An Introduction to Medicinal Chemistry, G. L. Patrick, Oxford University Press.
3. Introduction to Medicinal Chemistry, A. Gringauz, Wiley India Pvt Ltd.
4. Medicinal Chemistry, D. Sriram and P. Yogeeswari, Pearson Education. (Dorling Kindersley India).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	M	M	M
CO 3			H		
CO 4				H	
CO 5					H

CHRC0023: Recent Advances in Catalysis

Course Outcomes

CO 1: Recall the kinetics of heterogeneous catalysis. (Remembering)
CO 2: Explain the preparation and characterization of industrial catalysts. (Understanding)
CO 3: Explain the synthesis and properties of Zeolite and clays. (Understanding).
CO 4: Explain the environmental catalyst and role of catalyst in the petroleum industry. (Understanding)

Module I: Kinetics of heterogeneous catalysis (10 lectures)

Adsorption and catalysis, mechanism of heterogeneous catalysis, kinetics of heterogeneous catalytic reactions, volcano principle, shape and size selectivity of catalysts, characterization of catalysts and their surfaces, methods of surface analysis,

surface area, pore size, void fraction, particle size, mechanical strength, surface chemical composition, surface acidity and reactivity.

Module II: Preparation and characterization of industrial catalysts (8 lectures)
Catalyst design methods, catalyst support and preparation of industrial catalyst, supported and unsupported metal catalysts, bimetallic catalysts, Electron microscopy, XPS and PES, ESCA, IR and magnetic resonance spectroscopy, temperature programmed desorption (TDP), and DTA and TGA.

Module III: Zeolite and clays (15 lectures)
a. Synthesis of some selected important zeolites, modification of zeolites, ion exchange, metals supported on zeolites, dealumination and desilication of zeolites, shape selective catalysis in zeolites.
b. Properties of pillared clays, use of coordination and organometallic compounds as pillaring, pillaring of acid activated clays, mesoporous materials, ordered mesoporous materials, synthesis of silica molecular sieve materials,characterization of mesoporous molecular sieves, catalytic properties of mesoporous materials, catalytic applications of zeolite, clays and mesoporous materials.

Module IV: Catalysis in petroleum industry and environmental catalysts (12 lectures)
Design of catalytic reactors, promotion and promoters, catalytic processes in petroleum industry, reforming, cracking and hydrotreating, hydrogenation, hydrodesulphurization, Fischer-Tropsch process, Catalytic deactivation and reactivation, control of pollution from automobile exhaust, catalytic converters, abatement of nitrogen oxides and odours, cleaning of industrial effluents.

Suggested Readings
1. Fundamentals of Industrial Catalytic Processes, C. H. Bartholomew and R. J. Furrauto, Wiley Interscience.
2. Heterogeneous Catalysis, D. K. Chakrabarty and B. Viswanathan, New Age Int.
3. Catalytic Chemistry, B. C. Gates, John Wiley & Sons.
4. Heterogeneous Catalysts for Synthetic Chemists, R.L. Augustine, Marcel-Dekker.
5. Catalysis and zeolites – fundamentals and applications, J. Weitkamp and L. Puppe, Springer-Verlag.
6. Handbook of Heterogeneous Catalysis, Vol 4 and 5, G. Ertl, H. Knozinger and J. Weitkamp, Wiley-VCH.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

CHBC0024: Biophysical Chemistry

(3-0-0)

Course Outcomes
CO 1: Recall the fundamentals of biological macromolecules. (Remembering)
CO 2: Explain the molecular modelling and conformational analysis of biological macromolecules. (Understanding)
CO 3: Explain different methods for analysis and separation of biomolecules. (Understanding)
CO 4: Explain different techniques for the structural determination of biomolecules. (Understanding)
CO 5: Explain different optical methods in biological systems. (Understanding)

Module I: Fundamentals of biological macromolecules (5 lectures)
Chemical bonds in biological systems; properties of water; thermodynamic principles in biological systems; properties and classification of amino acids; protein structure and function; properties of nucleosides and nucleotides; composition of nucleic acids; structure of nucleic acids.

Module II: Molecular modelling and conformational analysis (10 lectures)
Complexities in modelling macromolecular structure; polypeptide chain geometries and internal rotation angles; Ramachandran plots; Molecular mechanics; stabilizing interactions in biomolecules; simulating macromolecular structure; energy minimization; molecular dynamics.

Module III: Methods for analysis and separation of biomolecules (10 lectures)
General principles, chromatography; analytical centrifugation – basic principles, sedimentation velocity, sedimentation equilibrium, density gradient sedimentation – isopycnic and rate- zonal centrifugation; electrophoresis, isoelectric focussing; capillary electrophoresis, MALDI-TOF, calorimetry – introduction, isothermal titration calorimetry, differential scanning calorimetry.

Module IV: Structural determinations: Physical Methods (10 lectures)
Ultracentrifugation and other hydrodynamic techniques; light scattering – fundamental concepts, scattering from a number of small particles, Rayleigh scattering, scattering from particles that are not small compared to the wavelength of radiation, dynamic light scattering, low angle X-ray scattering, neutron scattering, Raman scattering.

Module V: Optical Methods and Applications (10 lectures)
Optical techniques in biological systems – refraction, evanescent waves and plasmons-surface plasmon resonance; absorption spectroscopy, fluorescence spectroscopy, linear and circular dichroism, single and multidimensional NMRspectroscopy.

Suggested Readings
1. Biophysical Chemistry Parts I-III, C. R. Cantor and P. R. Schimmel, Macmillan.
2. Principles of Biochemistry,A. L. Lehninger, D. L. Nelson, L. Lehninger and M. M. Cox, W. H. Freeman.
3. Biophysical Chemistry the Royal Society of Chemistry, A. Cooper, UK.
4. Biophysical Chemistry, J. P. Allen, Blackwell Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H		L	M	
CO 2		H			
CO 3			H		
CO 4		L		H	
CO 5					H

CHHC0025: Heterocyclic Chemistry
(3-0-0)

Course Outcomes
CO 1: Recall the systematic nomenclature of heterocyclic compounds. (Remembering)
CO 2: Explain the synthesis and properties of azoles and condensed five-membered rings. (Understanding)
CO 3: Explain the synthesis and properties of three and four-membered heterocyclic compounds. (Understanding)
CO 4: Explain the importance and chemistry of natural heterocyclic compounds. (Understanding)
CO 5: Explain synthesis and properties of Diazines, bicyclic heterocycles & seven-membered heterocycles. (Understanding)

Module I: Introduction & Small Ring Heterocycles (10 lectures)
Hantzsch-Widman nomenclature for monocyclic, fused and bridged heterocycles; General approaches to heterocyclic synthesis; Aliphatic and aromatic heterocycles; Basicity and aromaticity of heterocycles.
Syntheses of aziranes, oxiranes &thiiranes; Ring openings and heteroatom extrusion; Synthesis & reactions of azetidines, oxetanes & thietanes; Strain.

Module II: Azoles and condensed five membered Rings (15 lectures)
Physical and chemical properties; Synthesis of pyrazole, isothiazole and isoxazole; Synthesis of imidazoles, thiazoles & oxazoles; Nucleophilic and electrophilic substitutions; Ring cleavages; Benzofused analogues.
Synthesis of indole, benzofuran and benzo-thiophene; Nucleophilic, electrophilic and radical substitutions; Additionreactions; Indole rings in biology.

Module III: Diazines, bicyclic heterocycles & seven membered heterocycles (10 lectures)
Physical & chemical properties and synthesis of pyridazines, pyrimidines, pyrazines; Nucleophilic and electrophilic substitutions.
Synthesis of quinolines, isoquinolines, benzofused diazines, acridines, phenothiazines, carbazoles and pteridines; Substitution reactions.
Synthesis & reactions of azepines, oxepines, thiepines & diazepines.

Module IV: Natural heterocycles (10 lectures)
a. **Porphyrins:** Classification and synthesis of porphin rings.
b. **Nucleic Acids:** Primary, secondary and tertiary structure of DNA; DNA replication and heredity; Structure and function of mRNA, tRNA and rRNA.
c. **Proteins:** Acid-base properties of amino acids; polypeptides; primary, secondary, tertiary and quaternary protein structures; classification of proteins on basis of structure and biological function; Merrifield peptide synthesis.

Suggested Readings
1. Modern Heterocyclic Chemistry, L. A. Paquette, W. A. Benjamin.
2. Organic Chemistry, Vol. II, I. L. Finar, ELBS.

3. Heterocyclic Chemistry, T. L. Gilchrist, Longman.
4. Biochemistry, A. L. Lehninger, Kalyani Publishers.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3	H			
CO 4				H
CO 5			H	

CHNP0026: Natural Products Chemistry

Course Outcomes

CO 1: Recall the chemistry of medicinal compounds of natural origin. (Remembering)
CO 2: Explain the role of co-enzyme during Bio-synthesis of natural products. (Understanding)
CO 3: Illustrate the biosynthesis and total synthesis of terpenoids and alkaloids. (understanding)
CO 4: Analyse the presence of isoprene units in the natural product. (Analysing)
CO 5: Analyse the practical utility of steroid chemistry. (Analysing)

Module I: Natural Products and their Biosynthetic Pathways (15 lectures)

General classification of natural products, sources and their isolation, characterisation and biosynthesis of common plant products; Extraction and Separation of Natural Products Biosynthesis pathways for natural products using co-enzymes and enzymes, general biogenesis and synthesis of cis-jasmone, methyl jasmonate, prostaglandins, exaltone and muscone.

Module II: Terpenoids and Alkaloids (15 lectures)

Terpenes and the Isoprene Rule; General biosyntheses of mono- and sesquiterpenes, trans-chrysanthemic acid, cyclo- pentato monoterpene lactones; Synthesis of α-vetinone and total synthesis of β-eudesmol; Synthesis of hirsutene, abietic acid, cis juvenile hormone, trans annular cyclisation of caryophyllene; Synthesis of caryophyllene and isocaryophyllene; Rearrangements of santonic acid and thujospene; Synthesis and rearrangement of longifolene; Structure, synthesis and biosynthesis of common alkaloids: reticuline, yohimbine and tylophorine.

Module III: Steroids (15 lectures)

Nomenclature of steroids and synthesis of squalene; Lanosterol and caretonoids; Synthesis of equlenins; Estrogens and total synthesis of non-aromatic steroids (progesterones); Corticosteroids; Degradation of diosgenin to progesterone and itssynthesis; Miscellaneous transformations of steroid molecules.

Suggested Readings

1. Natural Products Chemistry, Vols. I and II, K. Nakanashi, Academic Press, New York and London.
2. Natural Products Chemistry, sources, separations and structures, R. Cooper and G. Nicola, CRC Press, Taylor & Francis Group.
3. Chemistry of Natural Products, S. V. Bhat, B. A. Nagasampagi and M. Sivakumar, Springer Science & Business Media.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	H	L	L
CO 3		H	
CO 4		H	
CO 5			H

CHOC0027: Organometallic Chemistry

(3-0-0)

Course Outcomes

CO 1: Recall the fundamentals of organometallic compounds and their reactions. (Remembering)
CO 2: Explain the physical techniques required for the characterization of Organometallic compounds. (Understanding)
CO 3: Explain the synthesis and application of the main group organometallic compounds. (Understanding)
CO 4: Analyse the function of transition metal-based organometallic compounds. (Analysing)
CO 5: Evaluate potential applications of Organometallic chemistry in organic synthesis. (Evaluating)
CO 6: Design one-pot synthesis of complex molecules using organometallic chemistry. (Creating)

Module I: Introduction to organometallic compounds and reaction mechanisms (7 lectures)
History of Organometallic Chemistry, 18 electron rule, Electronic structure, Ligand substitution, oxidative addition, reductive elimination, migratory insertion, hydride elimination, trans-metallation, nucleophile and electrophilic attack on the ligands coordinated to metals.

Module II: Physical methods in organometallic chemistry (8 lectures)
Characterization of organometallic compounds using NMR, EPR, Mossbauer, IR, Mass spectroscopy and X-ray crystallography; Isotope effect; Fluxionality of organometallic complexes.

Module III: Main group organometallic compounds (8 lectures)
Synthesis and reactions of main group organometallic compounds including organo lithium, organo magnesium, organo boron, organo aluminium, organosilicon and organotin compounds.

Module IV: d-block organometallic compounds (8 lectures)
Structure, Preparation, and Chemistry of Transition metal carbene and –carbyne complexes. N-Heterocyclic Carbenecomplexes; Transition metal compounds with M-H bonds (classical and non-classical metal-hydrides), Agostic interaction.

Module V: Organometallic catalysis and application of organometallic chemistry to organic synthesis (14 lectures)
Synthetic applications of metathesis reactions, ring opening, ring closing metathesis in organic synthesis, macrocycle synthesis. Asymmetric hydrogenation, Hydrosilylation, Hydrocyanation, Palladium in Homogenous catalysis- Heck coupling, Stille coupling, Suzuki coupling, Negishi coupling, Sonogashira coupling and Buchwald-Hartwig coupling reactions. Synthetic utility of organotitanium, organochromium, organonickel, organocopper, organ rhodium compounds.

Suggested Readings

1. Organometallics, C. Elschenbroich, Wiley.
2. The Organometallic Chemistry of the Transition Metals, R. H. Crabtree, Wiley-Blackwell.
3. Organometallics and Catalysis: An Introduction, M. Bochmann, Oxford University Press.
4. Organometallic Chemistry, G. O. Spessard and G. L. Miessler, Oxford University Press, New York.
5. Transition Metal Organometallic Chemistry, F. Mathey, Springer.
6. Organic Synthesis, M. B. Smith, McGraw Hill Higher Education.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H		L	L	M
CO 2		H			
CO 3			H		
CO 4				H	
CO 5					H
CO 6					M

CHIP0028: Inorganic Rings, Clusters and Polymers

(3-0-0)

Course Outcomes

CO 1: Recall the knowledge of inorganic rings, clusters and inorganic polymers with respect to their structural diversity. (Remembering)
CO 2: Illustrate different theories to predict the structure of metal clusters. (Understanding)
CO 3: Make use of isolobal analogy in the understanding of structure and bonding of heteroboranes. (Applying)
CO 4: Analyse the concept of electron deficiency and sufficiency of Polyhedral boranes. (Analysing)
CO 5: Compare inorganic polymers with organic polymers. (Evaluating).
CO 6: Discuss the synthesis, structure, bonding and applications of inorganic polymers. (Creating)

Module I: Boranes and Heteroboranes (13 lectures)
Polyhedral boranes, concept of electron deficiency and sufficiency, types and IUPAC nomenclature of polyhedral boranes. Polyhedral skeleton electron pair theory (PSEPT). W. N. Equivalent and resonance structures. Wade's vs Lipscomb'smethods of studying higher boranes.
Heteroboranes: types and IUPAC nomenclature, structure and bonding of heteroboranes with special reference to carboranes, Metallaboranes, Metallacarboranes, metal σ and μ bonded borane/carborane clusters. Resemblance of Metallaboranes/Metallacarboranes with ferrocene and related compounds. Applications of Metallaboranes/Metallacarboranes as drug delivery system. Applications of PSEPT over heteroboranes.

Module II: Isolobility (6 lectures)
Concept of isolobility and isolobal groups with examples. Its application in the understanding of structure and bonding of heteroboranes.

Module III: Metal Clusters (11 lectures)
Metal-metal bonding, quadrupolar bond and its comparison with a C-C bond; Types of metal clusters and multiplicity of M- M bonds. Simple and condensed metal carbonyl clusters. Applications of PSEPT and Wade's-Mingo's and Lauhr's rule over metal carbonyl clusters. Metal halide and metal chalcogenide clusters, polyatomic Zintl ions, Bloomington shuffle.

Module IV: Inorganic Polymers (15 lectures)
Inorganic polymers, classification of inorganic polymers, comparison with organic polymers, Boron-oxygen and boron- nitrogen polymers, silicones, polysilanes, polyphosphazenes, coordination polymers, sulphur-nitrogen, sulphur-nitrogen- fluorine compounds, preceramic inorganic polymers.

Suggested Readings
1. Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley & Sons, New York.
2. Inorganic Chemistry, J. E. Huheey, Addison Wesley Pub. Co., New York.
3. Chemistry of the Elements, N. N. Greenwood and A. Earnshaw, Butterworth Heinemann, London.
4. Inorganic polymers, J. E. Mark, H. R. Allcock and R. West, Oxford University Press, New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	L	H	H
CO 2			H	
CO 3		H		
CO 4	H			
CO 5				H
CO 6				H

CHQT0029: Introduction to Quantum Chemistry and Group Theory

Course Outcomes
CO 1: Recall the postulates and principles of quantum chemistry. (Remembering)
CO 2: Explain the Schrodinger equation. (Understanding)
CO 3: Solve the problems related to wave functions. (Applying)
CO 4: Distinguish one approximation method from another, one molecular point group from another. (Analysing)

Module I: Quantum Chemistry I (20 lectures)
Planck's theory, wave-particle duality, uncertainty principle, operators, eigen functions and eigen values in quantum mechanics, postulates of quantum mechanics, Schrodinger equation, free particle, particle in a box, degeneracy, harmonic oscillator, rigid rotator, the hydrogen atom, angular momentum, electron spin, spin-orbit coupling.

Module II: Quantum Chemistry II (20 lectures)
Approximate methods in quantum mechanics - the variation theorem, linear variation principle and perturbation theory (first order and non-degenerate), application of variation method and perturbation theory to the Helium atom, anti- symmetry, Slater determinant, term symbols and spectroscopic states, Huckel approximation for small pi-conjugated molecules.

Module III: Chemical Applications of Group Theory (20 lectures)
Symmetry elements and operations, equivalent symmetry elements and equivalent atoms, identification of symmetry point groups with examples, groups of very high symmetry, molecular dissymmetry and optical activity, systematic procedure for symmetry classification of molecules and illustrative examples, brief review of matrix representation of groups, reducible and irreducible representations, rules about irreducible representations as derived from great orthogonality theorem, relationship between reducible and irreducible groups, character tables.

Suggested Readings
1. Molecular quantum Mechanics, P. Atkins and R. Friedman, Oxford University Press.
2. Quantum Chemistry, I. N. Levine, PHI Learning Pvt. Ltd.
3. Introduction to Quantum mechanics, D. J. Griffiths, Pearson Education Ltd.
4. Chemical Applications of Group Theory, F. A. Cotton, Willey India Pvt. Ltd.
5. Molecular Symmetry and Group Theory, R. L. Carter, John Wiley & Sons.
6. Molecular Symmetry and Group Theory, A. Vincent, Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	L	
CO 2	H		
CO 3	H	L	
CO 4	M	H	H

CHFY0030: Fundamentals of Spectroscopy

(4-0-0)

Course Outcomes

CO 1: Recall the fundamental aspects of absorption and emission spectroscopy. (Remembering)
CO 2: Explain the basic concepts of rotational and vibrational spectroscopy. (Understanding)
CO 3: Illustrate basics and applications of electronic spectra. (Understanding)
CO 4: Explain theories and applications of NMR, ESR and Mossbauer spectroscopy. (Understanding)
CO 5: Identify unknown molecules with the help of different spectroscopic techniques. (Applying)

Module I: Interaction of light with matter (5 lectures)

Fundamental aspects of absorption and emission spectroscopy, probability of transition, oscillator strength, dipole strength, Spontaneous and stimulated emission, origin of selection rules.

Module II: Rotational and Vibrational Spectroscopy (15 lectures)

Degrees of freedom of molecules, rigid rotor model, rotational spectra of diatomics and polyatomics, effect of isotopic substitution and non-rigidity, selection rules and intensity distribution, Vibrational spectra of diatomics, effect of anharmonicity, Morse potential, Vibrational-rotational spectra of diatomics, P, Q, R branches, normal modes of vibration, overtones, hot bands, Raman spectroscopy – Origin, rotational and vibrational Raman spectra of diatomics.

Module III: Electronic Spectroscopy (15 lectures)

Electronic spectra of diatomic molecules, Frank-Condon principle, vibronic transitions, Spectra of organic compounds, $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$ transition, Photoelectron Spectroscopy – basic principle, photoelectron spectra of simple molecules, X-ray photoelectron spectroscopy (ESCA), Auger electron spectroscopy, Lasers – Laser action, population inversion, properties oflaser radiation, examples of simple laser systems.

Module IV: Magnetic Resonance Spectroscopy (15 lectures)

a. **Nuclear Magnetic Resonance:** Nuclear spin and nuclear spin states in magnetic field, resonance phenomenon, relaxation process, NMR line shapes and saturation, shielding and de-shielding of magnetic nuclei, chemical shift, spin-spin interactions, spectra of two-spin system (A_2, AB and AX cases), ^{13}C, ^{19}F and ^{31}P NMR spectroscopy.
b. **Electron Spin Resonance:** Basic principles, factors affecting g values, hyperfine coupling, spin densities and McConnell relationship, Zero field splitting.

Module V: Mass spectrometry and Mossbauer spectroscopy (10 lectures)

a. **Mass spectrometry**: Basic principles, ionization techniques, isotope abundance, molecular ion, fragmentationprocesses of organic molecules, deduction of structure through mass spectral fragmentation
b. **Mossbauer spectroscopy**: Principles, instrumentation and applications.

Suggested Readings

1. Fundamentals of Molecular Spectroscopy, C.N. Banwell and E. M. McCash, Tata McGraw Hill.
2. Introduction to Spectroscopy, D.L. Pavia, G. M. Lampman and G. S. Kriz, Brooks/Cole Cengage Learning.
3. Physical Methods in Chemistry, R.S. Drago, Saunders, Thomson Learning.
4. Spectrometric Identifications of Organic Compounds, R.M. Silverstein, F. X. Webster, D. J. Kiemle and D. L. Bryce, Wiley India Pvt. Ltd.
5. Organic Spectroscopy, W. Kemp, Palgrave Macmillan.
6. Organic Structures from Spectra, L. D. Field, S. Sternhell and J. R. Kalman, John Wiley and Sons.
7. Structural Methods in Molecular Inorganic Chemistry, D. W. H. Rankin, N. Mitzel and C. Morrison, Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		

CO 4				H	H
CO 5	L	L	M	H	H

CHAP0031: Applied Spectroscopy

(3-0-0)

Course Outcomes

CO 1: Recall various principles involved in UV-Visible spectroscopy. (Remembering)
CO 2: Explain the theories and applications of IR and mass Spectrometry. (Understanding)
CO 3: Apply the NMR spectroscopy for structural elucidation of simple and complex molecules. (Applying)
CO 4: Explain the role of various spectroscopic tools required for analysing the structure of unknown molecules. (Analysing)
CO 5: Interpret the progress of organic reactions by FT-IR spectroscopy. (Evaluating)

Module I: Ultraviolet and visible spectroscopy (10 Lectures)

Electronic transitions, chromophores, auxochromes, red and blue shift, applications of UV spectroscopy, spectrum shifts with solvents, isolated and conjugated double bonds, woodward Fieser rules, Analytical uses of UV spectroscopy in polyenes, carbonyl compounds and aromatic systems.

Module II: IR and Mass Spectrometry (15 lectures)

a. **Infrared Spectroscopy**: Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols, amines; Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acid anydrides, lactones, lactams, conjugated carbonyl compounds); Effects of H- bonding and solvent effect on vibrational frequency, extension to various organic molecules for structuralassignment.
b. **Mass Spectrometry**: Mass spectral fragmentation of organic compounds, common functional groups; molecular peak, McLafferty rearrangements, examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

Module III: NMR spectroscopy (20 lectures)

a. **Nuclear Magnetic Resonance Spectroscopy**: Approximate chemical shift values of various chemically non- equivalent protons and correlation to protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic); Protons bonded to other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides, SH); Chemical exchange, effect of deuteration; complex spin-spin interaction between two, three, four and interacting nuclei (first order spectra); Complex interaction, virtual coupling, stereochemically hindered rotation, Karplus curve, variation of coupling constant with dihedral angle, nuclear magnetic double resonance, simplification of complex spectra using shift reagents, Fourier transform technique and nuclear Overhauser effect (NOE).
b. **C-13 NMR Spectroscopy**: Chemical shift (aliphatic, olefinic, alkynes, aromatic, hetero-aromatic, carbonyl carbon);Coupling constants, two-dimensional NMR spectroscopy, NOESY, DEPT and INEPT terminologies.
c. **Applications:** IR, NMR and Mass spectroscopy for structure elucidation of organic compounds.

Suggested Readings

1. Spectroscopic Identification of Organic Compounds, R. M. Silverstein, G. C. Basseler and T. Morill, C.John Wiley.
2. Organic Spectroscopy, W. Kemp, McMillan Press Ltd.
3. Spectroscopic Methods in Organic Chemistry, W. Williams, I. Fleming, McGraw Hill.
4. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash, Tata McGraw- Hill, New Delhi.
5. Introduction to Spectroscopy, D.L. Pavia, G. M. Lampman and G. S. Kriz, Harcourt College Publisher NY.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3			H
CO 4	L	H	H
CO 5		H	

CHSL0200: Elements of Service

(2-0-0)

Course Outcomes

1. Understanding social responsibility of higher educational institutes. (Understanding)
2. Identifying problems in the community and where students originated. (Applying)

3. Influence to get involved in the local community to gain insight into local issues. (Evaluating)
4. Adopt strong leadership skills which allow students to work well in a team. (Creating)

Module I (6 lectures)
Understanding social responsibility of higher educational institutes; community university engagement (CUE) and its importance, engaged teaching, engaged research. Community Based Participatory Research (CBPR). Statutory bodies of higher educational institutions and social responsibility.

Module II (9 lectures)
Service learning and active learning.; principles of service learning; classification of service learning models; servicelearning vis a vis other community experiences; historical context of university community partnership; chemistry and service learning; service Learning for a postgraduate chemistry student and its scope in research.

Module III (15 lectures)
Conceptualisation of the idea of service learning through their practical implementations (any two): (i) demonstrating experiments to inoculate scientific temper for nearby communities, (ii) organising awareness programmes for school children to eradicate the fear of pursuing higher studies in science, (iii) engaging with communities to find out various possibilities of providing the solutions to societal problems from chemistry point of view, (iv) providing consultancy to school students for various inter school science competitions.

Suggested Readings
1. Service-Learning Essentials: Questions, Answers, and Lessons Learned, B. Jacoby, Jossey-bass.
2. Where's the Learning in Service-Learning? J. Eyler, and D. E. Giles Jr., Jossey-bass.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		M	H
CO 3			M
CO 4	M		

LABORATORY COURSES

CHIQ6002: Inorganic Qualitative and Quantitative Analysis – Lab

(0-0-3)

Course Outcomes

CO 1: Recall the procedures followed to carry out the qualitative and quantitative analysis. (Remembering)
CO 2: Explain the reason behind each step for Analysing mixtures and preparing compounds and metal nanoparticles. (Understanding)
CO 3: Apply different spectroscopic methods to characterize coordination compounds. (Applying)
CO 4: Design protocols for Analysing inorganic mixtures and synthesizing nanoparticles. (Creating)

Experiments:

a. Qualitative analysis (tertiary mixtures, alloys, ores).
b. Quantitative analysis (binary mixtures, alloys, ores).
c. Inorganic preparation (crystallization, precipitation, calcination).
d. Coordination compounds through ligand synthesis and spectroscopic characterization, magnetic properties.
e. Metal Nanoparticle synthesis and characterization.

Suggested Readings

1. Vogel's Textbook of Quantitative Chemical Analysis,J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, and B. Sivasankar, Pearson.
2. Vogel's Qualitative Inorganic Analysis, G. Svehla and S. Mittal, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H			
CO 2	H	H	H	L	H
CO 3				H	
CO 4	M	M			M

CHEQ6003: Experimental Physical Chemistry – Lab

(0-0-3)

Course Outcomes

CO 1: Recall the theoretical concepts of experiments related to chemical kinetics and electrochemistry etc. (Remembering)
CO 2: Explain the principles and the procedures for spectrophotometry based experiments. (Understanding)
CO 3: Apply the theoretical knowledge for determination of rate constant, pH, emf etc. (Applying)
CO 4: Analyse the practical utility of different theories of chemical kinetics, electrochemistry, adsorption etc. (Analysing)

Experiments:

a. Chemical Kinetics based experiments.
b. Electrochemistry based experiments.
c. Spectrophotometry based experiments.
d. pH-metric Titrations.
e. Adsorption on porous materials - equilibrium, kinetic and thermodynamic studies.

Suggested Readings

1. Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publishing House.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H			
CO 2			H		
CO 3	H	H		H	
CO 4	M	M			M

CHQA6004: Organic Qualitative Analysis and Synthesis Lab

(0-0-3)

Course Outcomes

CO 1: Recall the procedures for qualitative analysis, separation of binary mixtures of organic compounds. (Remembering)
CO 2: Explain the chemistry behind the preparation of some important organic compounds. (Understanding)
CO 3: Apply different chromatographic techniques for the identification and purification of organic compounds. (Applying)
CO 4: Analyse practical utility of chromatographic techniques. (Analysing)
CO 5: Identify and extract different types of natural products. (Applying)

a. Qualitative analysis of binary mixtures of organic compounds

1. Separation of binary mixture into individual components.
2. Qualitative analysis of individual components by
   I. Detection of extra elements N, S, Halogens.
   II. Test for functional groups by systematic analysis.
   III. Solubility, melting point.
   IV. Preparation of a derivative and determination of its melting point.

b. Preparation of organic compounds by using single and multistep process.

1. Chromatographic techniques
2. Qualitative TLC separation and identification.
3. Column chromatographic separation of a mixture of compounds.

c. Extraction of natural products.

Suggested Readings

1. Vogel's Textbook of Practical Organic Chemistry, Including Qualitative Organic Analysis (5th Edition).
2. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.
3. Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A. R. Tatchell, 2012, Pearson.
4. Comprehensive Practical Organic Chemistry, V. K. Ahluwali and S. Dhingra, University Press.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c	Exp d
CO 1	H			
CO 2		H		
CO 3			H	
CO 4			H	
CO 5				H

CHRP6005: Research Project

(0-0-12)

Course Outcomes

This will be a research-based module, whereby, students will carry out either theoretical or wet lab experiments and present their findings in a thesis and perhaps as a paper in a conference or a journal.

CO 1: Learn to carry out experiments to fulfil their research objectives and will in the process learn a wide range of techniques both scientific and statistical, and also probably add to the existing body of scientific knowledge. (Remembering)
CO 2: Develop an understanding of the methods they use to carry out their research and why a certain set of methods is chosen. (Understanding)
CO 3: Apply their understanding to steer their research in the right direction. (Applying)
CO 4: Troubleshoot when a chosen approach does not yield the expected result. (Analysing)
CO 5: Critically analyse the results they obtain to decide whether the data obtained proves or disproves a stated hypothesis. (Evaluating)
CO 6: Learn to choose a methodology or approach to fulfil a set of objectives or prove or disprove a hypothesis. (Creating)

In this course, each student undertakes research on a topic that he/she chooses in project phase I or on a topic assigned to him/her by the concerned mentor.

To this end, the student will first review the current status of research on the selected topic, state a hypothesis or a set of objectives and then carry out experiments (either wet-lab or theoretical) to gather data, which he/she will then analyse, draw conclusions and finally present in a dissertation at the end of the semester.

The format for the final dissertation will be as prescribed by the department. There will be a viva voce examination on the dissertation by an expert committee comprising external and internal members of the department. The mode andcomponents of the evaluation and the weightages attached to them shall be published by the department at the beginning of the semester.

CHPC6137: Petroleum Chemistry

(1-0-1)

Course Outcomes

CO 1: To gain knowledge about the composition of crude petroleum and the refining process. (Remembering)
CO 2: To correlate the quality of fuels with various parameters. (Understanding)
CO 3: Determination of different types of water testing parameters required in thermal power plant. (Applying)
CO 4: Analysing of chemical impurities and their separation techniques. (Analysing)
CO 5: Designing of eco-friendly and sustainable energy source in future. (Evaluating)

Module I: Oil Section (15 Lectures)

Renewable and non-renewable source of energy, Petroleum, Composition of crude petroleum, Hydrocarbon, Distillation (Upper distillation, middle ditillation, Residue distillation), crude distillation unit, Fractional distillation, petroleum refining-applications of various fractions, Cracking, Reforming, Petrol, Diesel, viation turbine fuel, Kerocene, LPG, CNG, LNG, clean fuels, Octane number, Cetane number, Flash point, calorific value, knocking and antiknocking, isomerization, smoke point, Lubricants, viscosity index, cloud point, pore point, Density, Gas chromatography, HPLC.

Module II: Water section (15 Lectures)

Thermal power plant station, concept of zero discharge refinery, Oil content, Effluent treatment plant, boiler, demineralization, uses of cationic and anionic resin during neutralization reaction, requirement of *p*H determination, BOD, COD, TDS, TSS, DO, Microbiological treatment, Scavenger, alkalinity, corrosion monitoring, permanent alkalinity, Total hardness, temporary hardness, silica and phosphate removal process, removal of sulphate, sulphite, ammonia, cyanide, water testing.

Suggested Readings

1. Engineering Chemistry, P. C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.
2. Industrial Chemistry, B. K. Sharma, Goel Publishing House, Meerut
3. Fundamentals of Petroleum and Petrochemical Engineering, U.R. Chaudhuri, CRC Press, Taylor & Francis group.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H
CO 5	H	

CHPA6138: Pharmaceutical Chemistry and its applications

(1-0-1)

Course Outcomes

CO 1: Explanation of the preliminary concept of drug and their classification. (Remembering)
CO 2: To understand the mode of action of different kinds of drugs. (Understanding)
CO 3: Synthesis of simple drug molecules and their purification techniques. (Applying)
CO 4: Extraction of the medicinally active component from a plant source and their characterization techniques. (Analysing)
CO 5: To provide knowledge of computational chemistry in designing drug molecules. (Evaluating)

Module I: Introduction and importance of drug Chemistry (15 Lectures)

Definition of drug, pro-drug, host-receptors interactions in connection to biological response, pharmacokinetics andmechanism of drug action-absorption, distribution, metabolism, and excretion (ADME), Structure activity relationship (SARand QSAR), drug classification based on mode of action, analgesics and anti-inflammatory drug, COX-2 inhibitors, mode of action of NSAID and SAID, anti-histamine drugs, antidepressant drugs, narcotics, sedative-hypnotics and their mechanism of action, antibiotics, antiviral drugs, anti-bacterial drugs, anti-neoplastic drug, drugs derived from natural origin including plants and bacteria, chemotherapy, nano-drug delivery systems, toxicology, positive and negative aspect of drug chemistry, future scope of drug chemistry.

Module II: Hands on experience on drug chemistry (15 Lectures)

Experimental aspect of drug chemistry: Synthesis of simple drug molecules, various techniques used for purification including crystallization / recrystallization, acid-base purification, column chromatography, quality control / purity determination of drugs

using GC-MS, HPLC etc., extraction of active ingredient from various plants in North-eastern region having medicinal importance, procedure for bioactivity test.

Theoretical feature of drug chemistry: Application of computational chemistry in designing of drug molecule, computer simulation to assist in solving chemical problems, drug-DNA interaction study, drug-delivery study.

Suggested Readings

1. An Introduction to Medicinal Chemistry, G. L. Patrick, Oxford University Press.
2. Introduction to Medicinal Chemistry, A. Gringauz, Wiley India Pvt Ltd.
3. Medicinal Chemistry, A. Kar, New Age International Publishers.
4. Medicinal Chemistry: An Introduction, G. Thomas, John Wiley & Sons
5. Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems, D. C. Young, John Wiley & Sons, Inc.
6. Computational Materials Science: An Introduction, J. G. Lee, CRC press, Taylor & Francis Group.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H
CO 5		H

DEPARTMENT OF MATHEMATICS

VISION:

To elucidate the philosophy of Mathematical principles coupled with the exhibition of Mathematical laws in fundamental and frontier areas of science whereupon fostering an intuitive mathematical mind.

MISSION:

- To provide adequate understanding of Mathematical laws by means of both conventional techniques and skilful approaches.
- To familiarize students as well as faculty members with the state-of –the –art by means of talks,workshops, symposia.
- To invoke interest tinged with anxiety to facilitate further pursuit in terms of research pertaining to advanced knowledge.

PROGRAM OUTCOMES – MSC PROGRAMME

PO 1: **Critical Thinking**: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO 2: **Knowledge Skil**l: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculumcontent knowledge.

PO 3: **Scientific Communication Skill**s: Imbibe effective scientific and / or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since thebeginning of the civilization.

PO 4: **Ethics**: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behaviour such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actionsin all aspects.

PO 5: **Enlightened Citizenship**: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges

PO 6: **Analytical Reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO 7: **Multicultural Competence**: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".

PO 8: **Lifelong Learning**: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling.

PO 9: **Leadership Qualities**: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiringteam members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.

PO 10: **Research Skills**: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/ Matlab to various scientific investigations, problem solving and interpretation.

PROGRAMME SPECIFIC OUTCOMES FOR MSC MATHEMATICS

PSO 1: **Strong Foundation in Knowledge:** Have strong foundation in core areas of Mathematics, and able to communicate Mathematics effectively.

PSO 2: **Abstract Skills:** Evaluate hypotheses, theories, methods and evidence within their proper contexts

PSO 3: **Problem Solving**: Solve complex problems by critical understanding, analysis and synthesis

PSO 4: **Proficiency in Interdisciplinary Skills:** Select, interpret and critically evaluate information from a range of sources that include books, scientific reports, journals, case studies and internet.

PSO 5: **Application and Research Efficiency:** Provide a systematic understanding of the concepts and theories of mathematics and their application in the real world- to an advanced level, and enhance career prospects in a huge array of fields, viz. in industry, commerce, education, finance and research.

PSO 6: **Lifelong Practical Knowledge**: Recognise the need to engage in lifelong learning through continuous education, and research leading to higher degrees like PhD, DSc etc.

COURSES OFFERED IN MSC MATHEMATICS

Sl. No.	Course Name
1.1	Real Analysis
1.2	Linear Algebra
1.3	Abstract Algebra
1.4	Differential equations
1.5	Mathematical Methods I
1.6	Community engagement and Service Learning
1.7	Fractal geometry and Applications
2.1	Topology and Functional Analysis
2.2	Complex Analysis
2.3	Measure Theory and Probability Theory
2.4	Mathematical methods II
2.5	Classical Mechanics
2.6	Essential Mathematics for Machine Learning
3.1	Discrete Mathematics
3.2	Computer Programming In C
3.3	Computer Programming In C Lab
3.4	Research Methodology for Mathematical Sciences
3.5	Research Seminar
3.6.1	Field theory & commutative Algebra
3.6.2	Number Theory
3.6.3	Mathematical Logic
3.6.4	Fuzzy sets and Applications
3.7.1	Fluid Dynamics I
3.7.2	Riemannian Geometry & Tensor Calculus
3.7.3	Dynamical Systems and Chaos
3.7.4	Convex Optimization
3.7.5	Numerical solution of PDE
3.8.1	Computational Number Theory
3.8.2	Scientific Computing
3.8.3	Special Functions
3.8.4	Introduction to Game Theory
4.1.1	Advance Analysis
4.1.2	Graph Theory
4.1.3	Multivariable calculus
4.1.4	Algebraic Number Theory
4.1.5	Algebraic Geometry
4.2.1	Fluid Dynamics II
4.2.2	Continuum Mechanics
4.2.3	Theory of Relativity
4.2.4	Numerical Optimization
4.3.1	Design and Algorithms Analysis
4.3.2	Machine Learning
4.3.3	Finite Elements Methods
4.3.4	Introduction to Cryptography
4.4	Research Project
4.5	Statistical Methods & Software in Research

MSC MATHEMATICS- MAPPING OF COURSES TO PO/PSO

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PS01	PS02	PS03	PSO4	PSO5	PSO6
1.1	M	H	M			M		M		M	H	M	M		L	M
1.2	M	M	M	L		M			L	M	M		M	L	L	M

1.3		H	M			M	M	M	L	H	M		M		M	H
1.4	M	M	M		L	M				H	M	H	H	M	M	M
1.5	M	M	M	L	L	M			M		M	H	M		L	
1.6			L	M	M				H							L
1.7		M	M	H			L							M		
2.1	H	H			L	M	L		L	M	M	H	H	M		M
2.2	M	H	M	M		M	M	M	L		H		M	M		M
2.3	H	H	M			M	M			M	H	M	H		M	M
2.4		H	M			M		M		M		M	M	M	M	M
2.5		H	M			M			L		H		M	M		
2.6		M	M	H			L							M		
3.1	M	M				M	M						L		H	M
3.2		H	H			M		M		L			M		M	
3.3			H	M	M		M	M	M	L		H		M	L	L
3.4			M	M	M		L		M	L		M		M		L
3.5	M	H		M		M	M	M		M	H	H	M			M
3.6.1		M	M	L	L	M		M		H	M	M	M		M	H
3.6.2		M	M	L	L	M		M		H	M	M	M		M	H
3.6.3		M	M	L	L	M		M		H	M	M	M		M	H
3.6.4		M	M	L	L	M		M		H	M	M	M		M	H
3.7.1		M	H	L		M	L	M		M		M	M	M	H	M
3.7.2		M	H	L		M	L	M		M		M	M	M	H	M
3.7.3		M	H	L		M	L	M		M		M	M	M	H	M
3.7.4		M	H	L		M	L	M		M		M	M	M	H	M
3.7.5		M	H	L		M	L	M		M		M	M	M	H	M
3.8.1	M	M	H			M	L	M		M		M	M	M	H	M
3.8.2	M	M	H			M	L	M		M		M	M	M	H	M
3.8.3	M	M	H			M	L	M		M		M	M	M	H	M
3.8.4	M	M	H			M	L	M		M		M	M	M	H	M
3.9				H	H		M	M	M			M		M	M	
4.1.1	M	H		M		M	M	M		M	H	H	M			M
4.1.2	M	H		M		M	M	M		M	H	H	M			M
4.1.3	M	H		M		M	M	M		M	H	H	M			M
4.1.4	M	H		M		M	M	M		M	H	H	M			M
4.1.5	M	H		M		M	M	M		M	H	H	M			M
4.2.1		M	M	L	L	M		M		H	M	M	M		M	H
4.2.2		M	M	L	L	M		M		H	M	M	M		M	H
4.2.3		M	M	L	L	M		M		H	M	M	M		M	H
4.2.4		M	M	L	L	M		M		H	M	M	M		M	H
4.3.1		M	H	L		M	L	M		M		M	M	M	H	M
4.3.2		M	H	L		M	L	M		M		M	M	M	H	M
4.3.3		M	H	L		M	L	M		M		M	M	M	H	M
4.3.4		M	H	L		M	L	M		M		M	M	M	H	M
4.4			H	M	L		M		L	M		M		M		M
4.5	M	M	H			L							M		M	M

DETAILED SYLLABUS THEORY COURSES

MARA0014: REAL ANALYSIS

(4-0-0)

COURSE OUTCOMES

CO 1: Classify the convergence of sequences and series of real numbers, and study various tests. (Understanding)
CO 2: Recall the fundamental properties of continuity and uniform continuity. (Remembering)
CO 3: Test for uniform convergence of sequence and series of real valued functions. (Analysing)
CO 4: Solve problems of the Riemann integrals and improper integrals. (Evaluating)
CO 5: Develop the concepts of compact sets, connected sets and their properties. (Creating)

Module I: (14 lectures)

Review of set theory, relations and functions, finite and infinite sets, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequence of real numbers, bounded sequence, limsup, liminf, Cauchy sequences, Series, convergence of series, root and ratio tests, absolute convergence.

Module II: (8 lectures)

Limit, Continuity, types of discontinuity, Intermediate value theorem, Fixed point theorem, uniform continuity, Monotonic functions.

Module III: (14 lectures)

Sequence and series of real valued functions, Point wise and uniform convergence, uniform convergence and continuity, uniform convergence and differentiation, uniform convergence and integration. Cauchy criterion for uniform convergence. Series of functions and convergence, Weierstrass M-test.

Module IV: (12 lectures)

Riemann sums and Riemann integral, Riemann-Stieltjes Integrals, Improper Integrals Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems.

Module V: (16 lectures)

Open and closed sets, limit points, interior points, Euclidean space, compact spaces, Bolzano Weierstrass theorem, Heine Borel theorem in R only.

Suggested Readings

1. Principles of Mathematical Analysis, W. Rudin, McGraw Hill Kogakusha Ltd.
2. Mathematical Analysis, T. Apostol, Addison-Wesley; Publishing Company.
3. Introduction to Real Analysis, R. G. Bartle and D. R. Sherbert, John Wiley & Sons, Inc., New York.
4. The Elements of Real Analysis, R. G. Bartle, Wiley International Edition.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3	M		H		
CO 4				H	
CO 5	M				H

MALA0015: LINEAR ALGEBRA

(4-0-0)

COURSE OUTCOMES

CO 1: Find the fundamental concepts and properties associated with vector spaces. (Remembering)
CO 2: Demonstrate the algebra of matrices, eigenvalues and eigenvectors. (Understanding)
CO 3: Develop the representation between linear transformations and Matrix theory. (Applying)
CO 4: Choose various examples in Inner product spaces and study the applications to various problems. (Evaluating)
CO 5: Elaborate quadratic forms and solve related problems. (Creating)

Module I: (10 lectures)

Vector spaces, subspaces, quotient spaces, linear dependence, basis, dimension of a vector space, LinearTransformations.

Module II: (20 lectures)
Algebra of Matrices, trace of matrices, rank and determinant of matrices, system of linear equations. Eigenvalues and eigenvectors, relation between characteristic and minimal polynomial, Cayley- Hamilton theorem, Diagonalizability.

Module III: (10 lectures)
Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms.

Module IV: (15 lectures)
Inner product spaces, properties of inner products and norms, Cauchy-Schwarz inequality, Orthogonality and orthogonal complements, orthonormal basis, Gram-Schmidt process.

Module V: (5 lectures)
Quadratic forms, reduction and classification of quadratic forms.

Suggested Readings
1. Linear Algebra, K. Hoffman and R. Kunze, Prentice Hall.
2. Linear Algebra, G.E. Shilov, Prentice Hall.
3. Linear Algebra: A Geometric Approach, S. Kumaresan, Prentice-Hall of India Pvt. Ltd., New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		
CO 2		H	M		
CO 3			H		
CO 4				H	
CO 5					H

MAAB0016: ABSTRACT ALGEBRA
(4-0-0)

COURSE OUTCOMES
CO 1: Find the concepts of Group theory and the application of Sylow theorems. (Understanding)
CO 2: Categorize among unique factorization domain, Euclidean domain, Principal ideal domain and irreducible criteria. (Analysing)
CO 3: Organize the characteristics of field extensions, Algebraic extension, Galois theory. (Applying)
CO 4: Develop the concepts related to representation theory and study their application. (Creating)

Module I: (15 lectures)
Review of Groups, Cayley's theorem, class equations, Sylow theorems and its applications, Direct products of groups,Solvable groups, Jordan-Holder theorem.

Module II: (20 lectures)
Rings, ideals, prime and maximal ideals, quotient rings, Euclidean domain. principal ideal domain, unique factorization domain, Polynomial ring over a field, reducible and irreducible polynomials, irreducibility criteria.

Module III: (20 lectures)
Fields, finite fields, field extensions, Algebraic extensions, Galois Theory.

Module IV: (5 lectures)
Fundamentals of representation theory.

Suggested Readings
1. Topics in Algebra, I. N. Herstein, Wiley Eastern Limited, New Delhi.
2. University Algebra, N. S. Gopalakrishnan, Wiley Eastern.
3. Contemporary Abstract Algebra, J. A. Gallian, Narosa Publishing.
4. Algebra, Dummit & Foote, John Wiley & Sons

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	

CO 4				H

MADE0017: DIFFERENTIAL EQUATIONS

(4-0-0)

COURSE OUTCOMES

CO 1: Find the classification of differential equations with existence and uniqueness criteria. (Remembering)
CO 2: Develop appropriate methods to solve linear differential equations. (Applying)
CO 3: Examine the solvability of differential equation and partial differential equation. (Analysing)
CO 4: Determine various methods for the solution of Partial Differential Equation. (Evaluating)

Module I: (16 lectures)

Classification of Differential Equations, their origin and solution; Exact differential equation and integrating factors, special integrating factors, linear equation and Bernoulli equations. existence and uniqueness for initial Value problem: Peano and Picard theorem.

Module II: (18 lectures)

Second order Linear Differential equations, dimension of the solution space for homogeneous equations, general solution for non-homogeneous Equations.; method of undetermined coefficients, method of variation of parameters. Power series solution about an ordinary point, solution about singular points, Frobenius method BVP, Sturm-Liouville Problem, Orthogonality of Characteristic functions, Fourier series exp.

Module III: (26 lectures)

Origin of Partial Differential Equation, Linear and quasi-linear partial differential equation, method of characteristics, Lagrange's and Charpit's method to solve first order PDE, Cauchy problem for first order PDE, Classification of PDEs (second order), Method of separation of variables for Heat (one and two dimension), Wave and Laplace equation.

Suggested Readings

1. Differential Equations, S. L. Ross, Wiley-India.
2. Partial Differential Equations an introduction, W. Strauss, John Wiley and Sons Ltd.
3. Linear PDE for scientist and engineers, Tye Myint U and L. Debnath; Birkhauser, Boston.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	
CO 2	M	H	
CO 3		M	H
CO 4			H

MAMT0018: MATHEMATICAL METHODS I

(4-0-0)

COURSE OUTCOMES

CO 1: Explain basic numerical methods to solve algebraic and transcendental equations. (Understanding)
CO 2: Classify interpolation formulae and solve different numerical problems. (Applying)
CO 3: Make use of Interpolation formulae to solve numerical differentiation and integration. (Evaluating)
CO 4: Compose various methods to obtain numerical solutions of ODE and PDE. (Creating)
CO 5: Determine the methods to solve linear programming problems. (Evaluating)

Module I: (10 lectures)

Numerical solution of algebraic and Transcendental equations: Bisection method, Regula-Falsi methods and Newton- Raphson method; Rate of convergence of these methods. Of systems of linear algebraic equations: Gauss elimination method, Gauss-Jordan method, Gauss-Seidel methods, Error analysis.

Module II: (6 lectures)

Interpolation: Finite differences, Newton's forward and backward difference interpolations, Central difference interpolation, Lagrange's and Newton's divided difference interpolation, Hermite and spline interpolation.

Module III: (15 lectures)

Numerical differentiation and integration: Differentiation using interpolation formulae (Newton's forward and backward difference interpolation, Central difference interpolation, Lagrange's and Newton's divided difference interpolation), Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rule, Romberg method.

Module IV: (14 lectures)
Numerical solutions of ODE and PDE: Initial value problem for ODE of first and second order, Taylor series method, Picard's method, Euler and modified Euler methods, Runge-Kutta methods, Milne's and Adam's predictor and corrector methods, Finite difference solution of second order ODE and PDE.

Module V: (15 lectures)
Mathematical formulation of LPP, Solution of a LPP by graphical method, simplex method, Revised simplex method, Duality. Transportation and Assignment problem, Two person-zero sum games. Equivalence of Rectangular game and linear programming.

Suggested Readings
1. Numerical methods, Problems and solutions, M.K. Jain, S. R. K. Iyengar, R. K. Jain, New Age International(P) Ltd.
2. Elementary Numerical Analysis – An Algorithmic Approach, S D. Conte and Carlde Boor, McGrawHill.
3. Introduction to Numerical Analysis, K. E. Atkinson, John Wiley.
4. Operations Research: An Introduction, H. A. Taha, Macmillan.
5. Operations Research, Kant Swarup, P. K. Gupta and M. M. Singh, Sultan Chand and Sons.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M	M	H		
CO 3				H	
CO4	L	M	M	H	
CO5					H

MATF0019: TOPOLOGY AND FUNCTIONAL ANALYSIS
(4-0-0)

COURSE OUTCOMES
CO 1: Demonstrate the basic characteristics and properties of metric spaces. (Understanding)
CO 2: Categorize the various properties related to Topological Spaces. (Creating)
CO 3: Examine the Connectedness and Compactness of Topological Spaces. (Analysing)
CO 4: Deduct various results from separation axioms and Metrization theorem. (Evaluation)
CO 5: Explain basic results related to Normed linear spaces, Banach spaces and Hilbert spaces. (Understanding)

Module I: (10 lectures)
Metric spaces, open and closed sets, limit points, interior points, convergence, Cauchy sequence, completeness, completion in metric spaces, separable spaces.

Module II: (10 lectures)
Topological Spaces, Basis for a topology, The order topology, The product topology, The subspace topology, Closed sets and limit points, convergent sequence, Continuous function, homeomorphism, metric topology.

Module III: (10 lectures)
Connected spaces, connected subspaces of real line, Components, local connectedness, Compact spaces, compact spacesof real line, limit point compactness, local compactness.

Module IV: (15 lectures)
The countability axioms, the separation axioms, Urysohn Lemma, Urysohn metrization theorem. Tychonoff's theorem, Stone-Cech Compactification.
Local finiteness, the Nagata Smirnov Metrization theorem, paracompactness, the Smirnov Metrization theorem, space of continuous function.

Module V: (15 lectures)
Normed linear spaces, properties of normed linear spaces, Banach space, Hahn-Banach theorem, Open mapping theorem, Closed graph theorem, Principle of uniform boundedness, Hilbert spaces, Orthogonal complements, orthonormal sets, the Reisz representation theorem, Bessel's inequality, Parseval's identity, The dual space, self –adjoint, normal and unitary operators.

Suggested Readings
1. Introduction to topology and modern analysis, G. F. Simmons, Tata-McGraw-Hill.
2. Topology, J. R. Munkres, Prentice Hall.
3. Introductory functional analysis with application, E. Kreyszig, John Willey and Sons.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		
CO 2	M	H	M		
CO 3		M	H		
CO 4				H	
CO 5					H

MACA0020: COMPLEX ANALYSIS

(4-0-0)

COURSE OUTCOMES

CO 1: Define the concept analytic functions and the significance of CR-equations. (Remembering)
CO 2: Explain the basic concepts and theorems associated with complex functions. (Understanding)
CO 3: Apply Cauchy Integrals formulae and Residue theorem to evaluate real and complex integrals. (Applying)
CO 4: Analyse various theorems associated with entire functions and Complex integrals. (Analysing)

Module I: (10 lectures)

Complex numbers and their properties, Complex Plane, Polar form of complex numbers, Powers and roots, set of pointsin the complex plane. Complex function, Special power functions, Reciprocal function.

Module II: (15 lectures)

Limits and Continuity, differentiability and analyticity, Cauchy-Reimann equations, Harmonic functions, Exponential and Logarithmic functions, complex powers, Trigonometric and Hyperbolic functions.

Module III: (20 lectures)

Complex integrals, Cauchy-Goursat Theorem, Cauchy's integral formula and their consequences, Taylor and Laurent series, Zeroes and poles, Residues and residue theorem and consequences, evaluation of real improper integrals.

Module IV: (15 lectures)

Entire function, Liouville's theorem, Maximum modulus principle, Schwarz Lemma, Schwarz-Pick Lemma, OpenMapping theorem. Conformal Mapping, Linear Fractional Transformations, Cross Ratio.

Suggested Readings

1. Foundation of Complex Analysis, S. Ponnusamy, Alpha science International.
2. Functions of one Complex variable I, J. B. Conway, Springer.
3. Complex variable, Murray Spiegel, Seymour Lipschutz, John Schiller, Dennis Spellman, Schum's outlines.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		
CO 3			H	
CO 4			M	H

MAMP0021: MEASURE THEORY AND PROBABILITY THEORY

(4-0-0)

COURSE OUTCOMES

CO 1: Explain the concept of algebra of sets, measure and Lebesgue measure. (Understanding)
CO 2: Demonstrate understanding of the statement and proofs of monotone convergence theorems and their applications. (Understanding)
CO 3: Explain the axioms and properties of probability theory. (Understanding)
CO 4: Develop probabilistic concepts within the framework of measure theory. (Applying)

Module I: (12 lectures)

Algebra of sets, Borel set, extension of measures, Lebesgue measure on: outer measure, measurable sets and Lebesgue measure. Extension of measure, Lebesgue-Stieltjes measures and distribution functions.

Module II: (18 lectures)

Measurable functions and Integration: Lebesgue integral, Monotone convergence theorem, extended monotone convergence theorem, Fatou's Lemma, dominated convergence theorem, Comparison of Riemann and Lebesgue integral. Radon-Nikodym

Theorem and related results.

Module III: (10 lectures)
Probability axioms, sample spaces, events, law of total probability, conditional probability, Bayes Theorem and independence.

Module IV: (20 lectures)
Random Variables, types of random variables, distribution functions, function of random variables, standard univariate discrete and continuous distributions and their properties; expectations, moments, moments generating functions; Chebyshev's inequality, joint, marginal and conditional distributions; covariance, correlation; Random vectors, functions of random vectors, strong and weak law of large numbers, central limit theorem.

Suggested Readings
1. Probability and Measure Theory, R.B. Ash and C. Doleans Dade, Academic press.
2. An Introduction to Probability Theory and its Applications, W. Feller, Wiley.
3. An Introduction to Probability and Statistics, V. K. Rohatgi and A. K. Md. E. Saleh, Wiley.
4. Real Analysis, Royden, H.L. and Fitzpatrick, P. M., Pearson.
5. Measure Theory, Halmos, P. R., Springer-Verlag.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3	M		H	
CO 4			M	H

MAMD0022: MATHEMATICAL METHODS II
(4-0-0)

COURSE OUTCOMES
CO 1: Gain the knowledge fundamentals concepts of calculus of variation and integral equations and their applications. (Understanding)
CO 2: Use concept of Laplace and Fourier transform in solving science and engineering problems. (Applying)
CO 3: Analyse and classify Differential Equations, Partial Differential Equations and Integral Equations and their solutions by various methods. (Analysing)
CO 4: Determine the solutions of various classes of differential equations and special functions with their properties. (Evaluating)

Module I: (10 lectures)
Linear functional, minimal functional theorem, general variation of a functional, Euler- Lagrange equation, Necessary and sufficient conditions for extrema, strong extremum and weak extremum, broken extremum; Weirstras Erdmann corner conditions.

Module II: (10 lectures)
Linear integral equation of the first and second kind of Fredholm and Volterra type Reduction of ordinary differential equations into integral equations, Solution of integral Equations with separable kernels, Characteristic numbers and eigenfunctions, resolvent kernel.

Module III: (10 lectures)
Fourier Transform. Properties of Fourier Transform, Fourier sine and cosine transform, Inverse Fourier Transform, Application of Fourier transform to ordinary and partial differential equations of initial and boundary value problems.

Module IV: (12 lectures)
Laplace Transform and its properties, Convolution theorem, Inverse Laplace Transform, Application of Laplace Transform to solution of ordinary and partial differential equations of initial boundary value problems.

Module V: (18 lectures)
General solution of Bessel equation, Recurrence relations, Orthogonal sets of Bessel functions, Modified Bessel functions, Applications. General solution of Legendre equation, Legendre polynomials, Associated Legendre polynomials, Rodrigues formula, Orthogonality of Legendre polynomial, Concept and calculation of Green's function, Approximate Green's function, Green's function method for differential equations.

Suggested Readings
1. Introduction to Theory and Application of Laplace Transforms, Doetsch G., Springer Verlag.

2. Theory and problems of Laplace transforms, Murray Spiegel, Schum's Outline Series Tata Mc Graw Hill.
3. Integral Transforms & their applications, Brian Daries, Springers.
4. Integral Transforms & their applications, L Debnath, D Bhatta, Chapman & Hall/CRC.
5. Fourier analysis and its applications, G.B. Folland sally series, American Mathematical Society.
6. Fourier and Laplace Transform, R.J. Becrends H.G., Morsche. J.C. Vande Berg and E.M. VandeVrie, Cambridge Press.
7. Introduction to Fourier analysis and wavelets, Graduate Studies in Mathematics, Mark A. Pinsky, AmericanMathematical Society.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO2		H	M	M	
CO3			H		
CO4			M	M	H

MACL0023: CLASSICAL MECHANICS

(4-0-0)

COURSE OUTCOMES

CO 1: Learn and understand the fundamental of motion and its governing equations. (Understanding)
CO 2: Extend the concept of rigid body in two dimensions. (Understanding)
CO 3: Apply concepts of Lagrangian and Hamiltonian methods to model various practical situations. (Applying)
CO 4: Analyse diverse physical motions by studying the properties of mathematical model. (Analysing)
CO 5: Evaluate different practical situations by discussing the properties of existing models. (Evaluating)

Module I: (18 lectures)

Introduction to the ideas of constrained motion, Different classifications of constraints of motion, Holonomic and nonholonomic constraints, rhenomic and scleronomic dynamical constraints, Concept of degree of freedom.
Introduction to generalized coordinates, generalized velocities, Total Kinetic energy of a system of particles in terms of generalized velocity. Introduction to generalized momenta and generalized force. D'Alemberts principle and Lagrangian form of equation motion of a dynamical system of N particles. Calculus of variations, Euler-Lagrange equation, applicationof calculus of variations in dynamical problems.

Module II: (12 lectures)

Two-dimensional motion of rigid bodies, Euler 's dynamical equations of motion for a rigid body, Motion of a rigid body about an axis, motion about revolving axis, Eulerian angles, Euler's theorem on the motion of a rigid body, infinitesimal rotations, rate of change of a vector, Coriolis force, Euler 's equations of motion, force free motion of a rigid body.

Module III: (15 lectures)

Hamilton's principle, Lagrange's equations from Hamilton's principle, extension of Hamilton's principle to non- conservative and non-holonomic systems, conservation theorems and symmetry properties. Hamilton's equations of motion, conservation theorems and physical significance of Hamiltonian, Hamilton's equations from variational principle, principle of least action.

Module IV: (15 lectures)

Hamilton Jacobi Method: Hamilton - Jacobi equation, Time independent Hamilton - Jacobi equation, canonical transformation generated by Hamilton characteristic function, application of Hamilton- Jacobi equation in solving problems of mechanics.

Suggested Readings

1. Classical Mechanics, H. Goldstein, Addison Wesley Publications, Massachusetts.
2. Lagrangian and Hamiltonian Mechanics by M.G. Calkin, World Scientific, Singapore.
3. Classical Mechanics, Takwale, R. G. & Puranik, P. S., Tata-McGraw Hill.
4. Problems and Solutions on Mechanics, Yung-Kuo, World Scientific.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H	M	
CO 3	L	M	H	M
CO 4		M	H	M
CO 5		L	M	H

MADS0030: DISCRETE MATHEMATICS

(4-0-0)

COURSE OUTCOMES

CO 1: Explain how to work with some of the discrete structures which include sets, relations, functions, graphs andrecurrence relation. (Understanding)
CO 2: Construct mathematical statements using logical connectives and quantifiers. (Creating)
CO 3: Apply basic counting techniques to solve combinatorial problems. (Applying)
CO 4: Develop the given problem as graph networks and solve with techniques of graph theory. (Understanding)

Module I: Set Theory (18 lectures)

Sets and classes, relations and functions, Equivalence Relation, Partial Ordering Relation, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, Cardinal and ordinal numbers, Lattice; The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module II: Logic (15 lectures)

Propositional logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency. Predicate Calculus.

Module III: Combinatorics (12 lectures)

Combinatorics: Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (nth order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of generating functions., solution of recurrence relation using generating functions, solution of combinatorial problem using generating functions).

Module IV: Graphs and Trees (15 lectures)

Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges; trees.

Suggested Readings

1. Discrete Mathematics with Applications, Susanna S. Epp, Wadsworth. Publishing Co. Inc.
2. Elements of Discrete Mathematics A Computer Oriented Approach, C L Liu and D P Mohapatra, Tata McGraw – Hill.
3. Discrete Mathematical Structure and Its Application to Computer Science, J.P. Tremblay and R. Manohar, TataMcGraw-Hill.
4. Discrete Mathematics, N. Biggs, Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4	M			H

MACP0031: COMPUTER PROGRAMMING IN C

(2-0-0)

COURSE OUTCOMES

CO 1: Interpret the concepts of C language's syntax. (Understanding)
CO 2: Choose the loops and the decision-making statements to solve various problems. (Applying)
CO 3: Implement standard algorithms and translate pseudo-codes into C programs. (Applying)
CO 4: Apply their analytical skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. (Analysing)

Module I: Introduction to Algorithms and Programming Languages (8 lectures)

Introduction to structured programming and problem-solving methods: Algorithms, key features of algorithms, flowcharts, pseudocode, generation of programming languages, structured programming languages. Overview of C:Introduction to C, basic structure of a C program, compiling and executing C programs, comments, characteristics of a good program, character set, identifiers, keywords, data types, constants and variables, I/O statements, operators and expressions, precedence and

associativity of operators, type conversion and type casting.

Module II: Decision Control Statements, Loops and Functions (8 lectures)
Decision Control Statements and Loops: Introduction to decision control statements, conditional branching statements, goto statements, while loop, do-while loop, for loop, nested loops, break and continue statements Functions: Need for functions, function declaration and definition, user defined and library functions, passing parameters to function, return statement, scope of variables, storage classes, recursive functions.

Module III: Arrays (7 lectures)
Arrays: One-dimensional arrays, passing array to function, multidimensional arrays and their applications, character arrays, dynamic memory allocation. Some algorithms and programs on theory of matrices and numbers like Sieve method for primality test, generation of twin primes, solution of congruence using complete residue system, addition, subtraction and multiplication of matrices, transpose, and determinant.

Module IV: Structures, Files (7 lectures)
Structures and Unions: Declaration of structures and simple implementation of structures, unions, enumerated data types. Files: Introduction to files, file managements-open, close, input/output operations, command line arguments.

Suggested Readings

1. Computer Fundamentals and Programming in C, Thareja R., Oxford University Press, New Delhi.
2. Computer Programming in C Rajaraman V., 2005, Prentice-Hall of India Pvt. Ltd.
3. Computer Fundamental and C Programming, Balagurusamy E., Tata McGraw Hill publishing company limited, New Delhi.
4. Programming with C (Schaum's outlines series), Gottfried Byron S., Tata McGraw Hill publishing company limited,
5. New Delhi.
6. Primes and Programming – An Introduction to Number Theory with Programming, Goblin P., 1993, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			M
CO 2		H	M	
CO 3		M	H	M
CO 4				H

MARM0032: RESEARCH METHODOLOGY FOR MATHEMATICAL SCIENCES

(3-0-0)

COURSE OUTCOMES
CO 1: Learn and understand some basic concepts of research and its methodologies. (Remembering)
CO 2: Compare different results and identify appropriate research topics with the help of literature review. (Understanding)
CO 3: Select and define appropriate research problem and parameters. (Applying)
CO 4: Organize and conduct research (advanced project) in a more appropriate manner. (Evaluating)
CO 5: Design and write a research proposal, research report and thesis. (Creating)

Module I: (12 lectures)
Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, literature survey of a research topic, Importance of knowing how Research is done, Research Process, Criteria of good Research, Problems encountered by Researchers in India.
Defining the Research problem: Selecting the Problem, Necessity of Defining the Problem, Techniques involved in defining a problem.

Module II: (15 lectures)
Report writing: Significance of Report writing, Difference steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Precautions for Writing Research Reports, Publishing a paper, Research proposal writing, Copyright issues, Ethics and plagiarism.

Module III: (18 lectures)
Research tools: MathSciNet, Scopus, ISI Web of Science, Impact factor, h-index, Google Scholar, ORCID, JStor, Online and open access journals, Virtual library of various countries. Scientific writing and presentation: LaTeX, Beamer. Software for Mathematics: MATHEMATICA, MATLAB.

Suggested Readings

1. Research Methodology; C.R. Kothari, New Age Publishers.
2. LaTeX, a Document Preparation System, L. Lamport, Addison-Wesley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	M		
CO 3	M		M
CO 4		H	
CO 5		M	H

MAFA0033: FIELD THEORY AND COMMUTATIVE ALGEBRA

(4-0-0)

COURSE OUTCOMES

CO 1: Define the key notions of field theory and outline their interrelation. (Remembering)
CO 2: Demonstrate the key concepts by interpreting them under various hypotheses. (Understanding)
CO 3: Identify perfect fields using separable extensions, construct examples of automorphism group of a field. (Applying)
CO 4: Analyse the proof a theorem by imposing the rules of commutative algebra. (Analysing)
CO 5: Determination of validity of a problem such as insolvability of quantic by field theoretic techniques. (Evaluating)

Module I: (10 lectures)

Field extensions. Simple extensions, algebraic and transcendental case. Minimum polynomial. Construction of simple algebraic extension from an irreducible polynomial. Classification of simple extensions.

Module II: (15 lectures)

Degree of extension. Algebraic elements and algebraic extensions; finite extensions. Algebraic numbers. Geometric constructions with ruler and compasses. The Galois group of an extension. Examples. Splitting field for a polynomial. Existence, uniqueness up to isomorphism. Normal extensions. Relation to splitting fields. Normality of intermediate extension. Normal closure.

Module III: (15 lectures)

Separability. Example of inseparable polynomial. Separability of all polynomials in characteristic zero. Separable extensions. Separability of intermediate extensions. Degree of the extension corresponding to a group of field automorphisms.

Module IV: (12 lectures)

Integral extension, integral closure of a ring, finitely generated modules, localization of a ring, construction, localization of modules, Dedekind domain, factorization ideals, unique factorization of ideals.

Module V: (8 lectures)

Galois groups of normal separable extensions, Galois extensions, factorization of prime ideals in Galois extensions, discrete valuation.

Suggested Readings

1. A First Course in Abstract Algebra, J.B. Fraleigh, Addison-Wesley.
2. Galois Theory, I. Stewart, Chapman and Hall.
3. Abstract Algebra, Dummit D.S.; Foote R. M., John Wiley and sons.
4. Introduction to Commutative Algebra, Atiyah M.F.; Macdonald I.G., Addision-Wesley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	M
CO 2		H			
CO 3		M	M	M	
CO 4				H	M
CO 5					H

MANT0034: NUMBER THEORY

(4-0-0)

COURSE OUTCOMES

CO 1: Identify and analyse different types of divisibility tests, Euler's theorem, Wilson theorem etc and solve various related
CO 2: problems. (Applying)
CO 3: Apply Quadratic Reciprocity law and other methods to classify numbers as primitive roots, quadratic residues, and quadratic nonresidues. (Applying)
CO 4: Evaluate primitive roots and Pell's equation with the use of continued fraction. (Evaluating)
CO 5: Perceive classical cipher and public cryptosystem and their cryptanalysis. (Evaluating)

Module I: (15 lectures)

Divisibility, Congruences, complete residue system, reduced residue system, Chinese remainder theorem., Arithmetic modulo p, Fermat's little theorem, Wilson's theorem.

Arithmetic functions-Mobius function, Euler function.

Module II: (15 lectures)

Quadratic residues and congruences of second degree in one unknown, Legendre symbol, Jacobi symbol, congruences of second degree with prime modulus and with composite modulus.

Module III: (18 lectures)

Primitive roots and indices, order, necessary and sufficient condition for the existence of primitive roots, construction of reduced residue system.

Continued fractions, simple continued fractions, approximation of irrational numbers by continued fractions, solution of Pell's equation.

Introduction to partitions, geometric representation, generating functions, Euler's Pentagonal number theorem.

Module IV: (12 lectures)

Basic of Cryptography: History of cryptography, terminologies used in cryptography; Substitution Techniques- The Caesar Cipher, One Time Pads, The Vernam Cipher, Book Cipher; Transposition Techniques-Encipherment/Decipherment Complexity, Public Key Cryptography: Characteristics of Public Key System; RSA Technique-Encryption –Method; Diffie- Hellman Scheme.

Suggested Readings

1. Elementary Number Theory, M. Burton, Universal Book Stall, New Delhi.
2. An Introduction to the Theory of Numbers, G. H. Hardy and E. M. Wright, Oxford, Clarendon Press.
3. Number Theory, G. E. Andrews, Hindustan Publishing Corporation, New Delhi.
4. Number Theory, S. G. Telang, Tata McGraw Hill Publishing Company Limited, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3	M		H	
CO 4	M			H

MAML0035: MATHEMATICAL LOGIC

(4-0-0)

COURSE OUTCOMES

CO 1: Interpret any Mathematical statement into the language of logic. (Understanding)
CO 2: Analyse various methods of proofs and deduction theorems. (Analysing)
CO 3: Interpret the syntax of first-order logic and semantics of first-order languages. (Understanding)
CO 4: Analyse the validity a problem by means of completeness and consistency. (Analysing)
CO 5: Determine the valuation and validity of various logical statements. (Evaluating)

Module I: (15 lectures)

Propositions, truth table, negation, conjunction and disjunction. Adequate set of connectives, propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Arguments and validity.

Module II: (15 lectures)

Formal definition of proof, various methods of proof, theorem and deduction, theory of L of statement calculus. Valuation and tautology in L, extensions of L, adequacy theorem of L.

Module III: (15 lectures)
First order logic, truth values of well-formed formulas, first order systems with equality, first order arithmetic, formal set theory.

Module IV: (15 lectures)
Completeness and compactness, notion of consistency, Boolean algebra, incompleteness, first incompleteness theorem, undecidability.

Suggested Readings
1. Logic for Mathematicians - Hamilton A. G., Cambridge University press.
2. Introduction to Mathematical Logic - Mendelson E., CRC Press, Taylor and Francis Group.
3. Fundamentals of Mathematical Logic, Hinman P. G., A.K. Peters, 2005, Wellesley.
4. Mathematical Logic, 2nd edition, Ebbinghaus H.D., Flum J., Thomas W., Springer-Verlag

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	
CO2	M	H		
CO3	M	M	H	
CO4	M			H
CO5		M	M	M

MAFS0036: FUZZY SETS AND APPLICATIONS

(4-0-0)

COURSE OUTCOMES
CO 1: Classify the crisp and fuzzy set theorems. (Understanding)
CO 2: Apply fuzzy set theory in modelling and analysing uncertainty in a decision problem. (Applying)
CO 3: Analyse and examine the difference between the crisp set and fuzzy set concepts. (Analysing)
CO 4: Determine fuzzy set theory and uncertainty concepts. (Evaluating)

Module I: (17 lectures)
Fuzzy sets - Fuzzy numbers, fuzzy numbers in the set of Integers, arithmetic with fuzzy numbers. Definition of fuzzy sets, α-level sets, convex fuzzy sets. Basic operations on fuzzy sets, types of fuzzy sets, Cartesian products, algebraic products, bounded sum and difference, t-norms and t-conorms. Fuzzy sets in contrast of probability theory.

Module II: (12 lectures)
The extension principle - the Zadeh's extension principle, image and inverse image of fuzzy sets. Fuzzy relations, basic properties of fuzzy relations, fuzzy relations and approximate reasoning.

Module III: (16 lectures)
Fuzzy relations and fuzzy graphs, composition of fuzzy relations, min-max composition and its properties, fuzzy equivalence relations, fuzzy relational equations, fuzzy graphs.

Module IV: (15 lectures)
Possibility Theory: Fuzzy measures, evidence theory, necessity measure, probability measure, possibility measure,possibility distribution, possibility theory and fuzzy sets, possibility theory and probability theory.

Suggested Readings
1. Fuzzy Sets and Fuzzy Logic: Theory and Applications, Klir, G. J. and Yuan, B., Prentice Hall of India, New Delhi.
2. 2 Fuzzy set theory and its Applications, Zimmermann, H. J., Allied publishers Ltd., New Delhi.
3. Fuzzy sets, fuzzy logic applications, G. Bojadzieve and M. Bojadzieve, World Scientific.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		H
CO 2	M	H	M	M
CO 3		M	H	
CO 4			M	H

MAFD0037: FLUID DYNAMICS I

(4-0-0)

COURSE OUTCOMES

CO 1: Develop an appreciation for the properties of Newtonian fluids. (Remembering)
CO 2: Understand the dynamics of fluid flows and the governing non-dimensional parameters. (Understanding)
CO 3: Apply concepts of mass, momentum and energy conservation to flows. (Applying)
CO 4: Formulate the problems on buoyancy and solve them. (Evaluating)

Module I: (20 lectures)

Classification of fluids, Lagrangian and Eulerian methods. Equation of continuity. Irrotational flow, vorticity vector, equi-potential surfaces. Streamlines, pathlines, streak lines of the particles, stream tube and stream surface. Mass flux density, conservation of mass leading to equation of continuity. (Euler's form.) Conservation of momentum and its mathematical formulation: Euler's form. Integration of Euler's equation under different conditions. Bernoulli's equation, steady motion under conservative body forces.

Module II: (15 lectures)

Boundary surface, Theory of irrotational motion, Kelvin's minimum energy and circulation theorems, potential theorems. Some two-dimensional flows of irrotational, incompressible fluids. Complex potential. Sources, sinks, doublets and vortices. Milne-Thomson circle theorem, Images with respect to a plane and circles. Blasius theorem.

Module III: (10 lectures)

Vortex motion and its elementary properties. Wave motion in a gas. Speed of Sound. Equation of motion of a gas. Subsonic, sonic and supersonic flows of a gas. Isentropic gas flows. Flow through a nozzle. Normal and oblique shocks.

Module IV: (15 lectures)

Three-dimensional flows. Sources, sinks, doublets. Axi-symmetric flow and Stokes stream function. Butler sphere theorem, Kelvin's inversion theorem and Weiss's sphere theorem. Images with respect to a plane and sphere. Axi- symmetric flows and stream function. Motion of cylinders and spheres.

Suggested Readings

1. A Treatise on Hydrodynamics, W. H. Besant and A. S. Ramsey, CBS.
2. Text book of Fluid Dynamics, F. Charlton, CBS.
3. Fluid Mechanics, P.K. Kundu and I.M. Cohen, Academic Press.
4. Theoretical Hydrodynamics, L.M. Milne Thomson, The Macmillan company, USA.
5. Ideal and incompressible fluid dynamics, N.E. Neill and F. Chorlton, Ellis Horwood Ltd.
6. Fluid Dynamics, D.E. Rutherford, Oliver and Boyd Ltd, London.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		
CO 3	M		H	
CO 4			M	H

MARC0038: RIEMANNIAN GEOMETRY AND TENSOR CALCULUS

(4-0-0)

COURSE OUTCOMES

CO 1: Recall the concept of calculating length of a curve and area of a domain in manifold *M.* (Remembering)
CO 2: Explain the Riemannian metric on surfaces embedded in Euclidean space. (Understanding)
CO 3: Apply the properties of geodesics on a Riemannian manifold in Euclidean space and for Lobachevski plane. (Applying)
CO 4: Evaluate Riemann curvature tensor. (Evaluating)

Module I: (15 lectures)

Introduction to Tensor, space of n dimensions, subspaces; transformation of coordinates; scalar; contravariant (tangent) and covariant (cotangent) vectors; scalar product of two vectors; tensor space of rank more than one contravariant and covariant tensors; symmetric and skew-symmetric tensors; addition and multiplication of tensors; contraction; composition of tensors; quotient law; reciprocal symmetric tensors of the second order, relative tensor, group properties.

Module II: (15 lectures)

Riemannian space; fundamental tensor; length of a curve; magnitude of a vector; associated covariant and contravariant

vectors; inclination of two vectors, orthogonal vectors; coordinate hypersurfaces; coordinate curves; field of normals to a hypersurface; principal directions for a symmetric covariant tensor of the second order; Euclidean space of n dimensions.

Module III: (15 lectures)
Levi-Civita tensors; Christoffell symbols and second derivatives; need for covariant derivative; parallel transformations; covariant derivative of a contravariant and covariant vector; curl of a vector and its derivative; covariant differentiation of a tensor; divergence of a vector.

Module IV: (15 lectures)
Gaussian curvature; Riemann curvature tensor; geodesics; differential equations of geodesics; geodesic coordinates; geodesic deviation; Riemannian coordinates; geodesic in Euclidean space; straight lines.

Suggested Readings
1. An Introduction to Riemannian Geometry and Tensor Calculus, Cambridge university Press, C. E. Weatherburn.
2. Aspects of Gravitational Interactions, Nova Science publications Inc., Commack, NY, S. K. Srivastava & K. P. Sinha.
3. Tensor Analysis John Wiley & Sons, Inc., I. S. Sokolnikoff.
4. Tensor Calculus and Riemannian Geometry, Krishna Prakasahan Media (P) Ltd, D C Agarwal.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3		M	H	
CO 4				H

MANS0039: NUMERICAL SOLUTION OF PDE
(4-0-0)

COURSE OUTCOMES
CO 1: Define matrix norm, normed linear space and related results. (Remembering)
CO 2: Classify initial value problems (IVPs) and Boundary Value Problems (BVPs). (Understanding)
CO 3: Apply different numerical methods to PDEs. (Applying)
CO 4: Analyse accuracy of common numerical methods. (Analysing)
CO 5: Assess different numerical methods in order to find the approximate numerical solution of the PDEs. (Evaluating)

Module I: (10 lectures)
Review normed linear spaces, matrix norm and related results, eigenvalues for tridiagonal matrices. Matrix stability.

Module II: (20 lectures)
Classification of PDEs, Finite difference approximations to partial derivatives. Solution of one-dimensional heat conduction equation by Explicit and Implicit schemes (Schmidt and Crank Nicolson methods), CFL condition, stability and convergence criteria.

Module III: (15 lectures)
Hyperbolic equation, explicit/implicit schemes, method of characteristics. Solution of wave equation. Solution of 1st order Hyperbolic equation. Von Neumann stability.

Module IV: (15 lectures)
Finite difference method for stationary heat conduction, stability and convergence analyse.

Suggested Readings
1. Numerical methods for Ordinary differential equations, J.C. Butcher, John Wiley & Sons, New York.
2. Numerical methods for Ordinary differential systems: The initial value problem, J.D. Lambert, John Wiley & Sons,New York.
3. Numerical solution of ordinary differential equations, John Wiley, New York, K. Atkinson, W. Han and D.E. Stewart.
4. Finite Difference Methods (Oxford Applied Mathematics & Computing Science Series), G. D. Smith.
5. Numerical Solution of Ordinary Differential Equations (Wiley), E. Kendall, Atkinson, Han Weimin, David E. Stewart.
6. Numerical Methods for Scientific and Engineering Computation, M K Jain, S R K Iyengar, R K Jain, New AgeInternational.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		

CO 3			H	M
CO 4			H	M
CO 5	M			H

MACN0040: COMPUTATIONAL NUMBER THEORY

(4-0-0)

COURSE OUTCOMES

CO 1: Explain basic of fundamental number theoretic algorithms. (Understanding)
CO 2: Apply finite field theory in cryptography. (Applying)
CO 3: Analyse primality testing algorithms and their uses in Cryptography. (Analysing)
CO 4: Explain the number theoretic foundations of cryptography and the principles behind their security. (Understanding)

Module I: (10 lectures)

Representation of integers and polynomials, Divisibility and the Euclidean algorithm, extended Euclidean algorithm, Congruences, Chinese Remainder theorem, Hensel's lifting lemma, Modular exponentiation - Some applications to factoring.

Module II: (15 lectures)

Finite Fields, Multiplicative generators, Uniqueness of fields with prime power elements, Quadratic residues and reciprocity.

Module III: (20 lectures)

Primality Testing: Probabilities Primality testing, primality testing for numbers of a special form, AKS primality test including detecting perfect powers; Computing the Order of an element and generating primitive roots (and elements ofa certain order), Computing Discrete Logarithms, Factoring Integers, factoring polynomials and tests constricting irreducible polynomials; Solving equations over Finite Fields including computing square roots.
Elliptic curves: The Geometry of elliptic curves, the Algebra of elliptic curves, elliptic curves overs finite fields, The elliptic curve Discrete Logarithm Problem.

Module IV: (15 lectures)

Cryptosystems and basic cryptographic tools: Secret –key cryptosystems, Public-key cryptosystems, block and stream ciphers, message integrity; message authentication codes, Signature schemes, nonrepudiation, certificates, Hash functions; Some simple cryptosystems, Shift cipher, Substitution cipher, Affinecipher, Vigenère cipher, Hill cipher, Permutation cipher, Stream ciphers, Cryptanalysis of affine, substitution, Vigenère, Hill and LFSR stream ciphers. RSA cryptosystem and Rabin encryption.

Suggested Readings

1. Computational Number Theory, Abhijit Das, CRC Press.
2. Prime Numbers and Computer Method for Factorization, Hans Riesel, Birkhauser.
3. Modern Computer Arithmetic, R.P. Brent and Zimmermann, Cambridge University Press.
4. A Course in Number Theory and Cryptography, Neal Koblitz, Springer- Verlag.
5. Hand book of Applied Cryptography, Van Oorschot and Vanstone S.A, CRC Press.
6. Cryptography Theory and Practice. Douglas R. Stinson & Maura B. Paterson, Chapman & Hall/CRC Press, Taylor & Francis.
7. Cryptography. Simon Rubinstein-Salzedo, Springer.
8. An Introduction to Mathematical Cryptography, Jeffrey Hoffstein, Jill Pipher& Joseph H. Silverman, Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		
CO 3	M		H	
CO 4				H

MASC0041: SCIENTIFIC COMPUTING

(4-0-0)

COURSE OUTCOMES

CO 1: Classify Initial conditions and boundary conditions specific to the problem. (Understanding)
CO 2: Apply different numerical methods to ODEs. (Applying)
CO 3: Analyse accuracy of iterative numerical methods. (Analysing)
CO 4: Assess the approximate numerical solution of the linear and nonlinear problems. (Evaluating)

Module I: (13 lectures)
Initial value problems (IVPs) for the system of ordinary differential equations (ODEs); Difference equations; Numerical methods; Local truncation errors, Stability analysis; Interval of absolute stability; Convergence and consistency.

Module II: (13 lectures)
Single-step methods: Taylor series method; Explicit and implicit Runge-Kutta methods and their stability and convergence analysis; Extrapolation method; Runge-Kutta method for the second order ODEs; Stiff system of differential equations.

Module III: (16 lectures)
Multi-step methods: Explicit and implicit multi-step methods; General linear multi-step methods and their stability and convergence analysis; Adams-Moulton method; Adams-Bashforth method; Nystrom method; multi-step methods for the second order IVPs.

Module IV: (18 lectures)
Boundary value problems (BVPs): Two-point non-linear BVPs for second order ordinary differential equations; Finite difference methods; Convergence analysis; Difference scheme based on quadrature formula; Difference schemes for linear eigenvalue problems; Mixed boundary conditions; Finite element methods; Assemble of element equations; Variational formulation of BVPs and their solutions; Galerkin method; Ritz method; Finite element solution of BVPs.

Suggested Readings
1. Numerical methods for Ordinary differential equations, J.C. Butcher, John Wiley Sons, New York.
2. Numerical methods for Ordinary differential systems: The initial value problem, J.D. Lambert, John Wiley & Sons,New York.
3. Numerical solution of ordinary differential equations, K. Atkinson, W. Han and D.E. Stewart, John Wiley, New York.
4. Numerical Methods for Scientific and Engineering Computation (New Age International), M K Jain, S R K Iyengar, R KJain.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H	M	
CO 3			H	
CO 4				H

MASF0042: SPECIAL FUNCTIONS
(4-0-0)

COURSE OUTCOMES
CO 1: Define the different types of special functions and their properties. (Remembering)
CO 2: Apply the properties of special functions in the mathematical analysis, functional analysis etc. (Applying)
CO 3: Analyse properties of special functions by their integral representations and symmetries. (Analysing)
CO 4: Illustrate purpose and functions of the gamma and beta functions, Fourier series and Transformation.(Understanding)

Module I: (12 lectures)
The Gamma and Beta Functions: Euler's' integral for Γ(z), the beta function, factorial function, Legendre's duplication formula, Gauss's multiplication theorem, summation formula due to Euler, behaviour of log Γ(z) for large |z |.

Module II: (18 lectures)
The Hypergeometric function: An integral representation. Its differential equation and solutions, F(a,b,c;1) as a functionof the parameters, evaluation of F(a,b,c;1), contiguous function relations, the hypergeometric differential equation, logarithmic solutions of the hypergeometric equation, F(a,b,c;z) as a function of its parameters, Elementary seriesmanipulations, simple transformations, relation between functions of Γ(z) and, Γ(1-z) quadratic transformations, theorem due to Kummer, additional properties.

Module III: (18 lectures)
The Confluent Hypergeometric function: Basic properties of 1F1, Kummer's first formula. Kummer's second formula,
Generalized Hypergeometric Series: The function pFq, the exponential and binomial functions, differential equation, contiguous function relations, integral representation pFq, with unit argument, Saalshutz' theorem, Whipple's theorem, Dixon's theorem, Contour integrals of Barnes' type.

Module IV: (12 lectures)

Bessel Functions: Definition, Differential equation, differential recurrence relations, pure recurrence relation, generating function, Bessel's Integral, index half an odd integer, modified Bessel functions, Introduction to Legendre function, Meijer G-

function and some basic properties.

Suggested Readings

1. Special Functions, Macmillan, Earl. D. Ranvillie.
2. Special Functions of Mathematics for Engineers, L.C. Andrews, SPIE Press.
3. Orthogonal Polynomials, Gabor Szego, American mathematical society.
4. Generalized Hypergeometric Functions, Reissue edition, L.J. Slater, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3	M		H	
CO 4	M			H

MAAS0046: ADVANCED ANALYSIS

(4-0-0)

COURSE OUTCOMES

CO 1: Apply Holder and Minkowski inequalities in $L_p$spaces and understand completeness of L_p-spaces. (Applying)
CO 2: Explain the concepts of Banach algebras, culminating in the Gelfand-Naimark theorem. (Understanding)
CO 3: Define the concept of signed measure and significance of Hahn decomposition theorem. (Remembering)
CO 4: Assess the product measure by integrals and discuss the applications of Fubini's theorem. (Evaluating)

Module I: (15 lectures)

L_p −space, Holder inequality, Minkowski's inequality, convergence, completeness, bounded linear functional.

Module II: (17 lectures)

Banach Algebra, Gelfand theory, algebra, Gelfand-Naimark-Segal (GNS) construction, normal operators, spectral theorem, Fredholm operator, space, calculus for normal operators.

Module III: (16 lectures)

Signed measure, Hahn decomposition theorem, mutually singular measure, Radon-Nikodym theorem, Lebesgue decomposition, Reisz representation theorem.

Module IV: (12 lectures)

Outer measure, Caratheorory theorem, product measure, Fubini's theorem.

Suggested Readings

1. A first course in functional analysis, Conway J.B., Springer.
2. Banach algebra techniques in operator theory, Douglas R.G., Academic press.
3. Measure Theory, Halmos P.R., Springer-Verlag.
4. Measure theory and integration, Barra G.de, Wiley-Eastern.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4				H

MAGY0047: GRAPH THEORY

(4-0-0)

COURSE OUTCOMES

CO 1: Relate various basic terminologies, properties and results of graph theory. (Remembering)
CO 2: Classify different types of trees according to their properties. (Understanding)
CO 3: Analyse different properties of factorization, covering and colorability of graphs. (Analysing)
CO 4: Determine different results and properties of Eulerian, Hamiltonian and planner graphs. (Evaluating)

Module I: (13 lectures)

Graph, Types of Graphs, Subgraphs, walk, paths, cycles and components, intersection of graphs, Degrees, Degree sequences. operations on graphs, subdivision (of cycles), incentification (of vertices) homomorphism and contraction (of edges).

Module II: (18 lectures)
Trees, Spanning trees, Kruskal's and Prim's algorithm for minimal spanning tree, cycles, cocycles, cycle space, cocycle spaces, Connectivity, cut vertices, cut edges and blocks, connectivity parameters, Menger's theorem. Matching and covers.

Module III: (14 lectures)
Eulerian and Traversable graphs: Characterization theorems, characterization attempts for Hamiltonian graphs: Two necessary and sufficient conditions for a graph to be Hamiltonian, Factorization; Basic concepts, 1- factorization, 2- factorization, coverings, critical points and lines.

Module IV: (15 lectures)
Planarity and colorability: Plane and planar graphs, outer planar graphs, Euler's Polyhedron formula, Kuratowski's theorems. Chromatic number. Five colour theorem, Four Colour conjecture, chromatic polynomial. Adjacency matrix, Spectrum of a graph.

Suggested Readings
1. Graph Theory, F. Harary, Addison Wesley Publishing Co.
2. Introduction to graph theory, D. B. West, Prentice Hall, India (Pearson).
3. Algebraic Graph Theory, N. Biggs, Cambridge university press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3			H	
CO 4				H

MACA0048: MULTIVARIABLE CALCULUS

(4-0-0)

COURSE OUTCOMES
CO 1: Demonstrate an understanding of the concepts of multivariate and vector-valued functions and their applications. (Understanding)
CO 2: Examine differentiability of vector valued functions on R^n and understand the relation between directional derivative and differentiability. (Analysing)
CO 3: Learn about generalisation of concept of integration and ability to solve higher dimension integrals. (Understanding)
CO 4: Demonstrate an understanding of Green's, Stokes' and Gauss' theorem and of some physical applications of these theorems. (Applying)

Module I: (15 lectures)
Vectors, dot product of vectors, projection, triangle and Cauchy-Schwarz inequality, cross product of vectors and determinants. Non-linear function, parametric equation of curves, level surfaces, vector fields.

Module II: (20 lectures)
Open sets in Rn, sequences and closed sets, function of several variables, limit of a function of several variables, continuity, sequential continuity, partial and directional derivative, differentiability, chain rule, gradient, curl, divergence, Taylor's theorem, inverse function theorem, implicit function theorem, maximum value theorem, critical points, second derivative test.

Module III: (15 lectures)
Introduction to integration of a function of several variables, multiple integrals, iterated integral, fubini's theorem, physical applications, determinant in n-dimensions, Jacobian and change of variables.

Module IV: (10 lectures)
Green's theorem, Stokes' theorem, Divergence theorem. Manifolds in Rn, Differential forms.

Suggested Readings
1. Calculus and Analytic Geometry, Thomas G. B., Finney R.L., Pearson.
2. Advanced Calculus, P. M. Fitzpatrick, AMS, Indian Edition.
3. Analysis on Manifolds, Munkres J.R., Wisley.
4. Principles of Mathematical analysis, Rudin W. McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	M
CO 4				H

MAAY0049: ALGEBRAIC NUMBER THEORY

(4-0-0)

COURSE OUTCOMES

CO 1: Demonstrate Field extensions and characterization of finite normal extensions as splitting fields and study prime fields. (Understanding)
CO 2: Illustrate cyclotomic polynomials, cyclic extensions, Radical field extensions and Ruler & Compass constructions. (Understanding)
CO 3: Analyse the role of Minkowski's theorem towards the proof of Four-square theorem. (Analysing)
CO 4: Know the important applications of Galois Theory. (Applying))
CO 5: Discuss Artin-Whaples approximation theorem and Hensel's lemma. (Creating)

Module I: (15 lectures)

Integral extension, integral closure of a ring, finitely generated modules, localization of a ring, construction, localization of modules, norm, trace, transitivity of trace and norm, quadratic extension of rationales, discriminant, Dedekind domain, factorization ideals, unique factorization of ideals, the ideal class group.

Module II: (12 lectures)

Factorization of prime ideals in ring extensions, ramification, Ram-Rel identity, lifting of ideals, norms of ideals, norm of a prime ideal, lattices, Minkowski's theorem, the canonical embedding.

Module III: (12 lectures)

The Logarithmic embedding, The Dirichlet's unit theorem, real and imaginary quadratic fields, units in quadratic fields, cyclotomic extensions, an integral basis of a cyclotomic extension.

Module IV: (12 lectures)

Galois extensions, factorization of prime ideals in Galois extensions, decomposition of inertia groups, local fields, absolute values, discrete valuation.

Module V: (9 lectures)

Artin-Whaples approximation theorem, completions, Hensel's lemma.

Suggested Readings

1. Algebraic Theory of Numbers, Samuel P., Herman.
2. Algebraic Number Theory, Richard A. Mollin, CRC Press, Taylor and Francis group
3. Algebraic Number Theory, Stewart I., Tall D., Chapman and Hall.
4. Problems in Algebraic Number Theory, Esmonde J., Murthy M. R., Springer.
5. Algebraic Number Fields, Janusz G.J., AMS.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			M	
CO 2	H	H			
CO 3			H		
CO 4			M	H	
CO 5					H

MAFL0050: FLUID DYNAMICS II

(4-0-0)

COURSE OUTCOMES

CO 1: Explain the concept of Newtonian and non-Newtonian fluid. (Understanding)
CO 2: Relate entropy principle to various thermal engineering applications. (Understanding)
CO 3: Apply the concept of second law efficiency and exergy principle to various thermal engineering applications.(Applying)
CO 4: Analyse steady state and transient heat conduction problems of real-life Thermal systems. (Analysing)

Module I: (15 lectures)

Stress components in a real fluid. Relations between rectangular components of stress. Connection between stresses and gradients of velocity. Navier-stokes equations of motion. Plane Poiseuille and Couette flows between two parallel plates, steady flow between concentric rotating cylinders, steady flow through cylindrical pipes; Reynolds' number. Theory of Lubrication. Flow through tubes of uniform cross section in the form of circle, annulus, ellipse and equilateral triangle under constant pressure gradient. Unsteady flow over a flat plate.

Module II: (12 lectures)

Boundary layer concept, Boundary layer equations in two-dimensional flow, Boundary layer flow along the flat plates: Blasius

solution. Shearing stress, momentum loss thickness, Boundary layer thickness and skin friction. Exact solution of the steady state boundary layer equations in two-dimensional motion. Flow past a wedge. Flow in a convergent channel.

Module III: (13 lectures)
Boundary layer on a surface with pressure gradient, Momentum integral theorems for Boundary layer, The Von Karman integral relation, Application of Momentum integral equation to Boundary layers: Von Karman-Pohlhansen method, Separation of boundary layer flow, Boundary layer control, Methods of Boundary layer control, Introduction to turbulent flow: Origin of turbulence, Reynold's modification of Navier- Stokes equations for turbulent flow, Semi-empirical theory of turbulence.

Module IV: (20 lectures)
Basic concepts of Magnetohydrodynamics, Maxwell's equations, Frame of reference, Lorentz force, Electromagnetic bodyforce, Fundamental equations of MHD, Ohm's law for a moving conductor, Hall current, Conduction current, Kinematic aspect of MHD, Magnetic Reynolds number, MHD waves: alfven's waves, MHD waves in compressible fluid, MHD approximations, Electromagnetic boundary conditions, One dimensional MHD flow, Hartmann flow, MHD Couette flow, MHD Stoke's flow, MHD Rayleigh's flow, Hartmann-Stoke's boundary layer, Alfven's boundary layer, Two dimensional MHD flow (a) Aligned flow (b) Stagnation point flow, MHD flows in a rotating medium, Effects of Hall current on MHD flows in a rotating channel, MHD heat transfer.

Suggested Readings

1. Boundary Layer Theory, H. Schlichting, McGraw Hill Comp.
2. Laminar Boundary Layer, L. Rosenhead, Dover Pub.
3. Fluid Mechanics [Si Units]:, Cengel, Tata McGraw-Hill Education.
4. Magnetohydrodynamics, T. G. Cowling, Interscience Publishers New York.
5. A Text Book of Magnetohydrodynamics, J.A. Shercliff, Pergamo.
6. Magnetohydrodynamics and Plasma Dynamics, S. I. Pai, Springer Verlag, New York.
7. Magnetofluid Dynamics for Engineers and Applied Physicists, K. R. Cramer and S. I. Pai, McGraw-Hill, New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	M
CO 4			M	H

MACM0051: CONTINUUM MECHANICS

(4-0-0)

COURSE OUTCOMES

CO 1: Define principles, axioms and hypothesis of governing equations of continuum mechanics. (Remembering)
CO 2: Extend the same principles to solve deformed and un-deformed configuration of particles. (Understanding)
CO 3: Develop the general theory to formulate and solve problems in hydrodynamics. (Applying)
CO 4: Examine the concept of macroscopic behaviour of particles. (Analysing)
CO 5: Estimate the elasticity behaviour of particles in continuum media. (Evaluating)

Module I: (15 lectures)
Principles of continuum mechanics, axioms. Forces in a continuum. The idea of internal stress. Stress tensor, Cauchy's stress principle. Equations of equilibrium. Symmetry of stress tensor. Stress transformation laws. Principal stresses and principal axes of stresses. Stress invariants. Stress quadric of Cauchy. Shearing stresses. Mohr's stress circles.

Module II: (20 lectures)
Deformation. Strain tensor. Finite strain components in rectangular Cartesian coordinates. Lagrangian and Eularian descriptions, Infinitesimal strain components. Geometrical interpretation of infinitesimal strain components. Principal strain and principal axes of strain. Strain invariants, strain quadratic of Cauchy's. The compatibility conditions. Compatibility of strain components in three dimensions. Constitutive equations.

Module III: (10 lectures)
Inviscid fluid. Circulation. Kelvins energy theorem. Constitutive equation for elastic material and viscous fluid. Navier and Stokes equations of motion. Motion of deformable bodies.

Module IV: (15 lectures)
Lagrangian and Eulerian approaches to the study of motion of continua. Material derivative of a volume integral. Equation of continuity. Equations of motion. Equation of angular momentum. Equation of Energy. Strain energy density function.

Suggested Readings

1. Schaum's Outline of Continuum Mechanics, G. E. Mase, Mc-Graw Hill.
2. A first course in continuum mechanics, Y.C. Fung, Cambridge University Press.
3. A course in continuum mechanics. Vol – I, L. I. Sedov, Groningen: Wolters-Noordhoff Publishing.
4. The elements of continuum Mechanics, C. Truesdell, Springer-Verlag.
5. Mathematical Theory of Continuum Mechanics, Rabindranath Chatterjee, Narosa.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		M
CO 3		M	H	M
CO 4			H	
CO 5				H

MATR0052: THEORY OF RELATIVITY

(4-0-0)

COURSE OUTCOMES

CO 1: Recall the fundamental principles of inertial frames and uniform motion in relativistic mechanics. (Remembering)
CO 2: Illustrate the concept of vacuum and various physical quantities in flat space as well as curved space time. (Understanding)
CO 3: Apply the concept of relativistic mechanics to define physical quantities in various coordinate system. (Applying)
CO 4: Analyse the path of motion of particles in presence of curved space-time. (Analysing)
CO 5: Assess the relativistic frequency shifts for sources moving in a gravitational field. (Evaluating)

Module I: (20 lectures)

The special theory of relativity: inertial frames of reference; postulates of the special theory of relativity; Lorentz transformations; length contraction; time dilation; variation of mass; composition of velocities; relativistic mechanics; world events, world regions and light cone; Minkowski space- time; equivalence of mass and energy.

Module II: (10 lectures)

Energy-momentum tensors: the action principle; the electromagnetic theory; energy-momentum tensors (general); energy-momentum tensors (special cases); conservation laws.

Module III: (15 lectures)

General Theory of Relativity: introduction; principle of covariance; principle of equivalence; derivation of Einstein's equation; Newtonian approximation of Einstein's equations.

Module IV: (15 lectures)

Solution of Einstein's equation and tests of general relativity: Schwarzschild solution; particle and photon orbits in Schwarzschild space-time; gravitational red shift; planetary motion; bending of light; radar echo delay.

Suggested Readings

1. The Theory of Relativity, 2nd edition, R.K. Pathria, Hindustan Publishing co. Delhi.
2. General Relativity & Cosmology, J.V. Narlikar, Macmillan co. of India Limited.
3. Aspects of Gravitational Interactions, S. K. Srivastava and K. P. Sinha, Nova Science Publishers Inc. Commack, NewYork.
4. Essential Relativity – W. Rindler, Springer-Verlag.
5. General Relativity – R.M. Wald, University of Chicago Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		M
CO 3			H	
CO 4			M	M
CO 5				H

MAFE0053: FINITE ELEMENT METHODS

(4-0-0)

COURSE OUTCOMES

Learn and relate some basic concept of variational methods and finite element method. (Remembering)

CO 1: Relate simple problems into finite elements. (Understanding)
CO 2: Develop finite element models. (Applying)
CO 3: Analyse finite element method in two dimensional problems. (Analysing)

Module I: (15 lectures)

Integral formulations and variational methods: Weighted integral and weak formulations of boundary value problems, Rayleigh-Ritz method, Method of weighted residuals.

Module II: (15 lectures)

Finite element analysis of one - dimensional problems: Discretization of the domain, Derivation of element equations, Connectivity of elements, Imposition of boundary conditions, Solution of equations, Applications.

Module III: (15 lectures)

Time dependent problems in one dimension: Formulation of eigenvalue problem, Finite element models, Applications of semi discrete finite element models for time-dependent problems, Applications to parabolic and hyperbolic equations.

Module IV: (15 lectures)

Finite element analysis of two- dimensional problems: Interpolation functions – Evaluation of element matrices, Assembly of element equations, Imposition of boundary conditions, Solution of equations, Applications to parabolic and hyperbolic equations.

Suggested Readings

1. An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw Hill, New Delhi.
2. Finite Element Analysis, Schaum's Outline Series, Buchanen G.R. and Rudhramoorthy R, Tata McGraw Hill, New Delhi.
3. Fundamentals of Finite Element Analysis, Huttan D.V., Tata McGraw Hill, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2		H	M	
CO 3			H	
CO 4			M	H

MADN0054: DESIGN AND ANALYSIS OF ALGORITHMS

(4-0-0)

COURSE OUTCOMES

CO 1: Learn the formal definition and importance of analysis of an algorithm and their asymptotic bounds. (Remembering)
CO 2: Outline different design strategies for the design of algorithms. (Understanding)
CO 3: Develop and analyse algorithms for given problems. (Applying)
CO 4: Compare and analysis different design strategies. (Analysing)
CO 5: Assess various algorithms in terms of correctness, computation cost and memory space used. (Evaluating)

Module I: (16 lectures)

a. Model of computations: Algorithms and their complexity, Random access machines, Computational complexity of RAM programs, A stored program model, abstraction of RAM, A primitive model of computation: Turing machine, relationship between Turing machine and RAM model.
b. Algorithms Analysis Techniques: Efficiency of algorithms, analysis of recursive programs, solving recurrence equations, a general solution for large class of recurrences.
c. Algorithms Design Techniques: Data structures: List, queues and stacks; Set representations, Graphs, Trees, Divide and Conquer algorithms, dynamic programming, Greedy algorithms, Backtracking, Local search algorithms, Balancing.

Module II: (10 lectures)

a. Sorting and Order Statistics: The sorting problem, Radix sorting, Sorting by comparison, Heapsort-an O(n logn) comparison sort, quicksort-an O(n logn) expected time sort, Order Statistics, Expected time of order statistics.
b. Data structures for set Manipulation problems: Fundamental operations on set, Hashing, Binary search, Binary search trees, Optimal binary search trees, A simple-disjoint set union algorithm, tree structures for UNION –FIND problem, Application and extensions of the UNION-FIND algorithm, Balanced tree schemes, Dictionaries and priority queues, Mergeable heaps, Concatenable queues, Partitioning.

Module III: (14 lectures)

a. Algorithms on Graphs: Minimum-cost spanning trees, Depth-first search, Bi-connectivity, Depth-first search of a directed graph, strong connectivity, Path- finding problems, A transitive closure algorithm, A shortest path algorithm, Path problems and matrix multiplication, Single- source problems, Dominators in a directed acyclic graph.
b. Matrix multiplications and related Operations: Basics, Strassen's matrix multiplication algorithm, Inversion of matrices, LUP decomposition of matrices, Application of LUP decomposition, Boolean matrix multiplication.

Module IV: (12 lectures)

a. NP-Complete Problems: Nondeterministic Turing machine, The class P and NP, Languages and problems, NP-completeness of the satisfiability problem, Additional NP-Complete problem, Polynomial space –bound problems.
b. Some Provably Intractable Problems: Complexity hierarchies, The space hierarchy for deterministic Turing machine. A problem requiring exponential time and space, A non- elementary problem.

Module V: (8 lectures)

Data structures and Algorithms for External Storage: A model for External computation, External sorting, Storing information in files, External search trees. Memory Management: The issues in memory management, Managing equal- sized blocks, Garbage collection algorithms for equal-sized blocks, storage allocation for objects with mixed sizes, Buddy systems, Storage compaction.

Suggested Readings

1. The Design and Analysis of Computer Algorithms, Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, Addition Wesley.
2. Data Structures and Algorithms, Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, Addition Wesley.
3. Introduction to algorithms- A Creative approach, V Manbar, Addition Wesley.
4. Fundamentals of Computer Algorithms, Ellis Harwitz, Sartaz Sahani, Computer Science Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M	H			
CO 3		M	H		
CO 4			M	H	M
CO 5				M	H

MAIC0055: INTRODUCTION TO CRYPTOGRAPHY

(4-0-0)

COURSE OUTCOMES

CO 1: Define the terms and concepts of symmetric key ciphers. (Remembering)
CO 2: Identify the importance of modular arithmetic, modulo operator and algebraic structures in symmetric key cipher. (Applying)
CO 3: Discuss some asymmetric-key cryptography, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem. (Analysing)
CO 4: Discuss some primality test algorithms and their efficiencies. (Analysing)
CO 5: Explain the concept of elliptic curve cryptosystems. (Understanding)

Module I: (14 lectures)

Introduction to Cryptography, classical cryptosystem, cryptanalysis on Substitution Cipher, Play Fair Cipher, Block Cipher. Data Encryption Standard (AES), Triple DES, Modes of Operation, Stream Cipher, Pseudorandom Sequence.

Module II: (16 lectures)

LFSR based stream cipher; Modular inverse, Extended Euclid Algorithm, Fermat's Little Theorem, Euler Phi-Function, Euler's theorem, Quadratic Residue, Polynomial Arithmetic. Advanced Encryption Standard (AES), Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem.

Module III: (18 lectures)

Primality Testing: Probabilities Primality testing, primality testing for numbers of a special form, AKS primality test including detecting perfect powers; Computing the Order of an element and generating primitive roots (and elements ofa certain order), Computing Discrete Logarithms, Factoring Integers, factoring polynomials and tests constricting irreducible polynomials; Solving equations over Finite Fields including computing square roots. ElGamal Cryptosystem.

Module IV: (12 lectures)

Cubic curves, singular points, Discriminant, Elliptic curves, Elliptic Curve over the Reals, Elliptic Curve Modulo a Prime. Generalized ElGamal Public Key Cryptosystem, Chinese Remainder Theorem, Rabin Cryptosystem, Legendre and Jacobi symbol.

Suggested Readings

1. A Course in Number Theory and Cryptography, A Neal Koblitz, Springer.
2. An Introduction to Mathematical Cryptography, Jill Pipher, Jeffrey Hoffstein, Joseph H. Silverman, Springer.
3. An Introduction to theory of numbers, Niven, Zuckerman and Montgomery, Wiley.
4. Elliptic curves: number theory and cryptography, Lawrence C. Washington, Chapman & Hall/CRC.
5. An Introduction to Cryptography, R.A. Mollin, Chapman & Hall.
6. Rational Points on Elliptic Curves, Silverman and Tate, Springer.
7. Guide to elliptic curve cryptography Hankerson, Menezes, Vanstone, Springer.
8. Elementary Number Theory, Jones and Jones, Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3		M	H	
CO 4		M	M	
CO 5				H

MADS0059: DYNAMICAL SYSTEMS AND CHAOS

(4-0-0)

COURSE OUTCOMES

CO 1: Define the concepts of nonlinearity, iterated functions, fixed points, differential equations, metric space andtopology. (Remembering)
CO 2: Interpret the link between regular systems and unpredictable systems with chaotic nature. (Understanding)
CO 3: Classify and interpret the dynamical properties for a given problem in a dynamical system. (Analysing)
CO 4: Derive the model on of given physical situations to prove the basic dynamic behaviour with the existence of chaos. (Applying)
CO 5: Determine bifurcation points, Topological entropy, Topological transitivity, Devaney chaos, Li-Yorke chaos.(Evaluating)

Module I: Dynamical Systems and Vector Fields (12 lectures)

The notion of Dynamical systems and Vector Fields, The fundamental theorem on existence and uniqueness, Orbits, Topological conjugacy and orbits, Phase Portraits, Graphical analysis of orbits, Periodic orbits and stability theory, Nonlinear analysis on Logistic map and Tent Map.

Module II: Discrete systems and Bifurcations (12 lectures)

Period doubling bifurcations, Saddle-node bifurcation, Transcritical bifurcation, Pitchfork bifurcation, various universal routes to chaos, Feigenbaum universality, Chaos, Strange attractor, Fractals, Sharkovskii Order, Period 3 implies chaos.

Module III: Continuous systems and Dynamics (12 lectures)

First order continuous autonomous systems, Classification of fixed points of autonomous systems, Attractors and repellors, Second order continuous autonomous systems, Phase curves and fixed points, Classification of fixed points of linear systems.

Module IV: Topological Dynamics (12 lectures)

Topological Dynamical systems, Examples and Basic Properties, Topological transitivity, Mixing, Weak mixing, Devaney chaos, Li-Yorke chaos, Topological entropy and Application.

Module V: Symbolic Dynamics (12 lectures)

Shifts- one-sided and two-sided, Sub shifts and codes, Shift spaces, Languages, The Perron Frobenius theorem, Higher block shifts and Higher Power shifts, Entropy and application , Finite type constraints , Graph representations of shifts of finite type and their properties.

Suggested Readings

1. Nonlinear Dynamics and Chaos with application to Physics, Biology, Chemistry, and Engineering, Steven H Strogatz,West view Press.
2. A First Course in Chaotic Dynamical Systems: Theory and Experiments, Robert L Davaney, CRC Press, Taylor and Francis.
3. An Introduction to Symbolic Dynamics and Coding, Douglas Lind and Brian Marcus, Cambridge University Press.
4. Introduction to Dynamical Systems, Michael Brin and Garrett Stuck, Cambridge university Press.
5. Introduction to Nonlinear Dynamical Systems and Chaos, S Waggins, Springer.
6. Chaos and Fractals, H O Peitgen, H Jurgens and D Saupe , New Frontiers of Science, Springer.
7. Nonlinear Oscillations, Dynamical Systems and Bifurcation of Vector Fields, J Guckenhemer and P Holmes, Springer.
8. Introduction to Dynamical Systems, D K Arrowsmith, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		
CO 2	M	H			
CO 3	M		H		
CO 4	M	H	M	H	M
CO 5				M	H

MACO0060: CONVEX OPTIMIZATION

(4-0-0)

COURSE OUTCOMES

CO 1: Define some basic concept of functions and operations research. (Remembering)
CO 2: Analyse and solve a given a mathematical problem, classifying its algebraic structure. (Analysing)
CO 3: Derive the solution of a problem using mathematical methods and computing approach. (Applying)
CO 4: Determine the mathematical and social system solution procedure and analysing the results. (Evaluating)

Module I: Introduction (5 lectures)

Mathematical Optimization, least square and linear programming, convex optimization, nonlinear optimization.

Module II: Convex sets and functions (15 lectures)

Convex sets: Affine and convex sets, examples, operations that preserve convexity, generalised inequalities, separating and supporting hyperplanes, dual cones and generalised inequalities. Convex functions: Basic properties and examples, conjugate function, quasi-convex functions, log- concave and log convex functions, convexity with respect to generalised inequalities.

Module III: Convex optimization problems (20 lectures)

Optimization problems- convex, linear, quadratic, geometric, generalised inequality constraints, vector optimization. Duality: The Lagrange dual functions, geometric interpretation, saddle point, optimality conditions, perturbation andsensitivity analysis, theorem of alternatives.

Module IV: Applications (20 lectures)

Geometric problems- Projection on a set, distance between sets, Euclidean distance and angle, external volume ellipsoid, centering, classifications, placement and location, floor planning. Approximation and fittings- Norm, least- norm, regularised, robust, function fitting and interpolation, some problems involving two quadratic functions.

Suggested Readings

1. Convex optimization, Boyd and Vandenberghe, Cambridge University press.
2. Introductory lectures on convex optimization, YuriiNesterov, Kluwer Academic Publisher.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H	L	
CO 2	L			H
CO 3	M	M	H	M
CO 4				H

MAGT0061: INTRODUCTION TO GAME THEORY

(4-0-0)

COURSE OUTCOMES

CO 1: Define some basics of game theory, concepts of players, strategies, payoff etc. (Remembering)
CO 2: Illustrate different types of game strategies. (Understanding)
CO 3: Apply different methods to solve games and recommend which strategy to implement. (Applying)
CO 4: Analyse real life competitive situations using game theoretic techniques. (Analysing)
CO 5: Determine the methods of solution using simple real-life problem. (Evaluating)

Module I: Introduction (8 lectures)

Basics of game theory, Types of games, zero-sum games, non-zero-sum game, Simultaneous games, Sequential games, Prisoners Dilemma, Other Interesting two person games, Ultimate Game, Public Good Game, Theory of rational choice, Interacting decision makers, Solution of Game by Simplex method.

Module II: Games with Perfect Information (10 lectures)

Strategic games, the Prisoner's Dilemma, Nash equilibrium, Best response functions, Dominated actions, Equilibrium in a single population: symmetric games and symmetric equilibria, Cournot's model of oligopoly, Bertrand's model of oligopoly, Electoral

competition, The War of Attrition, Auctions, Accident law.

Module III: Mixed strategy Nash Equilibrium (12 lectures)
Strategic games with randomization, Mixed strategy Nash equilibrium: concept and examples, Correlated equilibrium, Expected Payoffs, Mixed Strategy Equilibrium, Dominated Actions, Formation of Players' beliefs, Information and Bayesian Games: examples, Bayesian game applications, Juries and Information Aggregation, Auctions with Private Information.

Module IV: Extensive Games (12 lectures)
Definitions, Subgame perfect equilibrium, the ultimatum game and the holdup game, Stackelberg's model of duopoly, buying vote, Extensive Games with Perfect Information: Extensions and Discussion, Coalitional Games and the Core, examples, Bayesian Games, Spence Signalling Game, Crawford and Sobel Cheap Talk Game.

Module V: Variants and Extensions (18 lectures)
Strictly Competitive Games and Maximization, Definition and Examples, Rationalizability, Iterated elimination of strictly and weekly dominated actions, Evolutionary Equilibrium, Monomorphic pure strategy equilibrium, Mixed strategies and polymorphic equilibrium, Asymmetric equilibria, Repeated games: The Prisoner's Dilemma, Infinitely repeated games, Strategies, Nash equilibria of general infinitely repeated games, Subgame perfect equilibria of general infinitely repeated games, Finitely repeated games, Bargaining, Repeated ultimatum game, Holdup game.

Suggested Readings
1. Game Theory, D. Fudenberg and J. Tirole, MIT press.
2. An Introduction to Game Theory, Osborne, M.J., Oxford University Press.
3. Microeconomic Theory, Mas-Colell, A., M.D. Whinston and J.R., Green Oxford University Press.
4. Primer in Game Theory, Gibbons, R.A, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			M	
CO 2		H			
CO 3			H	M	
CO 4				H	M
CO 5				M	H

MAAN0062: ALGEBRAIC GEOMETRY

(4-0-0)

COURSE OUTCOMES:
CO 1: Show the correspondence between algebraic objects and their geometric counterparts. (Remembering)
CO 2: Explain the interplay between algebraic geometry and commutative algebra. (Understanding)
CO 3: Analyse the connection between algebraic objects and geometric properties. (Analysing)
CO 4: Evaluate the properties of local rings with their validity in more generalized setting. (Evaluating)

Module I: (17 lectures)
Review of properties of polynomial rings on several variables, properties of algebraic sets, Nullstalensatz (weak form), Zariski topology on algebraic sets, correspondence between ideals of zero set and radical ideals, Nullstalensatz (strong form), irreducibility in Zariski topology, affine line and Zariski topology, Noetherian decomposition.

Module II: (15 lectures)
Topological dimension, Krull dimension, height of a prime ideal, ring of polynomial functions on affine variety, open sets and basic open sets in Zariski topology, quasi compactness, characterizing affine varieties, correspondence between k algebras and morphisms, the coordinate ring of an affine variety, automorphism of affine spaces and polynomial rings.

Module III: (16 lectures)
Projective spaces, projective spaces as copies of affine spaces, graded rings and homogeneous ideals, homogeneous localization and related properties, local rings, local rings at a point of a projective space, function fields, global regular functions on projective varieties, category of varieties, properties of homogeneous coordinate rings.

Module IV: (12 lectures)
Isomorphism of local rings, geometric interpretation of isomorphism of local rings, birationality, idea of non-singularity, smooth manifolds, correspondence between hypersurfaces and varieties.

Suggested Readings
1. Abstract Algebra, Dummit D.S., Foote R. M., John Wiley and sons Inc.
2. Undergraduate Commutative Algebra, Reid Miles, Cambridge university press.
3. Elementary Algebraic Geometry, Hulek Klaus, AMS Student mathematical library.

4. Basic Algebraic Geometry I, Shafarevich I.R., Springer-Verlag.
5. Algebraic Geometry, Hartshorne R., Springer-Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2		H		
CO 3		M	H	
CO 4			M	H

MANO0063: NUMERICAL OPTIMIZATION

(4-0-0)

COURSE OUTCOMES

CO 1: Learn some basic concept of numerical methods and operations. (Remembering)
CO 2: Illustrate the different optimization problem and their solving methods. (Understanding)
CO 3: Classify the algebraic structure and the solution procedure for a given a mathematical problem. (Analysing)
CO 4: Derive the solution of a problem using computing approach. (Applying)
CO 5: Evaluating the mathematical and social system solution procedure and analysing the results. (Evaluating)

Module I: Mathematical Formulation (5 lectures)

Transportation problem, continuous and discrete, constrained and unconstrained, global and local, stochastic and deterministic convexity, and optimization algorithms.

Module II: Fundamental of unconstrained optimization (10 lectures)

Solution of unconstrained problems, local minimum, non -smooth problems. Two strategies- Line search and Trust Region, search direction for linear search methods, models for Trust Region method, steepest Descent method, first order methods- Gauss- Seidel, method of successive approximation or Gradient method.

Module III: Line Search (15 lectures)

General scheme, computing new t, optimal step size, Wolfe's rule. Newton methods- Forcing global convergence, alleviating the method, Quasi- Newton methods, global convergence, local convergence. Conjugate gradient- developing the method, computing the direction, orthogonalization process.

Module IV: Trust Region (18 lectures)

Elementary problems, curvilinear search incidence on the sequence x_k, least square, Gauss- Newton, algorithm based on Cauchy point, improving on the Cauchy point. Quadratic programming-basic mechanism, solution algorithm and convergence.

Module V: Newton's methods in constrained optimization (12 lectures)

Differential calculus, existence and uniqueness of solutions, first order optimality condition, second order optimality condition, speed of convergence, projection onto a closed convex set.

Suggested Readings

1. Numerical Optimization, Jorge Nocedal, Stephen J Wright, Springer publication.
2. Numerical Optimization Theoretical and Practical Aspect, J Frederic Bonnans, J Charles Gibert Claude Lemarechal, Claudia A Sagastizabal, Springer publication.
3. Numerical methods and optimization an introduction, Sergiy Butenko, Panos M Pardalos, CRC press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				M
CO 2	M	H			
CO 3			H		
CO 4				H	
CO 5				M	H

MAML0064: MACHINE LEARNING

(4-0-0)

COURSE OUTCOMES

CO 1: Explain the basic concepts of Machine learning, Data Mining and AI and their importance in real life. (Understanding)
CO 2: Illustrate the various characteristics machine learning. (Understanding)
CO 3: Utilize the ML algorithms for finding solutions of real-life problem. (Applying)
CO 4: Analyse ML methods for identifying problems. (Analysing)

CO 5: Determine the performances of ML by implementing Python. (Evaluating)

Module I: Introduction to Statistics and Machine learning (8 lectures)
Statistical Inference, Types of Variables, Probability Distribution, Normality, Measures of Central Tendencies, Normal Distribution, Fundamentals of Machine Learning, Data Science vs Machine Learning, Introduction to AI, Machine Learning Concepts and types, KNN methods, Productive Models.

Module II: Supervised Learning (12 lectures)
Classification, Regression, Random Forest, Decision tree, Linear Regression, Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models, Logistic Regression, Ridge Regression.

Module III: Unsupervised Learning (12 lectures)
Clustering, Partitioning Clustering, Hierarchical Clustering, Grid based clustering, Clustering algorithms, K-means algorithm, Applications of Clustering in different fields.

Module IV: Advanced Machine Learning concepts and techniques (10 lectures)
Ensemble methods, Boosting, Support Vector Machines, Linear SVM Classification, Nonlinear SVM Classification, SVM Regression, ANN, Deep Learning, Semi-supervised learning, Tensor flow, Evaluation in ML.

Module V: Dimensionality Reduction (8 lectures)
The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Kernel PCA, LLE, Other Dimensionality Reduction Techniques.

Module VI: Introduction Python in Machine Learning (10 lectures)
Introduction to Python, Python Basics, Variables and Data Types, Decision Making and Loops, Functions, Modules and Packages, Exception handling, File and Directories, Classes and objects, Regular expressions, Socket programming.

Suggested Readings

1. The Elements of Statistical Learning, T. Hastie, R. Tibshirani, J. Friedman; Springer Series in Statistics.
2. Machine Learning, Tom Mitchell, McGraw Hill.
3. Introduction to Machine Learning with Python, Andreas C. Muller and Sarah Guido, Sebastopol.
4. Pattern Recognition and Machine Learning, Chris Bishop, Springer.
5. Lecture notes in Machine Learning, Zdravko Markov, Tioga Publishing Co.
6. Data Mining Techniques, Arun Kumar Pujari, University Press.
7. Pattern classification, Richard O. Duda, Peter E. Hart, David G. Stork, Wiley, New York.

Mapping of Cos to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M			
CO 3			H	H		
CO 4					H	M
CO 5					M	H

MAPD0065: PLASMA DYNAMICS

(4-0-0)

COURSE OUTCOMES

CO 1: Understand and use the basic mathematical formalism needed for describing the dynamics of continuous media (Understanding)
CO 2: Have a very good knowledge of mathematical models for plasma and will be able to distinguish the dynamics of plasmas and neutral fluid media. (Remembering)
CO 3: Use the general theory to formulate and modify the basic dynamic fluid equations to account for the dynamics of plasma media at different levels: from MHD to kinetic scales (Applying)
CO 4: Able to describe the propagation of waves in plasmas, plasma turbulence, instabilities and derive the dispersion relation for these waves (Analyzing)
CO 5: Solve complex model for the various astrophysical regions, and obtain analytical expressions for some characteristic quantities (Evaluating)

Module I (10 lectures) Introduction
Basic properties of plasmas: Definition, occurrence and importance of plasmas, Debye shielding, Quasi-neutrality, plasma parameter, plasma frequency, Larmor orbits (basics), Non-ideal plasmas

Module II (10 lectures) Elements of plasma dynamics
Single particle motion: Cyclotron motion, Electrodynamic equations for a conducting fluid (Maxwell's equations, Conservation

of electric charge, Generalized Ohm's law etc.) **,** Guiding center drifts: ExB, curvature and gradient.**,** Magnetic moment, adiabatic invariants, magnetic mirrors

Module III (18 lectures) Plasma as fluids
Introduction: The fluid equation of motion (Continuity equation, Momentum balance equation, Equations of state, Two-fluid equations, Plasma resistivity.
Waves in plasmas : Plasma oscillations, Langmuir waves, ion-acoustic waves ;Electromagnetic waves (parallel and perpendicular to B0)

Module IV (12 lectures) Kinetic plasma theory
Vlasov and Boltzmann equations, Obtaining fluid equations from Boltzmann equation, From the two-fluid to MHD description of plasmas;Longitudinal and transverse waves in an unmagnetized plasma. Solution of initial value problem by Landau's method. Landau damping.

Module V: (10 lectures) Nonlinear effects in plasmas
Introduction, The Sagdeev potential, Derivation of KdV equation for ion-acoustic waves, Soliton solution in one dimension, Elementary ideas about the ponderomotive force and parametric instability.

Suggested Readings:
1. Introduction to Plasma Physics and Controlled Fusion, F. F. Chen, Plenum Press, New York, Second Edition, Vol. 1, 1984.
2. Fundamentals of Plasma Physics, J. A. Bittencourt, Springer-Verlag New York, 2008.
3. Elements of Plasma Physics, S. N. Goswami, New Central Book Agency (P) Ltd, 2011.
4. Methods in Nonlinear Plasma Theory, R. C. Davidson, Academic Press, New York and London, 1972.
5. Waves in Plasmas, Thomas H. Stix, American Institute of Physics, USA, 1992.
6. Introduction to Plasma Physics, R. J. Goldston and P. H. Rutherford, IOP Publishing, Bristol & Philadelphia, 1995.

Mapping COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M			M	
CO 2	H	H			M
CO 3	M	M	H	M	
CO 4		M			
CO 5			M	H	H

MAFG0154: FRACTAL GEOMETRY AND APPLICATIONS

(2-0-0)

COUSE OUTCOMES
CO 1: Explain the basic concepts of fractals and their mathematical constructions. (understanding)
CO 2: Develop fractal dimensions and study their applications. (Applying)
CO 3: Categorize Mandelbrot set and Julia sets, and classify their graphical representation and geometric properties. (Analysing)
CO 4: Interpret random fractals, and study their applications to Health science and Stock markets. (Evaluating and Applying)
CO 5: Demonstrate various chaos, renormalization, universality of chaos, and their significance. (Understanding and Creating)
CO 6: Elaborate various applications in different fields of science and technology. (Creating)

Module I: Regular Fractals and Self-similarity (5 lectures)
Self-similarity, Examples of self-similarity, Fractals, Cantor Set, Koch Curve, Sierpinski gasket, Menger Sponge, Initiators and Generators, Geometry of Plane Transformations, Iterated Function Systems(IFS), Inverse problems, Random IFS, Driven IFS, Architecture.

Module II: Natural Fractals and Dimensions (5 lectures)
Ineffective way to measure, Fractal Dimensions and calculation, Hausdorff measure and dimension, Box counting dimension, Similarity dimension, The Moran formula, other dimensions, Area-Perim, Dim Algebra, Natural Fractals,Manufactured Fractals.

Module III: The Mandelbrot Set and Julia Sets (5 lectures)
Complex iteration, Julia sets, Julia sets of quadratic functions, The Mandelbrot set, Combinatorics of the Mandelbrot set, The boundary of the Mandelbrot set, Scaling in the Mandelbrot set, Complex Newton's method, Universality of the Mandelbrot set, Fractal in arts.

Module IV: Random Fractals and the Stock Market (5 lectures)
Self-similar distributions, Random Cantor set, Brownian motion, Fractional Brownian motion , Diffusion Limited aggregation , Levy Stable processes, Percolation , Bacterial Growth, Galaxy distributions, Internet traffic , Random fractal Cartoons, Stock

market surrogates.

Module V: Chaos and Fractals (5 lectures)
Doubling, Introduction to Chaos, Test functions, Graphical iterations, Time series, Histograms, Bifurcation diagrams, Return map, Driven IFS, Kelly plot, Fixed points, Cycles, Period doubling bifurcations, Dust in the Tent map, Tent and Logistic bifurcation diagrams, Tangent bifurcations, Intermittency, Discontinuous bifurcations, Scaling, Universality, Renormalization, Control of chaos, Synchronization of chaotic processes.

Module VI: Fractal Applications (5 lectures)
Fractal growth, Singularities of Electrostatic and gravitational potentials, Fractal Antennas, Fractal in Finance, Self-Affine set and dimension, Application to encoding images, Panorama of Fractals and their uses, Animations, application of fractal geometry to Computer science, Telecommunications, and Medicine .

Suggested Readings
1. A Text by Michael Frame and Amelia Urry, Fractal Worlds, Yale University Press.
2. Fractal Geometry; mathematical foundations and Applications, Kenneth Falconer, John Wiley & Sons Ltd, England.
3. Fractal Geometry and Applications, Michel L Lapidus, A Jubilee of Benoit Mandelbrot,
4. The Fractal Geometry of Nature, Benoit Mandelbrot, W.H. Freeman and Co.
5. Fractal Geometry, Mathematical methods, Algorithms, Applications, A K Evans, Woodhead Publishing.
6. Fractals Everywhere, Michael Barnsley, Dover Books on Mathematics.
7. Chaos and Fractals: New Frontiers of Science, Heinz, Otto Peitgen, Springer and Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2		H		M	L	
CO 3			H	H	M	
CO 4			M	H		L
CO 5				M	H	H
CO 6		H				H

MAMR0153: STATISTICAL METHODS AND SOFTWARE IN RESEARCH

(3-0-0)

COURSE OUTCOMES
CO 1: Explain the basis necessity and application of Statistics in different fields of Science and Social Sciences. (Remembering and understanding)
CO 2: Develop the significance of data analysis and interpretation. (Applying)
CO 3: Categorize Correlation and Regression, and interpret graphical representation. (Analysing and creating)
CO 4: Elaborate various software to study different problems in Statistics. (Creating)

Module I: Importance, Functions, Limitations (5 Lectures)
Importance, Statistics in States, Statistics in Economics, Statistics in Business, statistics in Astronomy, Statistics in Education, Statistics in Mathematics, Functions of Statistics, Limitations of Statistics.

Module II: Collection of Data, Classification and Tabulation (10 lectures)
Primary and Secondary data, Choice of methods, Direct personal observations, Information through Agencies, Sources of Secondary data, Meaning of Classification, rules of Classification, Statistical series, Frequency distribution, Continuous or Grouped Frequency Distribution Class Group Frequency, Structure and rules of Tabulation, and applications.

Module III: Correlation and Regression (10 lectures)
Significance of the study of Correlation, Correlation and Causation, Karl Pearson's coefficient of correlation, Rank Coefficient of correlation, Correlation of time series, Significance of Regression study, Correlation and Regression, Regression equations, Standard error of estimate.

Module IV: Statistical Analysis Software (20 lectures)
Importance of Software in Statistical problems, SPSS (IBM) ,(Statistical Package for Social Sciences), R Foundation for Statistical Computing, MATLAB (MathWorks), Microsoft Excel ,their algebraic results and Applications.

Suggested Readings
1. Statistics (Theory and Practice), RSN Pillai, and Bagavathi, S Chand & Company Ltd, New Delhi.
2. All of Statistics: A Concise Course in Statistical Inference, Larry A Wasserman, Springer Publishing Co.

3. A Second Course in Probability, Sheldon M Ross and Erol A. Pekoz, Pekozbooks.
4. Statistical Software (Free Websites).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H	M	
CO 3		L	H	M
CO 4				H

MAML0152: ESSENTIAL MATHEMATICS FOR MACHINE LEARNING

(2-0-0)

COURSE OUTCOMES

CO 1: Comprehend the basic and core concepts of vector space, matrices, matrix decompositions. (Understanding)
CO 2: Apply the concepts statistics and linear algebra in Dimension reductions. (Applying)
CO 3: Gain extensive knowledge of probability and statistics for analysis of data. (Analysing)
CO 4: Apply the fundamentals of calculus to evaluate partial derivatives, gradient and other concepts of vector calculus. (Applying)

Module I: (8 lectures)

Vector Spaces: Definitions and examples, Vector Subspaces: Examples and Properties, Basis and Dimensions, Linear Transformations, MATRIX THEORY- Norms and spaces, eigenvalues and eigenvectors, Special Matrices and their properties, least squared and minimum normed solutions.

Module II: (8 lectures)

Matrix Decomposition Algorithms- SVD: Properties and applications, low rank approximations, Gram Schmidt process, polar decomposition, DIMENSIONS REDUCTION ALGORITHMS and JCF- Principal component analysis, linear discriminant analysis, minimal polynomial and Jordan canonical form

Module III: (8 lectures)

Probability – Basic concepts of probability: conditional probability, Bayes' theorem, independence, theorem of total probability, expectation and variance, few discrete and continuous distributions, joint distributions and covariance.

Module IV: (6 lectures)

Calculus – Basic concepts of calculus: partial derivatives, gradient, directional derivatives, Jacobean, hessian, convex sets, convex functions and its properties.

Suggested Readings

1. Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press.
2. Analysis for Applied Mathematics. W. Cheney, New York: Springer Science Business Media.
3. Linear Algebra Done Right, Third Edition, S. Axler, Springer International Publishing.
4. Numerical Optimization. J. Nocedal and S. J. Wright, New York: Springer Science Business Media.
5. A First Look at Rigorous Probability Theory, Second Edition, J. S. Rosenthal, Singapore: World Scientific Publishing.

Mapping COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	L	H		
CO 3		L	H	
CO 4				H

MASL0200: COMMUNITY ENGAGEMENT AND SERVICE LEARNING

(2-0-0)

COURSE OUTCOMES

CO 1: Develop understanding on Community University Engagement. (Remembering)
CO 2: Acquire knowledge of the measures taken by HEIs towards community engagement. (Understanding)
CO 3: Analyse a problem pertaining to the community by applying methods of participatory research. (Analysing)
CO 4: Apply various tools of CPBR to address real life issues of the communities. (Applying)
CO 5: Decide a suitable tool to connect with a certain community by identifying the major barriers. (Evaluating)

Module I: (Service Learning and Community University Engagement) (10 lectures)

Definition of Service Learning (SL), goals and objectives of SL. Meaning of community university engagement (CUE), Historical overview of Higher Educational Institutes (HEIs) in India, role played by various commissions in CUE, various policies adopted by University Grants Commission (UGC), objectives and structure of schemes adopted by UGC, measures taken by HEIs towards community engagement.

Module II: (Role of HEI fostering social responsibility) (10 lectures)

Understanding social responsibility of higher education institutes, forms of community engagement, notion of engaged teaching, engaged research, engaged service, meaning of an active citizen. Meaning of Community Based Participatory Research (CBPR), methods and tools associated with CBPR. Skills to utilize CPBR fostering social responsibility especially post emergency like pandemic etc.

Module III: Assignments (10 lectures)

a. Visiting nearby villages to collect data on the percentage of students enrolling into schools per year and represent the same using various Mathematical models.
b. To conduct fact finding visits in local areas to address a particular problem by helping the community understanding the situation employing tools like maps and meetings.

Suggested Readings

Where's the learning in service learning, J. Eyler, D.E. Giles Jr.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	M		
CO 3		M	
CO 4		H	M
CO 5			H

LABORATORY COURSES

MARS6001: RESEARCH SEMINAR

(2-0-0)

Objective

Objective of the Research seminar is to conduct a research literature survey which may lead to the development of a proposed project model to be executed in the 4th semester. This will help the students to familiarize themselves with the current literature on recent trends in the chosen area.

Tasks to be performed by the students will include.

- Literature survey on the chosen topic.
- Presentation on the chosen topic, comprising the following components:
  - Presentation.
  - Report.
  - Viva Voce examination.

COURSE OUTCOMES

CO 1: Find the steps required to do research and projects (Remembering)
CO 2: Illustrate the methodology of research and journaling. (Understanding)
CO 3: Apply the research presentation skills in seminars and conferences. (Applying)
CO 4: List topics to pursue research in the field of pure and applied mathematics. (Analysing)
CO 5: Defend their research dissertations and reports. (Evaluating)
CO 6: Develop research topics and present the research ideas. (Creating)

MACP6002: COMPUTER PROGRAMMING IN C LAB

(0-0-1)

COURSE OUTCOMES

CO 1: Understand the fundamentals of OS, file handling, creating and editing simple C programs. (Understanding)
CO 2: Develop programming skills using the fundamentals and basics of C Language. (Applying)
CO 3: Develop programs using the basic elements like control statements, Arrays and Strings. (Applying)
CO 4: Effective usage of arrays, structures, functions and pointers. (Applying)

List of programs

1. Introduction to OS; file handling, directory structures, creating and editing simple C programs.
2. C programming using variables, assignment and simple arithmetic expressions.
3. Determination of roots of quadratic equations, $ax2+bx+c=0$, $a\neq0$.
4. Arranging given set of numbers in increasing/decreasing order, calculation of Mean.
5. Calculation of GCD/LCM of two integers.
6. Evaluation of factorial of a positive integer and evaluation of binomial coefficients.
7. Evaluation of factorial of binomial coefficients mod 2.
8. Sieve method for primality test.
9. Generation of twin primes.
10. Solution of congruence using complete residue system.
11. Addition, subtraction and multiplication of matrices.
12. Transpose, determinant .

Suggested Readings

1. Programming in ANSI C, E. Balaguruswamy, McGraw-Hill.
2. A first book of ANSI C, J. Brosin, Cengagedelmer Learning India P.Ltd.
4. C Programming Language, Brain W. Kernighan & Dennis Ritchie, PHI.
5. Let us C, Kanetkar Y, BPB Publications, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO 1	H	M										
CO 2		H	H	M								
CO 3			H	H	H	H	H	H	H	H	M	M
CO 4				H				H		H	H	H

MARP6003: RESEARCH PROJECT

(8 credits)

Objective

The objective of the research project is to train students to carry out research/investigation in a field that is of relevance to Mathematical science. During the project period, students will start a research project/investigation applying the knowledge acquired in the first three semesters and also incorporating the recent trends in the chosen area. In the project course, the student should be able to undertake detailed literature review as a way of information search, carry out detailed investigations as a way of solving project problems, write and put together a detailed report of the investigations carried out at the end of the fourth semester.

The mode and components of evaluation, supervisors and the weightages attached to them shall be published by the Department at the beginning of the semester.

COURSE OUTCOMES

CO 1: Identify different areas of research in the field of Mathematical sciences or in computing. (Remembering)
CO 2: Explain the importance of research in the chosen topic of interest. (Understanding)
CO 3: Apply theoretical knowledge to find out an appropriate topic of importance for research in the graduate level. (Applying)
CO 4: Analyse when a chosen approach does not yield the expected result. (Analysing)
CO 5: Evaluate the project and present in an appropriate form. (Evaluating)
CO 6: Learn to choose a methodology or technique or approach to fulfil a set of objectives or prove or disprove a hypothesis. (Creating)

MACM6004: COMPUTATIONAL SKILL DEVELOPMENT: MATHEMATICA

(2 Credits- 30 Lectures)

COURSE OUTCOMES

CO 1: Learn how to use Mathematica, a powerful coding language in science and engineeringcomputing (Remembering).
CO 2: Apply the application-oriented principle to various real-life problems (Applying)
CO 3: Evaluate simple math computations, modeling and simulation problems, data analysis andprocessing, as well as visualization techniques. (Evaluating)

Module I (10 Lectures)

Introduction to Mathematica and to the Wolfram Language (knowledge-based language, built- in support for real-world entities, Wolfram Alpha and the Wolfram Demonstrations Project), Notebook Interfaces, Text-Based Interfaces, Numerical Calculations: Arithmetic, Exact and Approximate Results, Some Mathematical Functions, Arbitrary-Precision Calculations, Complex Numbers, Getting Used to Mathematica, Mathematical Notation in Notebooks, Defining Variables, Making Lists of Objects, Manipulating Elements of Lists, The Four Kinds of Bracketing in Mathematica, Sequences of Operations.

Module II (10 Lectures)

Lists, strings, rules, patterns and pattern matching, different programming paradigms (procedural, functional and rule- based), Graphics and image manipulation (the 30+ members of the plot family, pixelsand voxels, the built-in image editor).

Module III (10 Lectures)

Linear and polynomial algebra. Exact and numerical optimization. Calculus and differential equations (analytic and numerical solutions of ODEs and PDEs). Plane and solid geometry. Probability and statistics(descriptive statistics, built-in support for 100+ distributions).

Suggested Readings

1. The Mathematica Book, S. Wolfram, 5th edition, Wolfram Media, 2003
2. Mathematica Basic Training Course Li Han Long, Sui Ying Deng, National Defense Industry Press,2016
3. Introduction to Mathematica with Applications, M. Muresan, Springer, 2017

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M		
CO 2		M	M
CO 3			H

MACS6005: COMPUTATIONAL MATHEMATICS WITH SAGE MATH

(2 Credits- 30 Lectures)

COURSE OUTCOMES

CO 1: Learn and understand the basic Python programming language. (Understanding)

CO 2: Understand how to use Sagemath software and its applications. (Understanding)

CO 3: Solve problems in Calculus, Applied Linear Algebra, Numerical Method and differential equations using Sagemath.(Evaluating)

Module I (10 lectures)

Installation of Python; Getting Started with Python Python as an advanced calculator; For loop in Python; While loop in Python; Use of SciPy and SymPy in Python; Classes in Python - Part 01; Classes in Python - Part 02;

Module II (12 lectures)

Solving Equations in SageMath;2d Plotting with SageMath;3d Plotting with Sage Math; Calculus of one variable with Sagemath, Integration with Sage Math; Improper Integral using SageMath; Application of integration using SageMath; Partial derivative with sage math, limit and continuity of real valued functions; working with vectors in sagemath; Solving systems of linear equation in sage math, vector space in sage math, Matrix Spaces with SageMath; Linear Transformations with SageMath, eigenvalues and eigenvectors with sage math;

Module III (8 lectures)

Finding Roots of algebraic and transcendental equations in Sage Math; Numerical solutions of linear equations and numerical integration with sagemath; Solving 1st and 2nd order ODE with Sage Math; Euler's Method to solve 1st order ODE with SageMath.

Suggested Readings

1. Computational Mathematics with SageMath, Paul Zimmermann , Siam
2. Mathematical Computational with Sagemath, Paul Zimmermann Alexandre Casamayou Nathann Cohen Guillaume Connan Thierry Dumont
3. An introduction to Sage Programming: With applications to SAGE Interacts for Numerical methods, Razvan A Mezei, Springer

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2		H	M
CO 3			H

DEPARTMENT OF PHYSICS

VISION:

To endow the students with profound understanding of physics, the foundation for all natural sciences, and drive them towards critical thought for further study and research, to pave the way for suitable career opportunities and enable them to be of service to the society as responsible human beings.

MISSION:

- To strengthen the fundamental concepts of physics and provide advanced understanding of physicalphenomena by emphasizing on the correlation between theory and observation.
- To spark creative interest towards the pursuit of innovative research in fundamental and appliedphysics.

PROGRAM OUTCOMES – MSC PROGRAMME

PO 1: **Critical Thinking**: Inculcate critical thinking to carry out scientific investigation objectively . Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO 2: **Knowledge Skil**l: Equip the student with skills to analyse problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions thereof .Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems , rather than replicate curriculum content knowledge .

PO 3: **Scientific Communication Skills**: Imbibe effective scientific and / or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.

PO 4: **Ethics**: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned .Ability to identify unethical behaviour such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actionsin all aspects.

PO 5: **Enlightened Citizenship**: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges

PO 6: **Analytical Reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO 7: **Multicultural Competence**: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is , "welcoming for allstudents" .

PO 8: **Lifelong Learning**: Ability to think, acquire knowledge and skills through logical reasoning and to inculcatethe habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/reskilling .

PO 9: **Leadership Qualities**: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.

PO 10: **Research Skills**: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/ Matlab to various scientific investigations , problem solving and interpretation

PROGRAMME SPECIFIC OUTCOMES FOR MSC PHYSICS

PSO 1: **Understand the advanced theoretical concept of physics:** Understand the advanced theoretical principlesof physics.

PSO 2: **Acquire analytical and logical skill for research**: Acquire the ability to analyse critical research orientedproblems logically.

PSO 3: **Expertise in experimental physics and learn to use sophisticated instruments safely:** Learn to handle sophisticated experiments perfectly and safely.

COURSES OFFERED IN MSC PHYSICS

Sl. No.	Course Name
1.1	Classical Mechanics
1.2	Quantum Mechanics I
1.3	Mathematical Physics

1.4	Electronics I
1.5	Physics Laboratory I
1.6	Value Added Course
2.1	Quantum Mechanics II
2.2	Condensed Matter Physics
2.3	Electrodynamics
2.4	Nanophysics I
2.5	Physics Laboratory II
3.1	Atomic and Molecular Physics
3.2	Nuclear Physics
3.3	Research Methodology
3.4	Computer Oriented Numerical Methods
3.5	Computer Oriented Numerical Methods Laboratory
3.6	Project Phase I
3.7	Particle Physics
3.8	Plasma Physics I
3.9	Electronics II
3.10	Nanophysics II
3.11	Physics and Service Learning
3.12	Value Added Course
4.1	Statistical Mechanics
4.2	Project Phase II
4.3	Study Tour
4.4	Gauge Theories
4.5	General Theory of Relativity and Cosmology
4.6	Astrophysics
4.7	Plasma Physics II
4.8	Plasma Physics Laboratory
4.9	Electronics III
4.10	Electronics Laboratory
4.11	Nanophysics III
4.12	Nanophysics Laboratory

MSC Physics- Mapping of Courses to PO/PSO

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
1.1	H	H	M			M		H		M	H	M	
1.2	H	H	M			M		H		M	H	M	
1.3	H	H	M			M		H		M	H	M	
1.4	H	H	M			M		H		M	H	M	
1.5	M	M	L	M		M	M	M	M	L		L	H
1.6			H							H		H	
2.1	H	H	M			M		H		M	H	M	
2.2	H	H	M			M		H		M	H	M	
2.3	H	H	M			M		H		M	H	M	
2.4	H	H	M			M		H		M	H	M	
2.5	M	M	L	M		M	M	M	M	L		L	H
3.1	H	H	M			M		H		M	H	M	
3.2	H	H	M			M		H		M	H	M	
3.3	M	M	M	H	H	M		H	M	H	L	H	M
3.4	H	H	M			M		H		M	H	M	
3.5	H	H	L			H		H		M	H	H	
3.6	H	H	H	H		M	H	H	H	H	M	H	H
3.7	H	H	M			M		H		M	H	M	
3.8	H	H	M			H		H		M	H	M	
3.9	H	H	M			M		H		M	H	M	

3.10	H	H	M			M		H		M	H	M	
3.11			H	H	H		H	H	H				M
3.12			H							H		H	
4.1	H	H	M			M		H		M	H	M	
4.2	H	H	H	H		M	H	H	H	H	M	H	H
4.3		H	H		H		H	H	H	M	M	M	H
4.4	H	H	M			M		H		M	H	M	
4.5	H	H	M			M		H		M	H	M	
4.6	H	H	M			M		H		M	H	M	
4.7	H	H	M			H		H		M	H	H	
4.8	M	M	L	M		M	M	M	M	L		L	H
4.9	H	H	M			M		H		M	H	M	
4.10	M	M	L	M		M	M	M	M	L		L	H
4.11	H	H	M			M		H		M	H	M	
4.12	M	M	L	M		M	M	M	M	L		L	H

THEORY COURSES

PSCM0020: CLASSICAL MECHANICS

(4-0-0)

COURSE OUTCOMES

CO 1: Explain Hamilton's and Lagrange's equations and use them for solving problems in physics. (Understanding)
CO 2: Build the concepts of Canonical transformation. (Creating)
CO 3: Explain the motion of rigid body and visualise the Euler rotations. (Understanding)
CO 4: Solve rigid body problems. (Applying)
CO 5: Develop the theory of special relativity in terms of four vector notation. (Creating)

Module I: (12 lectures)

Hamilton's variational principle; derivation of Lagrange's equations; velocity dependent forces; dissipation. Charged particles in an electromagnetic field. Space time symmetries and conservation Laws. Varial theorem. Space transformation.

Module II: (12 lectures)

Two-body problem; central forces; classification of orbits; differential equation for orbits. Kepler problem; scattering in laboratory and centre of mass frames, transformation of cross sections, energies. Rutherford scattering. Kinematics of decay of particles (into two particles).

Module III: (12 lectures)

Rigid body motion: fixed and moving coordinate systems; orthogonal transformations. Euler angles; angular momentum; rotational kinetic energy. Principal axes transformation; Euler equations; force free motion of a rigid body symmetric top.

Module IV: (12 lectures)

Legendre transformation; Hamiltonian equations; Significance of the Hamilton function. Cyclic coordinates and conservation theorems. Poisson Brackets – Poisson Bracket of Angular momentum with coordinates. Canonical Transformation Theory. Contact transformation; integral invariants.

Module V: (12 ectures)

Special theory of relativity: Lorentz transformations. Four dimensional formulation. Force momentum and energy inrelativistic mechanics. Properties of space-time in relativity. Two body decay of a particle.

Suggested Readings

1. Classical Mechanics, H. Goldstein, C. Poole and J. Safko, Pearson Education Asia.
2. Classical Mechanics, N. C. Rana and P. S. Joag, Tata McGraw Hills.
3. Classical Mechanics of Particles and Rigid bodies, K. C. Gupta, Wiley Eastern.
4. Principles of Dynamics, D. T. Greenwood, Prentice Hall.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			H	
CO 2			H		
CO 3		H			
CO 4			H		
CO 5					H

PSQM0021: QUANTUM MECHANICS I

(4-0-0)

COURSE OUTCOMES

CO 1: Conceptualise different interpretations of quantum mechanics. (Understanding)
CO 2: Apply the concepts of quantum mechanics to different problems in physics. (Applying)
CO 3: Make use of variational method and WKB approximation. (Applying)
CO 4: Inspect how to encounter spin. (Analysing)
CO 5: Comprehend the idea of symmetry in quantum mechanics. (Analysing)

Module I: (10 lectures)

Introduction and revision: inadequacy of classical mechanics; basic postulates of quantum mechanics; ensemble and Copenhagen interpretation. Schrödinger equation; continuity equation; Ehrenfest theorem; admissible wave functions; stationary states. One dimensional problems; potential well and barriers; harmonic oscillator.

Module II: (10 lectures)
Equation of motion: Schrodinger, Heisenberg and Dirac representations; equation of motion in the respective representations. Application to linear harmonic oscillator.

Module III: (10lectures)
Three dimensional problems: Separation of variables; orbital angular momentum; spherical harmonics. Harmonic oscillator in Cartesian and polar coordinates. A free particle and a particle in 3-D box in Cartesian and polar coordinates, Coulomb problem in spherical and parabolic coordinates - regular and irregular solutions.

Module IV: (11 lectures)
Spinors and their transformation properties. Pauli spin matrices. Identical particles and statistics. Addition of angular momenta. Clebsch-Gorden coefficients. Winger-Eckart Theorem.

Module V: (8 lectures)
Symmetry in quantum mechanics. Reflections, time reversal, space inversion, particle exchange. Displacement in space and time, space translation and rotational symmetry. Selection rule and conservation laws.

Module VI: (11 lectures)
Variational methods for bound states; lower and upper limits in simple cases. WKB approximation; connection with classical limits, validity of WKB approximation. Connection formulae; application to bound states, tunneling in one dimension. Application to radial Schrodinger equation.

Suggested Readings
1. Quantum Mechanics, E. Merzbacher, John Wiley.
2. Quantum Mechanics, G. Ahruldhas, Prentice Hall.
3. Quantum Mechanics, L. I. Schiff, McGraw Hill.
4. Quantum Mechanics, V. K. Thankappan, New Age Int. Pub.
5. Quantum Mechanics, P. T. Mathews and Venkatesan, Tata McGraw Hill.
6. Principles of Non-Relativistics and Relativistic Quantum Mechanics, K. D. Krori, PHI.
7. Quantum Mechanics (3 volumes), L. D. Landau and E. M. Lifshitz, Pergamon Press.
8. Quantum Mechanics, Albert Messiah, Dover Publications.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H				
CO 2			H	M	M	M
CO 3						H
CO 4				H		
CO 5					H	

PSQM0024: QUANTUM MECHANICS II

(4-0-0)

COURSE OUTCOMES
CO 1: Explain relativistic quantum mechanics. (Understanding)
CO 2: Interpret path integral approach to quantum mechanics. (Understanding)
CO 3: Apply the concept of quantum mechanics to the problems of scattering. (Applying)
CO 4: Build concept about perturbation theory. (Applying)
CO 5: Develop concepts on advanced topics like Hartree- Fock equation. (Applying)

Module I: (11 lectures)
Stationary perturbation theory: Non Degenerate case; first and second order of energy and wave functions, perturbation of one dimensional harmonic oscillator by potentials of the bx^2 and cx^3. Degenerate case; first order Stark effect in hydrogen; Zeeman effect without electron spin.

Module II: (9lectures)
Time dependent perturbation theory; first order transition probabilities; constant perturbation. Transition to continuum; Harmonic perturbation; Fermi's golden rule; Sudden and adiabatic approximations.

Module III: (10 lectures)
Many Electron Atoms: Indistinguishable particles; Pauli's Principle; inclusion of spin; spin functions for two and three electrons; the Helium atom; central field approximation, Thomas-Fermi model of the atom; Hartree equation, Hartree- Fock equation.

Module IV: (13 lectures)
Scattering theory: asymptotic behaviour of scattering wave function; relation to cross sections, Green's function for scattering problem; Green's function with different boundary conditions; scattering integral equations; Born approximation and its validity criteria; scattering by screened Coulomb potential; Born series. Partial waves and phase shifts. Scattering amplitude; optical theorem; low energy scattering. Effective range; scattering length; resonance.

Module V: (12lectures)
Relative wave equations: Klein-Gordon equation. Difficulty with probability interpretation. Dirac equation; four component solutions for free particle; negative energy solutions – particles and antiparticles. Covariant form of Dirac equation; 4-current density. Properties of γ-matrices. Dirac equation in the presence of electromagnetic field; non- relativistic reduction; spin and magnetic moment.

Module VI: (5 lectures)
Path integral approach to quantum mechanics: Feynman's Path Integral method, equivalence of Feynman and Schrödinger equations, Dirac-Feynman Action Principle.

Suggested Readings
1. Quantum Mechanics, E. Merzbacher, John Wiley.
2. Quantum Mechanics, G. Aruldhas, Prentice Hall.
3. Quantum Mechanics, L. I. Schiff, McGraw Hill.
4. Quantum Mechanics, V. K. Thankappan, New Age Int. Pub.
5. Quantum Mechanics, P. T. Mathews and Venkatesan, Tata McGraw Hill.
6. Quantum Mechanics Theory and Applications, Ghatak and Lokanathan, Laxmi Publications.
7. Principles of Non-Relativistics and Relativistic Quantum Mechanics, K. D. Krori, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1					H	
CO 2						H
CO 3				H		
CO 4	H	H				
CO 5			H			

PSCP0025: CONDENSED MATTER PHYSICS
(4-0-0)

COURSE OUTCOMES
CO 1: Explain about crystal structure in details. (Understanding)
CO 2: Illustrate physics of phonons. (Understanding)
CO 3: Identify free electron and nearly free electron models. (Applying)
CO 4: Discuss about advanced topics like plasmons, polaritons, polarons, etc. (Creating)

Module I: (11lectures)
Crystal structure. Diffraction of waves by crystal. Scattered wave amplitudes, Brillouin zones. Fourier analysis of the basis. Crystal binding and elastic constants.

Module II: (9 lectures)
Phonons: quantisation of lattice vibrations, dispersion relation for acoustic and optical phonon, energy gap, density ofstates, heat capacity, thermal conductivity and thermal expansion.

Module III: (8 lectures)
Free electron Fermi gas: Fermi energy, density of states, heat capacity, thermal conductivity and electrical conductivity. Wiedemann-Franz law.

Module IV: (10 lectures)
Nearly free electron gas: Schrodinger equation of an electron in a periodic potential, Bloch theorem, energy gaps at the zone boundary, approximation solution near a zone boundary, energy bands and their role in properties of metals, insulators and semiconductors. Holes on energy bands. Hall effect.

Module V:(12 lectures)
Shape of fermi surfaces in the free electron and nearly free electron models. Tight binding approximations. Electron orbits, hole orbits and open orbits. Quantization of orbits in a magnetic field. De Hass-van Alphen effect and its role in experimental

determination of Fermi surfaces.

Module VI: (10 lectures)
Plasmons, polaritons and polarons: dielectric functions of the electron gas, plasmons, electrostatic screening, Mott metal-insulator transition, polaritons, polarons. Peierls instability of linear metals.

Suggested Readings
1. Introduction to Solid State Physics, C. Kittel, John Wiley and Sons, Inc.
2. Quantum Theory of Solids, C. Kittel, John Wiley and Sons, Inc.
3. Quantum Theory of the Solid State, J. Callaway, Academic Press, New York.
4. Solid State Physics, H. Ibach and H. Luth, Narosa Pub. House.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H	H	H	
CO 4						H

PSED0026: ELECTRODYNAMICS
(4-0-0)

COURSE OUTCOMES
CO 1: Explain various phenomena from the standpoint of electrodynamics. (Remembering)
CO 2: Outline the origin and propagation of electromagnetic waves. (Understanding)
CO 3: Explain the nature of electromagnetic radiation. (Understanding)
CO 4: Infer the extension of classical electrodynamics to the generalized 4-dimensional case. (Analysing)
CO 5: Apply the laws of electrodynamics to solve various physical problems. (Applying)

Module I: (7 lectures)
Maxwell's equations: review of Maxwell's equations; boundary conditions at interface between different media; Poisson's and Laplace's equations

Module II: (8 lectures)
Electromagnetic waves: linear and circular polarisation; Stoke's parameters; Poynting theorem of complex field vectors; frequency dispersion (normal and anomalous); characteristics of dielectrics, conductors and plasma and their interaction with electromagnetic waves.

Module III: (10 lectures)
a. Simple radiating systems: Gauge invariance; Green's function for the wave equation; concept of retarded potential, radiation from an oscillating dipole and its polarisation. Electric dipole fields, magnetic dipole and electric quadrupole fields; centre fed linear antenna, scattering at long wavelengths – viz. by dipoles induced in a small scatterer, scattering by a small dielectric sphere.
b. Diffraction: Scalar diffraction theory; vectorial diffraction theory, Scattering in a short wavelength limit.
c. Guided waves: waveguides, TE waves in a rectangular waveguide, coaxial transmission lines.

Module IV: (15 lectures)
Radiation from accelerated charge: Lienard-Wiechart potentials; radiated power from accelerated charge at low velocities. Larmor 's power formula. The fields of a point charge in arbitrary and uniform motion. Radiation from an ultra-relativistic particle. Angular and frequency distribution of radiation from moving charges.

Module V: (12 lectures)
Special theory of relativity: matrix representation of Lorentz transformation; infinitesimal generators; Thomas precession; invariance of electric charge; covariance of electrodynamics; transformation of electromagnetic fields

Suggested Readings
1. Classical Electrodynamics, J. D. Jackson, John Wiley and Sons.
2. Classical Electrodynamics, S. P. Puri, Tata McGraw Hill Publishing Company Ltd.
3. Electrodynamics, S. L. Gupta, V. Kumar and S. P. Singh, Pragati Prakashan.
4. Introduction to Electrodynamics, D. J. Griffiths, Prentice Hall of India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V

CO 1	H				
CO 2		M	M	M	
CO 3		M	M	M	
CO 4					H
CO5	M	M	M	M	M

PSAM0028: ATOMIC AND MOLECULAR PHYSICS
(4-0-0)

COURSE OUTCOMES
CO 1: Explain atomic and molecular spectroscopy in details. (Understanding)
CO 2: Understand interaction of radiation with atoms. (Understanding)
CO 3: Analyse bond formation. (Analysing)
CO 4: Apply the concept of symmetry to molecules. (Applying)

Module I: (15 lectures)
Introduction of atomic spectrum; fine structure and hyperfine structure of energy levels. Angular momentum and magnetic moment. Doublet structure energy levels and single electron atom. Term symbols and fine structure of energy levels of two electron atoms using L-S coupling and j-j coupling schemes; identification of ground state. Interaction of nuclear and electronic magnetic moments and hyperfine structure with examples.

Module II: (10 lectures)
Interaction of radiation with atoms; spontaneous and stimulated emission; absorption; transition. Einstein's A and B coefficients. Working principles of He-Ne laser.

Module III: (12 lectures)
Theories of molecular bond formation; van der Waals bonding, ionic bonding, valence bond and molecular orbital models of covalent bonding. Homonuclear diatomic molecules and the term symbols and their ground states.

Module IV: (8 lectures)
Vibronic states of molecules and nature of vibronic spectra; harmonic and anharmonic vibrations and potential constants; rotational spectrum and moment of inertia of molecules.

Module V: (15 lectures)
Symmetry of molecules; symmetry elements and points group; proper and improper rotations and their matrix representation. Introduction to character table of point group; reducible and irreducible representation for simple molecules such as H_2O, NH_3, etc.Normal coordinates and normal modes of vibrations. Infrared absorption and Raman scattering form molecular vibrations and rotations, and selection rules.

Suggested Readings
1. Introduction to Atomic Spectra, H. E. White, Mc-Graw Hill.
2. Atoms and Molecules, Martin Karplus and Richard N. Porter, W. A. Benjamin.
3. Spectra of Diatomic Molecules, G. Hertzberg, Van Vostrand.
4. Principles of Lasers, O. Svelto, Plenum Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			H	
CO 2		H			
CO 3			H		
CO 4					H

PSCN0030: COMPUTER ORIENTED NUMERICAL METHODS
(2-0-0)

COURSE OUTCOMES
CO 1: Explain the concept of numerical methods. (Understanding)
CO 2: Apply numerical techniques to solve different problems in Physics. (Applying)
CO 3: Understand high level language through Fortran. (Understanding)

Module I: Numerical Analysis (10 lectures)
a. Introduction to numerical methods: approximate and significant figures, absolute and relative errors, general formula for

errors, application of the error formula to the fundamental operations of arithmetic and to logarithms. The error of a sum, the error of a difference, the error of a product and number of correct digits, the error of quotients and number of correct digits, the relative error of a power, the relative error of a root, successive approximation, Taylor 's series, principle of least square, law of error of residuals.

b. Matrices and linear equations: addition, subtraction and multiplication of matrices, inversion of matrices, Jacobi transformation of a symmetric matrix, determinant of a matrix, transpose of a matrix, solution of equations by matrix method, Gauss-Jordan elimination Method, eigenvalues and eigenvectors.

c. The solution of numerical, algebraic and transcendental equations: Equations in one unknown: Finding approximate values of the roots, finding roots by repeated application of location theorem, bisection method, the Newton- Raphson method; their convergence and geometric significance.

Module II: Solutions of Ordinary Differential Equations (9 lectures)

a. Equations of the first order: Euler 's method and its modification, the Runge-Kutta method, checks, errors and accuracy.

b. Equations of the second order and systems of simultaneous equations: Milne's-predictor and corrector methods, boundary value problems, conditions for convergence.

c. Minimization or maximization of functions: golden selection search in 1-D, parabolic interpolation and Brent 's method in 1-D, 1-D search with 1 derivatives, Downhill simplex method in multidimensions, Direction set (Powell's method in Multidimensions).

Module III: (5 lectures)

a. Numerical Integration: Classical formulae for equispaced abscissae: Simpson's rule, trapezoidal rule, Gaussian

b. quadrature formula.

c. Computation of factorials, computation of square roots, recurrence relations.

Module IV: Review of FORTRAN Language I (6 lectures)

a. Introduction to computing

b. Constants, variables, expressions, operations, statements, functions and built in functions.

c. Conditional and looping structures, arrays, subprograms and subroutines.

d. File operations.

Suggested Readings

a. Theory and problems of Programming with FORTRAN, Seymour Lipschutz and Arthur Poe, McGraw-Hill.

b. FORTRAN 77 and numerical methods, C. Xavier and R. Rajaraman, New Age International Publishers

c. FORTRAN 77 Programming, V. Rajaraman, Prentice Hall of India.

d. Numerical Analysis, V. Rajaraman, Wiley Eastern.

e. Numerical Recepies in FORTRAN, W. H. Press, S. S. Tenkulsky, W. T. Wettering and B. P. Flannery, CambridgeUniversity Press.

f. Introductory Methods of Numerical Analysis, S. Sastry, Prentice Hall of India.

g. Numerical Methods for Scientific and Engineering Computation, M. K. Jain et al., New Age International Publications.

h. Introduction to Numerical Analysis, F. B. Hildebrand, McGraw-Hill Book Company Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	
CO 2	H	H	H	
CO 3				H

PSSM0034: STATISTICAL MECHANICS

(4-0-0)

COURSE OUTCOMES

CO 1: Appreciate the connection between statistical mechanics and thermodynamics. (Analysing)

CO 2: Conceptualise quantum statistical mechanics. (Understanding)

CO 3: Understand the physics of phase transition. (Understanding)

CO 4: Understand non-equilibrium physics. (Understanding)

Module I: Essentials (17 lectures)

a. Probability theory: the random walk problem, binomial, Poisson and Gaussian distributions, central limit theorem.

b. Classical equilibrium statistical mechanics: concept of equilibrium; Ergodic hypothesis; microcanonical, canonical and grand canonical Ensembles; partition functions and their relation to thermodynamics.

c. Classical nonequilibrium statistical mechanics: approach to equilibrium, Liouville's theorem, Boltzmann's H theorem

Module II: Quantum Statistics (15 lectures)

a. Quantum statistical mechanics: Schrödinger and Heisenberg Picture; pure and mixed states, the density matrix, quantum mechanical Liouville's theorem; the fundamental postulates.
b. Quantum statistics: quantum gases of independent particles; partition functions; Bose Einstein's and Fermi Dirac's distributions; electrons in metals; black body radiation; Bose Einstein's Condensation

Module III: Phase Transitions (15 lectures)

a. Phenomenology: first and second order phase transitions; elementary ideas of critical phenomena; universalityof critical exponents; scaling of thermodynamic functions.
b. Theory: theLandau theory of phase transition with examples. c) Exact solutions: Ising model in one dimension.

Module IV: Non Equilibrium Phenomena and Irreversible Processes (13 lectures)

a. Non equilibrium phenomena: transport theory; Boltzmann equation; Maxwell-Boltzmann distribution.
b. Irreversible processes: fluctuations; Brownian motion; Langevin's equation; Wiener Khintchine relations, Nyquist theorem, Fluctuation-Dissipation theorem; Fokker Planck equation.

Suggested Readings

1. Fundamental of Statistical and Thermal Physics, FederickReif, McGraw Hill, Singapore.
2. World Scientific, Shang-Keng Ma, Statistical Mechanics, Singapore.
3. Wiley-Interscience, John Wiley and Sons Inc., Richard E. Wilde, and Surjit Singh, Statistical Mechanics: Fundamentaland Modern Applications, New York.
4. Statistical Physics: Statics, Dynamics and Renormalisation, Leo P.Kadanoff, World Scientific, River Edge, New Jersey.
5. Statistical Mechanics, K. Huang, John Wiley and Sons Inc., New York.
6. Statistical Physics, D. J. Amit and J. Verbin, World Scientific, Singapore.
7. Statistical Physics, L. D. Landau, E. M. Lifshitz, Butterworth-Heinemann.
8. Statistical Mechanics, R. K. Pathria, Academic Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PSPL0036: PLASMA PHYSICS I

(4-0-0)

COURSE OUTCOMES

CO 1: Understand and explain the basic theoretical concepts of plasma physics. (Remembering)
CO 2: Understand the behaviour of a single charged particle in electric and magnetic fields. (Understanding)
CO 3: Understand the purpose, principles and techniques of various plasma diagnostic. (Application)
CO 4: Understand the underlying principles of some laboratory and naturally occurring plasma. (Analysing)
CO 5: Know various applications of plasma. (Analysing)

Module I: Introduction to Plasma Physics (12 lectures)

Role of temperature in occurrence of plasma; definition of plasma: quasineutrality and collective behaviour of plasma; concept of temperature; Debye shielding; criteria for plasma; classification of plasma; occurrence of plasma in nature.

Module II: Single Particle Motion (12 lectures)

Uniform electric and magnetic fields; non-uniform magnetic field: grad-B drift, curvature drift, magnetic mirrors, the loss cone; non-uniform electric field; time-varying electric field; time- varying magnetic field; adiabatic invariants.

Module III: Plasma Diagnostics (14 lectures)

Langmuir probe: I-V characteristics, measurement of plasma potential, floating potential, electron temperature and electron density; double probe; optical emission spectroscopy: radiation from plasma, plasma models, temperature measurement by Boltzmann plot and line intensity ratio method, line broadening in plasma, Doppler broadening and stark broadening, applications; absorption spectroscopy; calorimetric methods; laser and microwave interferometer.

Module IV: Laboratory and Space Plasma (10 lectures)

Glow discharge plasma; production and stabilization of thermal plasma, principle of DC, AC and high frequency discharges, RF and ECR plasmas, dielectric barrier discharge plasma, laser produced plasmas; sun and solar winds, Van Allen belts, the

ionosphere, formation of, accretion disks, dusty plasmas.

Module V: Applications of Plasma (12 lectures)
Thermal plasma: nanoparticle synthesis, plasma spraying, waste management; plasma sputtering; plasma nitriding; plasma processing; plasma enhanced vapour deposition; plasma assisted surface engineering; biomedical applications; the magneto-hydrodynamic generator; plasma propulsion.

Suggested Readings
1. Introduction to Plasma Physics and Controlled Fusion, F. F. Chen, Plenum.
2. Fundamentals of plasma physics, J. A. Bittencourt, Springer.
3. Principles of plasma diagnostics, I. H. Hutchinson, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	
CO 5					H

PSEC0037: ELECTRONICS II

(4-0-0)

COURSE OUTCOMES
CO 1: Know about different types of transistors. (Understanding)
CO 2: Understand the application of transistors for circuit design. (Application)
CO 3: Utilize Describe devices like thyristors, operational amplifiers,oscillators, etc. (Analysing)
CO 4: Understand the digital electronics design using analog devices. (Understanding)
CO 5: Understanding the application of analog devices for electronic instruments and sensors (Application)

Module I: (20 lectures)
a. Bipolar junction transistor: BJT biasing: fixed bias, emitter bias, voltage divider bias, D.C. collector feedback bias; DC and AC load line, Q- point, stability considerations. BJT modeling: two port representation of BJT with z, y, h- parameters; re and hybrid models of C-E, C-B, C-C configuration.
b. Hybrid-pi model of C-E amplifier in voltage divider bias configuration, frequency response in low, mid and high frequency conditions, respective voltage gain, current gain, input and output impedances.
c. Field effect transistors: FET biasing: self bias, fixed bias, voltage divider bias, stabilization of Q-point. Small signal AC equivalent circuit of FET as amplifier, hybrid parameters. JFET amplifiers: CS, CD amplifiers; enhancement mode MOSFET amplifier, depletion mode MOSFET amplifiers; Introduction to CMOS, characteristics, structure of MOSFET, CMOS.

Module II: (25 lectures)
a. Thyristors: four layer diode, SCR, Photo SCR, gate controlled switch, silicon controlled switch, Diac, Triac, UJT;
b. Op-Amp - ideal operational amplifiers: Input impedance. DC offset parameters, frequency parameters, gain- bandwidth, CMRR, SVRR, SR. Op-Amp applications in constant gain multiplier, voltage summing, log - antilog amplifier, subtractor, comparator – zero crossing detector, Schmitt trigger, integrator, differentiator and controlled sources. instrumentation amplifier. Active filters: low, high and bandpass filters; ADC and DAC.
c. 555 timer: block diagram, monostable operation, astable operation, bistable operation, voltage controlled oscillator, ramp generator.

Module III: (15 lectures)
a. Feedback configurations: voltage series, voltage shunt, current series, current shunt.
b. Oscillators: introduction and classification, general form of LC oscillator, e.g. Hartley oscillator, Colpitts oscillator, RC phase shift oscillator, Wein Bridge oscillator, crystal oscillator.
c. Regulated power supply: voltage feedback regulation, current limiting characteristics, power supply characteristics, 3 terminal IC regulators, current boosters, switching regulators.
d. Characteristics of instruments: static characteristics, span, accuracy and precision, linearity, tolerance, error, repeatability, sensitivity, calibration, hysteresis, input impedance, resolution, bias and drift.

Suggested Readings
1. Electronic Devices and Circuit Theory, Robert L. Boylestad andLowisNashelsky, Pearson Education.
2. Millman's Electronic Devices and Circuits, Jacob Millman, Christos C. Halkias and Satyabrata Jit, Tata McGraw Hill.
3. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Tata McGraw- Hill.

4. Solid State Electronic Devices, Streetman and Banerjee, Prentice Hall.
5. Electronic Devices and Circuits, David A. Bell, Prentice Hall of India.
6. Integrated Electronics, Jacob Millman, Christos C.Halkias, McGraw Hill Int.
7. Op-amps and Linear Integrated Circuits, Ramakant A. Gayakwad, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	H	M	M
CO 3		H	M
CO 4	H	H	M
CO 5	M	M	H

PSNS0041: NANOPHYSICS II

(4-0-0)

COURSE OUTCOMES

CO 1: Explain different properties of nanomaterials. (Understanding)
CO 2: Know about different methods for the synthesis of nanomaterials. (Applying)
CO 3: Appreciate the technology associated with characterization of nanomaterials. (Applying)

Module I: (15 lectures)

Surfaces and interfaces in nanostructures; ceramic interfaces, superhydrophobic surfaces, grain boundaries in nanocrystalline materials, defects associated with interfaces; thermodynamics of nanomaterials, natural nanomaterials; toxicology of nanomaterials.

Module II: (25 lectures)

Chemical routes for synthesis of nanomaterials: electrochemical synthesis, photochemical synthesis; synthesis in supercritical fluids. hydrothermal growth of nanoparticles and different nanostructures. Ostwald ripening; zeta potential; fabrication of nanomaterials by physical methods: -inert gas condensation, arc discharge, plasma arc technique, RF plasma, MW plasma, ion sputtering, laser ablation, laser pyrolysis, ball milling, molecular beam epitaxy, physical and chemical vapour deposition method; electrodeposition. Core-shell quantum dots.

Module III: (20 lectures)

Nanostructures: zero-, one-, two- and three- dimensional structure, size control of metal nanoparticles; properties: optical, electronic, magnetic properties; surface plasmon resonance, structural characterization X-ray diffraction, small angle x-ray scattering, optical microscope and their description, scanning electron microscopy (SEM), scanning probe microscopy (SPM), TEM and EDAX, SAED analysis, scanning tunneling microscopy (STM), atomic force microscopy (AFM). Spectroscopic characterizations: basic concepts of spectroscopy, operational principle and application for analysis of nanomaterials, UV-VIS-IR spectrophotometers, principle of operation and application for band gap measurement (Taucplot).

Suggested Readings

1. A. Rao Introduction to nanoscience, G. L. Hornyak, J. Dutta and H. F. Tibbals, CRC Press.
2. Nano: The Essentials, T. Pradeep, McGraw Hill.
3. Nanotechnology and Global Sustainability, D. Maclurcan and N. Radywyl (Eds.), CRC Press.
4. Fundamentals of Nanoelectronics, G. W. Hanson, Pearson.
5. Springer Handbook of Nanomaterials, R. Vajtai (Ed.), Springer.
6. Springer Handbook of Nanotechnology, B. Bhushan (Ed.), Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		H
CO 2		H	
CO 3			H

PSGR0044: GENERAL THEORY OF RELATIVITY AND COSMOLOGY

(4-0-0)

COURSE OUTCOMES

CO 1: Relate the concepts from special theory of relativity with generalized tensor calculus. (Remembering)
CO 2: Explain Einstein's field equation from basic principles. (Understanding)
CO 3: Illustrate the implications of the general theory of relativity. (Understanding)
CO 4: Extend Einstein's gravity to the cosmological scale. (Understanding)
CO 5: Identify Newtonian gravity as a special case of general relativity. (Applying)

Module I: Theoretical Background of Relativity (15 lectures)

a. Foundations of relativity: postulates of relativity, GR units, space-time intervals, proper time; special Lorentz transformations in Minkowski space-time; four-vectors.
b. Review of tensor calculus in Euclidean space; tensor calculus in Riemannian space: generalized N-dimensional spaces, covariant and contravariant tensors; Riemann-Christoffel curvature tensor, Christoffel symbols, Einstein's tensor, geodesics; metric tensor, covariant differentiation, Bianchi Identities, Ricci tensor.

Module II: General Theory of Relativity (30 lectures)

a. Motion of a free particle in a gravitational field, equations of electrodynamics in the presence of a gravitational field; gravitational field equations – action for gravitational field, energy-momentum tensor, extremum principle, Einstein field equations, energy-momentum pseudotensor.
b. Field of gravitating bodies – Schwarzschild solution, Birkhoff 's theorem, motion in a centrally symmetric gravitational field, precession of perihelion of Mercury, deflection of light, gravitational lensing; black holes – Schwarzschild black holes, Kruskal space, black hole thermodynamics; gravitational waves – plane waves, weak field approximation, gravitational radiation, transverse-traceless gauge.

Module III: Fundamentals of Cosmology (15 lectures)

a. Cosmological principle, cosmological time; spaces of constant curvature, Hubble's constant, Hubble's Law, red-shift of galaxies, big bang, age and density of universe; cosmological constant
Einstein space, de Sitter space, anti-de Sitter space; Robertson-Walker metric, introduction to Friedmann-Robertson-Walker (FRW) universe.
b. The observed universe and its dynamics, Friedmann-Lemaitre-Robertson-Walker (FLRW) metric, Friedmann equation and its solutions; composition of the universe – origin of matter, big bang nucleosynthesis, abundance of light elements, dark matter and dark energy, cosmological constant as dark energy, origin of matter-antimatter asymmetry, baryogenesis.

Suggested Readings

1. Introduction to Tensor Calculus, Relativity and Cosmology, D. F. Lawden, Dover Publications.
2. A First Course in General Relativity, B. Shutz, Cambridge University Press.
3. Introduction to Cosmology, B. Ryden, Cambridge University Press.
4. Gravitation, C. W. Misner, K. S. Thorne and J. A. Wheeler, Princeton University Press.
5. The Classical Theory of Fields, L. D. Landau and E. M. Lifshitz, Butterworth-Heinmann.
6. The Meaning of Relativity, A. Einstein, Oxford & IBH.
7. General Theory of Relativity, P. A. M. Dirac, Prentice-Hall of India.
8. Feynman Lectures on Gravitation, R. P. Feynman, F. B. Moronigo and W. G. Wagner, Addison-Wesley.
9. Gravitation and Cosmology, S. Weinberg, Wiley.
10. Introduction to Cosmology, J. V. Narliker, Cambridge University Press.
11. Modern Cosmology, S. Dodelson, Academic Press.
12. Physical Foundations of Cosmology, V. Mukhanov, Cambridge University Press.
13. Fundamentals of Special and General Relativity, K. D. Krori, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3		H	H
CO 4		H	H
CO 5		H	

PSAR0045: ASTROPHYSICS

(4-0-0)

COURSE OUTCOMES

CO 1: Define and spell out fundamental concepts of Astronomy. (Remembering)
CO 2: Outline the various parameters describing the behaviour of stars and their evolution. (Understanding)
CO 3: Classify the various types of interstellar media. (Analysing)
CO 4: Explain the physical processes underlying the energy generation in stars. (Understanding)
CO 5: Apply astrophysical models to various observational scenarios. (Applying)

Module I: Fundamentals of Astronomy (12 lectures)

Astronomy fundamentals: celestial coordinate systems, telescope and its operational principles and mounting, atmospheric extinctions, magnitude systems. Radiation mechanism, flux density and luminosity, specific intensity, (emission/absorption coefficients, source functions), basics of radiative transfer and radiative processes.

Module II: Stellar Parameters (18 lectures)

Magnitudes, motions and distances of stars: absolute stellar magnitude and distance modulus, bolometric and radiometric magnitudes, colour-index and luminosities of stars, stellar positions and motions, velocity dispersion, statistical and moving cluster parallax, extinction, stellar temperature, effective temperature, brightness temperature, color temperature, kinetic temperature, excitation temperature, ionization temperature, spectral classification of stars, utility of stellar spectrum, stellar atmospheres. Binaries, variable stars, clusters, open and globular clusters, compact objects, shape, size and contents of our galaxy, normal and active galaxies.

Module III: Interstellar Medium (10 lectures)

Neutral and ionized gas, gaseous nebulae, HII regions, supernova remnants, photo-dissociation regions, different phases of the interstellar medium: cold neutral medium, warm neutral and ionized medium, hot medium, diffuse clouds, dense clouds.

Module IV: Stellar Physics (20 lectures)

Introduction to stars: HR diagram, a discussion on the variety of stellar phenomena, stellar structure, stellar opacities, stellar polytropes, energy generation in stars: calculation of thermonuclear reaction rates for non-resonant and beta-decay reactions, various reaction chains: pp-I, II, III, CNO, He-burning, C-burning, Si-burning, stellar degeneracy and equations of state: stellar degeneracy, Chandrasekhar mass, EoS of matter at near-nuclear and nuclear densities, final stages of stellar evolution: supernovae and neutron stars.

Suggested Readings

1. An Introduction to Astronomy and Astrophysics, P. Jain, CRC Press.
2. An Introduction to Astrophysics, B. Basu, PHI Learning Pvt. Ltd.
3. Astrophysics: Stars and Galaxies, K. D. Abhayankar, Universities Press.
4. Introduction to Stellar Astrophysics, Erika Böhm-Vitense, Cambridge University Press.
5. Gravity: Introduction to Einstein's General Relativity, J. B. Hartle, Pearson Education.
6. Physical Cosmology, P. J. E. Peebles, Princeton University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	L	L	
CO 2		H		
CO 3			H	
CO 4				H
CO 5				H

PSPM0046: PLASMA PHYSICS II

(4-0-0)

COURSE OUTCOMES

CO 1: Understand fluid and kinetic model of plasma and their uses in the study of plasma. (Understanding)
CO 2: Explain the theory of various kinds of waves existing in plasma. (Understanding)
CO 3: Explain the phenomenon of diffusion in plasma and its consequences. (Analysis)
CO 4: Explain some basic instabilities and non linear phenomena in plasma. (Remembering)
CO 5: Understand the principles and challenges involved in energy production by fusion. (Analysis)

Module I: Plasma as fluids and Plasma Kinetic Theory (20 lectures)

Introduction to fluid model; equation of motion; continuity equation; fluids drifts perpendicular to B; fluids drifts parallel to B;

the plasma approximation; Introduction to kinetic theory; equations of kinetic theory; derivation of the fluid equation; plasma oscillation; Landau damping: meaning and physical derivation.

Module II: Waves in Plasma (10 lectures)
Representation of waves; group velocity; plasma oscillation; electron plasma waves; sound waves;ion waves; validity of plasma approximation; ion acoustic waves; Alfven waves.

Module III: Diffusion and Resistivity (10 lectures)
Diffusion and mobility; plasma decay by diffusion; steady state solution; recombination; diffusion across a magnetic field;the single MHD diffusion equation; solutions of the diffusion equation.

Module IV: Instability and Non-linear Effects (10 lectures)
Hydro-magnetic equilibrium; diffusion of magnetic field into a plasma; classifications of instability; two stream instability; plasma sheaths; ion acoustic shock waves; the ponderomotive force; parametric instabilities; plasma echoes; nonlinear Landau Damping.

Module V: Controlled Fusion (10 lectures)
Controlled fusion and problems; magnetic confinement: toruses, mirrors, pinches; laser fusion;plasma heating; fusion technology; tokamaks; ITER.

Suggested Readings
1. Introduction to Plasma Physics and Controlled Fusion, F. F. Chen, Plenum.
2. Fundamentals of plasma physics, J. A. Bittencourt, Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L	L		
CO 2		H			
CO 3			H		
CO 4				H	
CO 5					H

PSER0047: ELECTRONICS III
(4-0-0)

COURSE OUTCOMES
CO 1: Illustrate advanced topics of digital electronics. (Understanding)
CO 2: Explain microprocessor, microcontroller and assembly language. (Understanding)
CO 3: Apply the knowledge in advanced digital structures. (Applying)
CO 4: Understand digital circuit design (Application)
CO 5: Analyse the working of processor for execution of computer program (Analysing)

Module I: (15 lectures)
a. Number system: representation of signed integers, binary arithmetic on signed and unsigned integers and detection of overflow and underflow, weighted binary Codes: BCD, 2421, non- weighted codes: excess-3 codes, gray codes, error detecting codes, error correcting codes, alphanumeric codes: ASCII code, EBCDIC codes.
b. Boolean algebra and logic gates: rules (postulates and basic theorems) of Boolean algebra, dual and complement ofa Boolean expression, sum of products and product of sums forms. canonical forms. Conversion between different forms, conversion between Boolean expression and truth table; implementing logic expressions with logic gates (logic circuits).
c. Digital logic families: designing of basic logic gates with diode and transistor; elementary idea of DTL, TTL, RTL, ECL, I2L logic family and characteristics.

Module II: (15 lectures)
a. Combinational circuit: Simplification of Boolean expressions using algebraic method, Karnaugh map method and Quine-McCluskey method, Don't Care conditions. Multiplexer, demultiplexer, encoder, decoder, half-adder, hull- adder, magnitude comparator, parity checkers: basic concepts, design of parity checkers, parity generation, code converters, binary –to- gray and gray-to-binary Code converter; concept of magnitude comparator.
b. Sequential circuit: simple R-S flip-flop or Latch, clocked R-S Flip-flop, D flip-flop. J-K flip-flop, T flip-flop, master-slave flip-flop, J-K Master-Slave flip-flop. Asynchronous preset and clear, edge triggering and level triggering. Registers: shift registers, parallel/serial in, parallel/serial out. Buffer counter design: different types of counters like asynchronous and synchronous, up and down, ring, Johnson etc. counter design using state diagram, state table and state equation.

c. Semiconductor memory: classification of memories, main memory and secondary memory, sequential access memory, static and dynamic memory, volatile and nonvolatile memory, concept of ROM, PROM, EPROM, RAM, DRAM, SDRAM, PSRAM, memory decoding.

Module III: (30 lectures)

a. History and evolution of microprocessor; introduction to CPU: components of CPU, block diagram, buses-data, control and address; ALU, control unit; main memory and secondary memory; I/O devices; memory addressing- memory mapped I/O and I/O mapped I/O; address decoding; memory and I/O interfacing.
b. Introduction to 8085; block diagram, registers, use of register pairs, PSW, accumulator; addressing modes; Instruction set of 8085: data transfer, arithmetic, logic, branch and machine control instructions; instruction cycle: fetch, decode and execute. Delay and counter; stack and its application; interrupt and its application; assembly level language programming of 8085.
c. Interfacing: Memory interfacing; I/O interfacing; interfacing small devices like keyboard,7-segment display, relay, event counter etc.; idea of PPIs like 8251, 8255, 8257 and 8279 (block diagram and function only); serial communication standard (RS-232C).
d. Example of 16-bit processors (introduction to 8086); microcontroller (block diagram and application of 8051).

Suggested Readings

a. Digital Logic and computer Design, M. Mano, PHI.
b. Modern Digital Electronics, R. P. Jain, TMGH.
c. Digital Fundamentals, Jain and Floyd, Pearson Education.
d. Digital Electronics, Malvino and Leach, Pearson Education.
e. Digital Computer Electronics, Malvino, TMGH.
f. Digital Design, Principles and Practices, Morris Mano, Pearson Education.
g. Digital Circuits and Design, S. Salivahanan and S. Arivazhagan, Vikash Publishing House Pvt. Ltd.
h. Digital Techniques, P. H. Talukdar, N. L. Publications.
i. Fundamentals of Digital Circuits, Anand Kumar, PHI.
j. Introduction to Microprocessors, Gaonkar, New age Publication.
k. Fundamentals of Microprocessor, B. Ram, Dhanpat Rai.
l. 8085 Microprocessor Programming and Interfacing, N. K. Srinath, PHI.
m. Microprocessor Based Design, Slater, PHI.
n. Microprocessors, Gilmore, McGraw Hill Publication.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	
CO 2		M	H
CO 3	M	H	M
CO 4	H	H	
CO 5			H

PSNY0048: NANOPHYSICS III

(4-0-0)

COURSE OUTCOMES

CO 1: Explain properties of nanomaterials in detail. (Understanding)
CO 2: Explain quantum effects on nanostructures. (Understanding)
CO 3: Give outline nanomechanics. (Understanding)
CO 4: Take part in higher studies and research in nanophysics. (Analysing)

Module I: (15 lectures)

Absorption and scattering of EM waves from nanoparticles based on bulk properties. Electronic phenomena in nanostructures: electronic structures and effective mass theory for bulk Si , Ge, GaAs; excitons. Boltzmann electron transport in bulk. Electron energy states in quantum confined systems, semiconductor heterojunctions.

Module II: (20 lectures)

a. X-ray photoelectron spectroscopy (XPS): fundamentals: photoelectric effect, binding energy and chemical shift,ultraviolet photoelectron spectroscopy (UPS): information.
b. Extracted: band structure, occupied band states of clean solid surfaces as well as bonding orbital states of adsorbed molecules; fundamentals of Fourier transform infrared radiation (FTIR) and Raman spectroscopy.
c. 2-DEG systems, quantum wires, quantum dots. Transmission in nanostructures: tunneling in planar barrier, resonant

tunnel diodes. Ballistic transport, Landauer formula, electron transport in quantum wave-guide structures.

Module III: (15 lectures)
Single electron phenomena: electronic states in quantum dots, without and with magnetic fields, single electron tunneling and Coulomb blockade, single electron tunneling, elastic, inelastic, spin polarized tunneling, surface density of states for different dimensions, role of tip geometry, lithography and atomic manipulation; single electron transistor. Spin-orbit interaction and spin effects.

Module IV: (10 lectures)
Nanomechanics: introduction to NEMS, CNT oscillation, nanoscale electrometer, bolometer nanophotonics; science of Graphene.

Suggested Readings
1. Transport in Nano-Structures, D. K. Ferry and S. M. Goodnick, Cambridge University Press.
2. Electronic Transport in Mesoscopic Systems, S. Datta, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		L	L
CO 2		H		
CO 3				H
CO 4			H	

PSEL0049: ELECTRONICS I
(4-0-0)

COURSE OUTCOMES
CO 1: Explain about passive components and DC networks, digital electronics (Understanding)
CO 2: Understanding physics of electronic devices and circuits (Understanding)
CO 3: Explain electronic communication. (Understanding)
CO 4: Experiment with electronic devices and circuits. (Applying)

Module I: Passive Components and DC Networks (15 lectures)
a. Passive components: resistors, capacitors and inductors-types, characteristics and applications;
b. DC networks: voltage and current sources, dependent sources, KCL, KVL, current division rule, voltage division rule, Y-Delta conversion, mesh analysis, node analysis, Thevenin's theorem, Norton's theorem, superposition theorem, maximum power transform theorem.

Module II: Electronic Devices and Circuits (20 lectures)
a. Semiconductor concepts: semiconductor material, intrinsic semiconductor, extrinsic semiconductor, energy levels, concept of hole and electron, mobility, conductivity, n-type and p-type, majority and minority carriers, mechanism of current flow.
b. Semiconductor diode: PN junction and various biasing conditions, V-I characteristics, diode equation, diode resistance, equivalent circuit, transition capacitance and diffusion capacitance; rectifier circuit with filter, clipper, clamper, voltage multiplier.
c. Special purpose diodes: Zener diodes, LED, 7 segment display, photo diode, photo transistor, opto coupler, Schottky diode, varactor diode, tunnel diode.
d. Transistor - BJT: construction, npn, pnp, operation and configuration, V-I characteristics, introduction to FET- JFET, MOSFET.
e. OP-AMP: block diagram, ideal op-amp equivalent circuit, ideal characteristics, transfer curve, open loop and closed loop configurations, op-amp as an inverting amplifier, non-inverting amplifier, adder, subtractor.

Module III: Digital Circuits (12 lectures)
Number systems, Boolean algebra, De-Morgan's law, AND, OR, NOT, Universal gates, combinational logic circuits.

Module IV: Communication (13 lectures)
a. Introduction: communication process, source of information, communication channels, modulation types andneed, block diagram of communication systems, AM, FM, PAM, PWM, PPM.
b. Introduction to digital modulation: ASK, PSK, FSK.

Suggested Readings
1. Electronic Devices and Circuits, S. Salivahanan, McGraw Hill Publications.
2. Communication System, R. D. Singh and S. D. Sapre, TMGH.

3. Networks and Systems, D. Roy Choudhury, New Age International.
4. Electronic Devices and Circuits, David A. Bell, Oxford University Press.
5. Digital electronics, Moris Mano, EEE.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	L	H	
CO 2	M	H	H	
CO 3	M	M		H
CO 4	H	H	M	

PSNP0050: NANOPHYSICS I

(4-0-0)

COURSE OUTCOMES

CO 1: Explain basic concepts of nanophysics. (Remembering)
CO 2: Explain the working principle of various characterization techniques. (Understanding)
CO 3: Explain various fabrication techniques. (Understanding)
CO 4: Analyse the relation between nanoparticles size and their properties. (Analysing)
CO 5: Understand various natural nanomaterials and bio-molecular nanoscience. (Understanding)

Module I: Introduction (20 lectures)

Distinction between nanoscience and nanotechnology, requisite definitions; historical perspectives; nanomaterials: overview, definitions, and examples; structurally confined materials: nanoparticles, islands, nanowires, thin films; metal nanoparticles: fundamentals and applications; self- assembled monolayers, semiconductor quantum dots: fundamentals and applications; ceramic nanomaterials: fundamentals and applications; carbon nanomaterials(Fullerenes and carbon nanotubes and nanofibers): fundamentals and applications; magnetic nanoparticles: fundamentals and applications; bionanomaterials, computational nanomaterials, composite nanomaterials and applications.

Module II: Characterization tools (10 lectures)

Electron microscopy, atomic force microscopes, X-ray spectroscopy, surface enhanced Raman spectroscopy, lithography, computer modelling and simulation.

Module III: General Fabrication Methods (12 lectures)

Background; top down fabrication: mechanical methods, thermal methods, high energy methods, chemical fabrication methods, lithographic methods; bottom up fabrication: gaseous phase methods, liquid phase methods, template synthesis

Module IV: Basic Properties of Nanomaterials (10 lectures)

Importance of surface: natural, inorganic and the nano perspectives; particle shape and surface; surface: geometricsurface to volume ratio, specific surface area; atomic structure: crystal systems.

Module V: Natural and Bio-nanoscience (8 lectures)

Natural nanomaterials: inorganic natural nanomaterials, nanomaterials from the animal kingdom, nanomaterials derived from cell walls, nanomaterials in insects; Introduction to biomolecular nanoscience: history, biomolecular nanoscience, nano perspective

Suggested Readings

1. Introduction to nanoscience, G. L. Hornyak, J. Dutta and H. F. Tibbals, A. Rao, CRC Press.
2. Nano: The Essentials, T. Pradeep, McGraw Hill.
3. Nanotechnology and Global Sustainability, D. Maclurcan and N. Radywyl (Eds.), CRC Press.
4. Environmental Chemistry for a Sustainable World, Vol.2, E. Lichtfouse, J. Shwarzbauer and D. Robert, Springer Verlag.
5. Introduction to nanotechnology, G. L. Hornyak, J. Dutta, H. F. Tibbals and A. Rao, CRC Press.
6. Fundamentals of Nanoelectronics, G. W. Hanson, Pearson.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			L	
CO 2		H			
CO 3			H		
CO 4				H	

CO 5					H

PSRM0051: RESEARCH METHODOLOGY
(3-0-0)

COURSE OUTCOMES
CO 1: Understand the meaning, significance and ethics of research. (Understanding)
CO 2: Conduct literature survey. (Understanding)
CO 3: Present and defend their project accurately, both orally and written. (Applying)
CO 4: Present and defend their research results accurately, both orally and written at specialized levels. (Creating)
CO 5: Appreciate statistics as a tool for designing research, analysing data and drawing validconclusions therefrom. (Analysing)

Module I: Introduction to Research (6 lectures)
Definition of research; objectives of research, importance of research, motivation in research, research methods and research methodology, importance of research methodology; types of research: Basic Research and Applied Research, theoretical; simulations and experimental research. Various stages of research; ethics in scientific research: ethical values of science, ethics of researcher, personal and internal code of conduct, conduct guidelines, ethical standards of publication, scientific fraud and malpractice; plagiarism.

Module II: Literature Survey (6 lectures)
Functions of the literature review in research, conducting a literature survey, sources of information, use of internet, technical and scientific documents, characteristics and quality indices of journals, developing theoretical and conceptual frameworks, writing literature review.

Module III: Research Documentation and Presentation (8 lectures)
Structure of scientific documents; types of scientific reports: research papers, patents, dissertation, posters, slide presentation; skills for academic writing, online communication technologies, preparation of research projects, monitoring and evaluation processes; writing dissertation using LaTeX documents and beamers; citing references and bibliography, thesis defense.

Module IV: Statistics in Research (10 lectures)
Discrete distributions – binomial, geometric, Poisson; continuous distributions – Gaussian, log-normal, gamma, chi- squared; central limit theorem; populations and samples, sample statistics – averages, variance, standard deviation, moments, covariance and correlation; standard errors and confidence limits; Bayesian inference; hypothesis testing – Neyman-Pearson test, Student's t-test, Fisher's F-test; goodness-of-fit.

Suggested Readings
1. Research Methodology: A Step-by-Step Guide for Beginners, Ranjit Kumar, Sage Publications Ltd.
2. Research Methodology: Methods and Techniques, C. R. Kothari, New Age International (P) Ltd.
3. Methodology of Educational Research, Lokesh Koul, Vikas Publishing.
4. The A-Z of PhD Trajectory, Eva O. L. Lantsoght, Springer.
5. Writing for Publication, Mary RenckJalongo and Olivia N. Saracho, Springer.
6. Mathematical Methods for Physicists: A Comprehensive Guide, George B. Arfken, Hans J. Weber and Frank E. Harris,Associated Press.
7. Bayesian Statistics for Beginners: A Step-by-Step Approach, Therese M. Donovan and Ruth M. Mickey, Oxford UniversityPress.
8. Data Analysis: A Bayesian Tutorial, D. S. Sivia and J. Skilling, Oxford University Press.
9. Mathematical Methods for Physics and Engineering, K. F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press.
10. Writing for Publication, Mary RenckJalongo and Olivia N. Saracho, Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4			H	
CO 5				H

PSHP0052: HIGH ENERGY PHYSICS I
(4-0-0)

COURSE OUTCOMES
CO 1: Summarize the mathematical skills like group theory, tensors, kinematics, etc. (Understanding)
CO 2: Explain different groups like Lorentz group, Lie group and their algebra. (Understanding)
CO 3: Explain scalar field quantisation. (Analysing)
CO 4: Explain quantum field theory and hence identify quantum electrodynamics. (Applying)

Module I: Preliminaries (8 lectures)
Tensors,covariant and contravariant tensors, Lorentz covariance and four vector notation; Klein-Gordon equation; Dirac equation and its covariant form.

Module II: Group theory and Tensors (10 lectures)
Introduction to group theory, Lie group and Lie Algebra, representation theory, Representations of both Lorentz and Poincaré groups, Irreducible representations of the Lorentz group; Young tableau.

Module IV: Quantum field theory (22 lectures)
Concepts of fields and quantisation, Lagrangian field theory, Hamiltonian field theory, Noether's Theorem and Conserved Currents, canonical quantization of freefields (Scalar, complex, EM and Dirac fields), conservation ofenergy, momentum and charge of the field, The concept of vacuum and Fock space in field theory; C, P, T transformation of scalar and E. M. fields.

Module V: Quantum Electrodynamics (20 lectures)
Concepts of Causality, propagator and Feynman propagator, Green's function, Interaction picture and time evolution operator, S-matrix, path integral formalism, Covariant perturbation theory, Feynman rules in momentum space, Wick's theorem, reduction of time-ordered products, calculation of second order process, Compton scattering, Klein-Nishima formula, Mott scattering, Basics of renormalization.

Suggested Readings
1. Introduction of Elementary Particle, D. Griffiths, Wiley-vch Verlag Gmbh.
2. Quarks and Leptons: An Introductory Course in Modern Particle Physics, F. Halzen and A. D. Martin, Wiley India.
3. Quantum Field Theory, L. H. Ryder, Cambridge University Press.
4. Introduction to High Energy Physics, D. H. Perkins, Addison-Wesley.
5. Particle Physics, Brian R. Martin and Graham Shaw, Wiley.
6. An introduction to Quantum Field Theory, Michael E. Peskin and Daniel V. Schroeder, Westview Press Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	H

PSEP0053: HIGH ENERGY PHYSICS II
(4-0-0)

COURSE OUTCOMES
CO 1: Explain gauge theories. (Understanding)
CO 2: Familiarise with physics of spontaneous symmetry breaking and Higgs mechanism. (Analysing)
CO 3: Explain standard model and physics beyond standard model. (Understanding)
CO 4: Build the theory of neutrino physics. (Analysing)
CO 5: Recall group theory and learn how to apply it to gauge theory. (Applying)

Module I: Introduction (10 lectures)
Introduction to Gauge symmetries – global and local gauge transformations, abelian group U(1) (QED), Yang-Mills (Non-Abelian) groups – SU(2) (isospin), SU(3)C (QCD).

Module II: Spontaneous Symmetry Breaking (SSB) (12 lectures)
Ground state with spontaneous symmetry breaking, some examples; global symmetry breaking and Goldstone bosons, proof of Goldstone theorem, local symmetry breaking and Higgs mechanism for giving masses to vector bosons, examples U(1), SU(2).

Module III: Standard Model (SM) (12 lectures)
Standard model of electroweak unification, gauge bosons W^+, W^-, Z^0, charged weak current and neutral current, Higgs particle, experimental status.

Module IV: Beyond Standard Model (12 lectures)
a. Introduction to Grand Unified Theories (GUTs) – SU(5) and SO(10), and proton decay predictions;
b. Minimal Supersymmetric Standard Model (MSSM) and its extension, its predictions;
c. Introduction to String Theories and Planck scale physics.

Module V: Neutrino Physics (14 lectures)
Solar and atmospheric neutrino puzzles, theory of neutrino oscillations in vacuum and medium (MSW mechanism), neutrino masses and leptonic mixings, survey of various neutrino oscillation experiments, seesaw mechanism for small neutrino masses.

Suggested Readings
1. Gauge Theory of elementary particle physics, Ta-Pei Cheng and Ling-Fong Li, Oxford University Press.
2. Quarks and leptons: An introductory Course in Modern Particle Physics, Francis Halzen and Alan D. Martin,John Wiley & Sons.
3. Introduction to Elementary Particles, David Griffiths, John Wiley & Sons.
4. A First Course in String theory, Barton Zwiebach, Cambridge Univ. Press.
5. Grand Unified theories, Graham G Ross, Oxford University Press.
6. Massive Neutrinos in Physics and Astrophysics, R. N. Mohapatra and P. B. Pal, World Scientific, Singapore.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H	H	
CO 4					H
CO 5	H				

PSNP0054: NUCLEAR AND PARTICLE PHYSICS
(4-0-0)

COURSE OUTCOMES
CO 1: Explain the properties of nucleus in details. (Understanding)
CO 2: Describe Shell model and learn to calculate the spin and parity of nuclear ground state. (Analysing)
CO 3: Knowledge of nuclear reaction and learn the selection rules for nuclear transitions. (Analysing)
CO 4: Classify the elementary particles and explain the quark model. (Understanding)

Module I: General Properties of Nuclei (6 lectures)
Nuclear size, shape and charge distribution, spin, parity and isospin of nucleon and nuclei. Determination of nuclear size and charge density, concept of magnetic dipole moment and electric quadrupole moment, Binding energy.

Module II: Nuclear Two Body Problem and Nuclear Force (12 lectures)
Properties of deuteron bound state and low energy n-p scattering in terms of scattering length and effective range, spin dependence, charge independence of nucleon force. Non-central part of nucleon force, exchange forces, Yukawa theory of nuclear force, magnetic moment and electric quadrupole moment of deuteron.

Module III: Nuclear Models (10 lectures)
Semiempirical mass formula, liquid drop model, Failure of Liquid drop model, Evidence of shell structure, magic numbers, effective single particle potentials (square well, harmonic oscillator, Wood-Saxon with spin orbit interaction), extreme single particle model and its successes and failures in predicting ground state spin, parity, Nordheim rule, rotational and vibrational model.

Module IV: Nuclear Reactions (12 lectures)
Kinematics governing nuclear reactions, Q-value, cross section of nuclear reactions, neutron reactions at low energies, Coulomb effects in nuclear reactions, neutron reactions, compound nucleus hypothesis, Breit Wigner one level formula for resonance reactions. Elements of direct reactions (qualitative), energies of fission and fusion, neutron induced fission, chain reaction.

Module V: Nuclear Decay (8 lectures)
Fermi theory of decay, selection rules, non-conservative of parity. Gamma decay, electric and magnetic multipole transitions,

selection rules, examples of beta and gamma decay.

Module VI: Particle Physics (12 lectures)
Classification of fundamental forces, Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.), Symmetries and conservation laws, SU(2) and SU(3), CPT theorem, CP violation in K decay, Gell-Mann Nishijima relation, quark model, baryons and mesons, coloured quarks and gluons, Relativistic kinematics.

Suggested Readings
1. Atomic and Nuclear Physics, Vol-II, S. N. Ghosal, S. Chand and company Ltd.
2. Introductory Nuclear Physics, S. M. Wong, Prentice Hall Inc.
3. Concepts of Nuclear Physics, B. L. Cohen, Tata McGraw Hill Publishing Company Ltd.
4. The Atomic Nucleus, R. D. Evans, Tata McGraw Hill Publishing Company Ltd.
5. Nuclear Radiation Detectors, S. S. Kapoor and V. S. Ramamurthy, Wiley Eastern Ltd.
6. An introduction to nuclear Physics, W. N. Cottingham and D. A. Greenwood, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H	H	H	
CO 4						H

PSMP0055: MATHEMATICAL PHYSICS-I

(3-1-0)

COURSE OUTCOMES
CO 1: Explain the concepts and applications of the function of complex variables. (Remembering)
CO 2: Apply the advanced concepts of vector spaces in solving physical problems. (Applying)
CO 3: Utilize the concepts and applications of some special functions. (Applying)
CO 4: Illustrate some of the basic concepts of residue theorem. (Understanding)
CO 5: Analyse physical scenarios using the concepts of vector space. (Analysing)

Module I: (16 lectures)
Functions of complex variable: Analytic functions; derivatives of an analytic function. Series of analytic functions: Taylor series, Laurent series; zeros and isolated singular points of analytic functions; the calculus of residues: theorem of residues; evaluation of integrals; Jordan's lemma; Principal value of an integral; multi-valued functions; Riemann surfaces; evaluation of an integral involving a multi- valued function; analytic continuation; dispersion relations.

Module II: (16 lectures)
Review of vector analysis; definition of vector spaces; finite dimensional vector spaces: linear independence, basis and dimensionality, inner product of vectors and norm of vector, Schemidt's orthogonalization method, Schwarz's and Bessel's inequalities; matrices: orthogonal, Hermitian, unitary and normal matrices; linear operators: matrix representation of linear operators; linear transformation: similarity transformation, orthogonal and unitary transformations; eigenvectors and eigenvalues, diagonalization of matrices (or operators); infinite dimensional vector space: Hilbert space, Fock space.

Module III: (20 lectures)
Special functions: associated Legendre differential equation and functions; generating functions; spherical harmonics; orthonormality. Bessel's equation; Bessel function; Spherical Bessel function, Neumann and Hankel functions; expansion of a plane wave into partial waves. Laguerre and associated Laguerre differential equation and functions; generating functions; recurrence relations; orthonormality. Hypergeometric and confluent hypergeometric functions.

Module IV: (8 lectures)
Integral transforms: general properties of Laplace transforms; inverse Laplace transform; application of Laplace transforms; convolution theorem; solution of differential equations using Laplace transform.

Suggested Readings
1. Mathematical Methods for Physicists, G. Arfken, H. Weber and F. Harris, Elsevier.
2. Mathematical Methods of Physics, J. Mathews and R. L. Walker, The Benjamin-Cumminngs Publishing Company.
3. Mathematics for Physicists, P. Dennery and A. Krzywicki, Harper and Row.
4. A.W.Joshi, Matrices and Tensors in Physics, 3rd Edition, New Age Int. (2005)
5. S. Andrilli & D.Hecker, Elementary Linear Algebra, Academic Press (2006).
6. J. Brown and R.V.Churchill, Complex Variables and Applications, McGraw-Hill, 8th Edition (2008)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module II
CO 1	H				
CO 2		H			
CO 3			H		
CO 4					H
CO 5				H	

PSMP0056: MATHEMATICAL PHYSICS-II

(3-1-0)

COURSE OUTCOMES

CO 1: Explain the concepts and applications of the special function (Applying)

CO 2: Illustrate some of the basic concepts of tensor analysis and its application to different brances of physics. (Understanding, Applying)

CO 3: Analyse Illustrate some of the basic concepts of group theory and its application to different brances of physics. (Understanding, Applying)

Module I: (20 lectures)

Special functions-II

Power series solution, Frobenius method, Sturm-Liouville theory and boundary value problems, boundary value problems on Laplace equation, Poisson equation and diffusion equation, Green's functions and method involving Green's function and its applications; method of separation of variables for different wave equations in Cartesian and curvilinear coordinates involving special functions like Legendre, Hermite, Laguerre and Bessel functions

Module II: (20 lectures)

Tensor Calculus

Manifolds and coordinate systems. Transformation of coordinates: Galilean and Lorentz transformations. Tangent vectors and gradients, inner and outer products, contraction, symmetric and antisymmetric tensors, metric tensor, covariant and contravariant derivatives. Metric tensor in different curved spaces. Four vectors and physical examples from special relativity and electrodynamics. Covariant derivatives and parallel transport. Geodesics. Idea of curvature. Calculation of Laplacian in curved spaces.

Module III: (20 lectures)

Group Theory

Group axioms, permutation groups (S2 and S3) and symmetry operations of equilateral triangle, multiplication table, subgroup, classes and characters, finite groups (Zn), cosets, factor group, normal subgroup, point symmetry group, direct and semi direct product of groups, homomorphism and isomorphism, direct and semi-direct products, block diagonalisation - reducible and irreducible representation, group representation by matrix [unitary representation and conservation laws], Lie groups and algebras [generators, SO(2), SO(3) and SU(2)]; unitary group, special unitary group, Lorentz group, rotation group, direct product, Young Tableau, Dynkin diagrams.

Suggested Readings

1. Mathematical Methods for Physicists, G. Arfken, H. Weber and F. Harris, Elsevier.
2. Mathematical Methods of Physics, J. Mathews and R. L. Walker, The Benjamin-Cumminngs Publishing Company.
3. Mathematics for Physicists, P. Dennery and A. Krzywicki, Harper and Row.
4. A.W.Joshi, Matrices and Tensors in Physics, 3rd Edition, New Age Int. (2005)
5. M. Hamermesh, Group Theory and Its Applications to Physical Problems, Dover (1989)
6. D.B. Lichtenberg, Unitary symmetry and elementary particles, second edition, Academic Press (1978).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 2		H	
CO 3			H
CO 4			

PSPS0200: PHYSICS AND SERVICE LEARNING

(2-0-0)

COURSE OUTCOMES

CO 1: Explain the meaning of service learning and active learning. (Understanding)

CO 2: Illustrate engaged teaching and engaged research. (Understanding)
CO 3: Organise service learning. (Applying)
CO 4: Illustrate CBPR. (Understanding)
CO 5: Find the regulations of educational statutory bodies on social responsibility. (Remembering)

Module I: (6 lectures)
Understanding social responsibility of educational institutes; meaning of community university engagement (CUE), engaged teaching, engaged research. Community Based Participatory Research (CBPR). Statutory bodies of higher educational institutions and social responsibility.

Module II: (9 lectures)
Active learning. Service learning; principles of service learning; classification of service learning models; difference between service learning and other community experiences; historical context of university community partnership;physics students and service learning. Service Learning for a postgraduate physics student and its scope in research.

Module III: (15 lectures)
Conceptualisation of the idea of service learning through any two of the following practical implementations: (i) conducting awareness programmes on scientific temper for nearby communities, (ii) organising demonstrations of scientific experiments for school children to eradicate the fear of pursuing higher studies in science, (iii) surveying the need of the communities and find out various possibilities of providing the solutions from physics point of view, (iv) providing consultancy to school students for various inter school science competitions, (v) providing video lectures and/or demonstrations for school students. (vi) Radiation measurement activity and awareness campaign by students.

Suggested Readings
1. Service-Learning Essentials: Questions, Answers, and Lessons Learned, Barbara Jacoby, Jossey-bass.
2. Where's the Learning in Service-Learning?,Janet Eyler and Dwight E. Giles Jr., Jossey-bass.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1		H	
CO 2	H		
CO 3			H
CO 4	H		
CO 5	H		

LABORATORY COURSES

PSPL6003: PHYSICS LABORATORY II

(0-0-4)

COURSE OUTCOMES

CO 1: Explain the characteristics of SCR. (Understanding)
CO 2: Find out resistivity of a semiconductor. (Application)
CO 3: Determine of difference in wavelengths of Na using Fabry-Perot interferometer. (Application)
CO 4: Verify the Beer-Lambert law using UV visible spectrometer. (Analysis)
CO 5: Use nuclear radiation detectors. (Application)
CO 6: Understand phonon dispersion using simulator. (Understanding)
CO 7: Have some fundamental understanding of plasma experiments. (Understanding)

At least 10 experiments should be performed from the following:

1. To study the characteristic of SCR using the breadboard.
2. To study resistivity of a semiconductor by probe method.
3. Determination of difference in wavelengths of Na using Fabry-Perot interferometer.
4. To verify the Beer-Lambert law using UV visible spectrometer.
5. Verification of inverse square law for gamma ray using GM counter.
6. To study attenuation of beta rays using GM counter.
7. To determine the activity of a gamma emitter.
8. To study gamma ray spectrum of Cs-137 source and determine the resolution of agamma-ray spectrometer.
9. To calibrate the scintillation spectrometer and determine the energy of gamma raysfrom an unknown source.
10. To study attenuation of gamma-rays from Cs-137 source by using different absorbers.
11. To study the decay curve for half-life components of irradiated 115In by a neutron source.
12. To study phonon dispersion of a monatomic chain of atoms using electronicanalogue of the chain.
13. Experimental verification of Paschen law in a glow discharge system.
14. To find the floating potential of a plasma using the Langmuir probe.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14
CO 1	H													
CO 2		H												
CO 3			H											
CO 4				H										
CO 5					H	H	H	H	H	H	H			
CO 6												H		
CO 7													H	H

PSPL6009: PHYSICS LABORATORY I

(0-0-4)

COURSE OUTCOMES

CO 1: Demonstrate the validity of various network theorems. (Understanding)
CO 2: Explain the working of various circuits containing semiconductor devices. (Understanding)
CO 3: Construct various rectifier circuits. (Applying)
CO 4: Build various filter circuits. (Applying)
CO 5: Illustrate the working of various transistor circuits. (Understanding)
CO 6: Explain the behaviour of Op-Amp circuits. (Understanding)
CO 7: Demonstrate the working of logic circuits. (Understanding)
CO 8: Explain the transmission of electromagnetic waves through optical fibers. (Understanding)

At least 10 experiments should be performed from the following:

1. Verification of KCL and KVL using discrete components.
2. Verification of Thevenin's theorem.
3. VI characteristics of PN junction diode.
4. Series voltage regulation using zener diode and transistor.
5. Design and study the clipper circuit.
6. Design and study the clamper circuit.

7. VI characteristics of Zener diode.
8. Design of Half wave and Full wave rectifier with and without filter.
9. RC low pass and high pass filter realization.
10. Static Characteristics of a Bipolar Junction Transistor (CE Mode).
11. Static Characteristics of a Bipolar Junction Transistor (CB Mode).
12. Design of voltage multiplier: voltage doubler / quadrupler.
13. Design BJT as a switch.
14. Op-Amp as Inverting and Non Inverting amplifier.
15. Realization of basic gates using discrete components.
16. To measure attenuation and bending losses of an optical fibre.
17. To study and verify the truth table of logic gates.
18. To realize half/full adder and half/full subtractor.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9
CO 1	H	H							
CO 2			H	H	H	H	H		
CO 3								H	
CO 4									H

Course Outcomes	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15	Exp 16	Exp 17	Exp 18
CO 5	H	H	H	H					
CO 6					H				
CO 7						H		H	H
CO 8							H		

PSCN6010: COMPUTER ORIENTED NUMERICAL METHODS LAB

(0-0-8)

COURSE OUTCOMES

CO 1: Find out inverse, eigenvalues and eigenvectors of a matrix. (Application)
CO 2: Perform numerical integration and differentiation and solution of differential equations. (Application)
CO 3: Understand special functions and orbitals. (Understanding)
CO 4: Numerical solutions of algebraic equations. (Application)
CO 5: Numerical solutions of simultaneous equations. (Application)
CO 6: Understand chaos. (Understanding)
CO 7: Apply Monte-Carlo simulations. (Application)
CO 8: Study LCR circuits. (Application)
CO 9: Model data. (Analysing)
CO 10: Compute Fourier transform. (Application)

At least 10 experiments should be performed from the following:

(All experiments are to be done using the Fortran, C Language)

1. Basic operations using a matrix A.
   a. To find the transpose of A.
   b. To find the inverse of A.
   c. To verify the accuracy of AA-1= I.
   d. To diagonalise a given matrix.
   e. To find the eigenvalues and eigenvectors.
2. Numerical differentiation.
   a. To find the derivative of a given function f(x) using the standard formula where h is the step size.
   b. To determine the second derivative of a given function f(x) using the standard formula.
   c. Plot the case (a) as a function of x.
   d. Plot the case (b) as a function of x.
   e. Compare the above cases (a) and (b) with the results obtained analytically in specific cases.
3. Numerical method of solving Schrödinger equation.
   a. Obtain numerical solution for the time independent Schrodinger equation in one dimension for a given potential using Runge-Kutta Method or Fox Godwin method.
   b. To plot the wave function obtained from above versus x.

c. Obtain numerical solution for the time independent Schrodinger equation in three dimension for a given potential using Runge-Kutta method or Fox Godwin Method.
d. To plot the wave function obtained from above versus r.
e. To evaluate the eigenvalues and eigenvectors for case (a).
f. To evaluate eigenvalues and eigenvectors for case (b).
g. To count the number of nodes of the function determined in (a) above and see if it is consistent with the theoretical expectation.
h. To determine the boundary value problems for cases (a) and (c).

4. Spherical harmonics.
   a. To compute the Legendre polynomials.
   b. To plot spherical harmonics as a function of polar angles.
   c. To compute the spherical Bessel function (regular and irregular).
   d. To plot the case (c).
5. Numerical integration.
   a. To integrate a given function numerically by Simpson's Rule.
   b. To compare the results obtained form (a) with those obtained analytically.
   c. To integrate a given function numerically by Trapezoidal rule.
   d. To compare the results obtained from (b) with those obtained analytically.
   e. To integrate a given function numerically by Gauss-Legendre integration.
   f. To compare the results obtained form (c) with those obtained analytically.
6. Solution of algebraic equations.
   a. Solve a given equation numerically using Newton Raphson method.
   b. Compare the result of (a) with those obtained numerically.
   c. To solve a given equation using bisection method.
   d. Comparative study of (a), (b) and (c).
7. Solution of simultaneous equations.
   a. Using Gauss-elimination and Gauss Jordan elimination method.
   b. Compare (a) with solutions obtained analytically or algebraically.
8. Logistic systems.
   To explore the regions of (a) stable fixed points (b) periodic and (c) chaotic solution.
9. Radioactivity.
   a. Use Monte-Carlo method to simulate radioactive decay.
   b. Write a program for a radioactive series, when the daughter is also radioactive and soon.
   c. Plot N (number of nuclei) Vs time t.
   d. From the slope calculate the activity at different times.
10. LCR circuits.
    a. To compute the charge and discharge of an RC circuit using DC source.
    b. To compute the charge and discharge of RC circuits using AC source.
    c. Analyse the energy in the RL circuit using the Runge-Kutta method.
    d. Study the energy dissipated in a series LCR circuit. Plot it versus time t.
11. Modelling of data.
    a. To compute for a given sample of data.
    b. To fit a given sample of data by least square method by a straight line.
    c. To fit by minimizing by straight line.
    d. To make a polynomial fit by least square method.
    e. To make a polynomial fit by minimizing.
12. Fourier transform special methods.
    a. To compute Fourier transform of discretely sampled data.
    b. To compute Fast Fourier transform of real functions and Sine and CosineTransformations.
    c. To compute Fourier transform of a given function in two or more dimensions.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	H											
CO 2		H	H		H							
CO 3				H								
CO 4						H						
CO 5							H					

CO 6								H				
CO 7									H			
CO 8										H		
CO 9											H	
CO 10												H

PSPM6013: PLASMA PHYSICS LABORATORY

(0-0-4)

COURSE OUTCOMES

CO 1: Explain the breakdown mechanism of gasses. (Remembering)
CO 2: Understand the electrical properties of a gas discharge. (Understanding)
CO 3: Operate and conduct experiments in plasma devices. (Application)
CO 4: Collect and analyse data from plasma devices. (Analysing)
CO 5: Use plasma diagnostic tools. (Application)

At least 10 experiments should be performed from the following:

1. Experimental determination of minimum breakdown voltage in a glow discharge system.
2. To study the effect of variation in chamber pressure on different regions of a glow discharge.
3. To study the effect of variation in discharge voltage on different regions of a glow discharge.
4. To plot the I-V characteristics of a glow discharge plasma.
5. To find the variation in resistance of a glow discharge plasma with chamber pressure.
6. To find the variation in resistance of a glow discharge plasma with discharge voltage.
7. To find the variation in floating potential with discharge voltage of a plasma using Langmuir probe.
8. To find the variation in floating potential with chamber pressure of a plasma using Langmuir probe.
9. To find the plasma potential of a plasma using Langmuir.
10. To find the electron temperature of a plasma using the Langmuir probe.
11. To find the electron density of a plasma using the Langmuir probe.
12. Identification of different ions/atoms/molecules in plasma by optical emission spectroscopy(OES).
13. To find the plasma density by optical emission spectroscopy (OES) using Stark Broadening of hydrogen lines.
14. To find the plasma temperature by optical emission spectroscopy (OES) using line intensity ratio method.
15. To find the plasma temperature by optical emission spectroscopy (OES) using Boltzmann Plot method.

Mapping of COs to Syllabus

Course Outcomes	Exp1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp10	Exp11	Exp12	Exp13	Exp14	Exp15
CO 1	H	M	M												
CO 2				H	M	M									
CO 3	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
CO 4	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
CO 5							M	M	M	M	M	M	M	M	M

PSEL6014: ELECTRONICS LABORATORY

(0-0-4)

COURSE OUTCOMES

CO 1: Explain transistor operation. (Remembering)
CO 2: Understand amplifier design using transistor. (Understanding)
CO 3: Operational Amplifier and Timer applications. (Application)
CO 4: Analyse Logic Gates. (Analysis)
CO 5: Application of gates for Digital circuits. (Application)

At least 10 experiments should be performed from the following:

1. Design of amplifiers: Transistor amplifiers with and without feedback.
2. Design of Integrator and Differentiator using Op-amp.
3. Op-amp linear applications: adders, subtractors, comparator.
4. Op-amp based active filters.
5. 555 timer as monostable multivibrator.
6. 555 timer as astablemultivibrator.
7. 555 timer as bistablemultivibrator
8. To verify the truth table of MUX and DEMUX.

9. Realization of 2:4 decoder and 4:2 encoder design.
10. To verify the truth table of one bit and four bit comparators using logic Gates.
11. Truth table verification of Flip-Flops: (i) RS-Type, (ii) D- Type, (iii) T- Type, (iv) J-K Master Slave
12. To study shift register in all its modes i.e. SIPO/SISO, PISO/PIPO.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	H	H										
CO 2	M	H			M	M						
CO 3			H	M	H	M	M	M				
CO 4	M				M	M	M	M	M	M	M	M
CO 5							M	M	M	H	M	M

PSNY6015: NANOPHYSICS LABORATORY

(0-0-4)

COURSE OUTCOMES

CO 1: Calculations of molarity. (Remembering)
CO 2: Understanding hydrothermal synthesis. (Understanding)
CO 3: Understanding characterization techniques. (Understanding)
CO 4: Application of characterization techniques on synthesized material. (Application)
CO 5: Analysis of characterizing results. (Analysis)

At least 10 experiments should be performed from the following:

1. Calculate molarity for different solutions. Learn to use the scientific balance (adjustments, taring,etc.).
2. Prepare stock solution of the following (100 ml)
   - 10mM $Zn(NO_3)_2 . 6H_2O$
   - 10mM 100ml $C_6H_{12}N_4$
   - 25 mM $Na_3C_6H_5O_7$
3. Synthesize ZnO nanoparticles using hydrothermal process.
4. Perform seeding of pre-synthesized ZnO nanoparticles on glass substrate. Also perform directseeding of ZnO particles on glass substrate by thermal oxidation.
5. Grow ZnO nanorods on glass substrate hydrothermally.
6. Synthesize ZnS nanoparticles using hydrothermal process.
7. Synthesize manganese doped ZnS nanoparticles using hydrothermal process.
8. Make film of ZnO nanoparticles on glass substrate using the LBL machine.
9. Use Super-hydrophobicity testing machine to find out the roll-off and contact angle of ananoparticle coated surface.
10. Synthesize CdS nanoparticles using hydrothermal process. Observe colour variations with sizewhen illuminated with UV light.
11. Synthesize gold nanoparticles using Turkevitch process.
12. Sample preparation for different characterization techniques.
13. UV-vis spectroscopy to study optical properties of nanomaterials.
14. Tauc's plot to determine band gap of semiconductors.
15. Electron Microscopy Imaging of metallic and semiconducting nanoparticles.
16. Analysing SAED patterns.
17. Measurement of lattice fringes in TEM images using ImageJ software.
18. Analysing EDS plots.
19. Extracting information from XRD plots.
20. Measurement of WCA and ROA for different nanomaterial coated substrates.
21. PL spectroscopy on luminescent nanoparticles.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11
CO 1	H	H	M	M	M	M	M	M			
CO 2	M	H			M	M	M	M	M	M	M

Course Outcomes	Exp 12	Exp 13	Exp 14	Exp 15	Exp 16	Exp 17	Exp 18	Exp 19	Exp 20	Exp 21
CO 2	M	M								

CO 3		H	M	H	M	M	M	M	M	M
CO 4		M	M	M	M	M	M	M	M	
CO 5						M	M	M	H	M

PSST6016: STUDY TOUR

Study Tour is a mandatory non-credited course to be taken up in the final semester of M.Sc. (physics) with an objective to provide students an exposure to higher studies and research in physics in other reputed institutes of the county. The study tour will not be less than 2 days and will not exceed 14 days. During the tour, the focus will be on visiting different higher educationalinstitutes and/ or research institutes. A report will be submitted and a presentation will be given at the end of the tour by each student based on which he/she will be declared "Pass"/"No Pass" in the course**.**

PSPP6017: PROJECT PHASE I

(2 credits)

During this phase the student will start a project applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

E-resource for learning:

LaTeX

PSPR6018: PROJECT PHASE II

(3 credits)

During this phase the student will complete the project started in the previous semester. The final implementation of the project and report writing shall be done in this semester. The student shall be required to make a number of presentations to report on the progress of the project. There will be a viva voce examination which shall follow the final submission of the project report. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

PSCP6120: COMPUTATIONAL PHYSICS USING PYTHON

(2-0-0)

COURSE OUTCOMES

CO 1: Outline the fundamental elements of Python computing. (Understanding)
CO 2: Estimate the accuracy and speed of a Python code. (Applying)
CO 3: Develop Python code for solving definite integrals and finding derivatives. (Applying)
CO 4: Solve systems of equations using Python arrays. (Applying)
CO 5: Develop optimized numerical solutions of ordinary differential equations. (Applying)
CO 6: Make use of Monte Carlo methods in random processes for solving physical problems. (Applying)
CO 7: Propose computational solutions to physical problems using Python. (Creating)

Module I: Elements of Python programming (9 lectures)

Data types, basic mathematical operations, variables; lists: indexing, slicing, altering, appending and deleting elements, concatenation; tuples and dictionaries; conditional statements; loops: while and for loops, nested-for loops; Python libraries: installing packages, importing packages; NumPy arrays and matrices, example: eigenvalues and eigenvectors; basics of data handling using Pandas; introduction to SciPy; data visualization using Matplotlib and Seaborn.

Module II: Accuracy and speed (2 lectures)

Variables and data ranges; numerical error; program speed.

Module III: Numerical integrals and derivatives (4 lectures)

Fundamental integral evaluation methods: trapezoidal rule, Simpson's rule; error estimation of integrals; Romberg integration; Gaussian quadrature; numerical differentiation: forward and backward differences, central differences, second derivatives, partial derivatives, differentiation error estimation.

Module IV: Solving linear and non-linear equations (6 lectures)

Linear equations: Gaussian elimination, back-substitution, pivoting, LU decomposition, matrix inverse, tridiagonal and banded matrices; nonlinear equations: binary search, Newton's method, secant method

Module V: Numerical solutions of ordinary differential equations (4 lectures)

First-order differential equations with one variable: Euler's method, Heun's method, 4^{th} order Runge-Kutta method; differential

equations with multiple variables; second-order differential equations; boundary value problems: shooting method, relaxation method; eigenvalue problems.

Module VI: Random processes (5 lectures)
Random numbers generators and seeds; non-uniform random numbers, Gaussian random numbers; Monte Carlo integration: mean value method, integrals in many dimensions, importance sampling; importance sampling; Markov chain methods.

Suggested Readings

1. Mark E.J. Newman, Computational Physics, Createspace Independent Pub.
2. Rubin H. Landau, Manuel J. Paez and Cristian C. Bordeianu, Computational Physics: Problem Solving with Python, Wiley.
3. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly Media.
4. David Beazley and Brian K. Jones, Python Cookbook: Recipes for Mastering Python 3, O'Reilly Media.
5. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly Media.
6. Duncan M. McGreggor, Mastering Matplotlib, Packt Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M	M	M	M
CO 3			H			
CO 4				H		
CO 5					H	
CO 6						H
CO 7		M	M	M	H	H

SCHOOL OF LIFE SCIENCES

SCHOOL OF LIFE SCIENCES
DEPARTMENT OF BIOSCIENCES
MASTER OF SCIENCE IN BIOCHEMISTRY

SEMESTER I				
Type of Course/Category	**Course Code**	**Course Name**	**Credits T-L-P**	**Page**
Core Course (Theory)	BTTE0009	Thermodynamics and Enzymology	3-0-0	1398
Core Course (Theory)	MBCG0011	Cell Biology and Genetics	4-0-0	1418
Core Course (Theory)	BCFB0013	Fundamentals of Biochemistry	4-0-0	1378
Core Course (Theory)	BCAT0014	Analytical Techniques	4-0-0	1379
Core Course (Lab)	BCFB6009	Fundamentals of Biochemistry Lab	0-0-1	1388
Core Course (Lab)	BTTE6009	Thermodynamics and Enzymology Lab	0-0-1	1408
Core Course (Lab)	BCAT6010	Analytical Techniques Lab	0-0-1	1388
Core Course (Lab)	MBCB6011	Cell Biology and Genetics Lab	0-0-1	1424
	BTIV6011	Industrial/Laboratory visit	0-0-1	1409
	BCRT6012	Remedial Teaching & NET Coaching course	NC	1389
	MBNT6013	NPTEL Course	NC	
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	1385
Total Credits			20	
SEMESTER II				
Core Course (Theory)	BTGE0005	Genetic Engineering	3-0-0	1396
Core Course (Theory)	BTCA0010	Computer Applications and Bioinformatics	3-0-0	1399
Core Course (Theory)	MBBM0014	Basic Microbiology	2-0-0	1419
Core Course (Theory)	BCMB0015	Molecular Biology	4-0-0	1380
Core Course (Theory)	BCFI0016	Fundamentals of Immunology	4-0-0	1381
Core Course (Lab)	BTGE6004	Genetic Engineering Lab	0-0-1	1406
Core Course (Lab)	BTCA6010	Computer Applications and Bioinformatics Lab	0-0-2	1408
Core Course (Lab)	MBBM6012	Basic Microbiology Lab	0-0-1	1424
Core Course (Lab)	BCMB6013	Molecular Biology Lab	0-0-1	1389
Core Course (Lab)	BCFI6014	Fundamentals of Immunology Lab	0-0-1	1390
Elective Skill Enhancement Courses				
Skill Enhancement Course 1	MBWM0012	Waste Management	1-0-0	1419
Skill Enhancement Course 2	BTFF0013	Fermentation and Food Microbiology	1-0-0	1401
Skill Enhancement Course 3	MBMC0013	Mushroom cultivation	1-0-0	1419
Skill Enhancement Course 4	BCHD0017	Herbal Drug Technology	1-0-0	1382
	MBIT6014	Internships/Summer Training	NC	
	BCRT6015	Remedial Teaching & NET Coaching	NC	1390
	BCSL0200	Service Learning in Biosciences	NC	1385
Total Credits			23	
SEMESTER III				
Core Course (Theory)	BTRM0003	Research Methodology &Biostatistics	4-0-0	1395
Core Course (Theory)	BCBM0010	Medical Biochemistry	3-0-0	1376
Core Course (Theory)	BCPY0011	Physiology	3-0-0	1377
Core Course (Lab)	BCIM6004	Medical Biochemistry Lab	0-0-1	1386
Core Course (Lab)	BCPY6005	Physiology Lab	0-0-1	1386
Core Course (Theory)	BCNM0019	Nutritional Biochemistry & Metabolism	3-0-0	1383
Core Course (Theory)	BCBE0018	Bioenergetics	3-0-0	1382
Core Course (Lab)	BCNM6013	Nutritional Biochemistry & Metabolism Lab	0-0-1	1389
Core Course (Lab)	BCBM6006	Bioenergetics Lab	0-0-1	1387
	BCDI6007	Dissertation Phase I	0-0-2	1397
	BCRT6015	Remedial Teaching & NET Coaching	NC	1390
Core Course (Theory)	BTIE0014	IPR & Entrepreneurship	1-0-0	
Core Course (Lab)	BCSC6017	Scientific Writings and Communications	0-0-1	1390
Service Learning	BCSL0200	Service Learning in Biosciences	NC	1385
Value Added Course	BTCL6014	Clinical Laboratory Techniques	NC	1410
Value Added Course	BTBB6015	Basic Bioinformatics	NC	1411
Total Credits			24	
SEMESTER IV				
Core Course (Theory)	BCOB0020	Omics Biology and its Tools	4-0-0	1384

Elective courses				
Elective Course 1 (Theory)	BTAT0017	Agriculture Technology	2-0-0	1404
Elective Course 2 (Theory)	MBNB0016	Nanobiology	2-0-0	1421
Elective Course 3 (Theory)	BCBM0021	Bioresource Management	2-0-0	1384
	BCDI6008	Dissertation Phase II	0-0-16	1387
Service Learning	BCSL0200	Service Learning in Biosciences	NC	1385
Total Credits			22	
Total Programme Credits			89	

MASTER OF SCIENCE IN BIOTECHNOLOGY

SEMESTER I				
Type of Course/Category	**Course Code**	**Course Name**	**Credits T-L-P**	**Page**
Core Course (Theory)	BTTE0009	Thermodynamics and Enzymology	3-0-0	1398
Core Course (Theory)	MBCG0011	Cell Biology and Genetics	4-0-0	1418
Core Course (Theory)	BCFB0013	Fundamentals of Biochemistry	4-0-0	1378
Core Course (Theory)	BCAT0014	Analytical Techniques	4-0-0	1379
Core Course (Lab)	BCFB6009	Fundamentals of Biochemistry Lab	0-0-1	1388
Core Course (Lab)	BTTE6009	Thermodynamics and Enzymology Lab	0-0-1	1408
Core Course (Lab)	BCAT6010	Analytical Techniques Lab	0-0-1	1388
Core Course (Lab)	MBCB6011	Cell Biology and Genetics Lab	0-0-1	1424
	BTIV6011	Industrial/Laboratory visit	0-0-1	1409
	BCRT6012	Remedial Teaching & NET Coaching course	NC	1389
	MBNT6013	NPTEL Course	NC	
Service Learning	BCSL0200	Service Learning in Biosciences	NC	1385
Total Credits			20	
SEMESTER II				
Core Course (Theory)	BTGE0005	Genetic Engineering	3-0-0	1396
Core Course (Theory)	BTCA0010	Computer Applications and Bioinformatics	3-0-0	1399
Core Course (Theory)	MBBM0014	Basic Microbiology	2-0-0	1419
Core Course (Theory)	BCMB0015	Molecular Biology	4-0-0	1380
Core Course (Theory)	BCFI0016	Fundamentals of Immunology	4-0-0	1381
Core Course (Lab)	BTGE6004	Genetic Engineering Lab	0-0-1	1406
Core Course (Lab)	BTCA6010	Computer Applications and Bioinformatics Lab	0-0-2	1408
Core Course (Lab)	MBBM6012	Basic Microbiology Lab	0-0-1	1424
Core Course (Lab)	BCMB6013	Molecular Biology Lab	0-0-1	1389
Core Course (Lab)	BCFI6014	Fundamentals of Immunology Lab	0-0-1	1390
Elective Skill Enhancement Courses				
Skill Enhancement Course 1	MBWM0012	Waste Management	1-0-0	1419
Skill Enhancement Course 2	BTFF0013	Fermentation and Food Microbiology	1-0-0	1401
Skill Enhancement Course 3	MBMC0013	Mushroom cultivation	1-0-0	1419
Skill Enhancement Course 4	BCHD0017	Herbal Drug Technology	1-0-0	1382
	MBIT6014	Internships/Summer Training	NC	
	BCRT6015	Remedial Teaching & NET Coaching	NC	1390
Service Learning	BCSL0200	Service Learning in Biosciences	NC	1385
Total Credits			23	
SEMESTER III				
Core Course (Theory)	BTRM0003	Research Methodology &Biostatistics	4-0-0	1395
Core Course (Theory)	BTBE0007	Bioprocess Engineering	3-0-0	1397
Core Course (Theory)	BTPB0011	Plant Biotechnology	3-0-0	1400
Core Course (Theory)	BTAB0012	Animal Biotechnology	3-0-0	1400
Core Course (Theory)	BTPE0015	Pharmaceutical & Environmental Biotechnology	3-0-0	1402
Core Course (Lab)	BTAP6003	Animal Biotechnology Lab	0-0-1	1406
Core Course (Lab)	BTBE6006	Bioprocess Engineering Lab	0-0-1	1407
Core Course (Lab)	BTBP6011	Plant Biotechnology Lab	0-0-1	1409
Core Course (Lab)	BTPE6012	Pharmaceutical & Environmental Biotechnology Lab	0-0-1	1409
	BTDI6007	Dissertation Phase I	0-0-2	1407
	BCRT6015	Remedial Teaching &NET Coaching	NC	1390

Core Course (Theory)	BTIE0014	IPR and Entrepreneurship	1-0-0	1402
Core Course (Lab)	BCSC6017	Scientific Writings and Communications	0-0-1	1390
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	1385
Value Added Course	BTCL6014	Clinical Laboratory Techniques	NC	1410
Value Added Course	BTBB6015	Basic Bioinformatics	NC	1411
Total Credits			24	
SEMESTER IV				
Core Course (Theory)	BTTB0016	Trends in Biotechnology	4-0-0	1403
Elective courses				
Elective Course 1 (Theory)	BTAT0017	Agriculture Technology	2-0-0	1404
Elective Course 2 (Theory)	MBNB0016	Nanobiology	2-0-0	1421
Elective Course 3 (Theory)	BCBM0021	Bioresource Management	2-0-0	1384
	BTDI6008	Dissertation Phase II	0-0-16	1408
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	1385
Total Credits			22	
Total Programme Credits			89	

MASTER OF SCIENCE IN MICROBIOLOGY

SEMESTER I				
Type of Course/Category	**Course Code**	**Course Name**	**Credits T-L-P**	**Page**
Core Course (Theory)	BTTE0009	Thermodynamics and Enzymology	3-0-0	1398
Core Course (Theory)	MBCG0011	Cell Biology and Genetics	4-0-0	1418
Core Course (Theory)	BCFB0013	Fundamentals of Biochemistry	4-0-0	1378
Core Course (Theory)	BCAT0014	Analytical Techniques	4-0-0	1379
Core Course (Lab)	BCFB6009	Fundamentals of Biochemistry Lab	0-0-1	1388
Core Course (Lab)	BTTE6009	Thermodynamics and Enzymology Lab	0-0-1	1398
Core Course (Lab)	BCAT6010	Analytical Techniques Lab	0-0-1	1388
Core Course (Lab)	MBCB6011	Cell Biology and Genetics Lab	0-0-1	1424
	BTIV6011	Industrial/Laboratory visit	0-0-1	
	BCRT6012	Remedial Teaching & NET Coaching course	NC	1389
	MBNT6013	NPTEL Course	NC	
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	1385
Total Credits			20	
SEMESTER II				
Core Course (Theory)	BTGE0005	Genetic Engineering	3-0-0	1396
Core Course (Theory)	BTCA0010	Computer Applications and Bioinformatics	3-0-0	1399
Core Course (Theory)	MBBM0014	Basic Microbiology	2-0-0	1419
Core Course (Theory)	BCMB0015	Molecular Biology	4-0-0	1380
Core Course (Theory)	BCFI0016	Fundamentals of Immunology	4-0-0	1381
Core Course (Lab)	BTGE6004	Genetic Engineering Lab	0-0-1	1406
Core Course (Lab)	BTCA6010	Computer Applications and Bioinformatics Lab	0-0-2	1408
Core Course (Lab)	MBBM6012	Basic Microbiology Lab	0-0-1	1424
Core Course (Lab)	BCMB6013	Molecular Biology Lab	0-0-1	1389
Core Course (Lab)	BCFI6014	Fundamentals of Immunology Lab	0-0-1	1390
Elective Skill Enhancement Courses				
Skill Enhancement Course 1	MBWM0012	Waste Management	1-0-0	1419
Skill Enhancement Course 2	BTFF0013	Fermentation and Food Microbiology	1-0-0	1401
Skill Enhancement Course 3	MBMC0013	Mushroom cultivation	1-0-0	1419
Skill Enhancement Course 4	BCHD0017	Herbal Drug Technology	1-0-0	1382
	MBIT6014	Internships/Summer Training	NC	
	BCRT6015	Remedial Teaching & NET Coaching	NC	1390
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	1385
Total Credits			23	
SEMESTER III				
Core Course (Theory)	BTRM0003	Research Methodology &Biostatistics	4-0-0	1395

Core Course (Theory)	MBVM0003	Virology and Mycology	3-0-0	1415
Core Course (Theory)	MBEM0009	Environment Microbiology	3-0-0	1416
Core Course (Theory)	MBMM0010	Medical Microbiology	3-0-0	1417
Core Course (Theory)	MBIM0015	Infection and Molecular Diagnostics	3-0-0	1420
Core Course (Lab)	MBVM6008	Virology and Mycology Lab	0-0-1	1425
Core Course (Lab)	MBEM6009	Environment Microbiology Lab	0-0-1	1425
Core Course (Lab)	MBMM6010	Medical Microbiology Lab	0-0-1	1426
Core Course (Lab)	MBIM6015	Infection and Molecular Diagnostics Lab	0-0-1	1426
	MBDI6006	Dissertation Phase I	0-0-2	1427
	BCRT6015	Remedial Teaching &NET Coaching	NC	1390
Core Course (Theory)	BTIE0014	IPR & Entrepreneurship	1-0-0	1402
Core Course (Lab)	BCSC6017	Scientific Writings and Communications	0-0-1	1390
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	1385
Value Added Course	BTCL6014	Clinical Laboratory Techniques	NC	1410
Value Added Course	BTBB6015	Basic Bioinformatics	NC	1411
Total Credits			24	
SEMESTER IV				
Core Course (Theory)	MBIF0018	Industrial and Food Microbiology	4-0-0	1422
Elective courses				
Elective Course 1 (Theory)	BTAT0017	Agriculture Technology	2-0-0	1404
Elective Course 2 (Theory)	MBNB0016	Nanobiology	2-0-0	1421
Elective Course 3 (Theory)	BCBM0021	Bioresource Management	2-0-0	1384
	MBDI6007	Dissertation Phase II	0-0-16	756
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	1385
Total Credits			22	
Total Programme Credits			89	

- Non- credit courses (NCC) are mandatory and assess the student performance by grading their score in internal and final examinations as – satisfactory (S) or Unsatisfactory (US) based on the performance of the students. Students securing 60% or above may be considered satisfactory (S).
- NPTEL -students can select any one course from NPTEL and produce a certificate as the end of the examination.
- Industrial or laboratory visit is mandatory on the basis of applicability and mentoring of the students. A report on the experience and learning can be submitted to respective mentors.
- Remedial Teaching & NET Coaching will be one hour/week
- Skill development program; options include Fermentation technology; herbal drug formulation; mushroom cultivation; waste management; (any 1)
- Value added course will be open for all and on completion of the course the student will receive a certificate to the learning
- Students will go for internships during the semester break between – I and II semester or II and III semester or III and IV Semester and produce a certificate and report of the training.
- Semester - IV- One Core course (4 credits) + One elective (2 credits) + Dissertation (16 credit)

DEPARTMENT OF BOTANY
MASTER OF SCIENCE IN BOTANY
MSc COURSE STRUCTURE

SEMESTER I				
Type of Course/Category	**Course Code**	**Course Name**	**Credits T-L-P**	**Page**
Core Course (Theory)	BOMP0021	Mycology and Phycology	4-0-0	1432
Core Course (Theory)	BOBP0022	Bryophytes, Pteridophytes and Gymnosperms	4-0-0	1432
	BOAN0023	Angiosperms	4-0-0	1433
Core Course (Lab)	BOMP6026	Mycology and Phycology Lab	0-0-3	1456
Core Course (Lab)	BOBA6027	Bryophytes, Pteridophytes and Gymnosperms and Angiosperms Lab	0-0-3	1456
Value added course	BOBF6035	Bio-Fertilizer Technology	NC	1461
Value added course	BOBC6038	Biomass Conversion, Biorefinery & Circular Bioeconomy	NC	1462
Service Learning	BOSL0100	Service Learning on Ethno Botanical Practices	NC	1464
Total Credits			18	
SEMESTER II				
Core Course (Theory)	BOCM0024	Cell and Molecular Biology	4-0-0	1434
Core Course (Theory)	BOPB0025	Plant Physiology and Biochemistry	4-0-0	1435
Core Course (Theory)	BOPP0026	Plant Microbiology and Plant Pathology	4-0-0	1437
Core Course (Theory)	BOPE0028	Plant Ecology and Phytogeography	4-0-0	1438
Core Course (Lab)	BOCB6028	Cell and Molecular Biology and Plant Physiology and Biochemistry Lab	0-0-3	1457
Core Course (Lab)	BOPP6041	Plant Microbiology and Plant Pathology Lab	0-0-2	1458
Core Course (Lab)	BOPE6042	Plant Ecology and Phytogeography Lab	0-0-2	1459
		MOOCS/NPTEL Course		
Service Learning	BOSL0100	Service Learning on Ethno botanical Practices	NC	1464
Total Credits			**23**	
SEMESTER III				
Core Course (Theory)	BOCP0027	Cytogenetics and Plant Breeding	4-0-0	1439
Core Course (Theory)	BOBB0029	Biochemicals, Molecular Techniques and Bioinformatics	4-0-0	1440
Core Course (Theory)	BOER0031	Environmental Management, Research Methodology and Biostatistics	4-0-0	1441
Core Course (Lab)	BOER6033	Environmental Management, Research Methodology and Biostatistics Lab	0-0-2	1458
Core Course (Lab)	BOCT6040	Cytogenetics, Molecular Techniques Lab	0-0-3	1459
Value added course	BOHM6036	Herbal Medicine	NC	1461
Value added course	BOFI6037	Forest Inventory and Mensuration	NC	1462
Core Course (Lab)	BODI6032	Dissertation Phase I	0-0-4	1458
Service Learning	BOSL0100	Service Learning on Ethno botanical Practices	NC	1464
Total Credits			**21**	
SEMESTER IV				
		Plant Biotechnology		
Discipline Specific Elective	BOFP0032	Fundamentals of Plant Biotechnology	4-0-0	1442
Discipline Specific Elective	BOAB0033	Advances in Plant Biotechnology	4-0-0	1443
		Genetics and Plant Breeding		
Discipline Specific Elective	BOGT0034	Genetics, Plant Breeding and Transformation	4-0-0	1444
Discipline Specific Elective	BOMB0035	Molecular Genetics and Bioinformatics	4-0-0	1445
		Angiosperm Taxonomy		
Discipline Specific Elective	BOTS0038	Taxonomy of Angiosperms and Biosystematics	4-0-0	1445
Discipline Specific Elective	BOBE0039	Economic Botany and Ethnobotany	4-0-0	1446
		Plant Ecology		
Discipline Specific Elective	BOEG0040	Ecology, Environment and Global concerns	4-0-0	1448
Discipline Specific Elective	BORG0042	Restoration Ecology and Geoinformatics	4-0-0	1449
		Plant Pathology and Microbiology		
Discipline Specific Elective	BOPY0043	Plant Pathology	4-0-0	1450

Discipline Specific Elective	BOMA0044	Microbial Genetics and Applied Microbiology	4-0-0	1450
		Plant Physiology and Biochemistry		
Discipline Specific Elective	BOPP0045	Advanced Plant Physiology	4-0-0	1351
Discipline Specific Elective	BOBM0046	Plant Biochemistry and Metabolism	4-0-0	1452
		Advances in Plant Science		
Discipline Specific Elective	BOBB0047	Biomass, Biorefinery and Circular Bioeconomy	4-0-0	1453
Discipline Specific Elective	BOPD0048	Bioprospecting of Plant Diversity and Automation	4-0-0	1455
Service Learning	BOSL0100	Service Learning on Ethno Botanical Practices		1466
Core Course (Dissertation)	BODI6034	Dissertation Phase II	0-0-10	1461
Total Credits			**18**	
Total Programme Credits			**80**	

DEPARTMENT OF ZOOLOGY
MASTER OF SCIENCE IN ZOOLOGY

SEMESTER I				
Type of Course/Category	**Course Code**	**Course Name**	**Credits T-L-P**	**Page**
Core Course (Theory)	ZGBE0027	Biosystematics and Evolution	4-0-0	1489
Core Course (Theory)	ZGCI0028	Cell Biology and Immunology–Theory and Applications	4-0-0	1490
Core Course (Theory)	ZGBG0029	Molecular Biology and Genetics	4-0-0	1491
Core Course (Theory)	ZGAP0030	Animal Physiology	4-0-0	1492
Core Course (Theory)	ZGEE0031	Ecology and Environmental Biology	4-0-0	1493
Core Course (Lab)	ZGBE6019	Biosystematics and Environmental Biology Lab	0-0-2	1509
Core Course (Lab)	ZGCI6020	Cell Biology, Genetics and Basic Bioinformatics Lab	0-0-2	1509
Total Credits			**24**	
SEMESTER II				
Core Course (Theory)	ZGDB0005	Developmental Biology	4-0-0	1471
Core Course (Theory)	ZGEB0032	Endocrinology and Biochemistry	4-0-0	1494
Core Course (Theory)	ZGAZ0033	Applied Zoology	4-0-0	1496
Core Course (Theory)	ZGEP0034	Ethology and Population Genetics	4-0-0	1497
Core Course (Lab)	ZGDB6021	Developmental Biology and Biochemistry Lab	0-0-2	1510
Core Course (Lab)	ZGEP6022	Ethology and Population Genetics Lab	0-0-2	1511
Value Added Course	ZGPR6004	Project Management, Reporting and Documentation	NC	1501
Service Learning Course	ZGSL0200	Service Learning in Zoology	NC	1499
Total Credits			**20**	
SEMESTER III				
Core Course (Theory)	BTRM0003	Research Methodology and Biostatistics	4-0-0	1471
Discipline Specific Elective	**Specialization 1: Entomology**			
	ZGIF0008	Insects- Structure & Function	4-0-0	
	ZGIP0009	Insect Physiology	4-0-0	798
	ZGEE6011	Specialization Lab I- Entomology and Environmental Biology	0-0-2	828
	Specialization 2: Cell and Molecular Biology			1473
	ZGCB0010	Cell and Molecular Biology –I	4-0-0	1474
	ZGIY0011	Immunology I	4-0-0	1475
	ZGCM6012	Specialization Lab I- Cell and Molecular Biology	0-0-2	1505
	Specialization 3: Fishery Science			
	ZGTF0012	Taxonomy and Functional Anatomy	4-0-0	1476
	ZGAF0013	Aquaculture and Fish Genetics	4-0-0	1478
	ZGFS6013	Specialization Lab I - Fishery Science	0-0-2	1506
	Specialization 4: Animal Ecology and Wildlife Biology			
	ZGEB0014	Animal Ecology and Biogeography	4-0-0	1479
	ZGWM0015	Wildlife Conservation and Management	4-0-0	1480
	ZGAW6014	Specialization Lab I- Animal Ecology and Wildlife Biology	0-0-2	1506
	ZGDI6006	Dissertation (Phase I)	0-0-4	1503
Value Added Course	ZGWP6011	Introduction to Wildlife Photography	NC	1503
Total Credits			**18**	
SEMESTER IV				
	ZGBB0036	Basic Bioinformatics Theory	1-0-0	1498
	ZGBB6023	Basic Bioinformatics Lab	0-0-1	1511
Discipline Specific Elective		**Specialization 1: Entomology**		
	ZGIG0017	Insect Ecology	4-0-0	1481
	ZGPM0035	Applied Entomology and Principles of Pest Management	4-0-0	1482
	ZGEE6015	Specialization Lab II- Entomology and Environmental Biology	0-0-2	1507
		Specialization 2: Cell and Molecular Biology		
	ZBMB0019	Cell and Molecular Biology –II	4-0-0	1483
	ZGIM0020	Immunology II	4-0-0	1484

	ZGCM6016	Specialization Lab II- Cell and Molecular Biology	0-0-2	1507
		Specialization 3: Fishery Science		
	ZGCP0021	Capture fishery and Post-harvest Technology	4-0-0	1485
	ZGLF0022	Limnology, Fishery economics, Ornamental Fishery and Fish pathology	4-0-0	1486
	ZGFS6017	Specialization Lab II - Fishery Science	0-0-2	1508
		Specialization 4: Animal Ecology and Wildlife Biology		
	ZGRE0025	Wildlife Resource management, Laws and Techniques in population study	4-0-0	1487
	ZGWC0026	Techniques in Wildlife study, Wildlife Health, Forensics and Conflict	4-0-0	1488
	ZGAW6018	Specialization Lab II- Animal Ecology and Wildlife Biology	0-0-2	1508
Core Course (Dissertation)	ZGDS6009	Dissertation (Phase II)	0-0-8	1504
Value Added Course	ZGTM6010	Teaching Methodology and Class room Management	NC	1504
Total Credits			**18**	
Total Programme Credits			**82**	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

SCHOOL OF LIFE SCIENCES
DEPARTMENT OF BIOSCIENCES
PROGRAMME: MASTER OF SCIENCE (MSC) BIOCHEMISTRY

PROGRAMME OUTCOMES

PO 1: Critical Thinking: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO 2: Knowledge Skill: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge

PO 3: Scientific Communication Skills: Imbibe effective scientific and/or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization

PO 4: Ethics: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects

PO 5: Enlightened Citizenship: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.

PO 6: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO 7: Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".

PO 8: Lifelong Learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling.

PO 9: Leadership Qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.

PO 10: Research Skills: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations, problem solving and interpretation

PROGRAMME SPECIFIC OUTCOMES:

PSO1: Confidence: Demonstrate a comprehensive understanding of chemical and biological structure, principles, techniques, and applications

PSO2: Knowledge based Skill: To develop better understanding and improve skills that would enable them to begin a career in research laboratories, industries as well as to generate self-employability

PSO3: Scientific Social Responsibility: To develop linkages between scientific community and society to build trust, partnership and responsibility of science towards achieving social goals

PSO4: Research and analysis: Realize the impact of science in society and plan to pursue research, and learn to work as a team as well as independently to retrieve information, carry out research investigations and result interpretations

PSO5: Diagnostic skills: Attain a remarkable understanding of biochemical principles of bioenergetics, metabolism, physiology and disorders through diagnostic laboratory procedures.
PSO6:Technical and analytical skills: Acquire a thorough knowledge on omics biology, high-throughput omics approaches to analyse biological samples such as genomics, transcriptomics, proteomics, metabolomics and comprehensive analysis approach.

MAPPING OF COURSES WITH POS/PSOS

Courses	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
Thermodynamics and Enzymology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1	2		
Cell Biology and Genetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1	2	1	1
Fundamentals of Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	1	3	2	1
Analytical Techniques	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	2	3	1	1
Lab I- Fundamentals of Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	1	3	2	1
Lab II- Thermodynamics and Enzymology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2		2		
Lab III- Cell Biology and Genetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	1	3	2	1
Lab IV- Analytical Techniques	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	2	3	1	1
Industrial/ Laboratory visit											2	3		3	2	3
Genetic Engineering	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	2			1
Computer Applications and Bioinformatics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	2		3
Basic Microbiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3		3		1		
Molecular Biology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	2	1	1
Fundamentals of Immunology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	3	2	1	1
Lab I- Genetic Engineering	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	2	2		2
Lab II- Computer Applications and Bioinformatics	**3**	**3**	**2**	**2**	2	3	2	3	3	3		3		3		3
Lab III- Basic Microbiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3		3		1		

Lab IV- Molecular Biology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	3	1	1
Lab V- Fundamentals of Immunology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	2	1	1
Waste Management (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	3	3	1	2
Fermentation and Food Micorbiology (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	3	1	3	1
Mushroom Cultivation (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	1	3
Herbal Drug Technology (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	1	3	3	3	1	2
Research Methodology & Biostatistics-common	**3**	**3**	**2**	**2**	2	3	2	3	3	3	1	2	3	3	1	1
Medical Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	3	1
Physiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	1	2	3	1
Lab I-Medical Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	3	1
Lab II- Physiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	1	2	3	1
Nutritional Biochemistry &Metabolism	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	2	3	3	1
Bioenergetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1	3		2
Lab-I- Nutritional Biochemistry &Metabolism	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	2	3	3	1
Lab II- Bioenergetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1			
Dissertation Phase	**3**	**3**	**2**	**2**							3	3	3	3		

I					2	3	2	3	3	3						
IPR &Entrepreneurship	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	2	2	1	1
Scientific writing and communications	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3			3		2
Value Added Course- Clinical Laboratory Techniques	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3			3	
Omics Biology and its Tools	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	2	3
Agriculture Technology (Elective)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	2	2	2
Nanobiology (Elective)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3		2			
Bioresource Management (Elective)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	1	2	2	3	1	1
Dissertation Phase II	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	3	3

DETAILED SYLLABUS
THEORY COURSES

BCBM0010: MEDICAL BIOCHEMISTRY (3-0-0)

Course Outcomes

CO 1: Define the different disorders of the body related to carbohydrate metabolism, lipid metabolism, Nitrogen metabolismand digestive disorders (Remembering)
CO 2: Develop an understanding o f how the different metabolism are interconnected (Understanding)
CO 3: Classify disorders of each metabolism (Understanding)
CO 4: Compare all metabolic disorders with their symptoms and etiology (Applying)
CO 5: Examine the normal level of glucose, glycogen, protein, amino acid, nitrogen, diagnostic enzymes (Analysing)
CO 6: Evaluate the genetic relation of each metabolic disorder with corresponding metabolism (Evaluating)
CO 7: Discuss the link between the metabolic disorders and genetic make of patients (Creating)
CO 8: Gain the knowledge on the molecular diagnostic test used in various infectious diseases (Understanding)

Module I (10 Lectures)

a. Disorders of Carbohydrate Metabolism - Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia.
b. Disorders of Lipids – Plasma lipoproteins, cholesterol, triglycerides and phospholipids in health and disease,hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies

Module II (10 Lectures)

a. Abnormalities in Nitrogen Metabolism – Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance.
b. Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and ureaclearance
c. Inborn Errors of metabolism – Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome, sickle cell anemia, histidinemia, disorders of blood

Module III (10 Lectures)

a. Digestive diseases – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea.
b. Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes.
c. Diagnostic Enzymes – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT,CPK, cholinesterase, LDH.

Module IV (15 Lectures)

a. Molecular diagnostics: Basic techniques used in molecular diagnostics, Molecular diagnostics of HIV, Tuberculosis, cholera and pathogenic E. coli
b. Cancer and Ageing –Molecular basis of carcinogenesis, Oncogene and signal transduction, oncogene and G-proteins, oncogene and cell survival, carcinogens and cancer therapy, Cancer pathways, Diagnosis, prevention and treatment of cancer. Ageing: Antioxidants and ageing, DNA repair, Heat shock proteins, role of dopamine receptors in ageing.
c. Disorders of Signal transduction: Disorders of cell surface receptors, Antibodies to receptors, Disorders of Intracellular receptors
d. Oxidative stress related diseases: Role of oxidative stress in various cancers, role of free radicals in diabetic I and diabetic II type of diseases, various inflammatory disorders associated with free radicals, oxidative stress in neurodegenerative diseases; Alzheimer's disease, Parkinson's disease, Huntington's disease. Mitochondrial free radical theory of aging.

Suggested Readings

1. Medical Biochemistry, 7th Edition, Chatterjee MN and Shinde R, 2007, Jaypee Brothers Medical Publishers P (Ltd)
2. Biochemistry, 5th Edition, Jeremy M Berg, John L Tymoczko, and Lubert Stryer, 2002, W.H. Freeman and Co.
3. Text-book of Biochemistry with clinical correlations,7th Edition, Devlin TMJ, 2010, Wiley and Sons.
4. Textbook of Medical Physiology, 12th Edition, Guyton AC and Hall JE, 2012, Elsevier Health Sciences

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	

CO 2	H	H	H	
CO 3	H	H	H	
CO 4	H	H	H	H
CO 5	H	H	H	H
CO 6	H	H	H	
CO 7	H	H	H	H
CO 8				H

BCPY0011: PHYSIOLOGY (3-0-0)

Course Outcomes

CO 1: Define and have an enhanced knowledge of the fundamentals of physiology by recalling and relating (Remembering).
CO 2: Summarize how the separate systems interact to yield integrated physiological responses (Understanding).
CO 3: Implement the acquired knowledge of the various mechanisms in executing and constructing experiments and apply in their day to day life (Applying).
CO 4: Analyze and report on experiments and observations in physiology (Analysing).
CO 5: Evaluate by presenting and defending opinions by making judgments about the mechanisms and functioning of organs and organ systems (Evaluating).
CO 6: Appreciate, compile and generate new ideas on physiology (Creating).

Part A: Plant Physiology Module I (13 lectures)

a. Electron transport system in plants - Oxidative phosphorylation, mitochondrial respiratory complexes, order and organization of electron carriers, electrochemical gradient, chemiosmotic theory, ATP synthase and mechanism of ATP synthesis.
b. Nitrate assimilation - Structural features of nitrate reductase and nitrite reductase, incorporation of ammonia into organic compounds, regulation of nitrate assimilation.
c. Photosynthesis – Photosynthetic apparatus, pigments of photosynthesis, role of carotenoids, photosystems I and II, their location; Hill reaction, photosynthetic electron transport and generation of NADPH & ATP, cyclic and non-cyclic photo-phosphorylations, complexes associated with thylakoid membranes; light harvesting complexes, path of carbon in photosynthesis – C_3 and C_4 pathway of carbon reduction and its regulation, Photorespiration.

Module II (10 lectures)

a. Special features of secondary plant metabolism - Terpenes (classification, biosynthesis), lignin, tannins, pigments, phytochrome, waxes, alkaloids, biosynthesis of nicotine, functions of alkaloids, cell wall components.
b. Toxins of plant origin – Mycotoxins, phytohemagglutinins, lathyrogens, nitriles, protease inhibitors, protein toxins.
c. Stress metabolism in plants - Environmental stresses, salinity, water stress, heat, chilling, anaerobiosis, pathogenesis, heavymetals, radiations and their impact on plant growth and metabolism, criteria of stress tolerance.
d. Antioxidative defence system in plants – Reactive oxygen species and their generation, enzymic and non-enzymic components of antioxidative defense mechanism.

Part B: Human Physiology Module III (12 lectures)

a. Blood and Circulatory system - Composition and functions of plasma, erythrocytes including Hb, Leucocytes and thrombocytes, plasma proteins. Blood Coagulation – mechanism and regulation. Transfer of blood gases – Oxygen and carbon dioxide, role of 2,3-diphosphoglycerate, Bohr effect and chloride shift.
b. Digestive system – Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins, & nucleic acids.
c. Respiratory system– Air passages and lung structure, pulmonary volumes, alveolar surface tension, work of breathing and its regulation.

Module IV (10 lectures)

a. Endocrine system – Secretion and functions of hormones of thyroid, pituitary and gonads. Role of hormones in reproduction.Mechanism of action of hormones.
b. Nervous system-Muscle proteins, molecular mechanisms of muscle contraction (skeletal and smooth), nerve conduction,chemical regulation of synapses, neurotransmitters, neurons, resting membrane potential and action potential.
c. Excretory system – Structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes.Tubular secretion. Homeostatic regulation of water and electrolytes, Acid-base balance.

Suggested Readings

1. Harper's Illustrated Biochemistry, 31st Edition, Rodwell VW, Bender DA, Botham KM, Kennely PJ, Weil PA, 2009, MHLMP
2. Textbook of Biochemistry with clinical correlations, 7th Edition, Devlin TM, 2010, WLP

3. Ganong's Review of Medical Physiology, 25th Edition, Barrett KE, Barman SM, Boitano S, Brooks HL, 2017, MHE
4. Textbook of Medical Physiology, 11th Edition, Guyton AC, Hall JE, 2015, EI
5. Principles of Biochemistry, 5th Edition, Voet D, Voet JG, Pratt CW, 2018, WP
6. Lehninger's Principles of Biochemistry, 7th Edition, Nelson DL, Cox MM, 2017, ML
7. Medical Biochemistry, 2nd Edition, Bhagavan N V, 2015, AP
8. Biochemistry, 6th Edition, Garret RH, Grisham CM, 2017, SCP

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	L	L	L	L
CO2	H	M	H	H
CO3	M	M	M	M
CO4	L	H	L	L
CO5	L	M	M	M
CO6			M	M

BCFB0013: FUNDAMENTALS OF BIOCHEMISTRY (4-0-0)

Course Outcomes

CO 1: Relate of the structural and functional aspects of biomolecules (Remembering)
CO 2: Compare and draw the chemical structures of different biomolecules (Understanding)
CO 3: Identify the monomers and polymers of biomolecules (Applying)
CO 4: Analyse the interaction and importance of equilibrium maintenance of different biomolecules for health related issues (Analysing)
CO 5: Estimate the different concentrations of biomolecules for biological applications (Evaluating)
CO 6: Elaborate the biological applications of different biomolecules in drug discovery (Creating)

Module I (6 lectures)

Introduction to Biochemistry, water as biological solvent, weak acids and weak bases, pH and pK, buffers, Henderson-Hasselbalch equation, physiological buffers, fitness of the aqueous environment for living organisms

Module II (14 lectures)

a. Classification, basic chemical structure, general reactions and properties, biological significance of monosaccharide, Sugar derivatives, deoxy sugars, amino sugars, and sugar acids, Mutarotation of sugar, Anomeric effect of sugar (Methylation effect), Inversion (hydrolysis) of cane sugar
b. Polysaccharides - occurrence, structure, isolation, properties and functions of homoglycans - starch, glycogen, cellulose, dextrin, inulin, chitins, xylans, arabinans, galactans
c. Occurrence, structure, properties, and functions of heteroglycans - bacterial cell wall polysaccharides, glycoaminoglycans, agar, alginic acid, pectins, blood group substances and sialic acids, Glycoprotein and their biological applications, Lectins structure and functions

Module III (14 lectures)

a. Definition and Classification - (simple, complex, derived lipids - structure and example). Saturated and unsaturated fatty acids, Nomenclature of fatty acids, General chemical reactions of fatty acids – esterification, hydrogenation and halogenations
b. Phospholipids - classification, structure and functions, Ceramides and Sphingomyelins, Eicosanoids, structure and functions of prostaglandins, thromboxanes, leukotrienes, Types and functions of plasma lipoproteins, Amphipathic lipids - membranes, micelles, emulsions and liposomes.
c. Steroids - cholesterol structure and biological role - bile acids, bile salts.
d. General chemical reactions of fats: Hydrolysis, Saponification number, I_2 number, acetylation, acetyl number, and volatile fatty acid number, Rancidity of fat.

Module IV (4 Hours)

Porphyrins: the porphyrin ring system, chlorophyll, hemoglobin, myoglobin and cytochrome.

Module V (10 lectures)

Watson-Crick Model of DNA structure: A, B and Z – DNA. Chemical Properties: Hydrolysis (acid, alkali), enzymatic hydrolysis of DNA. Cruciform structure in DNA, formation and stability of cruciform, HDNA, palindrome, secondary and tertiary structure of RNA, hnRNA, si RNA, Cot value curve, hypochromic and hyperchromic effect, DNA-protein interactions, Viscosity, Buoyant density, Tm

Module VI (12 lectures)

a. Definition, classification, structure, stereochemistry and reactions of amino acids;
b. Classification of proteins on the basis of solubility and shape, structure, and biological functions. Primary structure - determination of amino acid sequences of proteins, the peptide bond, Ramachandran plot.
c. Secondary structure - weak interactions involved - alpha helix and beta sheet and beta turns structure, Pauling and Corey model for fibrous proteins, Collagen triple helix, and super secondary structures - helix-loop-helix.
d. Tertiary structure - alpha and beta domains. Quaternary structure - structure of haemoglobin, Solid state synthesisof peptides, Protein-Protein interactions, Concept of chaperones.

Suggested Readings

1. Biochemistry, 5th Edition, Jeremy M Berg, John L Tymoczko, and Lubert Stryer, 2002, W.H. Freeman and Co.
2. Fundamentals of Biochemistry, 4th Edition, Voet D, Voet JG and PrattCW,2012, John Wiley and sons NY.
3. Lehninger's Principle of Biochemistry, 7th Edition, David L Nelson and Michael M Cox, 2017, W. H. Freeman and Co.
4. Biochemistry, 4th Edition, Zubey GL, 1998, WCB London.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1		H	H	H	H	H
CO 2		H	H	H	H	H
CO 3		H			H	H
CO 4	H	M	H	H		
CO 5	H	H	H		H	H
CO 6	M	M	M	H		H

BCAT0014: ANALYTICAL TECHNIQUES (4-0-0)

Course Outcome

CO 1: Define the basic principles, concepts and applications of various analytical techniques used in biological sciences (Remembering)
CO 2: Apply the knowledge of centrifugation to separate a constituent from a complex mixture (Applying)
CO 3: Choose a suitable microscopic, electrophoretic, and chromatographic technique to identify and purify a target molecule from a complex mixture (Applying)
CO 4: Select an opposite spectroscopic technique to characterize a sample (Analysing)
CO 5: Ability to appraise the various techniques and formulate an appropriate plan for research studies (Evaluating)

Module I (12 lectures)

Principle of centrifugation, concept of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical ultra-centrifugation, determination of molecular weights and other applications, subcellular fractionation

Module II (9 lectures)

Concepts of spectroscopy; Beer-Lambert's law, Principles and applications of colorimetry, Visible and UV spectroscopy, CD, IR and NMR

Module III (11 lectures)

Concepts of chromatography; Principles and applications of paper, thin layer, ion exchange, affinity, gel permeation, adsorption, partition and high-performance liquid chromatography

Module IV (13 lectures)

Principles of electrophoretic separation, types of electrophoresis viz. paper, cellulose, Native PAGE, SDS PAGE, Pulse field gel electrophoresis

Module V (15 lectures)

Basic concepts of microscopy, transmission electron microscopy, scanning electron microscopy, Freeze fracture technique. Principle and applications of Autoradiography

Suggested Readings

1. Instrumental Methods of Analysis. 6th Edition, H. H. Willard, L. L. Merritt Jr. and others1986, CBS Publishers and Distributors.
2. Instrumental Methods of Chemical Analysis, Chatwal G and Anand, S., 1989, Himalaya Publishing House, Mumbai.
3. A Biologist's Guide to Principles and Techniques of Practical Biochemistry Williams, B.L. and Wilson, K., 1975
4. Spectroscopy, Volume 1B. B. Straughan and S. Walker Eds., Chapman and Hall Ltd.

5. Gel Electrophoresis of Proteins - A Practical Approach Hanes,

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO 2	H				
CO 3			H	H	H
CO 4		H			
CO 5	H	H	H	H	H

BCMB0015: MOLECULAR BIOLOGY (4-0-0)

Course Outcomes

CO 1: Define the principles of DNA replication, transcription and translation (Remembering)
CO 2: Explain the structural and functional properties of biological macromolecules and to understand the role of gene regulation (Understanding)
CO 3: To recognize Central Dogma from replication of DNA till translation of protein (Applying)
CO 4: Distinguish between replication, transcription and translation (Analysing)
CO 5: Execute quantitative analysis to interpret biological data (Evaluating)
CO 6: Design a scientific process,gain insight into the most significant molecular methods to expand our understanding of biology (Creating)

Module I (15 lectures)

Nucleic acid as genetic material: it's proof; Different modes of replication (conservative, semi-conservative and dispersive); DNA replication in prokaryotes, eukaryotes and virus (rolling circle model): General features and enzymology; detailed mechanisms of initiation, elongation and termination; experiments underlying each step and role of individual factors; proofreading and processivity of DNA polymerase; telomerases: mechanism of replication, maintenance of integrity and role in cancer; effect of different inhibitors on replication.

Module II (15 lectures)

Basic concepts of promoter, operator, terminator, enhancer; RNA polymerases and its sub-Modules; different sigma factors and their relation to stress, viral infections etc; initiation, elongation and termination (rho-dependent and independent) mechanism of RNA synthesis; post transcriptional modification of RNA - capping, splicing and poly A tailing; effect of different inhibitors on prokaryotic and eukaryotic transcription.

Module III (20 lectures)

The genetic code and its nature; structure of t-RNA, ribosomal structure; activation of amino acids; initiation, elongation and termination mechanism of polypeptide chain synthesis; role of r-RNA in polypeptide chain synthesis; differences between prokaryotic and eukaryotic translational processes; post-translational modification of peptide, its transportation; non- ribosomal peptide synthesis with special reference to cyclic polypeptide antibiotics synthesis in bacteria; effect of different inhibitors on protein synthesis in both prokaryotes and eukaryotes.

Module IV (10 lectures)

Positive and negative control; catabolite regulation-definition and mechanism; effect of anti-termination and attenuation on the process of gene regulation; various protein motifs involved in DNA-protein interactions during gene regulation. Epigenetics - definition and mechanism.

Suggested Readings

1. Lewin's Genes XII,12 th Edition, Krebs JE, Kilpatrick ST, Goldstein ES, 2017, JB
2. Molecular Biology of the Gene, 7th Edition,Watson JD, Baker TA, Bell SP, Gann A, Levine M, Bell SP, Losick R, Harrison SC, 2020, PP
3. Molecular Biology, 5th Edition, Weaver RF,2011, MGHC.
4. Molecular Biology, 3rd Edition, Clark DP,Pazdernik NJ, 2014, API
5. Molecular Biology, 5th Edition, Freifelder D, 2004, NPHPL.

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	L	L	
CO 2		M	M	H
CO 3	H	H	H	
CO 4	M	M	H	

CO 5		L	L	
CO 6				H

BCFI0016: FUNDAMENTALS OF IMMUNOLOGY (4-0-0)

Course Outcomes

CO 1: Course begins with general overview of immunity to get you adjusted to the basics in the field. To demonstrate comprehension of general terms associated with immunological responses and the roles of nearly every cell associated with the immune system. Understand the differentiation of hematopoietic stem cells (HSCs) into lymphoid or myeloid immune cells (Understanding)

CO 2: To understand the immunological defense against intruders Cellular basis for innate immunity against all types of pathogens. To describe different mechanisms exist in body to recognize pathogens nonspecifically (Understanding)

CO 3: To demonstrate comprehension of antibody structure, composition, and classes. Understand antibodies associated with particular immunological responses. Gain insights into the coordination of innate and adaptive immune response (Understanding)

CO 4: Major Histocompatibility Complex (MHC), which determines how individuals display, present, and respond to foreign antigens. To understand the importance of MHC in determining transplant eligibility and autoimmune disease. Understand antigen transport through exogenous or endogenous location and attachment on MHC molecule on the cell surface. (Understanding)

CO 5: Understand how T cells develop, rearrange T-cell receptor. To develop insights into key differences between rearrangements and Differential pathways that a T cell undergoes (Understanding)

Module I (10 lectures)

General overview of Immunity, Introduction to Metaphors, Pathogens and Immunity, Surveying the cells and organs of Immune system- Innate and adaptive cells, Hematopoietic Stem Cell, primary and secondary organs; Innate and Adaptive Immune response

Module II (7 lectures)

Ubiquity of Innate immune response, Anatomic Barriers-Skin, Mucosa and GI defenses; Apoptosis, Inflammation- Extravasation, Lymphocyte Extravasation, Trafficking, and Homing, Inflammatory Mediators, Inflammatory Cytokines and Chemokines, Clinical Considerations, Chronic Inflammatory Response; Innate Targeting of Pathogens-Pathogen Recognition System, PAMPs (Pathogen Associated Molecular Patterns), TLR, Cell Types and Function

Module III (14 lectures)

Introduction to models in immune system, Immunoglobulin Superfamily, Structure of Immunoglobulin Receptors (BCR) and Antibodies, Immunoglobulin Classes, Antigen Binding, Antibody Dependent Cell Mediated Cytotoxicity (ADCC), Monoclonal Antibodies

Complement System: Overview and Terminology of the Complement System, Complement Activation, Classical, Alternative and Lectin pathway, Consequences of Complement Activation

Module IV (14 lectures)

Structure of the MHC Locus, Class I MHC, Class II MHC and Class III MHC, Haplotypes, Recombinant Haplotypes, MHC Protein Structure, Specifics of Peptide Binding, Genetic Expression and Cellular Expression, Non-Classical MHC Genes, MHC and Disease

Antigen Processing and Presentation: T Cell Antigen Recognition, Professional Antigen Presenting Cells (APCs), Self-MHC restriction, Cytosolic Pathway: Class I Processing and Presentation, Transport to the RER, Exogenous Pathway: Class II Processing and Presentation, Variations- Cross presentation, T-cell receptor-Structure and Roles, αβ versus γδ receptors, Common Elements, Functional Differences, T-Cell Receptor Genes, Gene Rearrangement- Alpha Rearrangement-,Beta Rearrangement, Delta Rearrangement

Module V (8 lectures)

Maturation in the Thymus, Double Negative Transitions, Double Positive (DP) Events Completing the Receptor, Displaying Co-Receptors, Beginning Selection; Positive and Negative Selection, CD4+ TH Cells: Types and Functions, Determination of Subclass,Superantigens, TH Cell Activation Pathway

Module VI (2 lectures)

Central and Peripheral Tolerance, Malnutrition, SCID, HIV

Module VII (5 lectures)

Types of hypersensitivity reactions 1,2,3 and 4, Autoimmunity and autoimmune diseases

Suggested Readings

1. Cellular and Molecular Immunology, 7h edition by Abbas, et al. 2012, Elsevier/Saunders.

2. Janeway Immunobiology, Kenneth Murphy, Casey Weaver, 9th edition, Norton & Company
3. Molecular Biology of the Cell, Alberts et al., 5th edition, 2014, W. W. Norton & Company
4. Kuby Immunology, Judy Owen, 6th and 7th editions, W H. Freeman

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module6	Module VII
CO 1	L						
CO 2		M					
CO 3			H				
CO4				M			
CO5					H	L	L

BCHD0017: HERBAL DRUG TECHNOLOGY (1 - 0 - 0)

Course Outcomes

1. Explain steps of herb selection, identification, raw material preparation, extraction and phytochemical study (Evaluating)
2. Perceive the application of herbs in formulation of herbal products and their multifarious application (Evaluating)
3. Design procedure of various plant-based products (Creating)

Definition of herb, source of herbs, selection, identification and authentication of herbal materials, processing of herbal raw material, Preparation of plant extracts and oil extraction. Phytochemical screening techniques. Herbal Products-Herbal cosmetics, Herbal Excipients, Herbal Formulations, Nutraceuticals

Activity:

1. Base preparation and herbal soap
2. Herbal Tea and/or green tea
3. Herbal incense sticks with mosquito and/or fly property
4. Herbal spray with insecticidal and/or pesticidal property
5. Herbal colourant
6. Herbal drink with health beneficial property

Suggested Readings

1. Herbal Drug Technology Mohan Lal Kori, Santram Lodhi, Tushar A Deshmukh, Rageeb Md. Usman, Vaibhav M Darvheka, NiraliPrakashan Publication
2. Herbal Drug Technology, Paridhavi Agarwal, Universities Press Private Ltd.

BCBE0018: BIOENERGETICS (3-0-0)

Course Outcomes

CO 1: Summarise the basic concepts of free energy, standard free energy, redox potential and other thermodynamic concepts about biological systems (Understanding)

CO 2: Use principle of transmembrane transport and its various types with special emphasis to mitochondrial respiratory chain and its carriers (Applying)

Module I (15 lectures)

Concept of free energy, standard free energy, determination of G for a reaction, Relationship between equilibrium constant and standard free energy change, biological standard state & standard free energy change in coupled reactions. Biological oxidation

- reduction reactions, redox potentials, relation between standard reduction potentials and free energy change (derivations included). High energy phosphate compounds – introduction, phosphate group transfer, free energy of hydrolysis of ATP and sugar phosphates along with reasons for high G. Energy charge.

Module II (15 lectures)

Chemotaxis and chemoreceptors chemo-osmotic theory, ion transport across energy transducing membranes, Influx and efflux mechanisms, Proton circuit and electrochemical gradient, the transport and distribution of actions, anions and ionophores, Uniport, antiport and symport mechanisms, shuttle systems.

Module III (15 lectures)

The mitochondrial respiratory chain, order and organization of carriers, proton gradient, iron sulphur proteins, cytochromes and their characterization, The Q cycle and the stoichiometry of proton extrusion and uptake; P/O and H/P ratios, Reversed electron transfer, respiratory controls and oxidative phosphorylation, uncouplers and inhibitors of energy transfer.

Fractionation and reconstitution of respiratory chain complexes, ATP- synthetase complex, Microsomal electron transport, partial reduction of oxygen, superoxides.

Suggested Reading

1. Biochemistry, M. Berg, J. L. Tymoczko, L. Stryer, Freeman Publicatio
2. Biochemistry, Voet and Voet, John Wiley and Sons
3. Bioenergetics: A practical approach, paperback Brown and Cooper, Oxford University Press

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO I	H		
CO 2		H	H

BCNM0019: NUTRITIONAL BIOCHEMISTRY & METABOLISM (3-0-0)

Course Outcomes

CO 1: To acquire the knowledge of the dietary requirement of vitamins and minerals in human body (Remembering).
CO 2: To describe the various pathways that describes the metabolism of breakdown and synthesis of carbohydrates, amino acids and lipids in a biological system (Understanding)
CO 3: Interpret the significance of nutritional distribution of the carbohydrates, amino acids, and fats and their disturbancesin the absence of its regulatory enzymes (Applying)
CO 4: Infer the deficiency diseases and abnormalities in response to the dysfunction of enzymes associated with carbohydrates, lipids and amino acids metabolism (Analysing)
CO 5: Compare the linkage of carbohydrate, amino acids and lipid metabolism in in a biological system (Evaluating)

Module I (11 lectures)

Brief account on carbohydrates; Glycolysis; Fates of pyruvate under aerobic and anaerobic conditions; Regulation of glycolysis; Pentose phosphate pathway; Oxidative and Non-oxidative phases of PEP; Citric acid cycle; Production of acetyl CoA, Pyruvate dehydrogenase complex, Regulations of the Citric Acid Cycle; Gluconeogenesis pathway and its regulation; Glycogen biosynthesis and its regulation.

Module II (11 lectures)

Brief account of amino acids; essential and non-essential amino acids; metabolic fates of amino acids; amino acid metabolism: transamination, deamination; amino acid pathway and its degradation; nitrogen excretion and urea cycle; linkage of urea cycle and citric acid cycle

Module III (10 lectures)

Brief account of lipids, Synthesis and storage of triacylglycerol, Transport and mobilization, Essential fatty acids, Fatty acid oxidation, Biosynthesis of cholesterol and steroids.

Module IV (8 lectures)

Importance of carbohydrates, lipids and amino acids in our daily diet; essential and non essential amino acids; dietary input of carbohydrates, lipids and amino acids; deficiency diseases associated with carbohydrates, lipids and amino acids; distribution process of carbohydrates, fats and proteins in the human body once injested.

Module V (5 lectures)

Importance of vitamins in our diet; nutritional significance of minerals and trace elements; dietary sources of vitamins and minerals; requirements and deficiency diseases associated with Vitamins (fat soluble and water soluble vitamins) and minerals

Suggested Readings

1. Biochemistry, 5th edition, M. Berg, J. L. Tymoczko, L. Stryer, 2002, Freeman Publication.
2. Biochemistry, 4th edition, Voet and Voet, 2002, John Wiley and Sons.
3. Lehninger's Principle of Biochemistry, 7th edition, David L. Nelson and Michael M. Cox, W. H., 2017, Freeman and Co.
4. Text Book of Biochemistry with Clinical Correlation, 6th edition, Thomas M. Devlin, John Wiley- Liss, ed. Hobokhen, 2006, NJ publishers
5. Nutritional biochemistry and metabolism: with clinical applications, 2nd edition, M.C. Linder, 1991.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1					H
CO 2	H	H	H	L	
CO 3				H	

CO 4	M	M	M	H	
CO 5	L	L	L	H	L

BCOB0020: OMICS BIOLOGY AND ITS TOOLS (4-0-0)

Course Outcomes

CO 1: Recall mapping and sequencing of genomes, transcriptome, proteome and metabolome (Remembering)
CO 2: Illustrate the different sequencing techniques (Understanding)
CO 3: Apply the tools of bioinformatics to analyze biological data (Applying)
CO 4: Analyze the data with biostatistics software (Analysing)
CO 5: Decide the type of spectroscopic method for sample analysis (Evaluating)
CO 6: Construct phylogenetic tree after analysis of biological samples (Creating)

Module I (15 Lectures)

a. Mapping and sequencing genomes: Genetic and physical mapping, Sequencing genomes different strategies, High-throughput sequencing, next-generation sequencing technologies, comparative genomics, population genomics, epigenetics.
b. Human genome project, pharmacogenomics, genomic medicine, genome editing, applications of genomics to improve publichealth, drug discovery and agriculture, metagenomics.

Module II (15 Lectures)

a. Transcriptome, analysis of gene expression - ESTs, SAGE, recent developments in RNA sequencing; metatranscriptomics, applications in gene regulation: alternative splicing, non- coding RNA.
b. Introduction to proteomics, techniques to study proteomics such as 1D and 2D PAGE, X- ray crystallography, Mass spectrometry including MALDI-TOF, protein microarrays, protein database analysis, comprehensive analysis of protein-protein interactions in different cell types.

Module III (10 Lectures)

a. Metabolomics, metabolome and metabolite, Structural diversity, number of metabolites in biological system, basic concept of metabolic channeling or metabolons, new approaches to analyze metabolic pathways.
b. Sample preparation, strategy and techniques used for metabolomic studies viz. GC-MS, LC-MS, NMR; data analysis (PDA,PLSDA), Lipidpomics, Glycomics, Phenomics, etc.

Module IV (20 Lectures)

a. Technical writing**:** Preparation of scientific report. Thinking and planning, information, ideas, order of paragraph writing; Presentation of a review; Objective and its importance; design of the experiment; parameters used; data interpretation; compilation of experimental record.
b. Case studies derived from scientific literature (genomics, transcriptomics, proteomics and metabolomics) including comparisons between healthy and diseased tissues.
c. Bioinformatics: Databases, phylogenetic tree, critical analysis of -omics data using advanced tools.
d. Biostatics tools: Data analysis with excel and software (SPSS).

Suggested Readings

1. Principles of Proteomics, 2nd Edition, Twyman RM, 2013, Garland Science
2. Metabolome Analysis: An introduction, 1st Edition, Villas-Boas SG, Roessner U, Hansen MAE, Smedsgaard J, Nielsen J, 2007, Wiley
3. Bioinformatics - From genomes to drugs, 1st Edition, Langauer T, Mannhold R, Kubinyi H, Timmerman H, 2002, Wiley VCH
4. Principles of gene manipulation, 7th Edition, Primrose SB, Twyman RM, 2006, Blackwell Publishing

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	M
CO 2	H	H	H	M
CO 3	M	M	M	H
CO 4				H
CO 5		H	H	
CO 6				H

BCBM0021: BIORESOURCE MANAGEMENT (2-0-0)

Course Outcomes

CO 1: Gain an enhanced knowledge of the fundamentals of bioresources and realize the impact of human activity on the environment Summarize how nature works regarding the climate, biodiversity, and the flow of natural resources, and realize the impact of human activity on the environment (Understanding).

CO 2: Acquire knowledge of bioresources eg., sericulture, captive breeding, integrated pest management etc., through different conservation methods, which will open scope for future research (Applying).

CO 3: Able to think innovatively and apply the understanding of bioresources, critically think through hands-on activities viz., biocosmetics, bioinsecticides etc, and industrial field visits which will motivate research, and entrepreneurship (Analyzing and Evaluating).

Module 1 Bioresource Management – approaches and tools

Definition of Bioresources and types, Bioresource and sustainability, Bioresource management through land use planning, Post- harvest management of agricultural produce, Sustainable agriculture, Earthworm technology, Integrated farming, Induced breeding, Captive breeding, Sericulture, Integrated pest management, Concepts of hot spots and red data book, Conservation of biodiversity in seed banks, gene banks and germplasm reserves, Habitat restoration. Application of remote sensing technology for bioresource management, Bio prospecting and bio piracy issues with particular reference to India's biodiversity Sustainable agriculture, Climate change and its impact on crop productivity

Module 2 Bioresource utilization and sustainability

Formulation of biopesticides, bio insecticides, bio weedicides, bio manure, bio cosmetics, bioplastics, Green energy, and biofuel generation from natural sources. Green building, Green walls Sustainable approach in floriculture and horticulture. Organization/Policy role and objectives -Indian Bioresources Information Network, Convention of Biological Diversity and Ramsar Convention, Hands-on Training and Industry/Field Visit with Report writing

Suggested Readings

1. Bioresource Management and climate change, 1st Edition, R. N. Kumar, 2015, OBC
2. Bioresources and their management, 1st Edition, Trivedi SP, Jahageerdar S, Rajendran KV, Kumar D, 2012, AP
3. Bioresources Conservation and Management, 1st Edition, Raju AJS, 2009, TTPP
4. Bioresources of the Eastern Ghats: Their Conservation and Management, 1st edition, Krishnamurthy KV, Murugan R, 2014,NHBS
5. Forest Management, 4th Edition, Davis LS, 2001, MHI
6. Human resource Management, 16th Edition, Dessler G, Varrkey B, 2020, PP
7. Research trends in Bioresource Management, 1st Edition, Maiti R, 2018, APC
8. Biofertilizer and biopesticide, 1st Edition, Lakshman HC, Channabasava A,2014, PP

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	M	H
CO 3		M
CO 4		M
CO 5		M
CO 6		M

BCSL0200: SERVICE LEARNING IN BIOSCIENCES (2-0-0)

Course Outcomes

CO 1: To understand the essence of learning through community service

CO 2: To realise and identify the needs of community

CO 3: To apply subject related knowledge for service to the community

Module I (8 lectures)

Service learning: Definitions; Principles of Service Learning; Awareness of Community; Involvement with Community; Commitment to service

Module II (12 hours)

Fermentation and food microbiology; Herbal Drug Technology; Waste Management; Mushroom cultivation; Principles of Floriculture and Horticulture; Health -hygiene and disease awareness

LABORATORY COURSES

BCIM6004: MEDICAL BIOCHEMISTRY LAB

Course Outcomes

CO 1: Practically estimate lipoprotein, bilirubin, blood urea, creatine phosphokinase from a serumsample (Applying)
CO 2: Perform glucose tolerance tests and understand the normal and abnormal constituents of urine (Applying)

List of Experiments

1. Estimation of lipoproteins
2. Glucose tolerance test
3. Estimation of bilirubin
4. Estimation of blood urea
5. Estimation of creatine phosphokinase
6. Normal and abnormal constituents of urine

Suggested Readings

1. Medical Biochemistry, 7th Edition, Chatterjee MN and Shinde R, 2007, Jaypee Brothers Medical Publishers P (Ltd)

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6
CO 1	H		H	H	H	H
CO 2		H				

***P: Practical**

BCPY6005: PHYSIOLOGY LAB

Course Outcome

CO 1: To be able to understand and master the conceptual and practical physiological functions of systems (Understanding)
CO 2: To acquire basic knowledge and perform experiments in physiology (Applying)
CO 3: To be able to determine, estimate and report on experiments and observations in physiology (Evaluating)
CO 4: To be able to perform an assay, analyse and report on experiments and observations in physiology (Analysing)
CO 5: To equip students with skills and techniques related to physiology to design experiments necessary for careers in research (Creating)

List of Experiments

1. Estimation of urea in serum
2. Estimation of cholesterol in serum.
3. Estimation of calcium in serum.
4. Assay of Serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT)
5. Assay of alkaline phosphatase
6. Assay of amylase in serum
7. Estimation of glucose in serum by glucose oxidase-peroxidase method.
8. Assay of LDH activity in serum
9. Separation of plasma proteins by electrophoresis
10. Estimation of glycosylated hemoglobin
11. Counting white blood cells, red blood cells, platelets

Suggested Readings

1. Laboratory Manual for Practical Biochemistry, 2nd Edition, Ganesh MK, Shivaraja SYM, 2013, JB
2. Textbook of Practical Physiology, 5th Edition, Pal GK, Pal P, 2001, UP

Mapping of COs to syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
CO 1	M	M	M	M	M	M	M	M	M	M	M
CO 2	M	M	M	M	M	M	M	M	M	M	M
CO 3	H	H	H	H	H	H	H	H	H	H	H
CO 4	M	M	M	M	M	M	M	M	M	M	M
CO 5	M	M	M	M	M	M	M	M	M	M	M

***P: Practical**

BCBM6006: BIOENERGETICS LAB

Course outcomes

CO 1: Interpret how cells manufacture energy-ATP generation (Evaluating)
CO 2: Illustrate the mechanism of cellular respiration in yeast, plants and mitochrondria (Understanding)

List of Experiments

1. Numerical solving related to determination of free energy, free energy determination from equilibrium constants and standard reduction potentials
2. Demonstration of cellular respiration in yeast
3. Isolation of chloroplast from plant cells
4. Isolation of mitochondria form mouse liver tissue

Suggested Readings

1. Bioenergetics: A Practical Approach Brown, G. C. and Cooper, C. E. Oxford University Press

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4
CO1	H			
CO2		H	H	H

***P: Practical**

BCDI6007: DISSERTATION PHASE I (0-0-2)

Course Outcomes

CO 1: Develop a scientific mindset with the capacity for analytical and innovative thinking (Creating).
CO 2: Develop writing skill, referencing and citations for effective communication (Applying).
CO 3: Improve communication and creative expression skills to articulate scientific ideas (Creating).
CO 4: Examine the research gap in the related field and formulate strategies to address the same (Analysing).

Syllabus

1. Familiarization with research topic and methodologies by a thorough literature review.
2. Writing of review of literature to brush up already existing knowledge on a given area.
3. Formulate a research hypothesis and a proposed work plan.
4. Presentation of the research topic at department level and submission of literature review.

Suggested Readings

1. Scientific review and research articles published in respective specialized area of research.

Mapping of Course outcomes to Syllabus

Course Outcomes	P1	P2	P3	P4
CO 1	H	H		
CO 2		H	H	
CO 3		H	H	H
CO 4	L	M	L	H

***P: Practical**

BCDI6008: DISSERTATION PHASE II (0-0-16)

Course Outcomes

CO 1: Support the research hypothesis with experiments executed ethically (Evaluating).
CO 2: Develop skill to independently carry out a research in the laboratory (Creating).
CO 3: Examine the methodology, analyse results, and defend the research work (Analysing).

Syllabus

1. Execute a scientific dissertation based on the proposed plan in Phase 1 through bench work.
2. Present and report data at various stages of the research work to the assigned supervisor.
3. Analysing the results, correlating it with different experiment performed during the dissertation.
4. Present the findings in a department level to internal and external examiners, and submission of completed thesis.

Suggested Readings

1. Scientific review and research articles published in respective specialized area of research.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4
CO 1	H	L	M	
CO 2	H	M	H	L
CO 3		H	H	H

***P: Practical**

BCFB6009: FUNDAMENTALS OF BIOCHEMISTRY LAB

Course Outcomes

CO 1: Estimate and prepare buffer solutions for different experiments
CO 2: Quantify various biomolecules at different concentrations for future research experiments
CO 3: Apply the technique based on spectrophotometer for analysis of various biomolecules

List of Experiments

1. Preparation of buffers
2. Determination of pKa and pI of acidic, basic, and neutral amino acids
3. Estimation of amino acids by Ninhydrin method
4. Estimation of DNA by DPA method
5. Estimation of RNA by Orcinol method
6. Estimation of proteins by Bradford method
7. Estimation of proteins by Lowry method
8. Isolation and estimation of lipids from seeds
9. TLC of plant pigments
10. TLC of lipids

Suggested Readings

1. The Protein Protocols Handbook, 3rd Edition, Walker, JH, 2009,HumanaPress
2. Biochemical methods, 2nd Edition, SadasivamandManickam,2004, New Age International(P) Limited Publishers, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
CO 1	H	H	H							
CO 2			H	H	H	H	H	H	H	H
CO 3			H	H	H	H	H			

***P: Practical**

BCAT6010: ANALYTICAL TECHNIQUES LAB

Course Outcome

CO 1: Recall and perform the laboratory analysis in accordance with Good Laboratory Practices, in conditions of hygiene and safety (Remembering)
CO 2: Describe the principles and the theoretical concepts of the instruments (Understanding)
CO 3: Choose an appropriate separation technique for analysis of the samples (Applying)
CO 4: Ability to undergo a comparative analysis of different identification and purification protocols that can best suit a particular experiment (Analysing)
CO 5: To evaluate the spectrophotometric parameter for understanding the nature of the biological sample (Evaluating)
CO 6: Design an analytical work flow to characterize a biological sample (Creating)

List of Experiments

1. Study of UV absorption spectra of biological macromolecules-proteins, nucleic acids
2. Separation of bacterial lipids/amino acids/sugars/organic acids by TLC
3. Separation of bacterial lipids/amino acids/sugars/organic acids by Paper Chromatography
4. Study of nucleic acids using Agarose gel electrophoresis.
5. Study of serum proteins by vertical gel electrophoresis
6. Separation of haemoglobin or blue dextran by gel filtration
7. Quantitative estimation of hydrocarbons/pesticides/organic solvents/methane by gas chromatography
8. Demonstration of PCR and its application

Suggested Readings

1. The Protein Protocols Handbook, Walker,J.H.(Ed.) Humana Press
2. Principles and Techniques of Biochemistry and Molecular Biology Wilson, K. and Walker,J., Cambridge University Press

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8
CO 1	H	H	H	H	H	H	M	M
CO 2	H	H	H	H	H	H	H	H
CO 3		H	H	H	H			
CO 4	M	M	M			H	H	
CO 5	H							
CO 6	H	H	H	H	H	H	H	H

***P: Practical**

BCRT6012: REMEDIAL TEACHING & NET COACHING

BCNM6013: NUTRITIONAL BIOCHEMISTRY & METABOLISM LAB

Course Outcomes

CO 1: To discuss the effect of pH and temperature on enzyme activity (Understanding).
CO 2: To analyze the saponification value (Analysing)
CO 3: To measure the content of vitamins in food sample (Evaluating)
CO 4: To estimate the acidity in milk and evaluate its causes (Evaluating)
CO 5: Design a protocol to study how pH and temperature effects the regulation of enzymes (Creating)

List of Experiments

1. Determination of saponification value of fats/oils
2. Estimation of acidity in milk
3. Estimation of vitamin C from biological sources
4. Effect of pH on amylase activity.
5. Effect of temperature on amylase activity

Suggested Readings

1. Fundamentals of Biochemistry, 5th edition, Voet, D., Voet, J. G., & Pratt, C. W., 2007. John Wiley.
2. Biochemistry, 4th Edition, Zubey, G. L., 1998, WCB London.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1				H	H
CO 2	H				
CO 3			H		
CO 4		H			
CO 5				H	H

BCMB6013: MOLECULAR BIOLOGY LAB

Course Outcomes

CO 1: Define the principles for isolation of DNA from bacteria, plant and animal (Remembering)
CO 2: Demonstrate the knowledge of laboratory practices in molecular biology and conduct independent work in laboratory (Understanding)
CO 3: Apply practical knowledge to perform isolation of genomic and chromosomal DNA from bacteria (Applying)
CO 4: Test for DNA amplification by PCR and observe the amplicons of gel electrophoresis (Analysing)
CO 5: Execute quantitative analysis to interpret clear and concise communication of biological data and evaluate student progress with guided enquires (Evaluating)
CO 6: Design a scientific process, think critically and employ the scientific method in the formal practices of observation and experimentation (Creating)

List of Experiments

1. Isolation of genomic DNA from bacteria/plant/animal
2. Isolation of chromosomal DNA from bacteria.

3. DNA amplification by PCR and visualization of DNA by gel electrophoresis
4. Restriction digestion of DNA

Suggested Reading

1. Molecular Biology Techniques, A Classroom Laboratory Manual, 4th Edition, Carson S, Heath M, Melissa S, Witherow DS, 2019, AP

Mapping of COs to syllabus

Course Outcomes	P1	P2	P3	P4
CO 1	M	M		
CO 2	H	H	H	H
CO 3	H	H		
CO 4			H	H
CO 5			H	
CO 6	M	M		

***P: Practical**

BCFI6014: FUNDAMENTALS OF IMMUNOLOGY LAB

Course Outcomes

CO 1: Visualize the types of cells present in the blood and understand their normal and abnormal percentage as a sign of infection
CO 2: Analyze the basic difference between serum and blood plasma
CO 3: Determine antigen antibody interaction
CO 4: Determine immunodiagnostic application
CO 5: Understand the type and detection of antibodies present in body secretions
CO 6: Understand the principles for isolation of various blood cell types

List of Experiments

1. Microscopic examination of blood cells
2. Isolation of serum and plasma from blood
3. Antibody capture ELISA
4. Antigen capture ELISA
5. Blood grouping through agglutination
6. Antibody IgG purification
7. Detection of secretory IgA from saliva
8. Apoptosis determination using standard kits
9. Separation of peripheral blood mononuclear cells by Ficoll-Hypaque

Mapping of COs to syllabus

Course Outcomes	P 1	P2	P3	P4	P5	P6	P7	P8	P9
CO 1	H								
CO 2		H							
CO 3			H						
CO4				H	H				
CO5						H	H	H	
CO6									H

***P: Practical**

BCRT6015: REMEDIAL TEACHING & NET COACHING

BCSC6017: SCIENTIFIC WRITINGS AND COMMUNICATIONS (0-0-1)

Course Outcomes

CO 1: Assess published data, critically read, interpret, and present it (Analysing)
CO 2: Compare the strengths and weaknesses of publications (Evaluating)
CO 3: Develop skills in interpreting and evaluating scientific data (Creating)
CO 4: Demonstrate ethics in research and related good laboratory practices (Understanding)
CO 5: Relate the relevance of personality for boosting overall confidence (Understanding)

CO 6: Design paper writing based on advanced fields of research (Creating)

Activities-Lecture/Talk by students/Faculty/Outsourcing

1. Introduction to Good Laboratory practices
2. Development of personality skills and refinement of communication skills for scientific presentation and interviews
3. Presentation of research articles/classical papers by 3rd Semester
4. Problem solving and critical thinking session by giving the research problem and allow them to present strategy
5. Scientific communication and its ethics
6. Invited Talk

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P 3	P4	P5	P6
CO1	H	M	M			
CO2	H	M	M			
CO3	H	M	M			
CO4	M	M	M	H		
CO5	M	M	M		H	
CO6	M	M	M			H

PROGRAMME: MASTER OF SCIENCE (MSC) BIOTECHNOLOGY

PROGRAMME OUTCOMES

PO 1: Critical Thinking: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO 2: Knowledge Skill: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge.

PO 3: Scientific Communication Skills: Imbibe effective scientific and/or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.

PO 4: Ethics: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects.

PO 5: Enlightened Citizenship: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.

PO 6: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO 7: Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".

PO 8: Lifelong Learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling.

PO 9: Leadership Qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.

PO 10: Research Skills: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations, problem solving and interpretation.

PROGRAMME SPECIFIC OUTCOMES:

PSO1: Confidence: Demonstrate a comprehensive understanding of chemical and biological structure, principles, techniques, and applications

PSO2: Knowledge based Skill: To develop better understanding and improve skills that would enable them to begin a career in research laboratories, industries as well as to generate self-employability

PSO3: Scientific Social Responsibility: To develop linkages between scientific community and society to build trust, partnership and responsibility of science towards achieving social goals

PSO4: Cell culture handling and transgenic technology: The programme will help in gaining knowledge on *in vitro* culture techniques for plant and animal cells which contributes in the development of transgenic plants and animals.

PSO5: Grasp of industrial and environmental aspects of Biotechnology: The programme will help in the understanding the application and working of pharmaceutical, and fermentation industry for healthcare and food products. It will also emphasise on environment protection and its long-term sustainability

PSO6: Scale-up and connect to advanced and modern concepts: The programme will update students about the most recent developments in the fields of OMICS, genome editing, systems biology, nano-biotechnology and nano-materials to stimulate scaling up to advanced learning.

MAPPING OF COURSES WITH POS/PSOS

Courses	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
Thermodynamics and Enzymology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1	2		
Cell Biology and Genetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1	2	1	1
Fundamentals of Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	1	3	2	1
Analytical Techniques	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	2	3	1	1
Lab I- Fundamentals of Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	1	3	2	1
Lab II- Thermodynamics and Enzymology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2		2		
Lab III- Cell Biology and Genetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	1	3	2	1
Lab IV- Analytical Techniques	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	2	3	1	1
Industrial/ Laboratory visit											2	3		3	2	3
Genetic Engineering	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	2			1
Computer Applications and	**3**	**3**	**2**	**2**												

Bioinformatics					2	3	2	3	3	3	2	3	1	2		3
Basic Microbiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3		3		1		
Molecular Biology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	2	1	1
Fundamentals of Immunology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	3	2	1	1
Lab I- Genetic Engineering	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	2	2		2
Lab II- Computer Applications and Bioinformatics	**3**	**3**	**2**	**2**	2	3	2	3	3	3		3		3		3
Lab III- Basic Microbiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3		3		1		
Lab IV- Molecular Biology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	3	1	1
Lab V- Fundamentals of Immunology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	2	1	1
Waste Management (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	3	3	1	2
Fermentation and Food Micorbiology (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	3	1	3	1
Mushroom Cultivation (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	1	3
Herbal Drug Technology (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	1	3	3	3	1	2
Research Methodology & Biostatistics-common	**3**	**3**	**2**	**2**	2	3	2	3	3	3	1	2	3	3	1	1
Medical Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	3	1
Physiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	1	2	3	1
Lab I-Medical Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	3	1
Lab II-Physiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	1	2	3	1
Nutritional Biochemistry &Metabolism	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	2	3	3	1

Bioenergetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1	3		2
Lab-I-Nutritional Biochemistry &Metabolism	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	2	3	3	1
Lab II-Bioenergetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1			
Dissertation Phase I	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3		
IPR &Entrepreneurship	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	2	2	1	1
Journal Club and scientific communications	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3			3		2
Value Added Course- Clinical Laboratory Techniques	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3			3	
Omics Biology and its Tools	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	2	3
Agriculture Technology (Elective)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	2	2	2
Nanobiology (Elective)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3		2			
Bioresource Management (Elective)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	1	2	2	3	1	1
Dissertation Phase II	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	3	3

BTRM0003: RESEARCH METHODOLOGY AND BIOSTATISTICS (4-0-0)

Course Outcomes

CO 1: Recall and classify the different forms of research – basic, applied, interdisciplinary, etc. Scientific literatures (Remembering)

CO 2: Summarize an understanding of various kinds of research, objectives of doing research, research process, research design and sampling, scientific problems (Understanding)

CO 3: Apply statistical methods of data analysis and interpretation. (Applying)

CO 4: Explain ethical conduct of research and its communication. (Analysing)

CO 5: Recommend adequate knowledge of hypothesis testing procedures, measurement, scaling techniques and quantitative data analysis (Evaluating)

CO 6: Produce a manuscript by conducting research work on original ideas, formulating research synopsis, research report, data analysis and meaningful interpretation of data (Creating)

Module I (15 lectures)

a. Scientific research- Definition, types: basic and applied research, interdisciplinary research, Steps involved in scientific research

b. Scientific literature primary and secondary literature, biological abstract, current content, review, monograph, peer-reviewed journals, e-resources; research and review articles; scientific communication- scientific paper, scientific posters

c. Scientific problems: What is scientific problem? Methods and techniques, research conditions, data types, techniques, repeatability, reproducibility and reliability, validity, effect measure and choice of statistical test, experimental protocol, experimental routine

d. Research design: Meaning, need for research design, features of a good design, Types of research design

Module II (5 lectures)

Brief introduction to ethics, scientific conduct and misconduct-plagiarism, authorship issues, investigation and punishment of scientific misconduct, ethics of animal and human research

Module III (15 lectures)

a. Introduction to Biostatistics: definition and applications of biostatistics;
b. Data-types and presentation: types of biological data, accuracy and significant figures;
c. Population and samples: populations, samples from populations, random sampling, variables and attributes, statistical errors.
d. Frequency distributions
e. Graphical representation of data: line diagram, bar diagram, pie chart, histogram
f. Measures of central tendency: the arithmetic mean, median and mode
g. Measures of dispersion: range, mean deviation, variance, standard deviation, standard error of mean, standard score

Module IV (6 lectures)

a. Permutations and combinations, sets
b. Probability: Introduction, counting possible outcomes, probability of an event, adding and multiplying probabilities
c. Probability distributions: Binomial, Poisson and Normal distribution

Module V (19 lectures)

a. Testing of hypothesis and goodness of fit: Null hypothesis, level of significance, errors of influence, Student's t-test,paired t-test, Fischer's test, Chi-square test, linear correlation and linear regression
b. Analysis of variance: variances of samples and their means, F distribution, partitioning of the total sum of squaresand degrees of freedom, models and types of ANOVA

Suggested Readings

1. Educational Research Planning, conducting and evaluating quantitative and qualitative research, 6th Edition, Creswell JW,2019, PP
2. Research Methodology in the medical and biological sciences, 1st Edition, Laake P, Benestad HB and Olsen BR. 2007,Academic Press, EP.
3. Research Methodology: Methods and technique, 2nd Edition, Kothari CR, 2008, NAIP
4. Research Methodology for Biological sciences. 5th t Edition, 2011, Gurumani N, MJPP
5. Introduction to Biostatistics, 5th Edition, Banerjee PK, 2014, SCCL
6. Biometry: The principles and practices of statistics in biological research, 3rd Edition, Sokal RR and Rohlf FJ, 1995, SFWHF
7. Biostatistical Analysis, 5th Edition, Zar JH, 2010, PPH.
8. Statistical Methods in Biology, 2nd Edition, Bailey NTJ, 1980, HP

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				M
CO 2	H	M			M
CO 3			H	H	M
CO 4	M	H			H
CO 5			H	H	H
CO 6	L		M	M	M

BTGE0005: GENETIC ENGINEERING (3-0-1)

Course Outcomes

1. To understand the properties and function of different enzymes used in genetic engineering (Understanding)
2. To compare the different types of cloning and expression vector used in genetic engineering and its limitations(Analysing)
3. To understand the concepts regarding different hybridization techniques and applications (Understanding)
4. To acquire theoretical knowledge in the techniques, tools, and application of genetic engineering (Remembering)
5. To develop an ability to design and conduct genetic engineering experiments, as well as to analyse and interpret data (Applying)

Module I (10 lectures)

Restriction nucleases: Exo and Endonucleases: History, Restriction endonuclease nomenclature, classification of restriction endonuclease–typeI, typeII, and typeIII, cleavage patterns– sticky ends, blunt ends, applications; Modifying enzymes–ligases, kinases, RNAse, polymerases, phosphatases and methylases, RNA dependent DNA polymerase, Terminal Deoxynucleotidyl transferase

Module II (13 lectures)
Cloning vectors: Plasmids and plasmid vectors, phagemids, cosmids, artificial chromosome vectors, (YAC, BAC), E. Coli plasmid vectors– pBR322, pUC18, pET21, Bacterio-phage vectors–λ and M13, Cosmids, phagemids and Phasmids, Shuttle vectors-Yeast vectors, Baculo virus vector. Intein-based vectors; Inclusion bodies; Plant based vectors, Ti and Ri as vectors, Yeast vectors, Insertion and Replacement vectors, Expression vectors; Strategies for production of foreign proteins in E.coli, Yeast,animalcell,pMal;GST;pET-basedvectors;Proteinpurification;His-tag;GST-tag;MBP-tag

Module III (12 lectures)
Isolation of genomic and plasmid DNA, DNA cloning; Strategies forc onstruction of genomic and cDNA libraries, chromosome walking; screening of ibraries; Oligonucleotide, cDNA and antibody probes; The Southern, Northern, Western, North-Western, Zoo blots, Southwestern, Farwestern blotting and Colony hybridization, yeast-two hybrid system, c-DNA synthesis and cloning: mRNA enrichment, reverse transcription, DNA primers, linkers, adaptors and their chemical synthesis; Cloning interacting genes two-hybrid systems, cloning differentially expressed genes. Site directed mutagenesis and protein engineering

Module IV (10 lectures)
Maxam and Gilbert method and Sanger's method, Next generation sequencing, Applications of genetic engineering: Transgenic animals and plants, production of recombinant pharmaceuticals, gene therapy, disease diagnosis, Transgenic and gene knockout technologies: Vector engineering, strategies of gene delivery, gene replacement/augmentation, gene correction, gene editing, gene regulation and silencing

Suggested Readings
1. Principles of Gene Manipulation and Genomics, 7th Edition, Primrose SB and Twyman R, 2006, Wiley-Blackwell
2. Genomes 4,4th Edition, Brown TA,2017, Garland Science
3. Molecular Cloning: A Laboratory Manual,3rd Edition, Sambrook J and Russell DW, 2001, Cold Spring Harbor Laboratory Press

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H
CO 5	M	M	L	

BTBE0007: BIOPROCESS ENGINEERING (3-0-1)

Course Outcomes
1. Outline the principles of fermentation, design and operation of bioreactors for production of biomass and products (Understanding)
2. Compare strategies of bioprocess development for industrial production of bioproducts and specialized applications (Analysing)
3. Relate fermentation and related bioprocess development in food, industry and environment(Understanding)
4. Estimate the contribution and prospect of bioprocess engineering in commercial biotechnology (Evaluating)

Module I (8 lectures)
Introduction to bioprocess engineering; Isolation, preservation and maintenance of industrial microorganisms, strain improvement strategies media formulation for industrial fermentation, air and media sterilization; kinetics of microbial growth, Fermenter/bioreactor- types and classes, Designing of a fermenter/Bioreactor.

Module II (10 lectures)
Kinetics of operation of bioreactors -batch, fed batch and continuous bioreactor; Measurement and control of bioprocess parameters in a bioreactor – heat and mass transfer, aeration and agitation, scale up ans scale down; Biotransformation, Mixed microbial cultures, immobilized cells, Specialized bioreactors (pulsed, fluidized, photo bioreactors); Advanced and non-conventional bioprocesses (animal and plant cell culture, genetic engineering, tissue engineering)

Module III (12 lectures)
Downstream processing: Product recovery and purification, removal of microbial cells and solid matters, precipitation, filtration, centrifugation, cell disruption, extraction and purification-, chromatography, drying and crystallization, ; Industrial production of chemicals using biological aid: alcohols, acids (citric, acetic and gluconic), solvents (glycerol, acetone, butanol), antibiotics (penicillin, streptomycin, tetracycline) amino acids (lysine, glutamic acid), biotransformation of steroids and non-steroid compounds.

Module IV (15 lectures)

Food: Bakery and dairy products, wine, beer and other alcoholic beverages and formulated bio-products, Conventional and molecular breeding of plants for food production; Mushroom production; Single cell proteins; Probiotics; Food spoilage and preservation process

Environment: Techniques of bioremediation of industrial and medical effluent disposal; Phyto- remediation and myco-remediation; Bioremediation of heavy metals, oil spills, dyes and plastics.

Suggested Readings

1. Principles of Fermentation Technology. 2ns Edition, Stanbury PF, Whitaker A, Hall SJ., 1995, Butterwoth Heinemann.
2. Bioprocess Engineering: Basic Concepts. 2nd Edition, Shuler, ML and Kargi, F., 2002, Prentice Hall, PTR.
3. Industrial Microbiology, 1st Edition, Casida LE., 2007, John Wiley and Sons.
4. Microbial Biotechnology, 2nd Edition, Glazer AN and Nikaldo H., 2007, WH Freeman & Co.
5. Prescott and Dunn's Industrial Microbiology. 4th Edition, Reed, G., 2004, CBS Publishers, New Delhi

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	M	
CO 2	M	H	H	
CO 3	M	M	H	H
CO 4	H	H	H	H

BTTE0009: THERMODYNAMICS AND ENZYMOLOGY (3-0-1)

Course Outcomes

1. To relate the entropy to law of thermodynamics and Free energy and its relation to chemical equilibria (Evaluating)
2. To understand the fundamentals of enzyme structure, properties and function (Understanding)
3. To compare the different types of methods for protein purification (Analysing)
5. To understand the rate of reactions and order of reactions, and inhibitions and their kinetics (Understanding)
6. To describe the structure, functions and the mechanism of different enzymes (Evaluating)
7. To understand the application of enzymes (Understanding)

Module I (5 lectures)

Laws of thermodynamics, reversible and irreversible processes, entropy, enthalpy, internal energy, free energy and equilibrium constant, Gibbs free energy equation, determination of free energy change of under standard and non-standard conditions, high energy compounds, coupled reactions, determination of feasibility of reactions.

Module II (5 lectures)

Classification, nomenclature and general properties like effects of pH, substrate and temperature on enzyme catalyzed reactions. Isolation and purification of enzymes, Salting out of protiens, Isoelectric point, Electrophoresis of protein.

Module III (7 lectures)

Kinetics of enzyme catalyzed reaction: Single substrate reactions, bi-substrate reactions, concept of Michaelis-Menten, Determination and significance of kinetic constants, Limitations of Michaelis-Menten Kinetics, Briggs Haldane relationship

Module IV (10 lectures)

Activation energy and Arrhenius concept, Binding energy, Enzyme catalysis: enzyme specificity and the concept of active site, determination of active site. Stereospecificity of enzymes, Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, concerted acid – base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis. Theories on mechanism of catalysis, Inhibition of enzyme activity: Competitive-cite: succinate on Malonate dehydrogenase a s e x a m p l e , n o n - c o m p e t i t i v e -cite: lodoacetamide on triose phosphate dehydrogenase and EDTA as example: Suicide inactivation-action of penicillin on bacterial cell wall biosynthesis as an example.

Module V (9 lectures)

Mechanism of enzymes action: mechanism of action of lysozyme, chymotrypsin, carboxypeptidase and DNA polymerase. Multienzymes system, Mechanism of action and regulation of pyruvate dehydrogenase and fatty acid synthetase complex. Coenzyme action.

Module VI (9 lectures)

Enzyme regulation: Allosteric enzymes, Feedback Regulation, Sigmoidal kinetics and their physiological significance, Symmetric and sequential modes for action of Allosteric enzymes. Reversible and irreversible covalent modification of enzymes, cascade systems, Immobilised enzymes and their industrial applications, Ribozyme (catalytic RNA) and Abzyme (use of antibody as enzyme) - definition only.

Suggested Readings

1. Lehninger Principles of Biochemistry, 6th Edition, Nelson DL and Cox MM,2013, W. H. Freeman
2. Physical Chemistry, Rakshit P C,2014, Sarat Book House
3. Biochemistry (Biochemistry (Berg)), 6th Edition, Berg JM,Tymoczko JL and Stryer L ,2006, W. H. Freeman
4. Fundamentals of Biochemistry: Life at the Molecular Level,4th Edition, Voet D,2012, John Wiley & Sons Inc
5. Textbook of Biochemistry with Clinical Correlations, 7th Edition, Devlin TM,2010, Wiley-Liss

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2	M	H				
CO 3		H				
CO 4			H	H		
CO 5					H	H
CO6						M

BTCA0010: COMPUTER APPLICATIONS AND BIOINFORMATICS (3-0-2)

Course Outcomes

1. To recall the basics of operation of computer and its related softwares, languages (Remembering)
2. To utilize concepts of C- programming language for preparing application based programs.(Applying)
3. To demonstrate the working principle of the World Wide Web and the internet protocols involved (Understanding)
4. To inspect the role of the biological resources in sequence alignment, methods of gene prediction, phylo-genetic tree construction and other tools (analysing)
5. To perceive the importance of methodologies involved in protein structure prediction, structure analysis tools and drug designing (evaluating)

Module I (10 lectures)

Basic computer organization, Processor and memory, secondary storage devices, Input-Output devices, Computer software, Computer language; Basic Ideas in Programming in C: Variables, data types, Constants, Keywords, Input/output, Control Statements, Functions, Structures; Operating system–Basic commands in Linux.

Module II (5 lectures)

Introduction to Spreadsheet, presentation software, document and word processing. WorldWideWeb, Client-server organization; Internet Protocols-FTP, HTTP, Telnet; Search engines- search concepts

Module III (12 lectures)

Concept of databases: Biological Databases-Primary, secondary, composite databases; Databases for Literature, Sequence and structure; Searching and their retrieval. DNA and Protein sequence alignments- Pairwise alignment, dot plot, global and local alignment algorithms-Needleman and Wunsch algorithm, Smith-Waterman algorithm; Multiple sequence alignment – progressivealignment and alterative alignment algorithms; PAM and Blosum scoring matrices; Multiple sequence alignment-based database searching– PSI-Blast

Module IV (9 lectures)

Gene prediction approaches in prokaryotic and eukaryotic genomes, Methods of gene prediction, Introduction to gene prediction tools, Regulatory sequence analysis, Oligo design and analysis tool. Bioinformatics for phylogenetic analysis. Character based and distance based phylogenetics tree, interpretation of phylogenetic tree, Construction of phylogenetic tree from distance matrix Human genome project; concept of microarray and principles of microarray data analysis

Module V (9 lectures)

Structural biology and Protein structure prediction, Methods of protein structure prediction: Homology modeling, Threading and Ab initio methods, Molecular visualization tools- Rasmol, Pymol and Swiss pdb viewer. Structure analysis tools -VAST and DALI. Stages of Drug development , Definition of drug, target and its properties Steps in Drug Designing, Lead identification, Types of drug designing, ADME along with concept of Lipinski rule of five and drug likeliness, Molecular docking, QSAR

Suggested Readings

1. Bioinformatics: Sequence and Genome analysis, Mount D, Cold Spring Harbor Laboratory Press.
2. Essential Bioinformatics. Xiong J, Cambridge University Press
3. Introduction to Bioinformatics, Attwood TK and Parry-Smith DJ, Pearson Education
4. C- Programming made easy. Rajaram R. Universities Press.
5. Bioinformatics Principles and Applications, Ghosh Z and Mallick B. Oxford University Press
6. Bioinformatics-Students Companion. Kalbulla Syed Abrahin, Guruswami Gurusubrmanian, Zothansanga, Ravi Prakash

Yadav, Nachimuthu Senthil Kumar, Shunmugiah karutha Pandian, Probodh Borah, Surendra Mohan, Springer

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2	H	M			
CO3	M	H			
CO4			H	H	M
CO5			M	M	H

BTPB0011: PLANT BIOTECHNOLOGY (3-0-2)

Course Outcome

1. To inspect the relevance of plant tissue culture and their application in *in vitro* propagation of indigenous as well genetically manipulated plants (Analysing)
2. To perceive the techniques of gene transfer by biological and non- biological methods in developing transgenic plants (Evaluating)
3. To examine the role of transgenic plants in developing plants carrying desirable traits and its related advanced techniques (Analysing)

Module I (15 lectures)

Definition, brief history, principle and significance of tissue culture; Cellular totipotency: Cytodifferentiation: Organogenic Differentiation: induction, factors affecting shoot bud differentiation; Cell suspension Culture, Callus Culture, Embryo Culture, Haploid Culture: microspore and macrospore culture. Triploid culture: Endosperm Culture, Protoplast: isolation, Culture and Fusion; Somatic hybridization and cybridization; Somatic Embryogenesis and Synthetic Seed Production; Androgenesis and its applications in genetics and plant breeding; Germplasm conservation and c ryopreservation.

Module II (15 lectures)

Introduction to transgenic plants, methods of gene transfer – Agrobacterium tumefaciens mediated, Agrobacterium rhizogenes mediated; Direct gene transfer methods – Chemical, Physical and alternative methods. Selectable markers, reporter gene and promoter in plant vectors

Module III (15 lectures)

Transgenic plants, characterization of transgenics; chloroplast transformation; marker-free methodologies; advanced methodologies- cisgenesis, intragenesis and genome editing .Strategies for Introducing genes of biotic and abiotic stress resistance in plants (Herbicide resistance; drought, Salinity, thermal stress, flooding and submergence tolerance, insect resistance, virus resistance) longer shelf life (including strategies for suppression of endogenous genes), male sterility, enhanced nutrition (golden rice), edible vaccines molecular pharming - concept of plants as biofactories, production for industrial enzymes and pharmaceutically important compounds.

Suggested Readings

1. Plant tissue and Organ culture fundamental methods. Gamburg OL, Philips GC., Narosa publications
2. Text book of BiotechnologySingh BD., Kalyani publishers

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III
CO I	H		
CO 2		H	M
CO 3	M	M	H

BTAB0012: ANIMAL BIOTECHNOLOGY (3-0-1)

Course Outcomes

1. Have a basic understanding on different types of media composition, different cell culture and its characteristics (Understanding)
2. Applications of various techniques involved in improvement of animal (Applying)
3. Application of Genetic engineering methods for production of important compounds and treating diseases (Applying)

Module I (10 lectures)

General considerations of cell culture: Aseptic condition, Media, Balanced salt solution, Carbon dioxide incubator, feeder layer,

serum, growth factors; Types of culture media (defined and undefined media), culture media composition; role of different media. Types of cell culture –organ, Organotypic, single cell, Histotypic/3D, primary cells, cell lines, adherent, suspension cell cultures, stem cell culture, embryonic stem cell culture; Characteristics of cells in culture; measurement of cell viability, apoptosis, senescence; Scaling up of animal cell culture.

Module II (8 lectures)
Embryology: Collection and preservation of embryos; culturing of embryos; micromanipulation technology and fertilization in animals; Equipment used in micromanipulation; Sperm sorting; Enrichment of semen for x (female) or y (male) sperm; Biotechnology Techniques in Animal Breeding: Artificial Insemination, In Vitro Fertilization and embryo transfer.

Module III (12 lectures)
Transgenic animal: methods of production and application; transgenic animals as models for human diseases; transgenic animals in livestock improvement; industry, biomedicine chimera mice production; Gene knockouts, production of human antibodies in animals; gene therapy for animal diseases; Animal cloning and ethical issues.

Suggested Readings

1. Animal Biotechnology, 2nd Edition, Ranga MM,2018, Agrobios India Limited
2. Culture of Animal Cells: A Manual of Basic Technique, 5th Edition, Freshney IR, 2005, Wiley
3. Plant tissue and Organ culture fundamental methods, Gamburg OL, Philips GC, 2005, Narosa publications
4. Text book of Biotechnology,5th Edition, Singh BD, 2016, Kalyani publishers

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	M
CO 3			H

BTFF0013: FERMENTATION AND FOOD MICROBIOLOGY (1-0-0)

Course Outcomes

1. Demonstrate the understanding of the principles of fermentation and food microbiology in skill development (Understanding)
2. Construct experimental platforms with fermentation systems to learn the making of commercial food products (Applying)
3. Analyze experimental data interpret results to arrive at credible conclusions (Analysing)

Module I (2 lectures)
Production of wine from fruit juice (Monitoring of sugar reduction during wine production; Estimation of alcohol concentration in wine)

Module II (2 lectures)
Production of traditional rice beer of ethnic communities of NE region (microbial isolation; growth monitoring, alcohol concentration)

Module III (1 lecture)
Estimation of vicinal diketone in beer

Module IV (1 lecture)
Microbial production of curd (assay milk quality by MBRT test; Isolation and identification of *Lactobacillus* from fermented dairy products; lactic acid estimation

Module V (2 lectures)
Making of bread and other bakery products by fermentation

Module VI (1 lecture)
Pickled products: Making of traditional pickles of India (NE region); production of Sauerkraut; fermented fish and other products

Module VII (2 lectures)
Fermentation in flavour and fragrance (tea processing; essential oil)

Module VIII (2 lectures)
Microbial enzyme production *via* liquid and solid-state fermentation

Module IX (1 lecture)
Sterility testing in food products (microbial examination of food)

Suggested Readings

1. Principles of Fermentation Technology. 2nd Edition, Stanbury PF, Whitaker A, Hall SJ. 1995, Butterwoth Heinemann
2. Industrial Microbiology, 1st Edition, Casida LE., 2007, John Wiley and Sons.
3. Prescott and Dunn's Industrial Microbiology. 4th Edition, Reed, G. 2004, CBS Publishers, New Delhi

Mapping of COs to Syllabus

Course outcomes	Module1	Module2	Module3	Module4	Module5	Module6	Module7	Module VIII	Module9
CO 1	H	H	H	H	H	H	H	H	H
CO 2	H	H		H	H	H	H		H
CO 3	H	H	H	H	H	H	H	H	H

BTIE0014: IPR AND ENTREPRENEURSHIP (1-0-0)

Course Outcomes

1. Interpret different IPR, laws governing IPR and their management in biosciences (Understanding)
2. Relate the fundamentals of business and entrepreneurship to biosciences (Understanding)
3. Apply the understanding of IPR and entrepreneurship in innovation management and start-up (Applying)

Module I (9 lectures)

Concept of Intellectual Property; Introduction to intellectual property rights and its types: patents, trademarks, copyright and related rights, industrial design, geographical indications, Protection of new varieties of plants and plant breeder's rights; World Intellectual Property Organization (WIPO) and its role, PCT; Indian Patent Act 1970 R u l e s and amendments thereof; Drafting and filing patent applications; management and practical use of IP rights, including licensing, enforcement and ethics.

Module II (6 lectures)

Entrepreneurship essentials: opportunities, ideas and Innovation; feasibility and market research; business plan; Building a business: business models, teams, pitching and investment, finance; Start-up ecosystem; Technology and bio-entrepreneurship – case studies.

Suggested Readings

1. Biotechnology and Intellectual Property Rights: Legal and Social Implications, 1st Edition, Singh, KK., 2015, Springer, India.
2. IPR, Biosafety and Bioethics, 1st Edition, Goel D, Parashar S, 2013, Pearson Publishers.
3. Fundamentals of Entrepreneurship. 3rd Edition, Nandan H, 2007, Phi Learning, New Delhi,.
4. Entrepreneurship and Small Business Management, 2nd Edition, Mariotti S and Glackin C, 2016, Pearson Publishers.

Mapping of COs to Syllabus

Course outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3	M	M

BTPE0015: PHARMACEUTICAL & ENVIRONMENTAL BIOTECHNOLOGY (3-0-0)

Course Outcomes

1. Choose suitable methods to distinguish the sources, types and composition of waste with methods of handling and sampling strategies (Remembering)
2. Demonstrate the concepts of environment, regulation of population and associated factors (Understanding)
3. Explain the basic concepts of pharmacology used in drug formulation (Understanding)
4. Inspect the working structure of pharmaceutical industries and role of regulatory bodies (Analysing)
5. Plan the management of the environmental pollution load with respect to its physical properties and associated critical considerations in view of emerging technologies (Applying)
6. Appraise the various steps involved in clinical trials and various approaches for toxicity studies (Evaluating)
7. Interpret and infer the relationships among the different constituents of the environment (Analysing)

Module I (9 lectures)

Pharmacology – history, nature and source of drug, classification of drugs, Dosage forms, Routes of drug administration, site of action of drug, Factors modifying drug action. Concept of Pharmacodynamics, Mechanism of action of drug, drug Interaction, adverse drug reaction, Pharmacogenetics, Principles of pharmacokinetic, models of pharmacokinetics, Transmembrane transport of drug, Drug absorption pathway, Bio-availability of drug, Drug metabolizing enzyme, Excretion of drug. Biological half-life of the drug, Bioassay and therapeutic drug monitoring

Module II (7 lectures)
Hit to lead optimization by Preclinal studies and clinical trials, Approaches to screen lead molecules, source of lead molecules, Clinical trials- Ethical considerations, regulatory requirements of clinical trials and phases of clinical trials. Preclinical Toxicology- Acute, subacute and chronic toxicity, Anima tests, prodrug, Formulation and drug delivery systems.

Module III (7 lectures)
Regulatory Authorities and regulatory application- Overview, policies and Procedure. Role of various regulatory organization- USFDA, WHO, CSDA. ICMR guidelines for drug discovery. Drug and Cosmetic Act, India.Good manufacturing Practices, Structure of Pharmaceutical Industry, Manufacturing small molecule APIs and large molecule APIs, Pharmacogenomics -the scope of personalized medicine

Module IV (10 lectures)
Basic concepts of environment viz. atmosphere, hydrosphere, lithosphere; biotic environment; biotic and abiotic interactions; energy flow and nutrient cycling (C,N,P); Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement; Population-environment relationship modules *viz*. Characteristics of a population; Survivorship graph curves; population dynamics; population density curves; population regulation strategies (r and K selection); meta population; age structured population.

Module V Environmental monitoring and pollution treatment (12 lectures)
Pollution types and monitoring approaches: Environmental pollution; sources (air, water, soil); pollutants and its types; standard criteria of pollution monitoring; biotechnological approaches of environmental monitoring viz. plant based, animal based, cell biology based, molecular biology-based approaches; pollution management.
Pollution treatment methodologies: sewage/waste water treatment; primary, secondary and tertiary methods of treatment; sources and characteristics of solid waste; Solid waste stabilization (aerobic and anaerobic treatment); Bioremediation strategies (in-situ and ex situ bioremediation); role of microorganisms in bioremediation; Significance of genetic engineering in degradation of toxic compounds

Suggested Readings

1. Microbial Ecology, 2nd edition, Campbell, R., 1983, Blackwell.
2. Microorganisms Function, Form and Environment, 2nd Edition, Hawker, L. E. and Linton, A. H., 1989, Edward Arnold.
3. Environmental Microbiology, 2nd edition, Mitchell, R., 1992, John Wiley & Sons.
4. Rang & Dale's Pharmacology 9th Edition James Ritter Rod Flower Graeme Henderson Yoon Kong Loke David MacEwan Humphrey Rang. Elsevier Publishing, 2019
5. Essentials of Medical Pharmacology, 8th Edition, KD Triparthi. Jaypee Brothers Medical Publisher
6. Biotechnology and Biopharmaceuticals: Transforming Proteins and Genes into Drugs. 2nd Edition, Rodney J Y Ho., Wiley Publishers, 2013

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV	Module V
CO1				H	M
CO2				H	H
CO3	H	M	M		
CO4	M	M	H		
CO5				M	H
CO6		H	L		
CO7				H	H

BTTB0016: TRENDS IN BIOTECHNOLOGY (4-0-0)

Course Outcomes
1. Recall the fundamentals of biotechnology, biochemistry, molecular biology to better comprehend the recent topics in biotechnology (Remembering)
2. Relate with developments in Omic, particularly Genomics, Transcriptomics, Proteomics, Metabolomics and other emerging fields of study (Understanding)
3. Assess the global and Indian scenario of innovation and commercial biotechnology and their impact on human life and environment (Evaluating)
4. Examine the new and emerging frontiers in biotechnology at an interdisciplinary level (Analysing)

Module I (30 lectures)
Genomics: Genome sequencing, History of sequencing, Next Generation Sequencing (NGS), whole genome sequencing, model organisms, genome projects, microarrays; epigenomics, pharmacogenomics, comparative genomics, metagenomics, and their

applications
Transcriptomics ESTs, SAGE, NGS(RNASeq); metatranscriptomics, alternative splicing, non- coding RNA
Proteomics: 2D PAGE, X-ray crystallography, Mass spectrometry including MALDI-TOF, protein microarrays, recent developments in secretomics, interactomics; applications of proteomics in drug discovery
Metabolomics: Metabolome diversity; Metabolite profiling; High throughput analytical techniques for metabolome analysis (GC-MS, LC-MS, NMR), applications
Other emerging Omics – Lipidpomics, Glycomics, Phenomics, etc.
Bioinformatics and statistical analysis in Omics (PCA, HCA, PLSDA, Heatmap and other tools of analysis and data representation)

Module II (10 lectures)
Genome editing, synthetic biology, molecular evolution, nanobiotechnology and advanced biomaterials, structural and computational biology, gene ontology, systems biology

Module III (10 lectures)
Global and Indian biotech sector, Segments of biotech market, Bioprospecting in biotechnology, ethical concerns; Commercial production of industrial bio-molecules; bio-products from both natural and synthetic source and their commercialization, vaccines and therapeutics, diagnostics; commercial plant tissue culture including automation, strategies for environment cleanup and their commercialization.

Module IV (10 lectures)
New colors of biotechnology: Blue (aquatic and marine life); Yellow (food and nutrition), White (gene-based bio-industry) Gold (bioinformatics and nanobiotechnology), Brown (extreme environments), Violet (bioethics and laws) Purple (Inventions and IPR), Dark (bio-terrorism, bio-weapons)

Suggested Readings
1. Principles of Gene Manipulation and Genomics, 7th Edition, Primrose, S.B. and Twyman, R., 2006, Wiley – Blackwell Publishers.
2. Genome, Trascriptome and Proteome Analysis. 1st Edition, 2001, Bernot, A., John Wiley & Sons Ltd.
3. Omics: Biomedical Perspectives and Applications. 1st Edition, Barh, D, Blum, K and Madigan, MA, 2012, Taylor & Francis Group.
4. Industrial Biotechnology: Products and Processes, 1st Edition, Wittman, C and Liao, JC, 2016, Wiley Publishers

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	H	M		
CO 3	M		H	
CO 4		H		H

BTAT0017: AGRICULTURE TECHNOLOGY (2-0-0)

Course Outcomes
1. Relate with agriculture as a multidisciplinary field of scientific study (Understanding)
2. Analyze the concepts of farming and agricultural technology and their impact on agriculture. (Analysing)
3. Apply principles of agriculture in farm and agribusiness management (Applying)

Module I (9 lectures)
Scope of agriculture and agro-economy of India, History of Indian agriculture, Green Revolution, Food security, Agencies involved in agricultural development (India and Global)
Introduction to disciplines of agricultural sciences: Agronomy, Horticulture, Plant Breeding and Genetics, Agricultural Biotechnology, Biochemistry and Microbiology, Physiology, Plant Pathology, Entomology, Soil Science, Water technology, Agricultural extension, Agricultural engineering, Agricultural economics and statistics, Meteorology, Seed technology, Plantation crops, Animal husbandry and Fishery

Module II (14 lectures)
Nature of soil, Soil chemistry, biology and biochemistry, Soil fertility and nutrient management, Soil analysis techniques, bio-fertiliser, organic farming, soil conservation
Principles of irrigation and water management, Water analysis techniques, Water stress, Dryland agriculture and watershed management; Flood stress, Salinity stress
Nutrition, Food testing, Crop varietal improvement, Crop breeding techniques, Seed technology, Crop production and protection techniques including biotech, post-harvest management, Farm machinery and equipment; Innovation in agriculture

Module III (7 lectures)

Farm management principles, integrated farming systems, agricultural market, agro-based industry, agribusiness and local farm economy, Government schemes, Credit, Crop insurance, Soil health cards.

Suggested Readings

1. Handbook of Agriculture, 6th Edition, ICAR, 2016, Indian Council of Agriculture and Research, New Delhi.
2. Fundamentals of Agriculture, 1st Edition, Singh KP, 2014, Kalyani Publishers, New Delhi.
3. Agricultural Microbiology, 2nd Edition, Rangaswami, G., Bagyaraj, D.J. 2005, Prentice Hall India Learning Private Limited, NewDelhi.
4. Textbook of Agricultural Biotechnology, 1st Edition, Nag, A., 2008, Prentice Hall India Learning Private Limited, New Delhi.

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	
CO 3		M	H

LABORATORY COURSES

BTAP6003: ANIMAL BIOTECHNOLOGY LAB

Course Outcomes

1. To understand the principle of the techniques (Understanding)
2. To prepare culture media and cell cultures (Analysis)
3. Analysis of the data (Analysis)
4. To develop research aptitude (Applying)
5. To develop writing skill (Applying)
6. To develop technical skills (Applying)

List of Experiments

1. Isolation of lymphocytes
2. Cell viability by using tryphan blue.
3. Isolation of genomic DNA from animal cells
4. Preparation of animal cell culture media and Filter sterilization
5. Preparation of single cell suspension from spleen/liver/thymus
6. Quantitation of animals cells using hemocytometer

Suggested Readings

1. John R W Masters Animal Cell Culture: A Practical Approach, Fifth Ediction
2. Hirenkumar Sherathiya (Author), 2012, Practical manual for Plant Tissue Culture, Munich, GRIN Verlag,

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6
CO 1	H	H	H	H	H	H
CO 2				H		
CO 3	L	H	M			H
CO 4	L	L	L	L	L	L
CO 5	L	L	L	L	L	L
CO 6	H	M	H	H	H	H

***P: Practical**

BTGE6004: GENETIC ENGINEERING LAB

Course Outcomes

1. To understand the different types of techniques used in genetic engineering experiments(Understanding)
2. To develop technical skills (Applying)
3. To interpret experimental datas (Evaluating)
4. To develop research aptitude (Applying)
5. To develop writing skill (Applying)

List of Experiments

1. Transformation
2. Cloning in plasmid/ Phagemid vectors
3. Gene expression in *E. coli* and analysis of gene product
4. Silver staining of gels (protein)
5. RFLP (Restriction fragment length polymorphisms)
6. RAPD (Random Amplification of Polymorphic DNA)

Suggested Readings

Molecular Cloning: A Laboratory Manual,3rd Edition, Sambrook J and Russell DW, 2001, Cold Spring Harbor LaboratoryPress

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6
CO 1	H	H	H	H	H	H
CO 2	H	H	H	H	H	H
CO 3	M	M	H	M	H	H
CO 4	M	M	M	M	M	M

CO 5	L	L	L	L	L	L

***P: Practical**

BTBE6006: BIOPROCESS ENGINEERING LAB

Course Outcomes

1. Recall the theoretical topics in bioprocess engineering (Remembering)
2. Experiment with fermentation systems for estimation of biomass and product formation (Applying)
3. Analysing data from the scientific experiments and interpret results (Analysing)

Syllabus

1. Parts and design of fermenter
2. Media for Industrial Fermentation
3. Isolation, preservation and maintenance of industrial microorganisms
4. Solid state fermentation
5. Submerged fermentation
6. Production and estimation of protease
7. Production and estimation of amylase
8. Growth kinetics for batch culture
9. Production and quantification of alcohol using yeast
10. Lactic acid fermentation process

Suggested Readings

1. Principles of Fermentation Technology. 2ns Edition, Stanbury PF, Whitaker A, Hall SJ., 1995, Butterwoth Heinemann.
2. Bioprocess Engineering: Basic Concepts. 2nd Edition, Shuler, ML and Kargi, F., 2002, Prentice Hall, PTR.
3. Industrial Microbiology, 1st Edition, Casida LE., 2007, John Wiley and Sons.
4. Microbial Biotechnology, 2nd Edition, Glazer AN and Nikaldo H., 2007, WH Freeman & Co.
5. Prescott and Dunn's Industrial Microbiology. 4th Edition, Reed, G., 2004, CBS Publishers, New Delhi

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
CO 1	H	H	H	H	H	H	H	H	H	H
CO 2			H	H	H	H	H	H	H	H
CO 3				M	M	H	H	H	H	H

***P: Practical**

BTDI6007: DISSERTATION PHASE I (0-0-2)

Course Outcomes

1. Develop a scientific mindset with the capacity for analytical and innovative thinking (Creating).
2. Develop writing skill, referencing and citations for effective communication (Applying).
3. Improve communication and creative expression skills to articulate scientific ideas (Creating).
4. Examine the research gap in the related field and formulate strategies to address the same (Analysing).

Syllabus

1. Familiarization with research topic and methodologies by a thorough literature review.
2. Writing of review of literature to brush up already existing knowledge on a given area.
3. Formulate a research hypothesis and a proposed workplan.
4. Presentation of the research topic at department level and submission of literature review.

Suggested Readings

Scientific review and research articles published in respective specialized area of research.

Mapping of Course outcomes to Syllabus

Course outcomes	P1	P2	P3	P4
CO 1	H	H		
CO 2		H	H	
CO 3		H	H	H
CO 4	L	M	L	H

***P: Practical**

BTDI6008: DISSERTATION PHASE II (0-0-16)

Course Outcomes

1. Support the research hypothesis with experiments executed ethically (Evaluating).
2. Develop skill to independently carry out a research in the laboratory (Creating).
3. Examine the methodology, analyse results, and defend the research work (Analysing).

Syllabus

1. Execute a scientific dissertation based on the proposed plan in Phase 1 through bench work.
2. Present and report data at various stages of the research work to the assigned supervisor.
3. Analysing the results, correlating it with different experiment performed during the dissertation.
4. Present the findings in a department level to internal and external examiners, and submission of completed thesis.

Suggested Readings

Scientific review and research articles published in respective specialized area of research.

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4
CO 1	H	L	M	
CO 2	H	M	H	L
CO 3		H	H	H

***P: Practical**

BTTE6009: THERMODYNAMICS AND ENZYMOLOGY LAB

Course Outcomes

1. To understand the principle of the experiments on enzyme activity (Understanding)
2. To conduct an experiment on enzyme activity (Applying)
3. To analyse the effect of different physicochemical condition on enzyme activity (Analysing)
4. To interpret experimental datas (Evaluating)
5. To develop research aptitude (Applying)
6. To develop writing skill (Applying)

Syllabus

1. Effect of pH on amylase enzyme activity
2. Effect of temperature on amylase enzyme activity
3. Determination of Km and V_{max} of salivary amylase enzyme
4. Assessment of inhibitor on enzyme activity.
5. Assessment of activatoron enzyme activity.

Suggested Readings

1. Introductory Practical Biochemistry, Sawhney SK and Singh R, 2001, Narosa Publishing
2. An Introduction to Practical Biochemistry,3rd Edition, Plummer D, 2017, McGraw Hill Education

Mapping of COs to Syllabus

Course outcomes	P 1	P 2	P 3	P 4	P 5
CO 1	H	H	H	H	H
CO 2	H	H	H	H	H
CO 3	H	H	H	M	M
CO 4	H	H	H	H	H
CO 5	M	M	M	M	M
CO 6	L	L	L	L	L

***P: Practical**

BTCA6010: COMPUTER APPLICATIONS AND BIOINFORMATICS LAB

Course Outcomes

1. To construct various application program by using the concepts of C programming (Applying)
2. To demonstrate the usage of basic commands for operation in LINUX systems (Understanding)
3. To execute sequence alignment, primer designing, gene prediction phylogenetic tree construction by utilizing thevarious

biological database and tools (Evaluating)

4. To build the 3D protein structures by homology modeling methods, visualize it to subject to molecular docking experiments (Creating)

Syllabus

1. Programs of C language
2. Introduction to basic commands used in LINUX operating systems
3. Introduction to various databases available, their usage in sequence searching, retrieval available in databases
4. Sequence alignment
5. Introduction to Gene prediction tools
6. Primer designing and analysis
7. Phylogenetic Analysis based on sequence alignment data and RAPD/ protein profile data
8. Visualization of structures of protein, ligands in databases and their molecular docking
9. Homology modeling

Suggested Readings

Bioinformatics. A Practical Approach. Shui Qing Ye, Chapman and Hall/CRC

Mapping of COs to Syllabus

Course outcomes	P1	P2	P 3	P 4	P5	P 6	P 7	P 8	P 9
CO1	H								
CO2		H							
CO3			M	H	H	H	H		
CO4			M					H	H

***P: Practical**

BTIV6011: INDUSTRIAL/LABORATORY VISIT

BTBP6011: PLANT BIOTECHNOLOGY LAB

Course Outcome

1. To design the composition of plant media and solution (Creating)
2. To develop various techniques of plant tissue culture. (Applying)
3. To determine the application of the various techniques used in plant tissue culture (Analysing)

Syllabus

1. Preparation of Plant tissue culture media and Stock solutions
2. Callus induction, Shoot/ Root induction – organogenesis
3. Cell suspension culture
4. Haploid production – Anther and ovule culture
5. Artificial seed production
6. Protoplast fusion by PEG

Suggested Readings

Hiren Kumar Sherathiya Practical manual for Plant Tissue Culture, Munich, GRIN Verlag.

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6
CO 1	H	M	M	M	M	M
CO 2	M	H	H	H		
CO 3					H	H

***P: Practical**

BTPE6012: PHARMACEUTICAL & ENVIRONMENTAL BIOTECHNOLOGY LAB

Course Outcomes

1. Experiment with handling animals and the routes of injections (Applying).
2. Determine the techniques of evaluation of sterility of pharmaceutical products(Evaluating)
3. Design experiments for testing cyto-toxicity of pharmaceutical products (Creating)
4. Test for the physical properties of wastewater and solid waste (Analysing)
5. Design protocol to estimate the level of pollution in water and solid (Creating)

6. Determine an appropriate method for waste management (Evaluating).

Syllabus

- Demonstration of method of injecting drugs by various routes.
- Sterility testing methods for pharmaceutical products
- Assessment of cyto-toxicity of drug by mitotic index
- Assay of vitaminB_{12} in commercially available capsules/tablets.
- Determination of pH and conductivity of wastewater.
- Determination of pH and conductivity of solid waste.
- Determination of BOD of wastewater samples.
- Determination of COD of wastewater samples.

Suggested Readings

1. Chandrakant Kokare. Pharmaceutical Biotechnology Experiments and Techniques, Nirali Prakashan, Fifth Edition
2. Microorganisms Function, Form and Environment, 2nd Edition, Hawker, L. E. and Linton, A. H., 1989, Edward Arnold.
3. Environmental Microbiology, 2nd edition, Mitchell, R., 1992, John Wiley & Sons.

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6	P7	P8
CO1	H							
CO2		H	M					
CO3		M	H	M				
CO4					H	H		
CO5							H	H
CO6					M	H	M	M

***P: Practical**

BTCL6014: CLINICAL LABORATORY TECHNIQUES (0-0-1)

Course Outcome

1. Perform the experiments necessary for careers in research and diagnostic laboratories. (Applying)
2. Detect Inflammation which could help them in diagnoses of underlying health condition (Analyzing)
3. These diagnostic tests will help learner to analyze the presence of pathogenic agents and guide them for further screening (Analyzing)
4. Analyze and correlate hemoglobin with different health conditions and can guide the patient for further diagnostic test (Analyzing)
5. Developing methods of identification of clinically important microorganisms and study response to antibiotics (Applying).

Syllabus

1. Good Laboratory practices
2. Determination of blood groups (A, B, O and Rh system)
3. Determination of total erythrocyte count, total leucocyte count and determination of platelet count
4. Estimation of sugar by DNS Assay
5. CRP estimation in blood
6. Antigen and antibody detection ELISA
7. Haemoglobin estimation in blood
8. Preparation of microbiological media
9. Isolation of microorganisms from a clinical sample.
10. Staining techniques and microscopic examination of microbial cells.
11. Antibiotic susceptibility testing

Suggested Readings

1. Laboratory Manual for Practical Biochemistry, 2nd Edition, Ganesh MK, Shivaraja SYM, 2013, JB
2. Textbook of Practical Physiology, 5th Edition, Pal GK, Pal P, 2001, UP
3. Practical Microbiology, Maheshwari DK, 3rd Edition, 2002, SCP

Mapping of COs to syllabus

Course outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
CO 1	H	H	H	H							
CO 2					H						
CO 3						H					

CO 4							H				
CO 5								H	H	H	H

***P: Practical**

BTBB6015: BASIC BIOINFORMATICS (0-0-1)

Course Outcome

1. To recognize the importance of various types of biological databases (Remembering)
2. To apply the bioinformatics tools for performing the different types of sequence alignments (applying)
3. To construct the phylogenetic tree by using various strategies (Creating)

Module I

Definition of Bioinformatics and introduction to Biological databases, classification, Concept of nucleotide sequence, protein sequence and sequence alignments, types

Module II

Features of Phylogenetic tree, types of trees, interpretation of tree.

Module III

Nucleic acid databases, Protein databases, Small molecules/ Ligand databases and literature databases, Searching of sequences and retrieval of sequences, Pairwise sequence alignment and multiple sequence alignment using BLAST, Introduction to MEGA sequence alignment tool

Module IV

Sequence based phylogenetic tree construction using BLAST, Phylogenetic tree construction from chromatogram of sequencing results using MEGA & BIOEDIT tool and tree construction from RFLP profile and protein profile using DendroUPGMA

Suggested Readings

1. Introduction to Bioinformatics, Attwood T K and Parry-Smith DJ, Pearson Education.
2. Bioinformatics-Students Companion. Kalbulla Syed Abrahin, Guruswami Gurusubrmanian, Zothansanga, Ravi Prakash Yadav, Nachimuthu Senthil Kumar, Shunmugiah karutha Pandian, Probodh Borah, Surendra Mohan, Springer

Mapping of COs to syllabus

Course outcomes	M1	M2	M3	M4
CO1	H	M	H	M
CO2	H	M	H	M
CO3	M	H	M	H

PROGRAMME: MASTER OF SCIENCE (MSC) MICROBIOLOGY

PROGRAMME OUTCOMES

PO 1: Critical Thinking: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO 2: Knowledge Skill: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge.

PO 3: Scientific Communication Skills: Imbibe effective scientific and/or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.

PO 4: Ethics: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects.

PO 5: Enlightened Citizenship: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.

PO 6: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO 7: Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".

PO 8: Lifelong Learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling.

PO 9: Leadership Qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.

PO 10: Research Skills: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations, problem solving and interpretation.

PROGRAM SPECIFIC OUTCOMES

PSO1: Confidence: Demonstrate a comprehensive understanding of chemical and biological structure, principles, techniques, and applications

PSO2: Knowledge based Skill: To develop better understanding and improve skills that would enable them to begin a career in research laboratories, industries as well as to generate self-employability

PSO3: Scientific Social Responsibility: To develop linkages between scientific community and society to build trust, partnership and responsibility of science towards achieving social goals

PSO4: Knowledge of microbial diversity – Students develop the understanding of microbial life in diverse environmental ecosystems for sustainability and economic benefit.

PSO5: Molecular diagnostic skills: Students shall develop and demonstrate competence in laboratory safety, practical quantitative and qualitative research skills that help evaluate the public health research affecting our own community, molecular diagnosis of infectious diseases caused by fungi, viruses and bacteria, Identification of new disease markers, Phage therapy.

PSO6: Industrial applications – Students learn to how to scale-up microbial cultures to an industrial set-up for production of medicine, solvents, biofuel, biofertilizers and food - quality control, safety regulations and ethics form an integral part of the same.

MAPPING OF COURSES WITH POS/PSOS

Courses	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
Thermodynamics and Enzymology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1	2		
Cell Biology and Genetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1	2	1	1
Fundamentals of Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	1	3	2	1
Analytical Techniques	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	2	3	1	1
Lab I- Fundamentals of Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	1	3	2	1
Lab II- Thermodynamics and Enzymology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2		2		
Lab III- Cell Biology and Genetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	1	3	2	1
Lab IV- Analytical Techniques	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	2	3	1	1
Industrial/ Laboratory visit											2	3		3	2	3
Genetic Engineering	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	2			1
Computer Applications and Bioinformatics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	2		3
Basic Microbiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3		3		1		
Molecular Biology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	2	1	1
Fundamentals of Immunology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	3	2	1	1

Lab I- Genetic Engineering	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	2	2		2
Lab II- Computer Applications and Bioinformatics	**3**	**3**	**2**	**2**	2	3	2	3	3	3		3		3		3
Lab III- Basic Microbiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3		3		1		
Lab IV- Molecular Biology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	3	1	1
Lab V- Fundamentals of Immunology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	1	2	1	1
Waste Management (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	3	3	1	2
Fermentation and Food Micorbiology (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	3	1	3	1
Mushroom Cultivation (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	1	3
Herbal Drug Technology (Skill Development course)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	1	3	3	3	1	2
Research Methodology & Biostatistics-common	**3**	**3**	**2**	**2**	2	3	2	3	3	3	1	2	3	3	1	1
Medical Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	3	1
Physiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	1	2	3	1
Lab I-Medical Biochemistry	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	3	1
Lab II-Physiology	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	1	2	3	1
Nutritional Biochemistry &Metabolism	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	2	3	3	1
Bioenergetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1	3		2
Lab-I- Nutritional Biochemistry &Metabolism	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	2	2	3	3	1
Lab II-Bioenergetics	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	2	1			

Dissertation Phase I	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3		
IPR &Entrepreneurship	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3	2	2	1	1
Journal Club and scientific communications	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3			3		2
Value Added Course- Clinical Laboratory Techniques	**3**	**3**	**2**	**2**	2	3	2	3	3	3	2	3			3	
Omics Biology and its Tools	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	2	3
Agriculture Technology (Elective)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	2	2	2
Nanobiology (Elective)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3		2			
Bioresource Management (Elective)	**3**	**3**	**2**	**2**	2	3	2	3	3	3	1	2	2	3	1	1
Dissertation Phase II	**3**	**3**	**2**	**2**	2	3	2	3	3	3	3	3	3	3	3	3

MBVM0003: VIROLOGY AND MYCOLOGY (3-0-1)

Course Outcomes

1. To develop a comprehensive understanding about viruses in general
2. To gain insights on the infection pattern of viruses and to detect viral infection in vitro
3. Understand the in vitro models of viral infection (Understanding)
4. To gain deep insights into various types of viruses on the basis of its genetic material
5. To understand detail mechanism on different types of viral diseases prevalent across the globe
6. To understand about bactriophages and how they play important role in the treatment of infections (understanding)
7. To understand basic principle behind how vaccine works and trace the history of vaccines
8. Understand diseases successfully recovered due to vaccination (Understanding)
9. Understand the risk and benefits of vaccination and develop vaccine schedule
10. To understand general overview and characteristics of fungi
11. To differentiate fungi on the basis of nutritional types and how fungi are important in plant growth (Understanding)
12. Fungi as a model to understand some of the human diseases
13. Understand how biotechnology helped in the exploitation of fungi industrially
14. Develop knowledge on various aspects of fungi from medicine to food security
15. Gain insights into the drug targets and antifungal agents (Analysing)

Module I (10 lectures)

Introduction to virology: Virus history, Diversity, shapes, sizes and components of genomes, Baltimore classification of Viruses Infectious cycle: Attachment and entry into the cells, entry of non-enveloped virions, Assay of virus infectivity, modes of transmission of viral diseases

Isolation and purification of viruses: animal cell culture, multiplicity of Infection, virus preservation

Module II (20 lectures)

Animal Viruses: + Stranded RNA viruses: Picornaviruses, Flaviviruses- West Nile virus and Dengue virus, Coronaviruses- SARS pathogenesis

–ve strand RNA viruses: Paramyxoviruses, Orthomyxoviruses: Influenza pathogenesis and Bird flu, Rhabdoviruses: Rabies pathogenesis

Retroviruses: structure, classification, life cycle; reverse transcription. Retroviruses: HIV, viral pathogenesis and AIDS Bacteriophages: Phage basics, Infectious cycle: Lytic and lysogenic, regulation of switch between lytic and lysogenic cycle, assay

of bacteriophages, Phage therapy

Module III (5 lectures)
Basic principles, Small pox and polio vaccine, subunit vaccine, Flu vaccination, how toxic are vaccines, Vaccine schedule

Module IV (10 lectures)
Introduction: Overview of fungi**,** general characteristics of fungi, fungal structure, Fungal Cell wall – architecture and biosynthesis, reproduction in fungi-vegetative, asexual and sexual, homothallism and heterothallism
Nutrition classification of fungi: fungi, saprophytic, parasitic, obligatory and facultative, biotrophic
Fungal-plant interactions: symbiotic and antagonistic interactions, ecto-mycorrhizae, endomycorrhizae and vesicular arbuscularmycorrhizae, Yeast as model for human diseases

Module V (5 lectures)
Importance of Fungi in biotechnology, industrially important enzymes from fungi, Fungal metabolites and their economic significance - mycotoxins, medicinal uses of fungi (antibiotics), Antifungal agents and their mode of actions, drug targets, Fungi as food - mushrooms, mushroom poisoning

Suggested Readings
1. Human Virology, 5th edition, Leslie Collier, John Oxford, and Paul Kellam,2016, Oxford university press
2. Medical Mycology, 1st edition, Christopher C et.al, 2017, OUP Oxford
3. Clinical Virology manual,5th edition, Michael Loeffelholz, Richard L. Hodinka, Benjamin Pinsky, Stephen Young,2016, Wiley
4. The Mushroom Cultivator, 1st edition, Paul Stamets and J.S. Chilton, 1985, Richmond Publishing Co Ltd
5. Radical Mycology, 1st edition, Peter McCoy's, 2016, Chthaeus Press
6. Fantistic fungi,1st edition, Paul Stamets and Schwartzberg, 2019, Earth Aware Editions

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				
CO 2		M			
CO 3			M		
CO4				M	
CO5					M

MBEM0009: ENVIRONMENT MICROBIOLOGY (3-0-1)

Course Outcomes
1. Outline the traditional and modern approaches of microbial biodiversity analysis (Understanding).
2. Relate the role of a habitat in natural selection of diverse microbial forms (Remembering).
3. Classify the different modes of microbial interaction in a micro- and macro-habitat (Understanding).
4. Apply the properties of microbes in agriculture and in wastewater remediation (Applying).

Module I (10 lectures)
a. Taxonomy: classical and modern - polyphasic approach, molecular chronometers, chemotaxonomy, genetic methods.
b. Biodiversity: structure and function of a microbial community, estimates of total number of species, measures, and indices of diversity (diversity, dominance, and species richness indices), culture dependent and culture independent methods, microbial biodiversity analysis and documentation.

Module II (10 lectures)
a. Ecology: Microbial ecology vs. macroecology, concept of habitat and niche, fundamental and realized niche, resource partitioning and character displacement, characteristics of microbial population growth curves, microbial population regulation, r and K selected strategies, microbial community succession.
b. Extremophiles: Molecular and physiological adaptation of acidophiles, alkalophiles, halophiles, thermophiles and hyperthermophiles, psychrophiles and barophiles.

Module III (15 lectures)
a. Microbial interaction: Brief account of the interactions - rhizosphere, phyllosphere, microbial interactions within community - mycorhizza, epiphytic and endophytic microorganisms and their functional capability, microbial biofilm: definition, development, and importance.
b. Biogeochemical cycles: microbial role in biogeochemical cycles (C, N, P, S), primary production and decomposition.
Application of bacteria in agriculture: nitrogen fixing organisms – nitrogenase system and nif genes. Bio fertilizers – Bacterial, Azotobacter and vermiform compost

Module IV (10 lectures)

Waste treatment: Types of waste – solid and liquid waste characterization, bioremediation - several sustainable approaches for remediation of xenobiotic compounds and hydrocarbons, Physical, chemical and biological treatment methods, wastewater remediation – trickling, activated sludge, oxidation pond. Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN tests, tests for faecal coliforms (b) Membrane filter technique.

Suggested Readings

1. A Textbook on Microbiology, 4th Edition, Dubey RC, Maheshwari DK, 2013, S Chand Publishing.
2. General Microbiology, 7th Edition, Schlegel HG, 1993, Cambridge University Press.
3. Applied Microbiology (Agriculture, Environmental, Food and Industrial Microbiology), 1st Edition, Reddy SM, Girisham S, Narendra Babu G, 2017, Scientific Publishers.

Mapping of Course outcomes to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	L	
CO 3		L	H	
CO 4			M	H

MBMM0010: MEDICAL MICROBIOLOGY (3-0-1)

Course Outcomes

1. Define the role of microflora in human body and its mode of transmission (Remembering).
2. Explain the mode of microbial pathogenesis in disease causation (Understanding).
3. Illustrate the differences in bacterial and fungal diseases (Understanding).
4. Examining different diagnostics methods and treatment options for microbial infections (Analysing).

Module I (5 lectures)

a. Human Microflora: Normal microbiota in human body, role of resident microbial flora.
b. Transmission: Routes of transmission, community and nosocomial infections, opportunistic infections
c. Detection strategies and protocol: Collection, transportation and processing of clinical samples, Quality control of a medicalmicrobiology laboratory

Module II (15 lectures)

a. Toxigenesis: Account of several virulence factors – pili, fimbriae, flagella, lipopolysaccharide, exo-enzymes, adhesins, capsules and toxins; classification and action of endo-toxins and exo-toxins.
b. Mechanisms of pathogenesis: adhesion, colonization and invasion of host tissue – mucous membrane of respiratory, enteric and urogenital tracts; role of aggressins, depolymerizing enzymes, organotropisms, pathogenecity islands, cytoskeletal modulation of host cell.

Module III (15 lectures)

a. Bacterial diseases: Clinical features, transmission, characteristics of causative organism, pathogenesis, laboratory diagnosis, prevention and control of bacterial diseases and clinical syndromes – typhoid fever, cholera, diphtheria, tetanus, meningitis, septic arthritis, conjunctivitis, otis media, pneumonia, gastroenteritis, urinary tract infections, wound infections, skin and soft tissue infections.
b. Fungal diseases: Clinical features, transmission, characteristics of causative organism, pathogenesis, laboratory diagnosis, prevention and control of bacterial diseases and clinical syndromes – Cutaneous mycoses: Tinea pedis (Athlete's foot) Systemic mycoses: Histoplasmosis, Opportunistic mycoses: Candidiasis.

Module IV (10 lectures)

a. Antibiotic therapy: antibiotic sensitivity assays - Stokes method, Agar dilution method, Broth dilution method, E-strip method, efficacy; pharmacokinetics and side-effects, prophylaxis.
b. Microbial drug resistance: emergence and evolution of antibiotic resistance, current issues of MDR/XDR microbial strains, resistance tests – phenotypic and molecular, combination therapy.

Suggested Readings

a. Essentials of Medical Microbiology, 3rd Edition, Sastry AS, Bhat S, 2020, Jaypee Brothers Medical Publishers (P) Ltd.
b. Review of Medical Microbiology, 27th Edition, Jawitz, Melnick and Adelberg, 2015, Mc Graw Hill education.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV

CO 1	H			
CO 2	L	H		
CO 3		M	H	
CO 4			H	H

MBCG0011: CELL BIOLOGY AND GENETICS (4-0-1)

Course Outcomes

1. Recall the fundamental concepts of cell biology and genetics (Remembering)
2. Relate cellular structure to function, physiology and communication (Understanding)
3. Examine the principles of genetics, mutation and recombination (Analysing)
4. Compare concepts in cell, developmental biology and genetics (Evaluating)

Module I (9 lectures)

Cell and its organelles: Structure of prokaryotic and eukaryotic cell and their organelle; Cell wall, nucleus mitochondria, chloroplast, ribosome, Golgi bodies, endoplasmic reticulum, lysosome; Plasma membrane: structure, transport across membrane, cell junction, Cytoskeleton and its role in topography, motility. Major cellular processes: protein synthesis, sorting and secretion, respiration and photosynthesis.

Module II (12 lectures)

Organization of genes and chromosomes: Structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin; Concept of gene, operons, gene families; Cell division and cell cycle and its regulation, Uncontrolled cell growth – cell cycle in cancer; oncogenes, tumor suppressor genes; Programmed cell death,; Basic concepts of development: stages and mechanisms of early and late development; differentiation, Stem cells.

Module III (15 lectures)

Cellular communication: General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation. Cell signaling: Hormones and their receptors, cell surface receptor, signal transduction pathways, second messengers and their roles in signal transduction, regulation of signaling pathways.

Module IV (15 lectures)

Mendelian principles: Mendel's laws, concept of allele, multiple alleles, pseudoallele, codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance, expressivity.

Linkage and crossing over, sex linkage, sex limited and sex influenced characters. Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes, maternal inheritance; Genetic disorders, Pedigree analysis; Gene Mapping- linkage maps, molecular markers; Basic principles of population and evolutionary genetics, Quantitative genetics- polygenic inheritance and biostatistics.

Module V (9 lectures)

Fine structure of a gene: Cistron, muton and recon; Basic genome organization (prokaryotic and eukaryotic); Bacterial genetics (transformation, transduction, conjugation)

Mutation: Types, causes and detection, mutant types– lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications. Transposable genetic elements;

Recombination: Homologous and non-homologous recombination, including transposition, site-specific recombination.

Suggested Readings

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, 1st Multicolor Edition, Verma,PS and Agarwal, VK,2005,S. Chand& Co.
2. Cell and Molecular Biology,8th Edition, deRobertis,EDPanddeRobertis,EMF,2017, Wolters Kluwer Publishing
3. Principles of Genetics.8th Edition, Gardner, J., Snustad, D. P., Simmons, M. J., 2005, Wiley, India
4. Cell-A Molecular Approach. 6th Edition, Cooper, GM. and Hausman, RE, 2015, SinauerAssociatesInc.US.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO 2	H	H	H		
CO 3				H	H
CO 4	M	M	M	M	M

MBWM0012: WASTE MANAGEMENT (1-0-0)

Course Outcomes

1. Choose an appropriate method to segregate and recycle different types of waste (Create)
2. Formulate a plan on recycling waste towards economic growth (Create)

Basic concepts and principle of waste management; sources of waste; waste management hierarchy; management strategies; challenges and opportunities; contribution to economic growth.

Activities:

1. Wastewater treatment technologies.
2. Reuse and recycling of plastic waste.
3. Solid organic waste conversion.
4. Preparation of liquid organic fertilizer.
5. Trainings/Field visit

MBMC0013: MUSHROOM CULTIVATION (1-0-0)

Course Outcomes

1. To develop comprehensive understanding basics of mushroom and their importance to humans and environment (Remembering)
2. To develop skills on techniques of mushroom cultivation and understand global market and demand of mushrooms (Understanding)
3. To develop skills on preservation techniques for mushrooms, risk and benefits associated(Analysing)

Module I (5 lectures)

Definition of a Mushroom, Mushroom Hunting, Ecological Classification of Mushrooms, Food Supply through Mushroom, Enhance Human Health through Mushroom Derivatives, Benefit the Environment through Mushroom Mycelia

Module II (7 lectures)

Mushroom Cultivation: Both a Science and an Art, World Mushroom Production, Differences in Mushroom Production Patterns, World Mushroom Market, Nutritive value of mushrooms, Poisonous Mushrooms

Phases of Mushroom Cultivation: Sterilization : Knowledge of General Safety, health and hygiene, Optimum growing condition Substrate: Preparation of beds for cultivation of various mushrooms and its maintenance, Problems in mushroom cultivation & its remedies Cultivation of selected mushrooms: Oyster Mushroom Cultivation, Milky Mushroom Cultivation, Button Mushroom cultivation, Shiitake Mushroom cultivation

Practical aspects: Sterilization process practice, morphological and microscopic identification of mushroom mycelium, Molecular identification of mushrooms, Spore printing technique, Growing and Identification of viable Spawn, microbial analysis of substrate and optimization,

Module III (3 lectures)

Economics of Mushroom cultivation, Post Harvesting care and processing, Packaging and storage

Practical aspects: Visits and trainings to research laboratories and Mushroom farms, mushroom trainings to community people

Suggested Readings

1. Paul Stamets. Growing Gourmet and Medicinal Mushrooms The Mushroom Cultivator by, 2000, Ten Speed Press
2. Paul Stamets and J.Chilton. A Practical Guide for Growing Mushrooms at Home, by,1985, Richmond Publishing Co Ltd

Mapping of Course outcomes

Course Outcomes	Module I	Module II	Module III
CO 1	M		
CO 2		H	
CO 3			H

MBBM0014: BASIC MICROBIOLOGY (2-0-1)

Course Outcomes

1. Differentiate and classify a significant number of common bacteria by their salient properties (Understanding).
2. Compare the nutritional needs of bacteria for growth and their metabolism (Understanding).
3. Identify key factors of the microbial growth curve and growth kinetics (Applying).
4. Define the physical and chemical methods of microbial growth control (Remembering).

Module I (5 lectures)

a. Historical perspective: Discovery of microbial world, Landmark discoveries relevant to the field of microbiology, controversy over spontaneous generation
b. Microbial taxonomy and diversity: Basis of microbial classification, Haeckel's 3 Kingdom concept, Whittaker's 5 Kingdom Concept, three Domain of Carl Woese, Archael taxonomy.
c. Staining techniques: Basic and acidic dyes, simple and differential staining, negative and positive staining, Grams' staining,acid fast staining, flagella and spore staining

Module II (10 lectures)

a. Nutritional classification: nutritional groups of bacteria - photoautotroph, photoorganotroph, chemolithotroph (ammonia, nitrite, sulfur, hydrogen, iron oxidizing bacteria), chemoorganotroph; classification based on - oxygen requirement, temperature, pH and salinity - and tolerance.
b. Microbial growth: Definition of growth and bacterial reproduction, microbial growth curve, mathematical expression of exponential growth phase, measurement of growth and growth yields - spectrophotometric method, microscopic counting, serial dilution and viable cell count, most probable number, synchronous and continuous culture
c. Microbial cultures: Concept of pure culture, methods of pure culture isolation, enrichment culturing techniques, single cell isolation, and pure culture development.
d. Culture media: chemically defined, complex, differential, and special selective media.
e. Transport of nutrients: Microbial nutrient uptake – diffusion, active transport (periplasmic binding protein and ABC transporters), group translocation and protein export system

Module III (10 lectures)

a. Photosynthesis: characteristics and metabolism of autotrophs, an-oxygenic photosynthetic bacteria and cyanobacteria, CO2fixation and mechanism of photosynthesis
b. Metabolism: An overview of metabolism, Glycolysis, Pentose-phosphate pathway, Entner- Doudoroff pathway, Citric acid cycle; electron transport system, aerobic and anaerobic respiration.
c. Endospore – Structure, properties, and germination.

Module IV (5 lectures)

a. Sterilization: physical and chemical control of bacteria.
b. Antimicrobials: General characteristics of antimicrobial drugs – antibiotics, antifungals and antivirals, classification and mode of action, antibiotic susceptibility testing - Kirby-Bauer's disc diffusion method; antiseptics and disinfectants

Suggested Readings

1. A Textbook on Microbiology, 4th Edition, Dubey RC, Maheshwari DK, 2013, S Chand Publishing.
2. General Microbiology, 7th Edition, Schlegel HG, 1993, Cambridge University Press.

Mapping of COs to syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		H	H	
CO 3			H	L
CO 4			L	H

MBIM0015: INFECTION AND MOLECULAR DIAGNOSTICS (3-0-0)

Course Outcomes

1. Develop understanding on basic terminology associated with infection and diseases
2. Understand how far vaccines are effective in reducing the burden of infectious diseases
3. To understand various challenges faced in the developing world to reduce the burden of infectious disease (Analysing)
4. To gain knowledge on various types of infectious agents as a means of infection
5. To understand different mechanism for the transmission, pathology and control of infectious diseases (Understanding)
6. To understand changing paradigm of global health and strategies towards their control
7. To understand novel emerging infectious diseases which are constant threat to public health
8. To understand the problem multidrug resistance and solutions
9. Gain insights into the role of IPC in control of infections

10. To develop an understanding on how human-induced environmental changes, such as global warming, deforestation and land-use conversion, urbanization, international commerce, and human migration, are altering the ecology of infectious disease transmission (Evaluating)
11. To gain knowledge on antigen antibody based immunodiagnostic test as a primary screening for detection of infection
12. To understand the mechanisms and advancement in the techniques for screening of infectious diseases(Understanding)
13. To understand problems associated with traditional approaches for detection and how advancement in nucleic acid-based detection method decreased time and increased specificity
14. To understand the currently available molecular diagnostic approaches for detection of infectious diseases (Understanding)

Module I (10 lectures)

a. Acute infections, chronic infections, outbreak, epidemic and pandemic, epidemiology, endemicity, reproductive number, Age dependent pattern of infection, herd immunity
b. Vaccines-Impact, questions, safety and challenges, disease eradication, Nutrition and infection in developing world

Module II (10 lectures)

a. Principles of the transmission of the infectious agents (viruses, bacteria, rickettsiae, mycoplasma, fungi, and protozoan), The role of vectors, reservoirs, and environmental factors
b. Epidemiology of diarrheal diseases, TB, Hepatitis B,A, C and E, epidemiology and control of Malaria, meningococcal diseases: global problem and solutions, bioterrorism

Module III (15 lectures)

Nipah virus, SARS, COVID-19, Ebola, Plague, Diptheria, Acute encephalitis syndrome (AES), Hantavirus Pulmonary Syndrome - causes, spread and control; Case studies, endemic, pandemic and epidemic diseases, Zoonotic diseases, Combating emerging infections, Viral mediated cancers, current issues of MDR/XDR microbial strains, concept of DOTS, emergence of antibiotic resistance, gut microbiota in health and disease, Role of Infection prevention and control (IPC)

Module IV (10 lectures)

Immunoelectrophoresis, agglutination, ELISA, immunofluorescence, Immunohistochemistry; Fluorescent Activated Cell Sorter (FACS); Single and double immunodiffusion, Immunofluorescence, RIA, ELISA, Western blot, FACS

Module V (10 lectures)

Non nucleic acid-based methods: Biotyping, Antimicrobial susceptibility testing, serotyping, bacteriophage typing, Nucleic acid-based methods - Agarose gel electrophoresis, RFLP, PFGE, PCR

Suggested Readings

1. Infectious Diseases, 4th Edition, Jonathan Cohen, William Powderly and Steven Opa,2016, Elsevier
2. Oxford handbook of infectious diseases and microbiology, 2nd Edition, Estee Torok , Ed Moran and Fiona Cooke,2010,Oxford University Press
3. Molecular diagnosis of infectious diseases, 2nd Eition, Jochen Decker and Udo reischl,2004, Springer
4. Clinical Immunodiagnostics,1st Edition, Ian C Clift,2020, Jones & Bartlett Learning
5. The elements of Immunology,1st Edition, Fahim Halim Khan,2009, Pearson Education India

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				
CO 2		M			
CO 3			M		
CO4				M	
CO5					M

MBNB0016: NANOBIOLOGY (2-0-0)

Course Outcomes

1. To understand the history and concept of nanotechnology (Understanding)
2. To explain the different types of nanomaterials (Applying)
3. To compare the different types of methods involved in the synthesis of nanoparticles (Evaluating)
4. To analyse the properties of nanoparticles by using different instruments (Analysing)
5. Application of nanotechnology in different fields (Applying)

Module I (5 lectures)

Introduction to nanobiotechnology; History of nanotechnology; Types of nanomaterials- Quantam dots, Carbon based, Metal

based, Dendrimer, Composite; Properties of nanomaterials

Module II (13 lectures)

Synthesis of Nanomaterials- Physical, Chemical, Biological (Bacteria, Fungus, Plants); Characterization of nanomaterials- UV-Vis Spectroscopy, Electron microscope- Energy Dispersive X-ray Spectroscopy, Mass Spectroscopy-Types-Nuclear Magnetic Resonance (NMR) Spectroscopy, FT-IR Spectroscopy- X-Ray Diffraction (XRD)

Module III (12 lectures)

Application of Nanotechnology- Drug delivery system; Disease treatment; Agriculture; Food industry; Detection system; Nanotechnology - Environmental and health effects

Suggested Readings

1. Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials, 1st Edition, Varghese T and Balakrishna KM, 2012, Atlantic
2. A Textbook of Nanoscience and Nanotechnology, Varghese PI and Pradeep T, 2003, Tata McGraw-Hill Education
3. Designing Hybrid Nanoparticles, Maria Benelmekki, 2015, Morgan & Claypool Publishers
4. A Textbook of Nanoscience and Nanotechnology, Bhattacharya SA, 2013, Wisdom Press
5. Textbook of Nanoscience and Nanotechnology, Murty BS, Shankar P, Raj B, Rath BB and Murday J,2013,Springer

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	H		
CO 3		H	
CO 4		H	
CO 5			H

MBIF0018: INDUSTRIAL AND FOOD MICROBIOLOGY (4-0-0)

Course Outcomes

1. Recall methods of isolation and screening methods for industrially important microorganisms (Remembering).
2. Illustrate techniques for scaling of microbial fermentation for food and product formation (Understanding)
3. Develop methods for production of economically important products and its preservation (Applying).
4. Categorize important preservation and safety measures for food production in North-east India (Analysing)
5. Compare the diverse fermented food products and its mode of preparation in tribal population of North-East India (Understanding)

Module I (15 hours)

a. Microbes: Isolation and Screening of industrially important microorganisms, improvement of microbial strains, qualities of anindustrially important microbe, preservation and maintenance of industrial strains.
b. Fermentation basics: Fermentation medium and sterility, types of fermentation process - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch (e.g. baker's yeast) and continuous fermentations, fermentationkinetics.
c. Industrial design: Bioreactor – design and components, bioreactor types - Laboratory, pilot- scale and production fermenters,constantly stirred tank and air-lift fermenters, fermentation process control. Post production techniques and down-stream processing.

Module II (15 hours)

a. Production: Microbial production of industrial products, micro-organisms involved, media formulation, fermentation conditions, upstream and downstream processing and uses - Citric acid, ethanol, penicillin, streptomycin, glutamic acid, Vitamin B12, Enzymes (amylase, protease, lipase), wine, beer.
b. Biofuel: Production of gaseous fuel – biohydrogen and biomethane; liquid fuel – bioethanol, biodiesel and biobutanol.
c. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes(glucose isomerase and penicillin acylase).

Module III (15 hours)

a. Food preservation: Food as a substrate for microbes, microbial growth in food, characteristics of micro-organisms in food, food preservation – physical methods (dehydration, freeze drying, heat and irradiation), chemical methods (chemical preservatives and additives), canning.
b. Food Spoilage: characterization of contamination and spoilage of cereals, sugar products, vegetables, fruits, meat and meat products, milk and milk products, fish and sea foods, poultry, beer and wines; Spoilage of fermented foods and

canned foods. Laboratory testing protocols and biosensors in food industry.

Module IV (15 hours)

a. Food safety: Microbiological quality standards of food, Food control agencies and their regulations – FDA, EPA, CDC and ISI. ISO and Hazard analysis and Critical Control point (HACCP) system, Food Safety Act and Trade Regulations.
b. Fermented food: Cultures for food fermentation, fermented foods and their production – bread, cheese, fermented vegetables, dairy products –acidophilus milk, yoghurt, single cell proteins, pickles, oriental foods and beverages, locally fermented alcoholic beverages, probiotics, prebiotics and symbiotic.

Suggested Readings

a. An Introduction of Industrial Microbiology, 1st Edition, Sivakumaar PK, Joe MM, Sukesh K, 2010, S Chand Publishing.
b. Food Microbiology, 5th Edition, Frazier WC, Westhoff DC, Vanitha NM, 2014, McGraw Hill Education.
c. Biotechnology, 1st Edition, Satyanarayana U, Chakrapani U, 2020, Books & Allied Ltd.

Mapping of COs to Syllabus

Course Outcomes	1	2	3	4
CO 1	H			
CO 2	H	H		
CO 3		H	L	L
CO 4			H	H

LABORATORY COURSES

MBCB6011: CELL BIOLOGY AND GENETICS LAB

Course Outcomes

1. Recall the theoretical topics in cell biology and genetics (Remembering)
2. Apply the fundamental concepts of cell biology and genetics in laboratory (Applying)
3. Analyze data and numerical problems from experiments and interpret results (Analysing)

Syllabus

1. Method s of cell lysis and staining
2. Cell imaging and documentation
3. Study of mitosis and meiosis in plants/cultured cells
4. Isolation of DNA from animal and plant sources
5. Agarose gel electrophoresis of isolated genomic DNA
6. Determination of Tmof DNA
7. Isolation of auxotrophic mutants by replica plating
8. Numerical problems in genetics(Mendelian, population and bacterial genetics, mutation, recombination, etc.

Suggested Readings

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, 1st Multicolor Edition, Verma, PS and Agarwal,VK,2 0 0 5 , S. Chand & Co.
2. Cell and Molecular Biology, 8th Edition, deRobertis, EDPanddeRobertis, EMF, 2017, Wolters Kluwer Publishing
3. Principles of Genetics.8th Edition, Gardner, J., Snustad, D. P., Simmons, M. J., 2005, Wiley, India
4. Cell-A Molecular Approach. 6th Edition, Cooper, GM. and Hausman, RE, 2015, Sinauer Associates Inc. US.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8
CO 1	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H
CO 3					H	H	H	H

***P: Practical**

MBBM6012: BASIC MICROBIOLOGY LAB

Course Outcomes

1. Experiment with different microbial isolation techniques (Applying)
2. Examine cell structure through microscopy and microbial colonies for identification (Analysing).
3. Determine the factors that affect microbial growth (Evaluating).

Syllabus

1. Preparation of various routine laboratory media - differential, selective and enriched.
2. Isolation of microorganisms by serial dilution method
3. Isolation of pure cultures by streak plate method
4. Staining techniques and microscopic examination of bacteria – Gram's staining, negative staining, capsule staining, spore staining, acid fast staining of bacteria
5. Staining techniques and microscopic examination of fungi – Lactophenol cotton blue
6. Measurement of microbial growth curve by direct cell count method/turbidity method
7. Measurement of fungal growth by colony diameter method/biomass method
8. Preservation of bacterial cells by various techniques
9. Antibiotic susceptibility testing (disc diffusion/broth microdilution)

Suggested Readings

1. Practical Microbiology, 3rdEdition, Maheshwari DK, 2002, S Chand Publishing
2. Experiments in Microbiology, Plant pathology, tissue culture and Microbial Biotechnology, 5thEdition, Aneja KR, 2017, NewAge International Publishers.

Mapping of COsto syllabus:

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9
CO 1	H	H	H						
CO 2			M	H	H				

CO 3						H	H	H	H

***P: Practical**

MBVM6008: VIROLOGY AND MYCOLOGY LAB

Course Outcomes

1. Apply the knowledge on bacteriophages to isolate and quantify (Applying)
2. Learn the technical skills to isolate DNA from phages (Analysing)
3. Apply the knowledge on fungi to isolate, and identify (Applying)
4. Learn the technical skills to isolate DNA from fungi (Analysing)
5. Analyse different nutrients in macro fungi (Analysing)

Syllabus

1. Isolation of bacteriophage from natural sources
2. Cultivation and quantification of phages
3. Isolation of DNA from bacteriophage
4. Phage identification by PCR
5. Isolation of fungi from soil
6. Staining of fungus
7. Nucleic acid isolation of fungi
8. Spore printing of fungi
9. Detection of protein, minerals and vitamins in fungi

Suggested Readings

1. General Virology, 3rd edition, S. E. Luria, J. E. Darnell, 1978, John Wiley & Sons
2. Textbook of Virology ,2nd edition, A.J. Rhodes and C.E. Van Rooyen,1953,The Williams & Wilkins Company
3. Virus-insect-plant Interactions, 1st edition, Kerry F. Harris, Oney P. Smith, James E,2001 Duffus, Academic Press Inc
4. Principles of Virology: Molecular Biology, Pathogenesis, and Control, 1st edition, S. J. Flint, Lynn W. Enquist, Robert M. Krug,Vincent R. Racaniello, 2000, American Society for Microbiology
5. Introductory Mycology, 4th edition, Constantine J. Alexopoulos, Charles W. Mims, Meredith M. Blackwell,1996, Wiley

Mapping of outcomes:

Course Outcomes	P 1	P2	P3	P4	P5	P6	P7	P8	P9
CO 1	H								
CO 2		H							
CO 3			H			H		H	
CO4				H			H		
CO5					H				H

***P: Practical**

MBEM6009: ENVIRONMENT MICROBIOLOGY LAB

Course Outcomes

1. Experiment with different protocols for isolation of microbes from natural habitats (Applying)
2. Examine microbial interactions in soil, water, and plant systems (Analysing)
3. Evaluate the roles of microbes for its medicinal, plant growth promoting, and degradation properties (Evaluating).

Syllabus

1. Isolation of microbes (bacteria & fungi) from soil (28ºC&45ºC)
2. Isolation of Cyanobacteria from natural sample
3. Isolation of antibiotic producing microbes from soil sample.
4. Determination of antimicrobial spectrum of isolate
5. Isolation of anaerobic microorganisms
6. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane
7. Isolation of protease secreting bacteria from soil
8. Isolation of xenobiotic compound degrading bacteria by enrichment culture technique
9. Assessment of microbiological quality of water
10. Microbial biofilm detection
11. Isolation and identification of symbiotic bacteroids of Rhizobium sp. from root nodules of leguminous plants
12. Isolation of phosphate solubilizing bacteria from soil and quantitative measurement of the phosphate solubilisation

Suggested Readings

1. Practical Microbiology, 3rd Edition, Maheshwari DK, 2002, S Chand Publishing
2. Experiments in Microbiology, Plant pathology, tissue culture and Microbial Biotechnology, 5th Edition, Aneja KR, 2017, NewAge International Publishers.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO 1	H	H	H	H	H	H	H	H	H	H	H	H
CO 2	M	L	H		H	H			L	H	H	H
CO 3			H	H			H	H			H	H

***P: Practical**

MBMM6010: MEDICAL MICROBIOLOGY LAB

Course Outcomes

1. Developing methods of identification of clinically important microorganisms (Applying).
2. Categorize microbes based on their physiology to develop methods for diagnosis (Analysing).
3. Assess the response of bacteria to antibiotics by *in vitro* assays (Evaluating).

Syllabus

1. Biochemical tests – IMViC tests – of enteric bacteria
2. Isolation and biochemical characterization of pathogenic bacteria from any clinical sample
3. Isolation and biochemical characterization of normal micro flora of skin, throat or oral cavity
4. Isolation and identification of fungal pathogens from clinical specimens
5. Isolation of hemolytic bacteria using blood agar media.
6. Minimum inhibitory concentration (MIC) determination of antimicrobial compound against microorganism
7. Isolation and screening of bacterial and fungal cultures for enzyme production – amylase or gelatinase
8. Determination of presence of catalase and oxidase activity in bacteria
9. Determination of the ability of bacteria to utilize sugars by oxidative or fermentative mode
10. Demonstration of sugar fermentation – sucrose, lactose and glucose

Suggested Readings

1. Practical Microbiology, 3rd Edition, Maheshwari DK, 2002, S Chand Publishing
2. Experiments in Microbiology, Plant pathology, tissue culture and Microbial Biotechnology, 5th Edition, Aneja KR, 2017, New Age International Publishers.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
CO 1	H	H	H	H	L		H	H	H	H
CO 2	H	H		M	H		H	H	H	H
CO 3					L	H				

***P: Practical**

MBIM6015: INFECTION AND MOLECULAR DIAGNOSTICS LAB

Course Outcomes:

1. Analyse antibodies by different types of ELISA generated due to microbial infection (Analysing)
2. Standardization of Indirect Immunoflourescence assay (Evaluating)
3. Demonstrate practical knowledge on Single radial immune diffusion (Analysing)
4. Demonstrate practical knowledge on Double immune diffusion method (Analysing)
5. Demonstrate practical knowledge on Immunoelectrophoresis (Analysing)
6. Standardize antimicrobial susceptibility test and learn analysing its result (Evaluating)

Syllabus

1. Detection of antimicrobial antibodies by ELISA
2. Indirect Imunoflourescence assay
3. Single radial immune diffusion
4. Double diffusion method of Ouchterlony
5. Immunoelectrophoresis
6. Rocket electrophoresis
7. DOT ELISA for the presence of specific antigen.

8. Antimicrobial susceptibility testing

Suggested Readings

1. Practical Immunology,4th edition, Drank C.Hay,2002, Wiley-Blackwell
2. Handbook of Practical and Clinical Immunology, 2nd edition, G.P. Talwar and S.K.Gupta,2017, CBS
3. Current diagnosis and treatment in infectious diseases, 2nd edition, Walter R. Wilson and Merle A. Sande, 2013, McGraw-Hill Education

Mapping of Course outcomes:

Course Outcomes	P 1	P2	P3	P4	P5	P6	P7	P8
CO 1	H						H	
CO 2		H						
CO 3			H					
CO4				H				
CO5					H	H		
CO6								H

***P: Practical**

MBDI6006: DISSERTATION PHASE I (0-0-2)

Course Outcomes

1. Develop a scientific mindset with the capacity for analytical and innovative thinking (Creating).
2. Develop writing skill, referencing and citations for effective communication (Applying).
3. Improve communication and creative expression skills to articulate scientific ideas (Creating).
4. Examine the research gap in the related field and formulate strategies to address the same (Analysing).

Syllabus

1. Familiarization with research topic and methodologies by a thorough literature review.
2. Writing of review of literature to brush up already existing knowledge on a given area.
3. Formulate a research hypothesis and a proposed workplan.
4. Presentation of the research topic at department level and submission of literature review.

Suggested Readings

1. Scientific review and research articles published in respective specialized area of research.

Mapping of Course outcomes to Syllabus

Course Outcomes	P1	P2	P3	P4
CO 1	H	H		
CO 2		H	H	
CO 3		H	H	H
CO 4	L	M	L	H

***P: Practical**

MBDI6007: DISSERTATION PHASE II (0-0-16)

Course Outcomes

1. Support the research hypothesis with experiments executed ethically (Evaluating).
2. Develop skill to independently carry out a research in the laboratory (Creating).
3. Examine the methodology, analyse results, and defend the research work (Analysing).

Syllabus

1. Execute a scientific dissertation based on the proposed plan in Phase 1 through bench work.
2. Present and report data at various stages of the research work to the assigned supervisor.
3. Analysing the results, correlating it with different experiment performed during the dissertation.
4. Present the findings in a department level to internal and external examiners, and submission of completed thesis.

Suggested Readings

Scientific review and research articles published in respective specialized area of research.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4

CO 1	H	L	M	
CO 2	H	M	H	L
CO 3		H	H	H

***P: Practical**

MASTER OF SCIENCE IN BOTANY
DEPARTMENT OF BOTANY

Vision:

To motivate and encourage the students in effective ways to utilize the knowledge of 'Plant Sciences' in order to solve the future needs of Food, Fuel, Energy and Environment for the betterment of mankind and society.

Mission:

The department endeavours to make substantial contribution in the field of 'Plant Sciences' by new research innovations and producing competent students who are not only well versed with the subject but are also better adjusted socially, emotionally and intellectually.

MSC PROGRAM OUTCOMES

PO 1: Critical Thinking: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO 2: Knowledge Skill: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge.

PO 3: Scientific Communication Skills: Imbibe effective scientific and/or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.

PO 4: Ethics: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects.

PO 5: Enlightened Citizenship: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.

PO 6: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO 7: Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".

PO 8: Lifelong Learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling.

PO 9: Leadership Qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.

PO 10: Research Skills: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations, problem solving and interpretation.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1: Acquire basic as well as in-depth knowledge on plant science in addition to understanding interdisciplinary fields such as molecular biology, cell culture, bioprocess engineering, computational biology, recombinant DNA technology, statistics etc, and their applications in healthcare, agriculture, environment, and industry.

PSO2: Acquire sound practical knowledge on plant science, molecular biology, microbiology, plant tissue culture, etc, and become well-trained for employment or self-employment.

PSO3: The students would be equipped and well-trained on applied sciences and also empowered to independently develop basic research projects on multidisciplinary fields.

PSO4: The students would be well-prepared for competitive examinations conducted by national and international organisations.

COURSES OFFERED IN M. SC BOTANY

SEMESTER	COURSE CODE	COURSE NAME
I	BOMP0021	Mycology and Phycology
	BOBP0022	Bryophytes, Pteridophytes and Gymnosperms
	BOAN0023	Angiosperms
	BOMP6026	Mycology and Phycology Lab
	BOBA6027	Bryophytes, Pteridophytes and Gymnosperms and Angiosperms Lab
	BOBF6035	Bio-Fertilizer Technology
	BOBC6038	Biomass Conversion, Biorefinery & Circular Bioeconomy
	BOSL0100	Service Learning on Ethno Botanical Practices
II	BOCM0024	Cell and Molecular Biology
	BOPB0025	Plant Physiology and Biochemistry
	BOPP0026	Plant Microbiology and Plant Pathology
	BOPE0028	Plant Ecology and Phytogeography
	BOCB6028	Cell and Molecular Biology and Plant Physiology and Biochemistry Lab
	BOPP6029	Plant Microbiology and Plant Pathology Lab
	BOPE6030	Plant Ecology and Phytogeography Lab
		MOOCS/NPTEL Course
	BOSL0100	Service Learning on Ethno botanical Practices
III	BOCP0027	Cytogenetics and Plant Breeding
	BOBB0029	Biochemicals, Molecular Techniques and Bioinformatics
	BOER0031	Environmental Management, Research Methodology and Biostatistics
	BOCT6031	Cytogenetics and Molecular Techniques
	BOER6033	Environmental Management, Research Methodology and Biostatistics Lab
	BOHM6036	Herbal Medicine
	BOFI6037	Forest Inventory and Mensuration
	BOSL0100	Service Learning on Ethno botanical Practices
	BODI6032	**Dissertation Phase I**
IV	BOFP0032	Fundamentals of Plant Biotechnology
	BOAB0033	Advances in Plant Biotechnology
	BOGT0034	Genetics, Plant Breeding and Transformation
	BOMB0035	Molecular Genetics and Bioinformatics
	BOTS0038	Taxonomy of Angiosperms and Biosystematics
	BOBE0039	Economic Botany and Ethnobotany
	BOEG0040	Ecology, Environment and Global concerns
	BORG0042	Restoration Ecology and Geoinformatics
	BOPY0043	Plant Pathology
	BOMA0044	Microbial Genetics and Applied Microbiology
	BOPP0045	Advanced Plant Physiology
	BOBM0046	Plant Biochemistry and Metabolism
	BOBB0047	Biomass, Biorefinery and Circular Bioeconomy
	BOPD0048	Bioprospecting of Plant Diversity and Automation
	BODI6034	Dissertation Phase II
	BOSL0100	Service Learning on Ethno botanical Practices
		MOOCS/NPTEL Course

Mapping of Courses to POs and PSOs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BOMP0021	M	H	L	L	L	L	M	M	L	H	H	H	H	H
BOBP0022	H	H	M				L	H		H	H	M	H	H
BOAN0023	H	H	H	M	M	M	M	H	H	H	H	M	H	L
BOMP6026	M	L	L	L	L	H	L	H	M	M	H	H	H	H

BOBA6027	H	H	M				L	H		H	H	M	H	H
VAC	L	H	M					M		M	M		M	L
VAC	H	H	H	M	M	M	M	H	H	H	H	M	H	L
BOCM0024	H	M									H		H	H
BOPP0026	M	H	L	L	L	L	M	M	L	H	H	H	H	H
BOER0031	H	M				M					H		H	L
BOPB0025	H	H	H	H	H	H		H	M	H	H	H	H	H
BOCB6028	H	H	H	H	H	H		H	M	H	H	H	H	H
BOPP6029	M	L	L	L	L	H	L	H	M	M	H	H	H	H
BOER6033	H	M		L			L		M		H		H	L
BOCP0027	H	H						M		M	H	M	M	M
BOPE0028	H	H	M	L	L	M	M	H	M	H	H	M	H	H
BOBB0029	H	H	H	M	M	H	L	M	M	H	H	H	H	H
BOTC0030	H	H	H	H	H	H	H	H	M	H	H	H	H	H
BOPE6030	H	H	M	L	L	M	M	H	M	H	H	M	H	H
BOCT6031	H	H	H	L	M	H	L	M	M	M	H	H	H	H
VAC	H	H	M	L		L	M	H	M	H	H	M	H	H
BOFP0032	H	H	H	H	H	H	H	H	M	H	H	H	H	H
BOAB0033	H	H	H	H	H	H	H	H	M	H	H	H	H	H
BOGT0034	H	M									H	H	H	L
BOMB0035	H	M									H	H	H	L
BOTS0038	H	M	M								M		M	L
BOBE0039	M	M	M									M	M	L
BOEG0040	H	H	M	L		M	M	H	M	H	H	M	H	H
BORG0042	H	H	M	L		M	M	H	M	H	H	M	H	H
BOPY0043	M	H	H	H				M		M	M	H	H	M
BOMA0044	H	H	H	M				M		H	M	H	M	M
BOPP0045	H	H	H	H	H	H		H	M	H	H	H	H	H
BOBM0046	H	H	H	H	H	H		H	M	H	H	H	H	H
BOBB0047	H	H	H	M	M	M	M	H	H	H	H	M	H	L
BOPD0048	H	H	H	M	H	H	L	H	H	H	H	H	H	H

THEORY COURSES

BOMP0021: MYCOLOGY AND PHYCOLOGY

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course outcomes

At the end of this course, student will be able to:

1. Understand general characteristics, classification and economic importance of fungi and algae (Remembering)
2. Able to compare the vegetative and reproduction structures among groups of fungi and algae (Understanding)
3. Able to tell the importance of algae in environment and agriculture (Evaluating)
4. Develop scientific skill sets in and implement in agriculture (Applying)

Module I: Introduction (4 Hours)

Introduction, history, general features and economic importance of fungi

Module II: Classification of fungi (20 Hours)

Myxomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina,Deuteromycotina - important features; thallus organizations; modes of reproduction

Module III: Role of Fungi in agriculture and environment (4 Hours)

Mycorrhizal associations and Lichens-their importance to agriculture and environment; Fungi asbio-fertilizers

Module IV: Introduction to algae (4 Hours)

History; general description; systems of classification and economic importance of algae

Module V: Classification of algae (20 Hours)

Classification (*Cyanophyta, Chlorophyta, Phaeophyta, Rhodophyta, Xanthophyta, Chrysophyta, Bacillariophyta, Pyrrophyta, Euglenophyta, Eustigmatophyta, Prasinophyta* and *Prochlorophyta*); cell structure; thallus organization and mode of reproduction in algae

Module VI: Role of algae in agriculture and environment (4 Hours)

Algal blooms - its importance; Algae as feed; bio-fertilizers; pollution indicators

Module VII: Research on Fungi and algae (4 Hours)

Current and future research; Future prospects/scopes in these areas

Suggested Readings:

1. Alexopoulos CJ, Mims CW, Blackwell M. Introductory Mycology, Willey.
2. Dube HC. An Introduction to Fungi, Scientific Publishers.
3. Aneja KR. Mehrotra RS. Introduction to Mycology, New Age International Publisher.
4. Peterson JH. The Kingdom of Fungi, Princeton University Press.
5. Smith AL. Lichens, Wentworth Press.
6. Sharma, O.P. Algae, McGraw-Hill Education.
7. Van Den Hoek, C., Mann, D. G. and Jahns, H.M. Algae: An Introduction to Phycology,Cambridge University Press.
8. Bilgrami, K.S. and Saha, L.C. A textbook of Algae, CBS.
9. Lee, R.E. Phycology, Cambridge University Press.
10. Bellinger, E.G. and Sigee, D.C. Freshwater Algae: Identification, Enumeration and use asBioindicator, Willey Blackwell.
11. Dutta, T.C. and Dutta, A. C. A Class-Book of Botany. Oxford University Press

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	M		H	M		L
CO2	L	H		L	H		L
CO3		M	H		M	H	L
CO4	L	M	H	L	M	H	H

BOBP0022: BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes:

At the end of this course, student will be able to:

1. Summarize the general characteristics, morphological and reproductive diversity amongdifferent groups of Bryophytes (Understanding)
2. Compare the general characteristics, morphological and reproductive diversity amongdifferent groups of Pteridophytes (Understanding)
3. Interpret the general characteristics, morphological and reproductive diversity amongdifferent groups of Gymnosperms (Understanding)
4. Identify the different economic importance of the Bryophytes, Pteridophytes andGymnosperms (Applying)
5. Infer fossils and fossilization (Understanding)

Module I: Bryophytes (20 Hours)

General introduction, Classification of Bryophytes; evolutionary history and phylogenetic characterization of bryophytes; comparative account of gametophyte and sporophyte structure of *Hepaticopsida, Bryopsida* and *Anthocerotopsida*; Peristome structure and its significance in the classification of Mosses; Economic importance of Bryophytes

Module II: Pteridophytes (20 Hours)

General introduction, Classification and range of thallus of Pteridophytes; evolutionary history and phylogenetic characterization of pteridophytes; Early vascular plants; A brief account of the following classes of Pteridophytes: *Psilotopsida, Lycopsida, Sphenopsida, Pteropsida*; Telome concept, apogamy and apospory, heterospory and seed habit; Economic importance of Pteridophytes

Module III: Gymnosperms (15 Hours)

General introduction, Classification of Gymnosperms; Comparative study of *Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitschiales* and *Gnetales*; Economic importance of Gymnosperms

Module IV: Paleo-botany (5 Hours)

Introduction, Fossils, Kinds of fossils and process of fossilization; Geological time scale; Importance of fossils

Suggested Readings:

1. Alam, A. Textbook of Bryophyta, I K International Publishing House Pvt Ltd.
2. Johri, R.M, Lata, S, Tyagi, K. A Textbook of Bryophyta, Dominant Publishers and Distributors (Cornell University).
3. Vashishta, P.C., Sinha, A.K. and Kumar, A. Botany for Degree Students-Pteridophyta, S.Chand.
4. Mitra, J.N, Mitra, D. and Chowdhury, S.K. Studies in Botany (Vol I & Vol II), MoulikLibrary.
5. Sharma, O.P. Pteridophyta, McMillan India Limited.
6. Rashid, A. An Introduction to Pteridophyta, South Asia Books.
7. Verma, H.K.A Textbook of Pteridophyta. Random Pub.
8. Bhatnagar, S.P. Gymnosperms, New Age International Publishers

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4	M	M	M	
CO5				H

BOAN0023: ANGIOSPERMS

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

1. Understand the concepts of plant identification, classification nomenclature(Understanding)
2. Understand the general morphology and distinguishing characteristics of different angiosperm families (Understanding)
3. Identification of dicotyledons and monocotyledons plants with reference to specific keycharacters (Applying)
4. Understand the internal organization of the tissue and cell structure of both vegetativeand floral parts of angiosperm plants (Understanding)
5. Understand the development of gametophytes, fertilization, endosperm, embryo,apomixis and parthenocarpy

in angiospermic families (Understanding)
6. Application of anatomy and embryology in taxonomy (Applying)

Module I: Taxonomy (12 Hours)
History of plant taxonomy; Methods of Plant identification; Taxonomic Keys: Single access and Multi-access; Field inventory; Collection; Herbaria: Functions of Herbarium, Preparation of Herbarium; Major systems of classification: Cronquist (1981); Takhtajan's System (1997), APG IV (2016) (merits and demerits). Principles and rules of Botanical Nomenclature

Module II: Morphology (8 Hours)
Vegetative Characters: Modified Roots and Stems; Leaf Phyllotaxy, Vennation; Trichomes. Reproductive Characters: Floral parts, Arrangements of flowers on the floral axis, Unisexual and Bisexual Flowers, Variation in fruit surface, Placentation, Variation in seed coats

Module III: Angiospermic Families (15 Hours)
Dicotyledons: Magnoliaceae, Annonaceae, Tiliaceae, Sterculiaceae, Rutaceae, Meliaceae, Vitaceae, Sapindaceae, Anacardiaceae, Fabaceae, Caesalpinaceae, Mimosaceae, Oleaceae, Apocynaceae, Asclepidaceae, Boraginaceae, Scrophulariceae, Bignoniaceae, Acanthaceae, Euphorbiaceae, Moraceae. Monocotyledons: Orchidaceae, Musaceae, Araceae, Commelinaceaee, Zingiberaceae, Cyperaceae, Poaceae

Module IV: Anatomy (10 Hours)
Meristem, Classification of meristems; Permanent tissue; Theory of shoot apical meristem and root apical meristem; Origin, structure and function of cambium; Primary and secondary structure of root and stem, Anomalous secondary growth in roots and stems. Cork cambium and its derivatives, function of cork and abscission layers. General structure of plants; cell wall, stomata and secretary structure; Anatomy of floral organs; Anatomy in relation to taxonomy

Module V: Embryology (15 Hours)
Structure of microsporangium, microsporogenesis and development of male gametophyte; Structure of ovule, megasporogenesis and development of female gametophyte; Pollen-Pistil interaction; Fertilization and its control; Endosperm types, structure and functions; Dicot and monocot embryo; Embryo endosperm relationship; Polyembryony and its induction, Apomixis, causes and significance; Parthenocarpy; Embryology in relation to taxonomy

Suggested Readings:

1. Pandey, B.P. A textbook of Botany: Angiosperms S. Chand.
2. Sharma, O.P. Plant Taxonomy McGraw-Hill Education
3. Nair, R. Taxonomy of Angiosperms APH Publishing Corporation
4. Singh, G. Plant Systematics: An Integrated Approach. CRC Press.
5. Lawrence, G.H.M. Taxonomy of Vascular Plants Scientific Publisher.
6. Subramanyam, N.S. Modern Plant Taxonomy. Vikas Publishing House Pvt. Ltd. New Delhi.
7. Sambamurty, A.V.S.S. Taxonomy of Angiosperms. I. K. International Publishing House Pvt.Ltd., New Delhi.
8. Verma, B.K. Introduction to Taxonomy of Angiosperms. PHI Learning Private Limited, NewDelhi.
9. Pandey, B.P. Plant anatomy, S. Chand & Co., New Delhi
10. Esau, Anatomy of Seed Plants. John Wiley & Sons, New York.
11. Grewal, Plant anatomy. Campus Books International, New Delhi.
12. Maheshwari, An Introduction to Embryology of Angiosperms. Tata McGraw Hill PublisingCo., New Delhi.
13. Bhojwani, S.S., Bhatnagar, S.P. and Dantu, P.K. The Embryology Angiosperms, VikasPublishing

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3			H		
CO4				H	
CO5					H
CO6				M	M

BOCM0024: CELL AND MOLECULAR BIOLOGY
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

1. Memorize the key concepts of cell and its structural organization (Remembering)
2. Analyse the process of DNA replication and compare various repair mechanism (Analysing)
3. Gain better understanding of gene cloning and DNA libraries (Understanding)
4. Understand the basics of gene cloning and importance of genome evolution (Understanding)

Module I: Basics of Cell (4 Hours)

Cell: Concept, structural organization of plant cell.

Module II: Cellular Organelles: Their Organizations and Functions (15 Hours)

Mitochondria: structure, genome organization, protein import and mitochondrial assembly. Chloroplast: structure, genome organization, import and sorting of chloroplast proteins. Endoplasmic reticulum: structure, translocation of secretory proteins across ER membrane, insertion of protein into ER membrane, protein folding and processing. Golgi apparatus: organization, protein glycosylation, protein sorting and export from Golgi, the vesicular transport mechanism. Nucleus: nuclear envelope, nuclear pore complex, trafficking between nucleus and cytoplasm.

Module III: Gene and Genome (6 Hours)

Gene and genome: fine structure of gene, genome organization

Module IV: Enzymes for Gene Manipulations (7 Hours)

DNA/gene manipulating enzymes, restriction enzymes: endonuclease, exonuclease, types of endonucleases, recognition sequences, ligase, polymerase, phosphatase, transcriptase,transferase, topoisomerase

Module V: DNA Replication (7 Hours)

Various models, enzymes for replication, structure of DNA polymerase, speed of replication, collaboration of proteins, process and termination of replication

Module VI: DNA Damage and Repair Mechanism (6 Hours)

Basic concept, types of DNA damage thymine dimer, 6- 4 photoproducts, photo-reactivation, excision repair

Module VII: Transposons and Genetic Recombination (8 Hours)

Mobile genetic elements: Insertion elements, transposons. Genetic recombination: Holliday, Potter & Dressler, Meselson and Radding and Szostak model of genetic recombination

Module VIII: Basics of Gene Cloning (7 Hours)

Gene cloning: cloning vectors (types and characteristics), molecular cloning and construction of DNA libraries

Suggested Readings:

1. Lewin. Genes. Published by Pearson Prentice Hall
2. Albert. Molecular Biology of Cell
3. Singh, B. D. Fundamentals of Genetics Kalyani Publications
4. Brown TA. Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing
5. Watson J. Molecular Biology of Gene

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	H	H	L	L	L		H	L
CO2		L			H	H		
CO3	L					M	L	H
CO4		L	H	M				M

BOPB0025: PLANT PHYSIOLOGY AND BIOCHEMISTRY
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course outcomes

At the end of this course, student will be able to:

1. Explain the concepts of plant water relation, transpiration, mineral nutrition, uptake and translocation of nutrients (Understanding)
2. Understand the process of photosynthesis and respiration (Understanding)
3. Analyze the role of photoreceptors, growth regulators in different physiological process and plants respond towards abiotic stress (Analyzing)
4. Explain the concepts of thermodynamics, enzyme kinetics and biomolecule metabolism (Understanding)

Module I: The Basic Concept and Transport Mechanism (4 Hours)
Water potential, theories supporting uptake of water: Bose theory, cohesion-adhesion theory, Comparison of xylem and phloem transports, phloem loading and unloading, passive and active transports

Module II: Photosynthesis and Transpiration (14 Hours)
Cyclic and non-cyclic photophosphorylation. PSI and PSII system, stages of photosynthesis, light reaction and dark reaction. C_3, C_4 and CAM pathways, photorespiration, photophosphorylation, factors effecting photosynthesis, types of transpiration, mechanism and factors effecting transpiration

Module III: Sensory Photobiology and Growth Hormones (8 Hours)
Discovery of phytochromes and cryptochromes and their photochemical and biochemical properties, molecular mechanism of action of photo morphogenetic receptors, physiologicaleffects and mechanism of action of plant growth hormones, signal transduction and gene expression

Module IV: Photoperiodism and Physiological Stress (6 Hours)
The flowering process: endogenous clock and its regulation, ABA model physiological responses to abiotic stresses: light, temperature, water and salts; acclimation of physiological processes under abiotic stresses

Module V: Thermodynamics and Bioenergetics: (8 Hours)
Laws of thermodynamics, Gibbs Free Energy, enthalpy, entropy, energy change in coupled reactions energy rich phosphate compounds, energetics of metabolic processes, energy rich phosphate compounds, ATP as universal currency of energy, ATP synthesis

Module VI: Properties of Water and Enzyme Kinetics (10 Hours)
Dissociation of water, ion product of water, pH, ionization of weak bases, biological buffers Henderson-Haselbach Equation. prosthetic groups and co-enzyme, mechanism of catalysis, kinetics, Michaelis-Menten Equation, bisubstrate reaction, active sites, factor contributing to catalytic efficiency, enzyme inhibition, regulatory enzyme, ribozyme

Module VII: Metabolism of Biomolecules (10 Hours)
Structures and functions of amino acids, peptides and proteins. lipid: synthesis of saturated and unsaturated fatty acids, oxidations of fatty acid. Carbohydrate- classification**,** structures, functions, biosynthesis and metabolism. glycolysis, gluconeogenesis, and the pentose phosphate pathway assimilation, transportation and metabolism of sulphur in plants

Suggested Reading:

1. Davies PJ. Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition, KluwerAcademic Publisher, Dordrecht, The Netherlands.
2. Nelson DL. and Cox MM. Lehninger Principles of Biochemistry, 4th Edition, W.H. Freemanand Company, New York, USA.
3. Jordan BR. The Molecular Biology and Biotechnology of Flowering, 2nd Edition, CABInternational, Oxford shire, U.K.
4. Taiz L and Zeiger E. Plant Physiology, 4th Edition, Sinauer Associates Inc. Publishers,Massachusetts, USA.
5. Lodish H, Berk A, Kaiser CA and Krieger M. Molecular Cell Biology, 6th Edition, W.H.Freeman and Company, New York, USA.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	M				L	
CO2		H		L			L
CO3	M		H	H			
CO4	L		M		H	H	H
CO5		M	H	M	M	L	H

BOPP0026: PLANT MICROBIOLOGY AND PLANT PATHOLOGY
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Classify various microorganisms and their reproduction and isolation methods (Understanding)
2. Analyze the roles of microorganisms in environment (Analyzing)
3. Identify and detect microbial plant diseases and decide control strategies (Applying)
4. Asses and apply post-harvest controls measures and techniques (Evaluating)

Module I: Introduction to microbial world and microscopy (6 Hours)
A brief history of microbiology and its evolution; Microscopy-principle, types and applications

Module II: Microbial diversity and applications (10 Hours)
Bacteria & Archaebacteria: properties, classification, nutritional types; Viruses- properties andclassification, prions and bacteriophages; Role of microorganisms in the environment

Module III: Isolation and cultivation of bacteria and viruses (10 Hours)
Types of nutritional media (Liquid & solid), types of bacterial cultures- batch, continuous and synchronous, growth curve and pure culture of microorganism; Isolation methods of bacteria, virus and phages

Module IV: Microbial Genetics and its life cycle (8 Hours)
Genome organization in microorganism (DNA, RNA, Plasmids); mechanisms of transformation, conjugation and transduction in bacteria; Life cycle of viruses and bacteriophages

Module V: An insight into Plant Pathology (8 Hours)
Historical and developmental aspects of plant pathology, mode of infection and role of enzymes and toxins in plant disease, defense mechanisms of plants against infection

Module VI: Plant diseases & control measures (12 Hours)
Study of plant diseases caused by fungi, bacteria, viruses, nematodes and mycoplasma; approaches for plant disease control- cultural, chemical, biological, bio pesticides, breeding for resistant varieties, plant quarantine, integrated pest management; molecular and transgenic approach for crop protection

Module VII: Post-harvest Management (6 Hours)
Post-harvest pathology: Fungal deterioration of food commodities, mycotoxins and health hazards, control measures; overview of integrated pest management

Suggested Reading:

1. Pelczar MJ. Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
2. Prescott L, Harley JP, Klein DA. Microbiology, McGraw Hill, India. 6th edition.
3. Campbell NA, Reece JB, Urry. A., Cain L, Wasserman SA, Minorsky PV, Jackson
4. Mehrotra RS, Aggarwal A. Plant Pathology, 2nd Edition, Tata McGraw-Hill PublishingCompany Ltd.
5. Singh RP. Plant Pathology, 2nd Edition, Kalyani Publishers.
6. Mehrotra RS, Aggarwal A. Fundamentals of Plant Pathology, Tata McGraw-Hill PublishingCompany Ltd.
7. Sambamurty AVSS. A textbook of Plant Pathology, Dreamtech Press, Wiley.
8. Gour HN. Physiological and Molecular Plant Pathology, Scientific Publishers India.
9. Dickinson M. Molecular Plant Pathology, Garland Science

Mapping of COs to syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	M	M	H		L	M	
CO2	L	H			M	M	M
CO3			M	L	M	H	
CO4				M	M	M	H

BOPE0028: PLANT ECOLOGY AND PHYTOGEOGRAPHY

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

1. Understand the concepts and scope of ecology (Remembering).
2. Understand about the fundamental structural and functional aspect of ecosystem (Understanding)
3. Analyze the characteristic feature of plant population, dynamics and interrelationships (Analysis)
4. Understand the concept of community, concept of climax, ecological succession (Understanding).
5. Understanding the concept of ecological stability and perturbations (Understanding)
6. Acquire detail knowledge on plant diversity, its status and threats, strategies for conservation (Remembering)
7. Understanding the concept of phytogeography and phyto-geographical division of India (Understanding)

Module I: Introduction to Ecology and Ecological Organization (12 Hours)

Introduction to ecology, scope of ecology, Ecosystem: concept, components and organization, structure and functions of ecosystem, energy dynamics (trophic organization, energy flow pathways, ecological efficiencies), eco-physiology, ecosystem nutrient cycles, ecological niche, ecosystem types, major ecosystems of the world

Module II: Population Ecology (14 Hours)

Population Ecology: Characteristics of population, population growth curves, population size and density, spatial distribution, Age structure, natality, mortality, biotic potential; life history strategies (r and k selection), population dynamics, competition and coexistence, population interaction, Intra-specific interactions, interspecific interactions, Mutualism and commensalism, Prey-predator interactions, Scramble and contest competition.

Module III: Community Ecology and Ecological Succession (12 Hours)

Concepts of community, species diversity and pattern diversity in community, Ecological succession: Trends of succession, Types and general process of succession, models and mechanisms of ecological succession, concept of climax, community evolution

Module IV: Ecosystem Stability (10 Hours)

Concept (resistance and resilience); ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion

Module V: Biodiversity and Phytogeography (12 Hours)

Plant diversity: Concept, status in India, utilization and concerns, Loss of diversity and causes, Indigenous medicinal systems, Strategies for conservation - in situ conservation and ex situ conservation: general account of the activities of Botanical Survey of India (BSI), Sustainable development, Phytogeography - Principles and importance of plant geography, phyto-geographicregions of world and India, biomes: Classification and components, Willis - Age and Area hypothesis. Continuous range, cosmopolitan circum polar, circum boreal and circum austral, Discontinues distribution - Wagener theory - continental drift hypothesis, endemism

Suggested Readings:

1. Kormondy EJ. Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition
2. Odum EP. Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5thedition.
3. Singh JS, Singh SP, Gupta S. Ecology Environment and Resource Conservation. AnamayaPublications, New Delhi, India.
4. Wilkinson DM. Fundamental Processes in Ecology: An Earth Systems Approach. OxfordUniversity Press. U.S.A.
5. Sharma PD. Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
6. Ambasht, R.S. (1988). A text books of plant ecology. Students, Friends & Co., Varanasi
7. Kumar, H.D. (1997). General ecology, Vikas Publication company, New Delhi
8. Pandey, K. and Shukla, J.P. (2009). Elements of toxicology, Wisdom press, New Delhi

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				L
CO2	H				
CO3		H			
CO4		L	H		
CO5				H	
CO6					H

CO7					H

BOCP0027: CYTOGENETICS AND PLANT BREEDING
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Infer eukaryotic genome organization structure of nucleosome, its assembly and deassembly (Understanding)
2. Summarize the cytogenetics of haploids and their uses in plant breeding (Understanding)
3. Compare euploids with aneuploids and explain chromosomal banding patterns (Understanding)
4. Illustrate the role of plant breeding and transgenic research in crop improvement (Understanding)
5. Outline the various methods of gene transfer (Understanding)
6. Compare the different types of DNA and also interpret gene mapping (Understanding)

Module I: Overview of Gene and Genome Organization (10 Hours)
Organization of eukaryotic genetic material, Chromatin organization and replication: Chemical constituents-DNA and histones, nucleosome and higher order organization, DNA packaging and genetic activity, nucleosome assembly and deassembly, DNA content and adaptability, nuclear DNA and C-value paradox

Module II: Cytogenetics of Haploids (8 Hours)
Haploidy/monoploidy, meiosis and breeding behaviour of haploids, uses of haploids in plant breeding and genetic studies

Module III: Euploidy and Aneuploidy (10 Hours)
Induction and characterization of monosomics, trisomics and nullisomics, aneupolid gene mapping, inheritance pattern in autopolyploids, status of allopolyploids in plant evolution

Module IV: Chromosomal banding (6 Hours)
Chromosome banding patterns: Linear differentiation of chromosome segments, types of chromosome banding, uses of chromosome banding in cytogenetics

Module V: Plant Breeding and Crop Improvement (10 Hours)
Objectives and scope of plant breeding, hybridization in self- and cross-pollinated crops, genetic basis of inbreeding depression and heterosis, breeding for disease and insect resistance, transgenes and transgenic plants, bio-safety concerns & regulation of transgenic crops in India

Module VI: Gene Transfer Technology (6 Hours)
Alien gene transfer through chromosome: Transfer of gene through individual chromosome, characterization and utility of alien addition and substitution lines

Module VII: Types of DNA and Gene Mapping (10 Hours)
Repetitive DNA, split genes, overlapping genes, physical and genetic mapping using molecular markers

Suggested Reading:

1. Allard RW. Principles of Plant Breeding (2nd Edition), John Wiley and Sons
2. Hartwell LH, Hood L, Goldberg ML, Reynolds AE, Silver LM, Veres RC. Genetics –FromGenes to Genomes, 3rd edition, McGraw Hill.
3. Acquaah G. Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. USA.
4. Hartl DL and Jones EW. Genetics – Analysis of Genes and Genomes, 7th edition, Jones andBarlett publishers.
5. Lewin B. Genes IX, Jones and Barlett Publishers.
6. Strickberger MW. Genetics, 3rd Edition, Pearson (Prentice Hall).

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H						
CO2		H					
CO3			H	H			
CO4					H		
CO5						H	
CO6							H

BOBB0029: BIOCHEMICALS, MOLECULAR TECHNIQUES & BIOINFORMATICS

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

1. Interpret different molecular biology techniques (Understanding)
2. Compare various blotting techniques, summarize spectrometry and spectroscopy (Understanding) CO3: Interpret RNAi (Understanding)
3. Demonstrate various chromatographic and microscopic techniques (Understanding)
4. Utilize the knowledge on bioinformatics to use various biological databases and software (Applying)

Module I: An introduction to Molecular Biology: methods & techniques (15 Hours)

Isolation and purification: Genomic and plasmid DNA; RNA; proteins. Electrophoresis: Polyacrylamide gel electrophoresis (PAGE), agarose gel electrophoresis, native PAGE, SDS- PAGE, 2D electrophoresis. DNA amplification and genome mapping: PCR, RT-PCR, RFLPs, RAPD, AFLP, SSR, ISSR, SNP, Isoelectric focusing (IEF): Principles, kinds of pH gradients used in IEF- free carrier ampholytes, immobilized pH gradients, genome expression analysis: Microarray, EST, SAGE. DNA sequencing: Various methods of DNA sequencing, protein and whole genome sequencing strategies. Isolation, separation and analysis of carbohydrate and lipid molecules, Bar-coding with references to plants

Module II: Immunotechniques & Biophysical methods (10 Hours)

Blotting: Principles, types of blotting, immunoblotting- Southern, Northern, Western and Dot blots, FISH, GISH, Mass spectrometry: GC-MS, LC-MS, Spectroscopy: basic concept, NMR & ESR spectroscopy

Module III: Basic principle of Gene silencing (5 Hours)

Gene silencing: RNA interference (RNAi)

Module IV: Chromatographic techniques (10 Hours)

Chromatography: Gel filtration, ion exchange & affinity chromatography, paper chromatography, TLC, HPLC, GC- basic concept

Module V: Microscopic techniques (10 Hours)

Resolving powers of different microscopes, Microscopy: Phase contrast, confocal, fluorescence, scanning & transmission electron microscopy

Module VI: Bioinformatics (10 Hours)

Basic concepts of computer hardware; Operating systems-Windows, Unix and Linux; use of common application software in biology: word processing, spread sheets, graphics and database; introduction to web browsing software and search engines with special reference to online bioscience resources; database, sequence analysis, phylogenetic inference package, sites and centres, Primer designing using various softwares, BLAST

Suggested Reading:

1. Hofmann A. Wilson and Walkers Principles and Techniques Of Biochemistry And Molecular Biology, 8th South Asia Edition, Cambridge University Press.
2. Carson S, Miller HB, Witherow DS. Molecular Biology Techniques: A Classroom Laboratory Manual, 4th Edition, Elsevier.
3. Agrawal and Suraksha. Techniques in Molecular Biology, 2008 Edition, IBDC Publishers.
4. Bajpai PK. Biological Instrumentation & Methodology, S. Chand.
5. Lesk AM. Introduction to bioinformatics, 4th Edition, Oxford Attwood TK, Parry-Smith DJ. Introduction to Bioinformatics, Pearson India

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H					
CO2		H				
CO3			H			M
CO4				H	H	H

BOER0031: ENVIRONMENTAL MANAGEMENT, RESEARCH METHODOLOGY & BIOSTATISTICS
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Acquire the concepts of Environmental Management and Environmental Impact assessment (Understanding)
2. Understand the salient features of EIA and safety norms (Understanding)
3. Identify and argue the complex issues inherent in selecting a research problem, selecting an appropriate research design and implementing a research project (Applying)
4. Understand the principal concepts in biostatistics (Understanding)
5. Analyze the concepts of scientific research problems and its solutions (Analyzing)

Module I: Basics of Environmental Management & Impact Assessment (10 Hours)
Introduction and scope of environmental management; basic concepts of sustainable development; Environmental impact assessment (EIA); general guidelines for the preparation of environmental impact statement; scope and types of environmental audit; energy audit; cost benefit analysis

Module II: Environmental Management Plans and Safety Norms (10 Hours)
Environmental management plan; ISO 14000 standards and certification; environmental risk management and environmental safety norms; International summits and treaties related with environment

Module III: Introduction to Research Methodology (10 Hours)
Definition; basic and applied research; interdisciplinary research; Discriminative reading; reading and reviewing scientific literature; biological abstract; review; monograph; peer- reviewed journals; e-resources; research and review articles

Module IV: Introduction to Research Problems, Communication and Ethics (10 Hours)
Definition of scientific problems; scientific papers and posters; Introduction to ethics, scientific conducts and misconduct; plagiarism; authorship issues; ethics of animal and human research

Module V: Introduction to Biostatistics (5 Hours)
General concepts and terminology; measures of location; scale and shape; mean, median, mode, standard deviation, standard error and coefficient of variance; Binomial, Poisson and Normal distribution

Module VI: Hypothesis Tests, Multivariate Analysis and Sampling Design (15 Hours)
Contingency tables and chi-square test; comparison of means: t-test, multiple range tests, F-test, Run test, sign test, Karl Pearson coefficient of correlation, Kruskal-Wallis H test and Mann-Whitney U-test, Analysis of variance; Correlation and regression analysis; Introduction to multivariate methods; Sampling methods; Simple experimental design

Suggested Readings:

1. Gupta SC, Kapoor, V.K. Fundamentals of Mathematical Statistics, 11th Edition, SultanChand & Sons
2. Krishnan V. Statistics for Beginners, Atlantic Publishers & Distributors Pvt. Ltd.
3. Fuller WA. Sampling Statistics, Wiley.
4. Easterling RG. Fundamentals of Statistical Experimental Design and Analysis, Wiley
5. Bhattacharyya, D. K. (2005): Research Methodology, Excel Books, New Delhi
6. Ahuja, R. (2001): Research Methods, Rawat Publications, Jaipur and New Delhi
7. Sulphey, M.M. and Safeer, M.M. (2015). Introduction to Environment Management (3rdedn.). PHI Learning Pvt.Ltd, New Delhi.
8. Tiwari, M., Khulbe, K. and Tiwari A. (2007) Environmental Studies. I.K. International, NewDelhi

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	L				
CO2	L	H				
CO3			H	H		L
CO4					H	
CO5				L	L	H

SPECIALIZATION: PLANT BIOTECHNOLOGY

BOFP0032: FUNDAMENTALS OF PLANT BIOTECHNOLOGY
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Grasp the insight of plant biotechnology (Remembering)
2. Comprehend the underlying concept of tissue culture (Understanding)
3. Learn and analyse the importance of genetic engineering in crop improvement (Analysing)
4. Utilize biosafety measures in handling GMOs and transgenics in laboratories (Applying)

Module I: Elementary Plant Biotechnology (5 Hours)
Historical background: plant cell and tissue and organ culture, principle of genetic engineering; totipotency and morphogenesis, scope and importance in crop improvement: plant tissue culture practical application and conventional plant breeding; Advantages - disadvantages

Module II: Basics of Organogenesis (7 Hours)
Organogenesis and somatic embryogenesis in plant tissue culture- development of whole plant - root formation, transfer of plant lets to the soil, hardening, principles of cellular regeneration, single cell culture and its applications, protoplast culture, factors effecting organogenesis, advantages-disadvantages and application

Module III: Micropropagation and Virus Indexing (8 Hours)
Shoot-tip meristem culture - raising virus free plants for rapid, methods of virus indexing *in vitro* mutagenesis; *in vitro* fertilization; *in vitro* germplasm conservation; hybrid embryo rescue, production of secondary metabolites, synthetic seed production technology, production of industrial phytochemicals, advantages of micropropagation in agriculture and horticulture

Module IV: Principles of Genetic Engineering (15 Hours)
Principles of recombinant DNA technology, restriction enzymes; vectors for gene transfer – gene cloning, viral vectors and their benefits, screening and selection of transformants; DNA profiling and blotting techniques, types, procedure, application, advantages-disadvantages, nanobiotechnology and its application

Module V: Genetically Modified Organisms (GMOs) and Transgenics (15 Hours)
GMOs and their significance in biotechnology, transgenic plants and its application in agriculture, different methods of plant genetic transformation, *Agrobacterium tumefaciens*, infection and molecular mechanism of tumor formation, Ti plasmids and RI plasmids, binary vectors, genetic markers, reporter genes and its application in genetic engineering, other methodsof plant genetic transformation, environmental issues associated with transgenic crops

Module VI: Biosafety, IPR and Bioethics (10 Hours)
Biosafety and risk assessment issues; national biosafety policies and law, General principles for the laboratory and environmental biosafety; creation of superweeds/superviruses, ecologicalaspects of GMOs and impact on biodiversity; food and feed safety issues associated with transgenic crops, intellectual properties, copyrights, trademarks, trade secrets, patents; Indian patent act and amendments, patent filing, Implications of intellectual property rights on the commercialization of biotechnology products

Suggested Readings:

1. Singh BD. Biotechnology: Expanding Horizon. Kalyani Publication
2. Pierik RLM. *In Vitro* Culture of Higher Plants. Kluwer Academic Publishers
3. George EF, Hall MA, Geert-Jan De Klerk. Plant Propagation by Tissue Culture (3rd Edition),Springer, Netherlands.
4. Herman EB. Media and Techniques for Growth, Regeneration and Storage Agritech Publications, New York, USA.
5. Brown TA. Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing
6. Watson J. Molecular Biology of Gene

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	H	H	H	H	H
CO2	H	H	H		L	
CO3	M			H	M	L

CO4	L	L	M	H	H	H

BOAB0033: ADVANCES IN PLANT BIOTECHNOLOGY
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course outcomes
At the end of this course, student will be able to:
1. Apply the concept of plant biotechnology into practice (Applying)
2. Work out the significance of tissue culture technique (Understanding)
3. Learn and analyze the importance of molecular techniques in up-scaling crop improvement (Understanding)
4. Figure out the importance of molecular farming in transforming secondary metabolites (Analysing)

Module I: Haploid Production and Cybridization (7 Hours)
Haploid production and uses, anther and microspore culture, pathways of development, factors affecting androgenesis, diploidization of haploids applications of haploids, limitations of haploids, cytoplasmic hybrids: technique of cybridization, application of cybrids, limitations, transgenics developed through cybridization and haploid productions

Module II: Biotransformation (7 Hours)
Hairy root cultures; screening of high yielding cell lines; procedures for extraction of high value industrial products, fractionation, bioassays; growth and production kinetics of cell cultures in shake flasks; scale-up procedures in bioreactors, types of bioreactors for plant cell cultures; Manipulation in production profile by biotic and abiotic elicitation; biotransformation of secondary metabolites

Module III: Molecular Farming and Energy Crops (7 Hours)
Aims and scope, strategies of molecular farming, production of industrial enzymes, biodegradable plastics, antibodies, edible vaccines; manipulation of metabolic pathways forproduction of secondary metabolites, transplastomics plants; energy crops: concept, types and examples, advantages-disadvantages of biofuels, application

Module IV: Molecular Markers in Crop Improvement (15 Hours)
DNA marker techniques, PCR and hybridization-based methods, methods of physical mapping – restriction mapping, DNA fingerprinting and foot printing methods, Development of sequence based molecular markers - SSRs and SNPs; advanced methods of genotyping, QTL mapping, Marker assisted selection (MAS)

Module V: Advanced Molecular Techniques (12 Hours)
Gel electrophoresis- agarose and PAGE (nucleic acids and proteins), isolation of high molecular weight DNA and analysis, southern hybridization; northern hybridization; western blotting and ELISA RNAi, antisense RNA, biosensor, Microarray studies, Marker-free transgenic development strategies

Module VI: Transgenics and Their Applications (12 Hours)
Target traits and transgenic crops, Genetic engineering for resistance against abiotic and biotic stresses; genetic engineering for increasing crop productivity by manipulation of photosynthesis, nitrogen fixation and nutrient uptake efficiency; genetic engineering for quality improvement; Discussion on application of molecular, transformation and genomic tools for the genetic enhancement in some major field crops such as rice, wheat, cotton, maize, soybean, oilseeds, sugarcane

Suggested Readings:
1. Singh BD. Biotechnology: Expanding Horizon. Kalyani Publication
2. Pierik RLM. *In Vitro* Culture of Higher Plants. Kluwer Academic Publishers
3. George EF, Hall MA, Geert-Jan De Klerk. Plant Propagation by Tissue Culture (3rd Edition),Springer, Netherlands.
4. Herman EB. Media and Techniques for Growth, Regeneration and Storage Agritech Publications, New York, USA.
5. Brown TA. Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing Watson J. Molecular Biology of Gene

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	H	H	H	H	H
CO2	H	H	H	-	-	M
CO3	-	-	L	H	H	H
CO4	-	H	H	-	-	L

SPECIALIZATION: GENETICS AND PLANT BREEDING

BOGT0034: GENETICS, PLANT BREEDING AND TRANSFORMATION
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Summarize the concepts of cell division and cell cycle (Understanding)
2. Interpret classical genetics (Understanding)
3. Illustrate the role of plant breeding in crop improvement (Understanding)
4. Outline the various techniques of plant genetic engineering (Understanding)
5. Infer the concept of cisgenics (Understanding)

Module I: Fundamentals of cell division and cell cycle (10 Hours)
Mitosis and meiosis: cell cycle, stages, synoptonemal complex, cytokinesis, molecular basis ofcell cycle: cyclin dependent kinases (Cdks) and cyclins, cell cycle and cancer

Module II: Plant Genetics: an overview (10 Hours)
Mendelian genetics, multiple alleles, linkage and crossing over, sex linked traits and sex determination, cytoplasmic inheritance, structural and numerical changes in chromosome, mutation

Module III: Plant breeding for crop improvement (20 Hours)
Hybridization techniques in self- and cross-pollinated crops, molecular markers and their applications, role of association mapping and allele mining in crop improvement

Module IV: Recombinant DNA technology and genetic engineering (20 Hours)
Gene cloning, methods of plant transformation, biosafety issues and regulation of GMOs, generation of marker free transgenic lines: cre-lox system, co-transformation, FLP/FRT recombination system, AC/DS transposon system, twin T-DNA binary vector, cisgenics

Suggested Reading:

1. Alberts B, Johnson A, Lewis J, Morgan D, Raff M, Roberts K, Walter P. Molecular Biologyof the Cell, 6th Edition, W.W. Norton & Co., U.S.
2. Acquaah G. Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. U.S.A.
3. Snustad DP, Simmons MJ. Principles of Genetics, 6th Edition, John Wiley & Sons, Inc., U.K.
4. Strickberger MW. Genetics, 3rd Edition, Pearson (Prentice Hall)
5. Singh BD. Plant Breeding: Principles and Methods, Kalyani Publishers, India
6. Brown TA. Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing
7. Primrose SB, Twyman R. Principles of Gene manipulation and Genomics, 7th Edition,Wiley-Blackwell
8. Nigel AS. Plant Biotechnology: The genetic manipulation of plants, 2nd Edition, OxfordUniversity Press
9. Gupta PK. Molecular Biology and Genetic Engineering, Rastogi Publications

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H
CO5				H

BOMB0035: MOLECULAR GENETICS AND BIOINFORMATICS
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Interpret the fundamental processes in biology (Understanding)
2. Summarize the concepts of gene silencing (Understanding)
3. Comprehend the notions of genome editing (Understanding)
4. Utilize the knowledge on bioinformatics to run various biological databases and soft-wares (Applying)

Module I: Understanding the fundamental processes (20 Hours)
DNA replication, repair and recombination, RNA and protein syntheses and their processing,regulation of gene expression

Module II: Gene silencing: Its concepts (10 Hours)
Transcriptional and post transcriptional gene silencing, RNAi: History, mechanism, enzymesinvolved; role of RNAi in crop improvement

Module III: Introduction to genome editing (15 Hours)
Genome editing: basic concepts, history, techniques of genome editing: TALENs, ZFNs,CRISPR/Cas (CRISPR/Cpf1), application of genome editing in crop improvement

Module IV: Bioinformatics (15 Hours)
Understanding the concepts of bioinformatics, its applications, introduction to online biological databases, phylogenetic inference package, sites and centers, BLAST, sequence alignment, primer designing, conceptual data modeling

Suggested Reading:

1. Watson J, Baker TA, Bell SP, Gann AAF, Levine M, Losick RM. Molecular Biology of theGene, 7th Edition, Pearson Education
2. Lewin B. Genes IX, Jones and Barlett Publishers
3. Sohail M. Gene silencing by RNA Interference, 1st Edition, CRC Press
4. Hannon GJ. RNAi a guide to gene silencing, 2nd Edition, Cold Spring Harbor LaboratoryPress, U.S.
5. Ridge Y. CRISPR: A powerful way to change DNA, Annick Press
6. Lesk AM. Introduction to bioinformatics, 4th Edition, Oxford Attwood TK, Parry-Smith DJ. Introduction to Bioinformatics, Pearson India

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

SPECIALIZATION: ANGIOSPERM TAXONOMY

BOTS0038: TAXONOMY OF ANGIOSPERMS AND BIOSYSTEMATICS
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Understand the concepts of plant identification, classification, nomenclature and biosystematics (Understanding)
2. Identification of plant with the help of keys and their relevant literatures (Applying)
3. Comparison of classical plant taxonomy with modern experimental plant taxonomy (Analyzing)
4. Summarize taxonomic hierarchy and principles and rules of botanical Nomenclature (Understanding)
5. Application of numerical taxonomy and phylogenetic systematic in angiosperms (Applying

Module I: Taxonomy and Biosystematics (10 Hours)

Taxonomy: Components of taxonomy, Phases of taxonomy, Integrative taxonomy, Cyber taxonomy, DNA taxonomy, Reverse taxonomy. Systematics: Development and scope, Aim and Objectives, Significance. Biosystematics: Objectives, Steps, Relationship with Classical Taxonomy

Module II: Identification and Taxonomic Literature (10 Hours)
Methods of Plant identification; Taxonomic Keys: Single access and Multi-access; Character andCharacter states; Field inventory; Collection; Herbaria: Functions of Herbarium, Preparation of Herbarium; Important herbaria and botanical gardens of the World and India; Virtual herbarium. Taxonomic Literature: Flora, E-flora, Monographs, Revisions, Checklists, Periodicals; Taxonomic Indexes; Ret Data Book

Module III: Taxonomic Hierarchy and Botanical Nomenclature (15 Hours)
Concept of taxa (family, genus, species); Categories and Taxonomic Hierarchy; Infra-species; Species Concept (taxonomic, biological, evolutionary); Principles of Nomenclature (ICNafp); Rules of Nomenclature: Ranks and names; Typification, Priority of Publication; Nomenclature of Taxa; Effective Publication; Valid Publication; Author Citation; Rejection of Names, principle of priority and its limitations; Names of hybrids

Module IV: Systems of classification and Systematic evidences (10 Hours)
Major systems of classification: basis, merits and demerits: Cronquist (1981); Takhtajan's System (1997), APG Classification, with special reference to APG IV (2016). Systematic evidences: Morphology, Anatomy, Embryology, Palynology, Cytology, Phytochemistry, Molecular taxonomy–DNA barcoding

Module V: Numerical Taxonomy, Phylogenetic Systematic (Cladistics) (15 Hours)
Numerical Taxonomy: Principles, Methods, Characters, Variations; OTUs, Character Weighting,Coding, Cluster analysis, Phenogram, Merits and Demerits; Biometrics. Cladistics: Methodologyof Cluster Analysis, Applications. Homology and Homoplasy; Monophyly, Paraphyly and Polyphyly; Primitive and Advanced; Phylogenomics

Suggested Readings:

1. Pandey, B.P. A textbook of Botany: Angiosperms S. Chand.
2. Sharma, O.P. Plant Taxonomy McGraw-Hill Education
3. Mandal, A.K. Advanced Plant Taxonomy New Central Book Agency
4. Nair, R. Taxonomy of Angiosperms Aph Publishing Coorporation
5. Gupta, R. Plant Taxonomy: Past, Present and Future The Energy and Research InstituteTERI.
6. Balfour, A. (Editor) Plant Taxonomy Syrawood Publishing House.
7. Singh, G. Plant Systematics: An Integrated Approach. CRC Press.
8. Bhojwani, S.S., Bhatnagar, S.P. and Dantu, P.K. The Embryology Angiosperms, VikasPublishing.
9. Davis, P.H. and Heywood, V.H. Principles of Angiosperm Taxonomy, Scientific Publishers(India).
10. Lawrence, G.H.M. Taxonomy of Vascular Plants Scientific Publisher.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3	M			H	
CO4			H		
CO5					H

BOBE0039: ECONOMIC BOTANY AND ETHNO-BOTANY

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Understand the nature of plant products, aspects and classification of economic important plants (Understanding)
2. Taxonomic status of food plants, industrial plants and drug plants and its uses (Understanding)
3. Understand the cultivation, extraction processes and uses of different economically useful plants (Understanding)
4. Understand the need to conserve floristic and cultural diversity of the region (Understanding)
5. Rescue and document Ethno-botanicals for sustainable use of plant resources (Analyzing)

Module I: Introduction to Nature of Plant Products (10 Hours)
Importance and Nature of Plant Products: Protoplasm and its Activities; Photosynthesis; Plant skeleton; Reserved food (Carbohydrates, Fats and Proteins); Secretions and Excretions (Essential Oils, Pigments, Tannins, Latex, Waxes, Alkaloids, Glycosides, Organic Acids, Enzymes, Vitamins, Hormones). Different Aspects of Economic Botany;

Classification of Economically Important Plants

Module II: Fibers and Fibers Plants (5 Hours)
Economic Classification of Fibers: Textile Fibers; Surface Fibers; Soft Fibers; Structural Fibers; Brush Fibers; Plaiting and Rough Weaving Fibers; Filling Fibers; Natural Fabrics; Paper Making Fibers. Cotton, Jute, Flax and Agave (Characteristics, Cultivation, Extraction, Uses)

Module III: Forest Products and Resources (5 Hours)
Importance and Structures of Wood; Mechanical Properties and Factors of Wood; General account with special reference to Teak, Sal, Pine and Bamboos

Module IV: Tanning and Dye materials (5 Hours)
Sources of Tanning Materials: Barks, Leaves, Fruits, Roots; Manufacture of Tannins inks. Sources of dyestuffs: Barks, Leaves, Flowers, Fruits, Roots, Woods. General account withspecial reference to Indigo, Safflower and Lichens

Module V: Oil-Yielding, Sugar-Yielding and Rubber-Yielding Plants (5 Hours)
General account with special reference to Drying oils, Semi drying oils; Non-drying oils and Vegetables Fats. Sugarcane and Sugar beet (cultivation, extraction and uses); Para rubber and Assam Rubber: Tapping, Processing and Uses. Fatty oils and their extractions

Module VI: Cereals, Pulses, Beverages and Spices (5 Hours)

Staple food crops - cereals, pulses, millets; tropical, subtropical and temperate fruits; Tea, Coffeeprocessing and uses; Important spices, their family and part used

Module VII: Introduction to Ethno-botany (10 Hours)
Concept, Relevance, Scope and Status; Plant parts used in Ethno-medicine; Role of Ethno- medicine and its scope in modern times. Concept of Protected Areas; CITES, IUCN Red List Categories. Role of Ethno-botany in conservation and sustainable development; Centers of Ethno botanical studies in India; Contributions of AICRPE and FRLHT to ethno-biology of India

Module VIII: Methods and techniques in Ethno botany (15 Hours)
Field activities for data collection: Approach, Documentation, Consent forms, Forest productivity check by analyzing the log books of Forest, Authentication of plant species and Lab Procedures, Preparation of Data Sheet and Data Base. People Biodiversity Register (PBR). Impact of Ethno-botany in herbal medicine industry, land-use development, agriculture, forestry, betterment of rural livelihoods and education; Biodiversity and conservation of useful medicinal plants; Sharing of wealth concept with few examples from India; Plant used in ethno-medicine e.g.: *Emblica officinalis*, *Ocimum sanctum*, *Saraca asoca*, *Rauwolfia serpentina*, *Mentha piperita*, *Aloe vera*, *Eclipta alba*, *Azadirachta indica*, *Centella asiatica* preparation and their uses.

Suggested Readings:

1. Pandey B.P. Economic Botany, Revised edition, S. Chand Publishers, New Delhi References
2. Verma V. Textbook of Economic Botany, First edition, Ane Books Pvt. Ltd., New Delhi
3. The Wealth of India – Raw Materials Series. CSIR publications, New Delhi.
4. Sharma, O.P. Hill's Economic Botany. Tata McGrow Hill, New Delhi.
5. Kocchar, S.L. Economic Botany of the Tropics. McMillan India Ltd., Delhi.
6. Pandey, B.P. Economic Botany. S. Chand & Co., New Delhi.
7. Das, A.P. & Pandey, Advances in Ethno-botany. Bishen Singh Mahendra Pal Singh, DehraDun.
8. Saroya, A.S. Herbalism, Phytochemistry and Ethnopharmacology, CRC Press, UK
9. Jain, S. K. & Mudgal, V. A. Handbook of Ethno botany, Bishen Singh Mahendra Pal Singh, Dehra Dun.
10. Nair, M. N. B., Hamami, S. M. & Ashaari, Z. Sustainable Management of Non-Wood Forest Products. Sustainable management of non-wood forest products: proceedings of an international workshop. University Putra Press, Malaysia.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	H							
CO2		M	M	M	M	M		H
CO3		H			H			

CO4							M	H
CO5							H	
CO6								H

SPECIALIZATION: PLANT ECOLOGY

BOEG0040: ECOLOGY, ENVIRONMENT AND GLOBAL CONCERNS
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Understand about the fundamental characteristic, structural and functional aspect of ecosystem (Understanding)
2. Understand environmental pollution its cause, effects and control (Understanding)
3. Understand the scenario and mechanism of climate change and also various mitigation initiatives undertaken (Understanding)
4. Addresses ecological resilience and its relationship to ecosystem services (Analyzing)

Module I: Ecology and Ecosystem Analysis (12 Hours)
Principles and Scope of Ecology Structure and Functions of Ecosystems - Abiotic and Biotic components; Energy dynamics; Niche concept; Eco-physiology; Ecosystem nutrient cycles; Ecosystems Types and Diversity; Concepts relating to limiting factors; Populations and communities characteristics; Population dynamics; Population interaction; Models and mechanisms of ecological succession; Ecosystem Stability

Module II: Environment and Pollution (18 Hours)
Energy and Environment; Components, types and segments of Environment; Environmental pollution: Origin of pollution, types of pollutions; Atmosphere: region and composition ofatmosphere; Air pollution: classification and major air pollutants, sources and effect of airpollution; Water pollution: types of pollution and pollutants, sources and effect of water pollution; Soil pollution: sources and effect of soil pollution; Treatment and control of pollution

Module III: Climate Change and Awareness (18 Hours)
Basic concepts and mechanism: Climate change, ozone layer depletion, global warming and greenhouse effect, causes and consequences; Mitigation and adaptation: Carbon storage and sequestration, carbon management: biotic and abiotic, Carbon farming and carbon trading; International responses: Intergovernmental Panel on Climate Change (IPCC) and its role, United Nations Framework Convention on climate change (UNFCCC), CDM and Kyoto Protocol, REDD+, The Copenhagen Accord; India's response to climate change

Module IV: Ecological Resilience and Ecosystem Services (12 Hours)
Definitions and concepts of ecological resilience; Characteristics of Resilient Ecosystem; Ecological, General, and Spatial Resilience; Linkage between Resilience, Vulnerability and Adaptive Capacity; Components of Resilience-Based Management; Ecosystem service concept, model and classification; Factors and drivers determining ecosystem services; Mapping and assessment of ecosystem services, Ecosystem services in natural resource management

Suggested Readings:

1. Odum, E., & Barrett, G. (2009). Fundamentals of ecology. Australia: Cengage Learning.
2. Kormondy, E., & Kormondy, E. (1986). Concepts of Ecology. Prentice Hall, New Delhi.
3. Singh, J.S., Singh, S.P., & Gupta, S. (2014). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
4. Sharma, P.D. (2012). Ecology and Environment. Rastogi Publications, Meerut, India. 8thedition
5. Ahluwalia, V., & Malhotra, S. (2013). Environmental Science. New Delhi: Ane Books.
6. Parry, M.L., et al. Climate change 2007: Impacts, Adaptation and Vulnerability, CambridgeUniversity Press
7. Singh, P., Singh, S., Rangabhashiyam, S., & Srivastava, K.K. (2021). Global Climate Change. Elsevier Science, Netherlands
8. Gunderson, L., Allen, C.R., & Holling, C.S. (2012). Foundations of Ecological Resilience,Island Press.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			L
CO2		H	M	
CO3		M	H	L

CO4			L	H

BORG0042: RESTORATION ECOLOGY AND GEOINFORMATICS
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Understand the ecological perspectives of restoration including factors that regulate ecosystem function (Understanding)
2. Understand the ecological theories that have moulded restoration ecology (Understanding)
3. Relate restoration practices and efforts to different ecological levels (Applying)
4. Explores into the planning, execution, monitoring, and assessment of restoration work (Analysing)
5. Role of remote sensing as a tool for ecological restoration processes (Applying)

Module I: Introduction to Restoration Ecology (8 Hours)
Concept and Definition of Restoration Ecology; Degradation of Ecosystems; Different Restoration Approaches; Varying Scales of Restoration; Ecosystem Disturbances; Fire Disturbances; Fragmentation; Nutrient and Hydrological Cycling; Keystone Species

Module II: Succession and Assembly (8 Hours)
Theories of Succession; Successional Processes and Restoration; Management of Succession; Monitoring Succession; Ecosystem Resistance and Stability; Regime Shift; Assembly Rules

Module III: Biodiversity and Forest Restoration (10 Hours)
Levels of Biodiversity; Threats to Biodiversity; Extinction; Rate of Extinction and Species vulnerability; Restoration of Genetic Diversity; Restoration of Species Diversity; Ecosystem Diversity; Forest Degradation; Forest Restoration

Module IV: Landscape and Invasive species (12 Hours)
Definition and Types of Landscape; Landscape matrices; Connectivity and Metapopulation; Landscape Restoration; Process of Invasion; Effects of Invasion on Ecosystems; Methods to Control Invasion; Restoration to Constrain Invasion

Module V: Management of Restoration Plans (10 Hours)
Project Planning; Implementation; Adaptive Management Cycle; Monitoring; Selecting Monitoring Parameters and Methods; Additional Considerations in Developing a Monitoring Plan; Legal Framework and International Agreements

Module VI: Remote Sensing in Restoration Ecology (12 Hours)
Remote sensing fundamentals; Satellite Data and Sensors; Spectral, Temporal, Radiometric and Temporal Resolutions; Image Processing; Image Interpretation and Classification; Accuracy Assessment; Measuring and Monitoring Land Cover, Land Use, Change and Vegetation Characteristics; Conservation and Ecology Applications; Global Positioning System

Suggested Readings:

1. Greipsson, S. (2011). Restoration Ecology. United States: Jones and Bartlett Publishers.
2. Holl, K. (2016). Foundations of Restoration Ecology. United States: Island Press.
3. Holl, K. (2020). Primer of Ecological Restoration. United States: Island Press.
4. Aronson, J., (2012). Restoration Ecology: The New Frontier. Germany: Wiley.
5. Sarah, E.G., & Turner, M. (2017). Learning Landscape Ecology: A Practical Guide to Concepts and Techniques. Germany: Springer New York.
6. Lillesand, T. M., & Kiefer, R. W. (1994). Remote Sensing and Image Interpretation. UnitedKingdom: Wiley.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	L				
CO2		H				
CO3			H	H	L	
CO4					H	
CO5			L	L		H

SPECIALIZATION: PLANT PATHOLOGY AND MICROBIOLOGY

BOPY0043: PLANT PATHOLOGY

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

1. Classify various Plant diseases and their causative organisms (Understanding)
2. Analyze the roles of pathogens in diseases development (Analyzing)
3. Identify and detect various modes of pathogen attack and defence strategies of plants (Applying)
4. Asses specific plant diseases caused by various microorganisms (Analyzing)
5. Asses and apply disease control measures and techniques (Evaluating)

Module I: Introduction (16 Hours)

Introduction to Plant pathology; The concept of disease in Plants; History of plant pathology; Types of plant diseases; Role of pathogens as causes of plant disease; Significance of plant disease; Basic procedure in diagnosis of plant diseases-Infectious diseases (caused by Parasitic higher plants, Nematodes, Fungi, bacteria, Viruses and Viroids) and non-infectious diseases; Identification of previously unknown disease: Koch's rules

Module II: Parasitism and Disease Development (8 Hours)

Parasitism and pathogenicity; Development of disease in plants: Stages in the development of disease (Disease cycle); Relationship between disease cycle and epidermis.

Module III: Pathogen attack and Plant Defense Mechanisms (10 Hours)

Mode of pathogen attack via various means (Mechanical force, Chemical, Enzymatic, Microbial toxins); Role of growth regulators in plant disease; Plant defence against pathogen: Pre-existing Structural and chemical defenses, Induce structural and biochemical defense

Module IV: Specific Plant Diseases (20 Hours)

Plant diseases caused by Fungi: Characteristics of fungal pathogen; Symptoms and Isolation of pathogen; Late blight of potato, Downy mildews/Powdery mildews, Ergot of cereals and grasses, Loose smuts of cereals; Plant diseases caused by Bacteria: Characteristics of bacterial pathogens, Identification and symptoms caused; Bacterial blight of beans, Crown gall, Citrus canker; Plant diseases by Viruses: Characteristics of Viruses; Symptoms caused by viruses and their transmission, Viroids; Plant diseases caused by Nematodes: Characteristics of plant pathogenic nematodes; Isolation of nematodes and their symptoms; Root-knot, cyst, lesion caused by nematodes; Plant diseases caused by Protozoa: Charatcteristics; Phloem necrosis of Coffee, Empty root of Cassava

Module V: Disease Control Management (6 Hours)

Control methods: Exclusion of plant pathogens; Eradication or reduced pathogen inoculum; Immunizing or improving the host resistance; overview of integrated pest management

Suggested Reading:

1. Agrios GN. Plant pathology, 4th Edition, Academic Press London, UK.
2. Mehrotra RS, Aggarwal A. Plant Pathology, 2mnd Edition, Tata McGraw-Hill Publishing Company Ltd.
3. Singh RP. Plant Pathology, 2nd Edition, Kalyani Publishers.
4. Mehrotra RS, Aggarwal A. Fundamentals of Plant Pathology, Tata McGraw-Hill Publishing Company Ltd.
5. Sambamurty AVSS. A textbook of Plant Pathology, Dreamtech Press, Wiley.
6. Gour HN. Physiological and Molecular Plant Pathology, Scientific Publishers India.
7. Dickinson M. Molecular Plant Pathology, Garland Science

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H			L	
CO2		H			
CO3		M	H		
CO4				H	
CO5					H

BOMA0044: MICROBIAL GENETICS AND APPLIED MICROBIOLOGY

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

1. Tell the chemistry and functions of microbial cells and organelles (Understanding)
2. Apply the concepts of vector and cloning mechanisms in plant improvement (Applying)

3. Understand the gene regulatory mechanisms and pathways and their functions (Understanding)
4. Understand the roles of microbes in industries and environment (Understanding)
5. Detect and identify microorganisms from any samples (Evaluating)
6. Use microbes in agriculture, industries and environmental protection (Applying)

Module I: Microbial Cells and organelles (8 Hours)
Over view of prokaryotic cell- structure &functions, cell wall synthesis, Membrane transport in bacteria-simple, group translocation, ABC transporters, Protein export in bacteria. Membrane organelles: lysosomes, mitochondria (with small ribosomes), Golgi bodies, endoplasmic reticulum, nucleus

Module II: Microbial Genetics and Microbial vectors in genetic Engineering (18 Hours)
Structure, function and types of DNA and RNA, DNA replication in bacteria; Gene expression (concept of gene, gene structure, genetic code, transcription and translation, post transcriptional and post translational modifications); Gene regulation in prokaryotes- The operon concept (Lac and Trp operon -induction and repression); Mutations (Definition, types, molecular basis of mutations, detection of mutants); DNA repair mechanisms (Dark repair, photo-reactivation, recombination repair, SOS repair), Transposons; Plasmid (size, copy numbers, classification, applications as vectors; Bacteriophages (types, applications as vectors); vectors for eukaryotes and other higher plants; plasmids and antimicrobial resistance, cloning (basic principle, techniques and applications)

Module III: Microbes Preservation and Fermentation technology (12 Hours)
Importance of preservation of microbes, types of preservation techniques, revival of microbes; History of fermentation, introduction to fermentation processes, Microbial culture selection for fermentation processes. Media formulation and process optimization; Design and operation of Fermenters, Basic concepts for selection of a reactor, Packed bed reactor, Fluidized bed reactor, Trickle bed reactor, Bubble column reactor, Scale up of Bioreactor; basic concept of upstream and down-stream processing

Module IV: Microorganisms in Environmental and Agriculture (15 Hours)
Microbes as tools for pollution abatement, bio-indicators, restoration of degraded ecosystem, biodegradation, bioremediation, biogenic gases; Role of microbes in relation to agriculture: nitrogen economy, plant health, biological control. Symbiotic association: concepts, types and application

Module V: Microorganisms in Food and Pharmaceutical Industries (10 Hours)
Microbes in food and dairy industries: mushroom, fermented foods, microbial spoilage of food and dairy products; Gene manipulation for production microbial toxin, types, mode of action, production of novel commercial products such as biopolymer and antibiotics; basic concepts of immunology, vaccines, immunotherapy, microbes in biological warfare

Suggested Reading:
1. Willey JM, Sherwood L, Woolverton CJ (2013) Prescott's Microbiology, 9 th edition, McGraw-Hill, New York.
2. Pelczar M.J., Chan E.C.S. and Krieg N.R. (2003) Microbiology. 5 th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Waites MJ, Morgan NL, Rockey JS, Higton G. Industrial Microbiology: An Introduction, Wiley-Blackwell
4. Brock T.D. and Madigan M., Biology of Microorganisms, Prentice Hall of India Pvt. Ltd.
5. Moat A.G. and Foster S.W., Microbial Physiology, John Wiley and Sons, New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3		H			
CO4			H		
CO5			H		
CO6			L	H	H

SPECIALIZATION: PLANT PHYSIOLOGY AND BIOCHEMISTRY

BOPP0045: ADVANCE PLANT PHYSIOLOGY
(4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Analyze the role of microbes in mineral acquisition (Analyzing)
2. Understand the process of photosynthesis and respiration and its regulatory enzymes (Understanding)

3. Interpret the signal transduction and gene expression of growth hormones (Understanding)
4. Assess the mechanism of plant response towards abiotic and biotic stresses and action of photoreceptors (Evaluating)

Module I: Mineral nutrition (8 Hours)
Mineral Absorption and transport, Role of microbes in nutrient acquisition by plants; Assimilation of mineral nutrients with emphasis on phosphorus and potassium assimilation

Module II: Photosynthesis (10 Hours)
Primary charge separation events in reaction centres; regulatory action of uncoupling agents of photophosphorylation; energy loss during vectorial electron transfer in light reaction; genetics of RUBISCO subunit assembly and organization in plants; physiological and ecological aspects of photosynthesis; efficiency of carbohydrate synthesis

Module III: Respiration (12 Hours)
Regulation of key respiratory enzymes with particular emphasis on phosphofructo kinase, glyceraldehydes-3-phosphate dehydrogenase and pyruvate dehydrogenase; mechanism of action of inhibitors of oxidative phosphorylation; arrangement and organization of protein complexes in mitochondrial electron transport chain

Module IV: Plant growth regulators (12 Hours)
Signal perception and signal transduction, hormone binding receptors, hormone induced changes in gene expression and specific functions of Auxin – cell elongation, Gibberellins – germination of dormant seeds, Cytokinins – cell division and retardation of senescence of plant parts, Abscisic acid – stomatal closure and induction of drought resistance and Ethylene – fruit ripening

Module V: Stress Biology and Sensory Photobiology (18 Hours)
Mechanism of plant response to water (low and high), temperature (low and high), Salt (Salinity and Alkalinity), heavy metals and biotic stresses (Pathogens and insects), Oxygen deficiency. Sensory Photobiology: Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins

Suggested Reading:

1. Davies PJ. Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition, Kluwer Academic Publisher, Dordrecht, The Netherlands
2. Taiz L and Zeiger E. Plant Physiology, 4th Edition, Sinauer Associates Inc. Publishers, Massachusetts, USA
3. Bajracharya D. (1999) Experiments in Plant Physiology- A Laboratory Manual, Narosa Publishing House, New Delhi
4. Hopkins, W.G. and Huner, A. (2008) Introduction to Plant Physiology, 4th edition, John Wiley and Sons, USA

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H	H		
CO3				H	
CO4					H

BOBM0046: PLANT BIOCHEMISTRY AND METABOLISM

(4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Understand the molecular biology of nitrogen fixation (Understanding)
2. Interpret the biosynthesis of secondary metabolites and their defence mechanism (Understanding)
3. Rephrase the structure and functions of vitamins (Understanding)
4. Understand the mechanism of cell signalling (Understanding)
5. Determine and estimate different phytochemical compounds from plant samples (Evaluating)

Module I: Nitrogen metabolism (10 Hours)
Process of biological nitrogen fixation; nodule formation-role of NOD genes and nodulins; NIF genes; molecular biology of nitrogenase complex; regulation of nitrogen fixation; nitrogen assimilation in higher plants

Module II: Secondary metabolites (12 Hours)
Biosynthesis and roles of terpenes, phenolic compounds, nitrogen containing compounds; commercial and economic importance of secondary metabolites; role of secondary metabolites in plant defence against insects, herbivores and pathogens

Module III: Vitamins (10 Hours)

Structure, and functions of Thiamine, Riboflavin, Nicotinic Acid, Pantothenic Acid, Pyridoxine, Biotin, Folic Acid, Vitamin B12, Ascorbic Acid, Vitamin A, D, E and K

Module IV: Cell Signalling (16 Hours)
Overview, second messengers, receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascade, diversity in protein kinases and phosphatases, specific signaling mechanisms and their regulation, e.g. simple and hybrid type of two-component sensor-regulator system in bacteria and plants (examples of chemotaxis, osmosensing, ethylene and cytokinin signaling), quorum sensing

Module V: Biochemical methods (12 Hours)
Determination of mineral nutrients in plant samples; Estimation of chlorophyll and carotenoids from leaf sample; Preparation of standard curve, extraction and estimation of total soluble sugars, starch, total free amino acids, total protein, fats, vitamins, antioxidative enzymes, secondary metabolites from plant samples.

Suggested readings
1. Nelson DL and Cox MM. (2004) Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, USA.
2. Davies PJ. Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition, Kluwer Academic Publisher, Dordrecht, The Netherlands
3. Taiz L and Zeiger E. Plant Physiology, 4th Edition, Sinauer Associates Inc. Publishers, Massachusetts, USA
4. Bajracharya D. (1999) Experiments in Plant Physiology- A Laboratory Manual, Narosa Publishing House, New Delhi

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H		M		
CO2	M	H			
CO3				H	
CO4			H		
CO5				H	M

SPECIALIZATION: ADVANCES IN PLANT SCIENCE

BOBB0047: BIOMASS, BIOREFINERY AND CIRCULAR BIOECONOMY
(4 CREDIT, 60 Hours T-L-T:4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Identify potential biomass feedstocks including energy crops based on its biochemical composition (Analysing)
2. Have an understanding of the existing and emerging biomass to various technologies (Understanding)
3. Develop a critical thinking about sustainability and its prospect to generate circular bio-economy (Evaluating)
4. Determine sustainable solutions for bioresources by incorporating different technologies and assessment will be explored. (Application)

Module I: BIOMASS FEEDSTOCK, COMPOSITION AND SUPPLY LOGISTICS (10 Hours)
Biomass Feedstocks I- Harvested Feedstocks (first generation feedstock, second generation, third generation feedstocks) in context to biofuel and biorefinery. Biomass Feedstocks II- Residue Feedstocks (Agricultural waste, Forestry waste, Farm waste, Organic components of residential, commercial, institutional and industrial waste). Biochemical composition of different biomass feedstock. Conventional and Advanced logistic Systems, Feedstock barriers and strategies moving forward, Supply chain and reverse logistics

Module II: BIOMASS CONVERSION TECHNOLOGIES (12 Hours)
Biomass Conversion Technologies I- Biorefinery Concept -Understanding biorefinery concept, Bio-refineries & endproducts. Biomass Conversion Technologies II- Biochemical Conversion I-(Hydrolysis, enzyme & acid hydrolysis, Fermentation). Biochemical Conversion II- (Anaerobic digestion, Trans-esterification. Biomass). Conversion Technologies III- Thermochemical Conversion -(Combustion, Gasification, Pyrolysis. Other thermochemical conversion technologies, Scaling up emerging technologies.

Module III: LOW CARBON CIRCULAR ECONOMY and VALUE-ADDED CHEMICALS (16 Hours)
Advanced low-carbon economy from biofuel/biopolymer/value added product–Case study, Mixed alcohols (Acetone, ethanol, butanol), C3 sugars (Lactic acid, Propionic acid), C4 sugars (Malic acid), C5 sugars (Furfural, levulinic acid, xylitol), C6 Sugars Hydroxymethylfurfural (HMF), Lignin, PHB, Bio-oil, biochar, biodiesel, bio hydrogen and other value-added

organic products. carbon credit and carbon economy. Bioeconomy, value creation and business development, Circular economic principles and business models Biotechnology and other bioprocesses enabling circular bioeconomy. Opportunities, framework conditions and barriers for a circular bioeconomy.

Module IV: BIOREFINERY (10 Hours)
Basic Concept and Types of Integrated biorefinery (Aquaculture and algal biorefinery, waste biorefinery). Economics and Life Cycle Analysis I- (General understanding of LCA, Cradle-to-grave, field to wheels concepts, Goal and scope determination, defining LCA boundaries). Life Cycle Analysis II. Life Cycle Inventory, Life Cycle Assessment. GIS based distribution study.

Module V: BIOSAFETY, IPR AND ENTREPRENEURSHIP (12 Hours)
History of biosafety, risk assessment, biosafety levels, personal protective equipment, laboratory facilities and safety equipment, disinfection, decontamination, sterilization, regulatory compliance, laboratory security and emergency response, administrative controls, Current trends in biosafety. Patentability search in biofuel sectors. Entrepreneurship essentials: opportunities, ideas and Innovation; feasibility an-d market research; business plan; Building a business: business models, Startup ecosystem; Technology and bio-entrepreneurship – case studies.

Suggested readings:

1. Ashok Pandey, R. D. Tyagi, Sunita Varjani. Biomass, Biofuels, Biochemicals: Circular Bioeconomy—Current Developments and Future Outlook. 2021, Elsevier Science Publishing Co Inc.
2. Wiebke Reim, Vinit Parida, David R. Sjodin. Circular Business Models for the Bio-Economy: A Review and New Directions for Future Research. Sustainability; 11, 2558.
3. Juan-Rodrigo Bastidas-Oyanedel, Jens Ejbye Schmidt. Biorefinery “Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels, and Fertilizers.”Springer.
4. Fundamentals of Entrepreneurship. 3rd Edition, Nandan H, 2007, Phi Learning, New Delhi.
5. Entrepreneurship and Small Business Management, 2nd Edition, Mariotti S and Glackin C, 2016, Pearson Publishers.
6. Ipr Biosafety And Bioethics 2013 Edition by GOEL, PEARSON

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H		M		
CO2	M	H			
CO3				H	
CO4			H		
CO5					
CO6				H	M

BOPD0048: BIOPROSPECTING OF PLANT DIVERSITY AND AUTOMATION
(4 CREDIT, 60 Hours T-L-T:4-0-0)

Course Outcomes
At the end of this course, student will be able to:
1. Identify and explore the prospect of Plant and its molecules in industry (Understanding)
2. Recalling the Bio prospect of various plant molecules for commercialization (Remember)
3. Application of GIS and remote sensing in plant resource utilization and mapping (Analysing)
4. Understanding the impact climate change in soil microbiome affecting Plant diversity (Understanding)
5. Understanding the role of Automation in plant Science (Applications)

Module 1: Introduction to Bioprospecting: (6 Hours)
Definition, Introduction, recent trends in Bioprospecting, Pros and Cons, Omics and in silico bioprospecting, bionic bioprospecting, Bioprospecting Act and Biopiracy.

Module 2: Microbial and Marine Bioprospecting: (8 Hours)
Sources of marine planktons and their Bioprospecting, Isolation and cultivation of Marine Bioresource, Isolation of algal strain, Types of cultivations and its industrial applications, Bioactive chemicals from Seaweeds and their applications. Role of algae in Biodiesel, fertilizers and nanobiotechnology. Isolation of Microbial metabolites and their bioactivity. Endophytic microbial products as Antibiotics.

Module 3: Bioprospecting of Forestry and above ground biomass residues (8 Hours)
Cultivation and uses of Food, Fodder, paddy waste, Fibers, Oil yielding crops, wood and timber, Non-wood forest products (NWFPS): Bamboos, Invasive Plant management and valorization, Gums, Dyes, Resins, Fruits etc, Botany, Chemistry, Properties and uses of Medicinal, herbal and Aromatic plants, rle of plants in phytoremediation of industrial waste

Module 4: Application of Remote Sensing and GIS in Bioresource management and Conservation. (10 Hours)
GIS in agro-residue bioenergy planning, Issues needing attention while using GIS, Life Cycle Assessment (LCA) in agro-residue, Spatial LCA in bioenergy and environmental planning, Satellite sensors used in Remote sensing, Predictor variables, Spectral indices, vegetation index and spatial imagery for biomass distribution

Module 5: Biotransformation and Fermentation technology (10 Hours)
Molecular farming, production of industrial enzymes, biodegradable plastics, antibodies, edible vaccines; manipulation of metabolic pathways for production of secondary metabolites, transplastomics plants, extraction of high value industrial products, growth and production kinetics of cell cultures in shake flasks; scale-up procedures in bioreactors, types of bioreactors for plant cell cultures; Manipulation in production profile by biotic and abiotic elicitation. Production of crop plants under organic and conventional fanning system, Bio-fertilizers, Bio-methylation, preparation of compost / vermicomposting.

Module 6: Microbiome and Climate Change (8 Hours)
Microbiome data for applications in energy, environment, health, and agriculture, Implication of Soil microbiome, climate change and carbon storage nexus, Clean Development Mechanism, carbon offset, carbon cycle, carbon sequestration, Carbon capture, storage and uptake and Artificial photosynthesis

Module 7: Automation in Plant Science (10 Hours)
Application of IOT, digital image processing in plants (quantifying disease detection, quantification and Precision agriculture. Big Data in Plant study and conservations, Application of spectral signatures in plant distribution, taxonomy, biochemical estimation, vegetation index (NDVI, PVI, SVI), characterize by its size, shape, boundaries and internal structure ETC

Suggested Readings

1. C Sudhakar Reddy. (2015) Application of remote sensing in plant Sciences. An Overview. Springer India.
2. Charis, G., Danha, G., Muzenda, E., 2019. A review of the application of gis in biomass and solid waste supply chain optimization: gaps and opportunities for developing nations. Waste management 6; 1-11.
3. IoT in Agriculture Investigation on Plant Diseases and Nutrient Level Using Image Analysis Techniques
4. Sathiya S., Cecil, A., Ghodke. P.K., 2022. Plant disease identification using IoT and deep learning algorithms. Artificial Intelligence for Signal Processing and Wireless Communication. doi.org/10.1515/9783110734652-002.
5. Advanced Remote sensing and GIS. Training Manual Developed by CEGIS, USFS and BFD, 2014-15
6. Upadhyay S., Singh S.P. Bioprospecting of Plant Biodiversity for Industrial Molecules. Wiley. ISBN: 9781119717218
7. Jansson, J.K., Hofmockel, K.S. Soil microbiomes and climate change. Nat Rev Microbiol 18, 35–46 (2020). https://doi.org/10.1038/s41579-019-0265-7

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H		M				
CO2	M	H	H				
CO3				H			
CO4						H	
CO5				L	M		H

LABORATORY COURSES

BOMP6026: MYCOLOGY AND PHYCOLOGY LAB (3 CREDITS-60 HOURS) (L-T-P: 0-0-3)

Course Outcomes

At the end of this course, student will be able to:

1. Learn about the vegetative and reproductive structures of some important classes of fungi and algae (Understanding)
2. Acquire knowledge and importance of mycorrhizae and lichens (Understanding)
3. Learn the techniques of isolation of fungi and algae (Applying)
4. Learn the technique of producing fungal and algal bio-fertilizers (Applying)

Expt.1. Study of thallus organization, Spore producing organs, and accessory structures of Myxomycotina, Mastigomycotina, Oomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina

Expt.2. Study of morphological and anatomical features of Crustose, Foliose and Fruticose lichens

Expt.3. Isolation and characterization of fungi up to species from soil

Expt.4. Study of range of vegetative and reproductive structures of algae in Cyanophyta, Chlorophyta, Phaeophyta, Rhodophyta, Xanthophyta, Bacillariophyta, and Euglenophyta

Expt.5. Production techniques of fungal and algal based bio-fertilizers

Mapping of COs to syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5
CO1	H	L	L	H	L
CO2	L	H	L	L	L
CO3	L	L	H	L	L
CO4	L	L	L	L	H

BOBA6027: BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND ANGIOSPERMS LAB (3 CREDITS-60 HOURS) (L-T- P: 0-0-3)

Course Outcomes

At the end of this course, student will be able to:

1. Interpret the concepts of classification system and identification of few important bryophytes (Understanding)
2. Infer the concepts of classification system and identification of few important pteridophytes (Understanding)
3. Summarize the concepts of classification system and identification of few important gymnosperms (Understanding)
4. Collect, prepare and document herbarium specimens through non-destructive field collection method so as to get acquainted with herbarium technique (Applying)
5. Differentiate between monocots and dicots (Understanding)
6. Interpret sporogenesis and gametogenesis in angiosperms (Understanding)

Part 1: Bryophytes, Pteridophytes and Gymnosperms

Expt.1. Study of morphology and reproductive structures of the following bryophytes: Riccia, Marchantia, Anthocerus, Sphagnum, Polytrichum, Funeria, Porella.

Expt.2. Study of morphology and reproductive structures and observe arrangement of Sori on a receptacle of the following pteridophytes: Lycopodium, Selaginella, Marsilea, Equisetum, Azolla, Salvinia, Adiantum

Expt.3. To study the anatomy, morphology and reproductive features of the following gymnosperms: Cycas, Pinus, Cryptomeria, Thuja, Podocarpus, Gnetum , Zamia, Ginkgo

Part 2: Angiosperms

Expt.4. Collection, preparation and documentation of herbarium specimens through non-destructive field collection method so as to get acquainted with herbarium technique.

Expt.5. Taxonomic study of selected families of dicots and monocots of angiospermic plants with the help of analytical drawings, botanical description and identification up to the rank of species.

Expt.6. Study of various stages of sporogenesis and gametogenesis in selected species of angiospermic plants

Mapping of COs to Syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6
CO1	H					
CO2		H				
CO3			H			

CO4				H		
CO5					H	
CO6						H

BOCB6028: CELL & MOLECULAR BIOLOGY, PLANT PHYSIOLOGY & BIOCHEMISTRY LAB (3 CREDITS-60 HOURS) (L-T- P: 0-0-3)

Course Outcomes

At the end of this course, student will be able to:

1. Get acquainted with tools and techniques of molecular biology (Remembering)
2. Perform isolation of genomic DNA and their quantification and understand how to calculate recombination frequencies (Understanding)
3. Analyze the concept of osmosis and impact of organic solvent in membrane permeability (Analyzing)
4. Understand the underlying principle behind respiration, transpiration and photosynthesis. (Understanding)
5. Analyze the functions of phytohormones and the properties of plant biomolecules (Analyzing)

Part 1: Cell & Molecular Biology

Expt.1. Acquaintance with molecular biology laboratory and instruments
Expt.2. Practical on cytoplasmic streaming in plant cell
Expt.3. Extraction of DNA from strawberry/banana by alcohol precipitation method
Expt.4. Isolation of genomic DNA from plant materials using SDS/CTAB method
Expt.5. Calculation of recombination frequencies of genes

Part 2: Plant Physiology

Expt.6. Determination of osmotic potential in potato tuber
Expt.7. To study the effect of different organic solvents (alcohol, formalin, benzene) on the permeability of plasma membrane of beet root
Expt.8. Determination of the effect of CO2 concentration on the rate of photosynthesis by inverted funnel method
Expt.9. Determination of the effect of intensity of light on the rate of photosynthesis
Expt.10. To study the effect of different Phytohormones on the germination of seeds

Part 3: Plant Biochemistry

Expt.11. Estimation of protein using calibration curve following the protocol of Lowry et al., method
Expt.12. Estimation of nitrate reductase activity
Expt.13. To study the effect of NR activity in presence of light and dark period
Expt.14. Preparing the calibration curve of nitrite using azo-coupling method of Snell and Snel
Expt.15. Isolation of Plant DNA and their spectrophotometric quantification

Mapping of COs to Syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8
CO1	H	H	H	H	H			
CO2			H	H	H			
CO3						H	H	H
CO4						H	H	
CO5	H		H	H				

Course Outcomes	Expt. 9	Expt. 10	Expt. 11	Expt. 12	Expt. 13	Expt. 14	Expt. 15
CO1							H
CO2							H
CO3	H	H					
CO4			H				
CO5			H	H	H	H	H

BOER6033: ENVIRONMENTAL MANAGEMENT, RESEARCH METHODOLOGY AND BIOSTATISTICS & BIOCHEMICAL LAB (2 Credits-40 Hours) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

1. Apply ideas gained for experimental surveys and writing sound scientific papers (Applying)
2. Apply the concepts of statistics for interpreting scientific data (Applying)
3. Develop ideas for small scale start-ups (Creating)

Expt.1. Practical on design of vermicompost/mushroom unit
Expt.2. Survey of environment risk prone areas
Expt.3. Scientific search engine tour for e-resources, research article, review article, scientific problems
Expt.4. Calculation of mean, median, mode, standard deviation, quartile deviation and coefficient of variation from a given dataset
Expt.5. Calculation of chi square statistic (goodness of fit & independence of attributes)
Expt.6. Calculation of student's t-test
Expt.7. Calculation of analysis of variance (ANOVA)
Expt.8. Designing CRD for an experimental layout
Expt.9. Designing RBD for an experimental layout
Expt.10. Determination of coefficients of partial and multiple correlation
Expt.11. Determination of the regression coefficient

Mapping of COs to Syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10	Expt. 11
CO1			H								
CO2				H	H	H	H	H	H	H	H
CO3	H	H									

BODI6032: DISSERTATION PHASE I (4 CREDITS-80 HOURS)

Description

1. Review of literature related to the research problem assigned to the students.
2. Practicing research ethics and methodology
3. Writing review articles related to the research problem.
4. Publishing these review articles in peer-reviewed journals.
5. Initial setting up of experiments to resolve the research problem
6. Writing and presenting the synopsis of the research problem.

BOPP6041: PLANT MICROBIOLOGY AND PLANT PATHOLOGY LAB (2 CREDITS-40 HOURS) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

1. Prepare different media used in microorganism isolation (Applying)
2. Apply various techniques for identifying different microbes (Applying)
3. Develop protocols and methods for characterizing microbes (Creating)
4. Identify chemicals agents, plants pathogens and their symptoms on diseased plant (Applying)

Expt.1. Preparation of nutrient media (solid/liquid) for culture
Expt.2. Staining techniques (Grams staining, flagella staining, capsule staining and acid fast staining of bacteria)
Expt.3. Isolation and characterization of pure cultures of microbes from soil, water and plant samples
Expt.4. Estimation of bacterial growth by spectrophotometric method
Expt.5. Culturing and isolation techniques of viruses (through seminar/virus lab visit)
Expt.6. In vitro and in vivo evaluation of chemicals against plant pathogens
Expt.7. Detailed study of symptoms of representative diseases of plantation crops, Collection and dry preservation of diseased specimens of important crops

Mapping of COs to syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7
CO1	H	H	M	L	L		
CO2	M	H	H	L	M		

CO3	M	M	H	M	M		
CO4					L	H	H

BODI6034: DISSERTATION PHASE II (10 Credits-200Hours)

Description

1. Conducting experiments to resolve the research problem
2. Writing research articles and reviewing papers related to the research problem
3. Publishing these research and review papers in peer-reviewed journals
4. Presenting, explaining and defending the dissertation
5. Writing the dissertation

BOPE6042: PLANT ECOLOGY AND PHYTOGEOGRAPHY LAB (2 CREDITS-40 HOURS) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

1. Gain knowledge about the population and communities characteristics in a given field
2. Gain knowledge about the concepts of analyzing edaphic characteristics
3. Gain knowledge about the analysis of physicochemical properties of water bodies

Expt.1. To determine the minimum size of the quadrat by species area-curve method.
Expt.2. To determine abundance, density, frequency, basal covers of plant communities by quadrat method.
Expt.3. To determine minimum number of quadrats required for reliable estimate of biomass in grasslands.
Expt.4. To compare protected and unprotected grassland stands using community coefficients (similarity indices).
Expt.5. Estimation of Importance Value Index (IVI) of the species in a grassland/woodland using quadrat method.
Expt.6. To estimate the above ground and below ground biomass from unit area.
Expt.7. To analyze the edaphic characteristics- Soil profile, Texture, Soil moisture, Water holding capacity, Porosity, pH, Organic matter content, and quantitative estimation of N, P, K.
Expt.8. To study the physicochemical characteristics from polluted and unpolluted water bodies: DO, COD, BOD, pH, Hardness, Alkalinity, Conductivity, Free CO2, Chloride, Nitrate and Phosphate.
Expt.9. Field Study

Mapping of COs to Syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9
CO1	H	H	H	H	H	H			H
CO2				L	L	L	H		M
CO3								H	M

BOCT6040: CYTOGENETICS AND MOLECULAR TECHNIQUES LAB (3 CREDITS-60 HOURS) (L-T-P: 0- 0-3)

Course Outcomes

At the end of this course, student will be able to:

1. Interpret mitosis, meiosis and chromosomal aberration (Understanding)
2. Solve problems based on gene interactions (Applying)
3. Show hybridization in self- and cross-pollinated crops (Applying)
4. Utilize various chromatographic techniques to separate amino acids and plant pigments (Applying)
5. Isolate biomolecules and learn to use a thermal cycler (Applying)
6. Design primers using various software and use BLAST to identify sequences of similarity (Applying)

Part 1: Cytogenetics

Expt.1. Identification of mitosis from suitable plant material (Onion and garlic root tips)
Expt.2. Identification of meiosis from suitable plant material (Onion floral buds)
Expt.3. Study of chromosomal aberrations in plant (Rhoeo)
Expt.4. Study of numerical problems involving gene interactions
Expt.5. Practice of hybridization technique in self- and cross-pollinated plants species

Part 2: Molecular Techniques & Bioinformatics

Expt.6. Separation of amino acids and plant pigments by paper chromatography and thin layer chromatography (TLC)
Expt.7. Isolation of plasmid/genomic DNA
Expt.8. Isolation of total RNA from plant sample using Trizol method
Expt.9. Understanding the functioning of a thermal cycler/ Amplification of a gene using PCR
Expt.10. Designing of primers and identifying regions of similarity in biological sequences using BLAST

Mapping of COs to Syllabus:

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1	H	H	H							
CO2				H						
CO3					H					
CO4						M	H	H	H	
CO5						L				H
CO6									L	H

VALUE ADDED COURSES

BOBF6035: BIO-FERTILIZER TECHNOLOGY (NON-CREDIT COURSE - 30 HOURS)

Course Outcomes:
At the end of this course, student will be able to:

1. Gain the basic knowledge about Bio-fertilizer and Organic farming and its field application (understanding).
2. Able to prepare bio-compost/organic compost/vermicomposting (Applying)

Module I: (3 Hours)
Bio-fertilizer concepts, types and applications; microorganisms used as bio-fertilizers

Module II: (12 Hours)
Rhizobium, *Azospirillum*, *Azotobacter*: classification, isolation, characterization and massmultiplication – carrier-based inoculant, associative effect of different microorganisms, Cyanobacteria as fertilizer, *Azolla-Anabaena* association and their role in agriculture, Mycorrhizal association, types, applications in crop fields

Module III: (15 Hours)
Organic farming concept; Green manure and organic fertilizers; bio-composts, vermicomposting– field applications Preparation of organic compost/bio-compost/bio-fertilizer; setting up of vermicomposting unit

Suggested Readings:
1. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay -Publication, NewDelhi.
2. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
3. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
4. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming AktaPrakashan, Nadiad 55

Mapping of COs to syllabus:

Course Outcomes	Module I	Module II	Module III
CO1	H	H	H
CO2	L	H	H

BOHM6036: HERBAL MEDICINES (NON-CREDIT COURSE - 30 HOURS)

Course Outcomes:
At the end of this course, student will be able to:

1. Acquire the concepts of herbal medicines (Understanding)
2. Utilize knowledge about conservation strategies and IPR principles (Applying)
3. Develop formulations of herbal medicines (Creating)

Module I: Module I: Introduction to Herbal Medicines (6 Hours)
Medicinal plant research scenario in India; Commercial cultivation of medicinal plants

Module II: Module II: Herbal Medicines in Medical Science (14 Hours)
Diagnostic features, bioactive molecules and therapeutic value of some common medicinalplants. Standardization of herbal drugs; Neutraceutical and medicinal food

Module III: Module III: IPR and Conservation Strategies (10 Hours)
Conservation of medicinal plants; Bioprospecting, biopiracy and protection of traditional medicinal knowledge (IPR)

Suggested Readings:
1. Alamgir ANM. Therapeutic Use of Medicinal plants and Their Extracts. Volume I.
2. Panda H. Handbook of Medicinal Plants with Uses. Publisher: Centre for Information Technology.
3. Singh KP. Conservation, Cultivation and Sustainable Utilization of Medicinal and herbal Plants. SR Scientific Publication Rastogi RP. A Compendium of Indian Medicinal Plants. Publisher: Publications and Information Directorate.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III
CO1	H	H	M
CO2	L	M	H
CO3	H	H	H

BOFI6037: FOREST INVENTORY AND MENSURATION (NON-CREDIT COURSE - 30 HOURS)

Course Outcomes:
At the end of this course, student will be able to:

1. Exhibit forest inventorying and mensuration skills for data collection, analysis, andinterpretation (Applying)
2. Interpret a wide range of scientific and popular literature related to forest inventories(Analyzing)
3. Prepare, analyses and present both written and verbal technical reports on forestinventories (Applying)

Module I: Introduction to Forest Inventory and Sampling Design (15 Hours)
Introduction; Types of forest inventory; Choosing a sampling design: Simple random sampling, Stratified random sampling, Systematic sampling, Cluster sampling, Choosing sampling intensity, Locating sampling units: compass and measuring distance, GPS device; Sampling approaches: Fixed-area methods, Line intercept method, Distance-based sampling, Selecting an appropriate sampling unit

Module II: Forest Mensuration (15 Hours)
Measuring individual trees: Age, Stem diameter, Height, Canopy cover; Characterizing stand structure: Age and size structure, Height and vertical structure, Leaf area, Stand volume, Stand density; Spatial structure of tree populations; Species richness and diversity: Species richness, Species diversity, Beta diversity and similarity; Analysis of floristic composition: Cluster analysis, Ordination, Importance values

Suggested Readings:

1. Avery, T. E. and Burkhart, H. E. (2002). Forest measurements, 5th edition. McGraw-Hill,NY
2. Newton, A.C. (2007). Forest Ecology and Conservation - A Handbook of Techniques.Oxford University Press Inc., New York
3. Sutherland, W. (ed.) (1996). Ecological census techniques, a handbook. Cambridge University Press, Cambridge
4. Underwood, A. J. (1997). Experiments in ecology: Their logical design and interpretation using analysis of variance. Cambridge University Press, Cambridge
5. West, P. W. (2004). Tree and forest measurement. Springer-Verlag, Berlin

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II
CO1	H	H
CO2	M	M
CO3	M	M

BOBC6038: BIOMASS CONVERSION, BIOREFINERY & CIRCULAR BIOECONOMY (NON-CREDIT COURSE - 30 HOURS)

Course Outcomes:
At the end of this course, student will be able to:
1.Identify potential biomass feedstocks including energy crops based on its biochemical composition (Analysing)
2.Have an understanding of the existing and emerging biomass to various technologies (Understanding)
3.Have an understanding of Biorefinery, LCA and applications. (Understanding)
4.Develop a critical thinking about sustainability and its prospect to generate circular bio-economy
5.(Evaluating)
6.Determine sustainable solutions for bioresources by incorporating different technologies and assessment will be explored. (Application)

Module I: INTRODUCTION TO DIFFERENT BIOMASS TYPES AND COMPOSITION (4 hours)
Biomass Feedstocks I- Harvested Feedstocks (first generation feedstock, second generation, third generation feedstocks) in context to biofuel and biorefinery. Biomass Feedstocks II- Residue Feedstocks (Agricultural waste, Forestry waste, Farm waste, Organic components of residential, commercial, institutional and industrial waste). Biochemical composition of different biomass feedstock

Module II: BIOMASS CONVERSION TECHNOLOGIES (8 hours)

Biomass Conversion Technologies I- Biorefinery Concept -Understanding biorefinery concept, Bio-refineries & end products. Biomass Conversion Technologies II- Biochemical Conversion I-(Hydrolysis, enzyme & acid hydrolysis, Fermentation). Biochemical Conversion II- (Anaerobic digestion, Trans-esterification. Biomass). Conversion Technologies III- Thermochemical Conversion -(Combustion, Gasification, Pyrolysis. Other thermochemical conversion technologies, Scaling up emerging technologies.

Module III: LOW CARBON CIRCULAR ECONOMY VALUE ADDED PLATFORM CHEMICALS (10 hours)

Advanced low-carbon economy from biofuel/biopolymer/value added product–Case study, Mixed alcohols (Acetone, ethanol, butanol), C3 sugars (Lactic acid, Propionic acid), C4 sugars (Malic acid), C5 sugars (Furfural, levulinic acid, xylitol), C6 Sugars Hydroxymethylfurfural (HMF), Lignin, PHB, Bio-oil, biochar, biodiesel, bio hydrogen and other value-added organic products. Low carbon credit and carbon economy. Bioeconomy, value creation and business development, Circular economic principles and business models. Biotechnology and other bioprocesses enabling circular bioeconomy. Opportunities, framework conditions and barriers for a circular bioeconomy.

Module IV: BIOREFINERY (8 hours)

Basic Concept and Types of Integrated biorefinery (Aquaculture and algal biorefinery, waste biorefinery). Economics and Life Cycle Analysis I- (General understanding of LCA, Cradle-to-grave, field to wheels concepts, Goal and scope determination, defining LCA boundaries). Life Cycle Analysis II. Life Cycle Inventory, Life Cycle Assessment. GIS in agro-residue bioenergy planning, Biomass Supply and Logistics management.

Suggested readings:

1. Ashok Pandey, R. D. Tyagi, Sunita Varjani. Biomass, Biofuels, Biochemicals: Circular Bioeconomy—Current Developments and Future Outlook. 2021, Elsevier Science Publishing Co Inc.
2. Wiebke Reim, Vinit Parida, David R. Sjodin. Circular Business Models for the Bio-Economy: A Review and New Directions for Future Research. Sustainability; 11, 2558.
3. Juan-Rodrigo Bastidas-Oyanedel, Jens Ejbye Schmidt. Biorefinery “Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels, and Fertilizers.”Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	3		2	
CO2	2	3		
CO3			1	1
CO4			3	
CO5				3

SERVICE-LEARNING COURSE

BOSL0100: SERVICE LEARNING ON ETHNOBOTANICAL PRACTICES (NON-CREDIT COURSE - 30 HOURS)

Course Outcomes:

1. Ability to think critically and analyze what they have learned in the classroom and how toapply their theoretical knowledge in the real world for the betterment of the society (Applying)
2. Development of social accountability and greater participation in community services. (Applying)
3. Development of communication skill, personality skill, decision making ability and other career related skill. (Evaluating)
4. Awareness about the cultural diversity and their relationship with traditional plants (Understanding)
5. Better understand the basic concepts of ethno-botany and their conservation practices (Understanding)
6. Recognize the ethno-botanically important plants species (Remembering)

Module 1: Introduction to Service Learning (10 Hours)

Definitions; Aims and Objectives of Service Learning; Types of Service Learning; Principles of Service Learning; Important tools of Service Learning; Scopes of Service Learning; Benefits of Service Learning ; Community based Service Learning and Volunteering Service Learning

Module 2: Introduction to Ethno-botany (10 Hours)

Concepts of Ethno-botany: Definitions, Interdisciplinary; Aims and Objectives of Ethno-botany; Scope of Ethno-botany: Documentation, Preservation, Conservation; Application of Ethno- botany; Concept on Rare Endangered and Threatened (RET) Taxa; Basic concept on the Conservation and Management of native plants; Basic concept on Intellectual Property Right (IPR)

Module 3: Orientation Programme (10 Hours)

Lectures from experts; Discussion on various issues related to health and wellness, environment,waste management, education; Videos on community services

Module 4: Service Learning on Ethno-botanical practices (180 Hours)

Implement of an interaction programme with the local ethnic group to understand their relationships with the native plants; Awareness programme on the conservation and management of rare and medicinal plants; Awareness campaign on the reconstruction of forest in the local community; Fundraise for cultivation of medicinal plants in the community; Creation of medicinal plant garden for recreation and to earn income for livelihood and to help those who arein need; Combat of invasive plants to restored ecosystems in preserve areas for public use.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H		L	H
CO2	H		L	H
CO3	H		M	H
CO4		H		M
CO5		H		M
CO6		H		M

DEPARTMENT OF ZOOLOGY
DETAILED SYLLABUS

VISION:

- To develop the Department as an interdisciplinary centre for learning, research, and innovation
- To develop the Department into a hub of biodiversity research while making the surrounding a natural laboratory

MISSION:

- To provide a better understanding of Zoological Sciences through interaction with the natural environment and sensitizing the students about their social responsibilities
- to expose the learners to recent advances in Zoology and to provide high quality education with an emphasis on learning and research.

PROGRAMME: BSC ZOOLOGY (HONOURS)

PROGRAM OUTCOMES (PO) - BSC PROGRAMME

PO 1: **Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspective.

PO 2: **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Effective Citizenship**: Demonstrate empathetic social concern and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

PO 7: **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)- BSc (Honours) Zoology

PSO 1: **Knowledge and Concept:** Acquire detailed knowledge on the extensive diversity of organisms inhabiting varied ecological niches of the earth as well as understand the complexity of the various life-systems operating in these organisms.

PSO 2: **Applying knowledge for self-sustenance:** Build foundations for novel thinking through application-based studies such assericulture and aquarium fish keeping, thus ensuring better opportunities for self-sustenance in future.

PSO 3: **Skills in handling scientific instruments:** Develop interest as well as proficiency in handling scientific instrumentsintroduced as part of practical courses, thereby warranting all-around growth.

PSO 4: **Conservation strategies:** Recognize the importance of conservation and encourage designing of effective strategies toaddress present conservation issues with preference to sustainable development.

COURSES OFFERED IN BSC (HONOURS) ZOOLOGY

Sl. No	COURSE NAME
1.1	Environmental Studies
1.2	English Communication
1.3	Foundations of Service Learning
1.4	Non-chordates I: Protista to Pseudocoelomates
1.5	Perspectives in Ecology
1.6	Non-Chordates II: Coelomates
1.7	Cell Biology
1.8	Animal Diversity
1.9	Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons
2.0	Environment and Public Health
2.1	Diversity of Chordates
2.2	Animal Physiology: Controlling and Coordinating Systems

2.3	Fundamentals of Biochemistry
2.4	Research Methodology
2.5	Comparative Anatomy of Vertebrates
2.6	Animal Physiology: Life-Sustaining Systems
2.7	Biochemistry of Metabolic Processes
2.8	Sericulture
2.9	Aquarium Fish Keeping
3.0	Environmental Biotechnology
3.1	Economic Botany and Plant Biotechnology
3.2	Chemical Energetics, Equilibria and Functional Organic Chemistry - I
3.3	Molecular Biology
3.4	Principles of Genetics
3.5	Wildlife Conservation and Management
3.6	Animal Behaviour and Chronobiology
3.7	Computational Biology
3.8	Animal Biotechnology
3.9	Developmental Biology
4.0	Evolutionary Biology
4.1	Immunology
4.2	Parasitology
4.3	Fish and Fisheries
4.4	Biology of Insecta
4.5	Non-chordates I: Protista to Pseudocoelomates Lab
4.6	Perspectives in Ecology Lab
4.7	Non-Chordates II: Coelomates Lab
4.8	Cell Biology Lab
4.9	Animal Diversity Lab
5.0	Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons Lab
5.1	Environment and Public Health Lab
5.2	Diversity of Chordates Lab
5.3	Animal Physiology: Controlling and Coordinating Systems Lab
5.4	Fundamentals of Biochemistry Lab
5.5	Comparative Anatomy of Vertebrates Lab
5.6	Animal Physiology: Life-Sustaining Systems Lab
5.7	Biochemistry of Metabolic Processes Lab
5.8	Environmental Biotechnology Lab
5.9	Chemical Energetics, Equilibria and Functional Organic Chemistry – I Lab
6.0	Economic Botany and Plant Biotechnology Lab
6.1	Molecular Biology Lab
6.2	Principles of Genetics Lab
6.3	Wildlife Conservation and Management Lab
6.4	Animal Behaviour and Chronobiology Lab
6.5	Computational Biology Lab
6.6	Animal Biotechnology Lab
6.7	Developmental Biology Lab
6.8	Evolutionary Biology Lab
6.9	Immunology Lab
7.0	Parasitology Lab
7.1	Fish and Fisheries Lab
7.2	Biology of Insecta Lab

BSC (HONOURS) ZOOLOGY MAPPING OF COURSES TO PO/PSO

Sl. NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
1.1						H					H
1.2					M	M		M	M		H

1.3	H				M	M		H	M	M	
1.4	H					M		H	H		
1.5		H	H	H					M		
1.6	H							H	M		
1.7	H							H	M		
1.8	M							H	M	H	
1.9	H							M	H	H	
2.0						H					H
2.1	H							H	M		
2.2	H						H	H			
2.3								H	M	H	
2.4						H		H	H		M
2.5	H							H	H		
2.6	M							H	H	H	
2.7						H		H			M
2.8	M							M			
2.9	H							H	H		
3.0								H	M	H	
3.1	M							M			
3.2	H							H	H	H	
3.3	H		M		H					H	
3.4								H	M		
3.5								H	H		
3.6	M							H	H		
3.7	M							H	H	H	
3.8								H	H	H	
3.9	H							H	H	H	
4.0								H	H	H	
4.1	H							H	H		
4.2	H							H	H		
4.3	H							H	H	H	
4.4	H				M			H	H	M	
4.5	M							H			H
4.6	M				M			H	M	M	H
4.7	H							H			
4.8	H				M			H	H	H	
4.9	H							H	H		
5.0	H							H	H	M	
5.1	H				H			H	H		
5.2	H				H			H	H	H	
5.3	H							H	M		
5.4	M							M	M		
5.5	M				M			H	H	H	
5.6								H	M	M	
5.7	H							H	H		M
5.8	H				H			H	H	H	
5.9	M							H	H		
6.0	M				M			H	H	M	H
6.1	M							H	H		
6.2					M			H	H	H	
6.3	M							H	H		
6.4	M				M			H	M	H	
6.5	H				M			M	H	M	M
6.6	M				M			H	M	M	
6.7	H				M			M	H	H	
6.8	M				M			H	M	M	M

6.9	M				M			H	M	M	
7.0	H				M			M	H	M	
7.1	H				H			M	M	M	
7.2	M				H			M	M	M	M

PROGRAMME: MSC ZOOLOGY

PROGRAM OUTCOMES (PO)- MSC ZOOLOGY

PO 1: **Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspective.

PO 2: **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Effective Citizenship**: Demonstrate empathetic social concern and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

PO 7: **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PO 8: **Skill Development**: Acquire and develop skills in handling scientific instruments, planning and executing biological research for employability and social service.

PO 9: **Entrepreneurship**: Inculcate a holistic approach towards amalgamating and applying the acquired knowledge, ideas and views towards formulating a model that would not only encourage financial stability of the person concerned but also generate employability and strengthen the socio-economic aspect of a region or locality as a whole.

PO 10: **Creative Thinking**: Promote creative thinking and innovative ideas for the welfare of the society.

PROGRAMME SPECIFIC OUTCOMES (PSOs)- MSc ZOOLOGY

PSO 1: **Knowledge and concept**: To acquire in-depth knowledge about the complexity of life systems at the molecular level.

PSO 2: **Research-inclined mindset**: To apply and analyze the various research techniques through minor dissertation projects, thus inculcating the fundamentals for future scientific studies.

PSO 3: **Applied Zoology and Entrepreneurship**: To apply the acquired knowledge to invigorate the existing areas of application-based zoological studies for creating productive models for self-sustenance.

PSO 4: **Conservation Models**: To specifically recognize the existing conservation issues with regards to both animal and environment and develop strategies to address these issues through ecologically sustainable methods.

COURSES OFFERED IN MSC ZOOLOGY

Sl. No	Course Name
1.1	Research Methodology and Biostatistics
1.2	Developmental Biology
1.3	Insects: Structure and Function
1.4	Insect Physiology
1.5	Cell and Molecular Biology I
1.6	Immunology I
1.7	Taxonomy and Functional Anatomy
1.8	Aquaculture and Fish Genetics
1.9	Animal Ecology and Biogeography
2.0	Wildlife Conservation and Management
2.1	Insect Ecology
2.2	Principles of Pest Management
2.3	Cell and Molecular Biology II
2.4	Immunology II
2.5	Capture Fishery and Post-Harvest Technology
2.6	Limnology, Fisher Economics, Ornamental Fishery and Fish Pathology
2.7	Wildlife Resource Management, Laws and Techniques In Population Study

2.8	Techniques in Wildlife Study, Wildlife Health, Forensics, and Conflict
2.9	Biosystematics and Evolution
3.0	Cell Biology and Immunology – Theory and Applications
3.1	Molecular Biology and Genetics
3.2	Animal Physiology
3.3	Ecology and Environmental Biology
3.4	Endocrinology and Biochemistry
3.5	Applied Zoology
3.6	Ethology and Population Genetics
3.7	Service Learning in Zoology
3.8	Project Management, Reporting, and Documentation
3.9	Dissertation Phase I
4.0	Introduction to Journalism and Photography
4.1	Dissertation Phase II
4.2	Teaching Methodology and Classroom Management
4.3	Specialization Lab I-Entomology
4.4	Specialization Lab I-Cell and Molecular Biology
4.5	Specialization Lab I-Fishery Science
4.6	Specialization Lab I-Animal Ecology and Wildlife Biology
4.7	Specialization Lab II-Entomology
4.8	Specialization Lab II- Cell and Molecular Biology
4.9	Specialization Lab II- Fishery Science
5.0	Specialization Lab II- Animal Ecology and Wildlife Biology
5.1	Biosystematics and Environmental Biology Lab
5.2	Cell Biology, Genetics and Basic Bioinformatics Lab
5.3	Developmental Biology and Biochemistry Lab
5.4	Ethology and Population Genetics Lab

Mapping of Courses to PO/PSO

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
1.1	M	H			H			H		H		H	M	M
1.2	H				M						H	M		
1.3											H			
1.4	M										H			
1.5	M										H	M		
1.6											H	M		
1.7	M										H			
1.8							M				H	M		M
1.9											H			
2.0	M			M	H	H	H				H	M		H
2.1											H			H
2.2							H	M			H		M	
2.3											H			
2.4											H			
2.5							H				H	M	M	
2.6											H		H	H
2.7							H	H			H	M		H
2.8					M	H	H	H			H	M		H
2.9	H										H			
3.0	M						H				H	M		
3.1	H				M						H			
3.2											M			
3.3						H					M			H
3.4											H	M		
3.5	M				M		H	H	H	H			H	
3.6	H				H						H	M		M

3.7			H		H		H			H	H	M	M	H
3.8		H	M	M			H	H		H			M	
3.9		M	M		M									
4.0		H			H		H	H				M	M	
4.1		H	M		H									
4.2								H					M	
4.3		M					M							
4.4		M					M							
4.5		M					M							
4.6		M				H	H							
4.7		M					H							
4.8		M					H							
4.9		M					H							
5.0		M												
5.1		M				H	H							
5.2		M					H							
5.3		M					H							
5.4		M					H							M

DETAILED SYLLABUS
THEORY COURSES

BTRM0003: RESEARCH METHODOLOGY AND BIOSTATISTICS (4 CREDITS – 60 HOURS) [L-T-P: 4-0-0]

Course Outcomes

At the end of the course students will be able to:

1. Identify the complex issues inherent in selecting a research problem, selecting an appropriate research design and implementing a research project (Applying)
2. Define various kinds of research, objectives of doing research, research process, research designs and sampling. (Remembering)
3. Analyze the application of statistics in educational research. (Application)
4. Identify the ethical issues of research. (Applying)
5. Design and develop synopsis and thesis writing. (Creation)

Module I: Introduction to Scientific Research (15 hours)

a) Definition, basic and applied research, interdisciplinary research,
b) Discriminative reading, reading and reviewing scientific literature – consulting source material, primary and secondary literature, biological abstract, current content, review, monograph, peer- reviewed journals, e-resources; research and review articles
c) Introduction on scientific problems, your scientific problem, methods and techniques, research conditions, data types, techniques, repeatability, reproducibility and reliability, validity, effect measure and choice of statistical test, experimental protocol, experimental routine
d) Scientific communication - scientific paper, scientific posters

Module II: Ethics and Scientific Conduct (5 hours)

Brief introduction to ethics, scientific conduct and misconduct-plagiarism, authorship issues, investigation and punishment of scientific misconduct, ethics of animal and human research

Module III: (15 hours)

a) Introduction to Biostatistics: definition and applications of biostatistics;
b) Data-types and presentation: types of biological data, accuracy and significant figures;
c) Populations and samples: populations, samples from populations, random sampling, variables and attributes, statisticalerrors
d) Frequency distributions
e) Graphical representation of data: line diagram, bar diagram, pie chart, histogram
f) Measures of central tendency: the arithmetic mean, median and mode
g) Measures of dispersion: range, mean deviation, variance, standard deviation, standard error of mean, standard score

Module IV: (6 hours)

a) Permutations and combinations, sets
b) Probability: introduction, counting possible outcomes, probability of an event, adding and multiplying probabilities
c) Probability distributions: Binomial, Poisson and Normal distribution

Module V: (19 hours)

a) Testing of hypothesis and goodness of fit: Null hypothesis, level of significance, errors of influence,

Student's t-test, paired t-test, Fischer's test, Chi-square test, linear correlation and linear regression

b) Analysis of variance: variances of samples and their means, F-distribution, partitioning of the total sum of squares anddegrees of freedom, models and types of ANOVA

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L	L	H	M
CO 2	L	H			
CO 3	M	M	H	H	H

ZGDB0005: DEVELOPMENTAL BIOLOGY (4 CREDITS–60 HOURS) (L-T-P: 4-0-0)

Objective: The objective of this course on Developmental Biology is to enable the students to understand the process of development in animals and the phenomena associated with it. It will enable the students to understand the environmental

influences on development and factors responsible for age so as to imbibe the current knowledge pertaining to the development of animal embryos of diverse taxonomic groups through experimental analyses based on modern biological tools.

Course Outcomes

1. Develop the concepts of mechanisms of embryonic development. (Applying)
2. Categorize different mechanisms of embryological development through experimental techniques. (Analyzing)
3. Assess the effects of various teratogenic agents and environmental estrogens on development. (Evaluating)
4. Appraise the interactions of maternal effect of gene, gap gene, pair-rule gene, and hox- gene in development with respect to Drosophila. (Evaluating)
5. Discuss the various methods of assisted reproductive technology. (Creating).

Module I (14 hours)

a) Fertilization-pre and post fertilization events: activation of eggs, gamete fusion and concept of prevention of polyspermy

b) General concept of embryonic Induction in animals (experimental evidence); Imaginal disc of insects

c) Experimental evidence of hybridization experiments in animals, nuclear transplantation experiments.

Module II (10 hours)

a) Principles of experimental embryology: the developmental dynamics of cell specification, stem cells and developmental commitment, totipotency and pluripotency.

b) Morphogenesis and cell adhesion- the thermodynamic model of cell interactions, concept of morphogen gradient and morphogenetic field, cell adhesion molecules.

Module III (10 hours)

Role of maternal contribution in early embryonic development in Drosophila: maternal effect genes, gap genes, pair rule genes and hox genes in development

Module IV (10 hours)

Organogenesis: Vulva formation in Caenorhapditis elegans; Regeneration of Salamander limbs; Lens regeneration in amphibia; Bone and neural regeneration-Medical Advances in regeneration.

Module V (16 hours)

a) Medical implications of Developmental Biology - Genetic error of human development; Environmental assault on human development, Teratogenic agents (Retinoic acid, pathogens, alcohol, drugs and chemicals, heavy metals);

b) Infertility- In vitro fertilization and embryo transfer. Cloning experiments- Amphibians and Mammals.

c) Sex determination- Temperature-dependent sex determination in animals, Endocrine disruptors and sex determination problems

Suggested Readings

1. Balinsky, B.I. An Introduction to Embryology. W.B Saunders Co., Philadelphia.
2. Gilbert, S.F. Developmental Biology. Sinamer Associates Inc. Saunderland, Massachusetts, U.S.A.
3. John E. Hall: Textbook of Medical Physiology. Guyton & Hall
4. Kalthoff: Analysis of biological development. McGraw-Hill, 1996.
5. Karp, G. and Berrill, N.J. Development. McGraw Hill, New York.
6. Nagabhushanam, R. and Sarojini, R. Invertebrate Embryology. Oxford and IBA Publishing Co.
7. Oppenheimer, S.B. Introduction to Embryonic Development. Allyn and Bacon, Inc.
8. Saunders, J.W. Developmental Biology. MacMillan Co., London.
9. Tyagi and Shukla, Development of Fishes. Jaya Publishing House, New Delhi.
10. Wolpert: Principles of development. Oxford.
11. N. Arumugan, A textbook on Embryology, Saras Publication.
12. Gurbachan S. Miglani, Developmental Genetics, I.K. International Publishing House Pvt. Ltd.
13. VermaP.S. and Agarwal V.K, Chordate Embryology, S. Chand Publishing.
14. Chordate Embryology by Verma P.S. and Agarwal V.K., S. Chand Publishing.
15. Saidapur.S.K. Reproductive cycles of Indian vertebrates. (Allied Publishers Ltd. New Delhi)
16. Sarkar. H.B.D Principles of Vertebrate reproductive Biology
17. Chester-Jones I: Fundamentals of Comparative vertebrate Endocrinology (Pleum Press: NY)

Mapping COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	L					
CO2		H				
CO3				H		
CO4						H
CO5			H		H	

SPECIALISATION I: ENTOMOLOGY

ZGIF0008: INSECTS- STRUCTURE AND FUNCTION (4 CREDITS-60 HOURS; L-T-P: 4-0-0)

Course/Learning Outcomes (CO)

At the end of this course students will be able to:

1. Recall the basics of insect classification of different insect orders up to family level. (Remembering)
2. Identify details of insects' morphology, origin and locomotion and the different receptor organs. (Applying)
3. Discuss the basic concepts of insect-plant interactions. (Creating)

Module I (20 hours)

a) Origin and evolution of insects
b) Segmentation of insect: head, thorax and abdomen: body tagmata, sclerites and segmentation, Type of mouthparts, antennae, legs, their modifications and functional significance; model Genitalia and their modifications; Embryonic and post-embryonic development; Types of metamorphosis in insects.
c) Wings: wing structure, venation and wing coupling; Insect flight taking Drosophila as a model.

Module II (20 hours)

Basic concept of surveillance and sampling of insect.

Classification of insect up to family with example : a) Coleoptera, Diptera, Hymenoptera; b) Lepidoptera, Odonata; c) Orthoptera, Hemiptera and; Insect molecular taxonomy-DNA as a new tool for insect identification

Module III (8 hours)

Insect integument: Structure, chemical composition, bio-composition of chitin, function of integument

Module IV (12 hours)

a) Receptor organ in insects (Chemoreceptors,
b) mechano receptors and photoreceptors);
c) Sound and Light producing organs in insects;
d) Locomotion in insects,
e) Insect Muscle,
f) Insect eye.

Suggested Readings

1. R.F. Chapman, The Insect Structure and Functions, Cambridge University Press
2. D.B. Tembhare, Modern Entomology, Himalaya Publishing House
3. K.P. Srivastava, Textbook of Applied Entomology Vol- I & Vol- II, Kalyani Publishers
4. Abhishek Shukla and Sushil Kumar Saxena, Introduction to General and Applied Entomology, Astral International (P) Ltd.
5. H. Maxwel-Lefroy & F.M. Howlett, Indian Insect Pests, Astral International (P) Ltd.
6. Abhishek Shukla, A Handbook on Economic Entomology, Astral International (P) Ltd.
7. T.V. Sathe & Jyoti M. Oulkar, Insect Pest Management: Ecological Concepts, Astral International (P) Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H		L
CO 2	H	H	H	H
CO 3	L	H		
CO 4	H	M	M	M
CO5	H			

ZGIP0009: INSECT PHYSIOLOGY (4 CREDITS-60 HOURS; L-T-P: 4-0-0)

Course/Learning Outcomes

1: Develop knowledge on detailed different systems of physiology of insects. (Applying)
2: To analyze the different reproductive system of insects in relation to recent literature (Analyzing)
3: Improve the knowledge that neural and hormonal controls have within each system. (Creating)
4: Develop a sense of how physiology can be infused in major research topics in entomology. (Applying)

Module I (25 hours)

a) **Digestive System:** Different types of alimentary canal, salivary glands, physiology of digestion and absorption.
b) **Respiratory System**: General organization of respiratory system, classification of respiratory system, respiration in terrestrial insects-different types of spiracles and their structure, opening and closing mechanism of spiracle, trachea and tracheoles, air sac, ventilation of tracheal system, mechanism of gaseous exchange, respiration in aquatic insects, physiology of gill andplastron respiration, respiration in parasitic insects.
c) **Circulatory system**: Diaphragm and sinuses, dorsal vessels, accessory pulsatory organs, blood circulation, chemical composition of haemolymph, different types of haemocytes and their functions.

Module II (18 hours)

a) **Nervous system:** Structure and types of neurons, central nervous system basic plan, gross anatomy and microanatomy of brain and ganglion, sympathetic nervous system, nerve impulse transmission.
b) **Excretory System**: Basic and cryptonephridial system, malpighian tubules-anatomy and histology, Accessory organs of excretion, metabolic pathways of formation of uric acid and ammonia, elimination of Uric acid by malpighian tubules;
c) **Diapause**: Hormonal control of embryonic, larva, pupal and reproductive diapause

Module III (17 hours)

a) **Reproductive System:** male and female reproductive system, spermatogenesis, oogenesis; Hormonal control of reproduction in male and female insects;
b) **Neuroendocrine System**: Neuroendocrine organs, hormones produced by neurosecretory cells, corpus allatum, corpus cardiacum and prothoracic gland, their chemical nature and functions; Insect immunity; Growth and metamorphosis of insects; Insect Pheromones.

Suggested Readings

1. The Insect Structure and Functions, R.F. Chapman, Cambridge University Press
2. Modern Entomology, D.B. Tembhare Himalaya Publishing House
3. Text Book of Applied Entomology Vol- I & Vol- II, K.P. Srivastava, Kalyani Publishers
4. Introduction to General and Applied Entomology, Abhishek Shukla and Sushil kumar Saxena, Astral International (P)Ltd.
5. Indian Insect Pests, H. Maxwel-Lefroy & F.M. Howlett, Astral International (P) Ltd.
6. A Handbook on Economic Entomology, Abhishek Shukla, Astral International (P) Ltd.
7. Insect Pest Management: Ecological Concepts, T.V.Sathe & Jyoti M. Oulkar, Astral International (P) Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H

SPECIALIZATION II: CELL AND MOLECULAR BIOLOGY SPECIALIZATION

ZGCB0010: CELL AND MOLECULAR BIOLOGY-I (4 CREDITS; 60 HRS; 4-0-0)

Course Outcomes

1. Analyze the structure and working of various components of the cell such as bio membrane structure and organization; genes and gene regulation and protein hierarchical structure. (Analyzing).
2. Evaluate the various types of protein in the cell organization. (Interpreting)
3. Classify the positive and negative control of gene expression and also the molecular structure of chromosomes. (Analyzing)
4. Recommend the use, Ramachandran plot for the prediction of secondary structure of protein. (Evaluating)

Module I (10 hrs)

Transport across cell membrane: Mechanism of diffusion, Facilitated diffusion; Osmosis and water channels, movement, Flick's law, Donnan equilibrium; Uniporter-catalyzed transport, difference between uniport-catalyzed transport and passive diffusion, GLUT- 1 transport & its kinetics; Intracellular ion environment and membrane electric potential; Active transport - P-class ion pumps, F-class and V-class ion pumps and ABC superfamily, Plasma Membrane Ca++ ATPase pump, Muscle Ca++ ATPase pump and Na+/K+ ATPase pump; Cotransport by symportors and antiporters; Transport across epithelia, Receptor mediated

endocytosis.

Module II (15 hrshrs)

Cytoskeleton: Microfilaments: Actin cytoskeleton, G-actin and F-actin; structural and functional polarity. Cortical actin network, erythrocyte and platelet cytoskeleton; Actin bundle support projecting fingers of membrane; Dynamics of actin assembly, actin polymerization; Toxins effect on actin monomer - polymer equilibrium, stabilization of actin filaments by actin capping proteins; Movement with actin polymerization (a) Intracellular bacterial and viral movements (b) Actin polymerization at the leading edge of moving cells; Myosin: (a) Structure and mechanism of movement with actin (b) Conformational changes in myosin during movement.

Microtubules: Microtubules structure and microtubule assembly from organizing centers, Microtubule dynamics, Microtubule associated proteins (MAP's) and crosslinking of microtubules.

Microtubules and mitosis (a) Centrosome duplication (b) Kinetochore and force for poleward chromosome movement (c) Organization of spindle pole and orientation of assembly (d) Formation of poles and capture of chromosomes (e) Kinetochore and force of poleward chromosome movement (f) Astral microtubule and cytokinesis (g) Microtubules and plant cell formation.

Module III (20 hrs)

Molecular structure of genes and chromosomes: Definition of gene; Chromosomal organization of genes- coding and non-coding DNA; Functional re-arrangements in chromosomal DNA; Organizing cellular DNA into chromosomes; Morphological and functional elements of eukaryotic chromosomes.

Regulation of Gene expression: Operon concept; Positive and Negative regulation; Inducers and corepressors; Regulation by attenuation-his and trp operons.

Module IV (15 hrs)

Protein structure and function: Structure and chemistry of amino acids; Hierarchical structure of proteins-Secondary structure: α-helix, β-pleated sheets and bends; Prediction of secondary structure, Ramachandran plot; Tertiary structure, forces stabilizing tertiary structure; Domains and Motifs; Quarternary structure of proteins

DNA binding proteins and gene regulation: DNA binding domain**;** Homeodomain proteins; Zinc finger proteins**;** Winged-helix (Forked head) proteins; Leucine-Zipper proteins; Helix Loop helix proteins.

Suggested Readings

1. Cooper, G. M., Cell (A Molecular Approach)
2. DeRobertis&DeRobertis: Cell and Molecular Biology
3. Lodish et al: Molecular Cell Biology
4. Karp: Cell and Molecular Biology
5. Becker et al: World of Cell
6. T.A. Brown: Genome
7. Griffith et al: Modern Genetic Analysis
8. Hartl& Jones: Essential Genetics: A Genome Perspective
9. Ram Mahabal, Fundamental of Cytogenetics and Genetics
10. Lewin, Genes VIII

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	L			
CO2		M		
CO3			H	
CO4				H

ZGIY0011: IMMUNOLOGY-I (CREDIT 4; 60 HRS; 4-0-0)

Course Outcomes

1. Demonstrate the basic concepts of the immune system and its components. (Understanding)
2. Apply the concept of antigenic determinant, antigen specificity and hybridoma technology to construct monoclonal antibodies. (Applying)
3. Examine how the antigen processing and presentation of both exogenous and endogenous antigen works. (Analyzing)
4. Compare various agents responsible for different types of hypersensitivity reactions. (Evaluating)
5. Elaborate the network of various components and complexes of the immune system and make a checklist of organ specific and systemic autoimmune diseases. (Creating)

Module I (15 hrs)

Cells and organs of immune system: Hematopoiesis- B-Lymphocytes, T-lymphocytes and Null cells; Mononuclear cells (antimicrobial and cytotoxic activities, secretion of factors); Granulocytic cells (Neutrophils, Eosinophils and Basophils); Mast cells; Dendritic cells and Langerhans cells; Organs of immune system: Primary lymphoid organs (Thymus and bone marrow), Secondary lymphoid organs (Lymph nodes, spleen, mucosal associated lymphoid tissue and cutaneous associated lymphoid tissue, tonsils and Peyer's patches; Lymphatic system.
Molecular Immunology: Components of immunity**;** Innate (nonspecific) immunity**-** Anatomic barriers**,** Chemical barriers**,** Phagocytic barriers**,** Inflammatory barriers; Adaptive (specific) immunity**-**Humoral and cell-mediated immunity (CMI):(a) Recognition of antigen by B-and T-lymphocytes and antigen presenting cell (APC)(b) Clonal selection of lymphocytes**;** Cellular interactions required for generation of immune responses(a) Activation and proliferation of B and T cells (b) Generation of humoral immune responses (c) Generation of Cell mediated immune responses.

Module II (15 hrs)
Antigens: Immunogenicity versus antigenicity**;** Factors that influence immunogenicity**,** Contribution of the immunogens (foreignness, molecular size, chemical composition and heterogenesity, susceptibility to antigen processing and presentation); Haptens and epitopes; Immunogen dosage and route of administration and adjuvants.
Immunoglobulins structure and function: Molecular structure of Ig**;** Immunoglobulin classes (lgG, lgM, IgE and lgD and their biological activities; Immunoglobulin - mediated effector functions (Opsonization, activation of complement, antibody dependent cell- mediated cytotoxicity , neutralization); Antigenic determinants on immunoglobulin (isotype, allotype and idiotype); Monoclonal antibodies: Formation and selection of hybrid cells, Production of monoclonal antibodies, Clinical uses of monoclonal antibodies, Catalytic monoclonal antibodies (abzymes).
Antigen - Antibody Interaction: Antibody affinity and activity; Cross reactivity; Agglutination reactions; Precipitation reaction.

Module III (20 hrs)
Major Histocomptability complex: General organization and inheritance of MHC; Location and function of MHC; MHC haplotypes; MHC molecules and gene: Structure of class I molecules; Structure of class II molecules; Organization of class I and II genes; Peptide binding by MHC molecules; Class III molecules; Regulation of MHC expression; MHC and immune responsiveness; MHC and disease susceptibility.
Antigen processing and presentation: Role of antigen presenting cell**,** Early evidence for the necessity of antigen processing; Cells that function in antigen presentation; Evidence for two processing and presentation pathways; Endogenous antigens (The cytosolic pathway): (a) Peptide generation by proteosomes (b) Peptide transport from the cytosol to rER (c) Assembly of peptide with class I MHC molecules**;** Exogenous antigens (The endocytic pathway)(a) Peptide generation in endocytic vesicles(b) Transport of class II MHC molecules to endocytic vesicles.(c) Assembly of peptide with class 11 MHC molecules.

Module IV (10 hrs)
Hypersensitivity: Type I, II, III and IV; *In vivo* and *in vitro*
Autoimmunity: Organ specific autoimmune disease; Systemic autoimmune disease.

Suggested Readings
1. Kuby et al.: Kuby Immunology
2. Abbas A.K., Lichtman A.K. and Pober J.S. Cellular and Molecular Immunology
3. Roitt et al, Essential Immunology
4. Price C.P., Newman D.J., Principles and Practices of Immunology
5. Kindt T.J., Osborne B.A., Goldsby R., Immunology

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
1	L			
2		H		
3			M	
4				M

SPECIALIZATION III: FISHERY SCIENCE

ZGTF0012: TAXONOMY AND FUNCTIONAL ANATOMY (4 CREDITS- 60 HOURS/L-T-P: 4-0-0)

Course Outcomes
1. Analyze the non-piscine fishery resources and their importance in fisheries. (Analyzing).
2. Apply the knowledge of fish biology and its importance in fishery practices for the development of future entrepreneurship. (Applying).
3. Develop fundamental skill to identify and classify various groups of fishes, their relationship with morpho-anatomical and

molecular techniques. (Creating)

Module I (10 hours)

a) **Fin fish taxonomy:** General characters and classification, major fish groups (extant & extinct), phylogeny of fishes;
b) **Gross external anatomy of fishes:** skin and its derivatives, scales and their significance; Significance of fish osteology in taxonomy.
c) Fish barcoding.

Module II (30 hours)

a) **Fin fish functional biology:** Food and feeding habits: Food– Kinds and varieties, abundance of food and its availability,structural adaptation, search for food, classification based on food and feeding habits;
b) **Respiratory organs in fishes** – Modification of gills and Tracheae in relation to habit – Structural adaptations of air breathing fishes;
c) **Age and growth:** Growth, length weight relationships, condition factors, morphometric indices and bioenergetics index, variation in growth rate, age determination;
d) **Fin fish reproductive biology:** Modes of reproduction, reproductive cycle, gonad maturity stages, Hormonal regulation of gonadal development, activity of Gonadotropin-releasing hormone, modes of spawning; Environmental factors controlling reproduction and factors affecting development.

Module III (20 hours)

a) Shellfish taxonomy:
General characters and classification of major groups of crustacean and molluscs.

b) Food and feeding biology of Shellfish:
- Food, feeding habits and adaptations of cultured prawn and shrimps.
- Food, feeding habits and adaptations of cultured Molluscs.

c) Shellfish reproductive biology:
- Reproductive patterns in prawn and shrimp, reproductive organs, gonad maturity, spawning and fertilization.
- Endocrine organs in crustaceans and their role in reproduction.
- Reproductive patterns in Molluscs, reproductive organs, gonad maturity, spawning and fertilization.

Suggested Readings

1. Barrington, F.J.W. Invertebrates: Structure and Functions. EIBS.
2. Carl, B.E. Biology of Fishes. Saunders,
3. Fretter, V. & A. Graham.The functional anatomy of vertebrates. Academic Press Inc. (Lon.) Ltd.
4. Kaestner, A. Invertebrate Zoology. Vol. I – III, John Wiley & Sons
5. Kurian, C.V. & V.O. Sabastian. Prawns and Prawn Fisheries of India.
6. Lagler, K.E. et. Al. Ichthyology. John Wiley,
7. Low, M.S. & G.M. Calliet (eds.). Readings in Ichthyology. Prentice Hall,
8. Moyle Peterb, Fishes: An Introduction to Ichthyology. Prentice Hall.
9. Nikolsky, G.V. Ecology of Fishes. Academic Press, NY. Howar, W.S. & D.J. Randal. Fish Physiology, Vols.1–4, Academic Press,NY
10. Norman, J.R. & P.H. Greenwood.A History of Fishes, Ernest Benn Ltd.
11. Jayaram K. C. The fresh water fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka.
12. Jhingran V. G. Fish and Fisheries of India.
13. Lagler, K.F. Ichthyology. John Wiley Publication
14. Norman, J.R. & P.H. Green Wood.A history of fishes.
15. Bond, E. Carl. Biology of fishes.
16. Kumar S and Thembre M Anatomy and Physiology of Fishes (Vikas Publishing House)
17. Srivastava, C.B.L. Textbook of Fishery Science and Indian Fisheries. KutubMahal
18. Khanna S. S. and H. R. Singh. A textbook of Fish Biology and Fisheries, Narendra Publishing House
19. Beaven C R. Handbook of the freshwater fishes of India (Narendra Publishing House)
20. Biswas K P A Text Book of Fish, Fisheries and Technology, (Narendra Publishing House)
21. Brown E and Margaret 1957 Physiology of Fishes Vol I & II (Academic Press, Inc. Publishers)
22. Daniels R J R Freshwater fishes of Peninsular India (Universities press)
23. Lagler, K.F. Ichthyology. John Wiley Publication
24. Love, M.S. & Cailliet, G.M. Readings in Ichthyology. Prentice Hall Publications, 1979.
25. Norman, J.R. & P.H. Green Wood. A history of fishes.
26. Pandey. Fish and Fisheries. Rastogi Publications

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1			H
CO 2		H	
CO 3	H		

ZGAF0013: AQUACULTURE AND FISH GENETICS (4 CREDITS-60 HOURS/ L-T-P: 4-0-0)

Course Outcomes

1. Identify various freshwater fish culture methodologies and their significance. (Applying).
2. Utilize the knowledge on the process of fishery and aquaculture management for development of future entrepreneurship. (Applying).
3. Determine the nutritional requirements in fishery and development of skill on fish feed formulation for a profitable fish farming system. (Creating).
4. Apply the knowledge of the application of modern biotechnological tools and their role in the development of fishery. (Applying)

Module I (15 hours)

a) **Fishery Management:** Construction of fish farm and reclamation of swamps; Selection of species for culture – Biological principles, Preparation and management of nursery ponds, rearing ponds and stocking ponds along with control of weeds, pests and predators, Construction of hatcheries and their management.
b) **Aquaculture Management**: Feed, health and water quality management.

Module II (15 hours)

Freshwater fish culture: Indian Major carps and exotic carps - Composite Fish Culture; Air breathing fishes; Integrated Fish Farming – Paddy cum Fish Culture and Fish cum Livestock Culture, Monoculture, Monosex culture; Sewage fed fisheries, Catfish culture, Trout culture, Freshwater prawn culture; shrimps and Crab culture; cage culture and pen culture, Lobster culture, Mussel culture; Pearl oyster culture; Edible oyster culture

Module III (15 hours)

a) **Fish nutrition:** Nutritional requirements, formulation and preparation of fish feeds Food & Feeding habits of commercially important fishes. Larval nutrition — Importance of live feed and artificial feed, Different types of feed available for larvae.
b) **Fish seed resources:** Procurement and transportation of seed from natural resources.

Module IV (15 hours)

a) **Fishery Genetics and Biotechnology:** Inheritance in fishes, sex determination, hybridization
b) **Cytogenetics and molecular techniques in fisheries:** Comet Assay, Micronuclei Test, Fish cell lines and cell culture. Application of biotechnological tools: Recombinant DNA, Transgenesis, Gynogenesis and Androgenesis, Jellyfish Green Fluorescent Proteins and their applications; Cryopreservation.

Suggested Readings

1. Arumugam, N. Aquaculture & Fisheries, Saras Publication
2. Bardach, J.E., Ryther, J.H. and McLarney, W.O. Aquaculture. John Wiley & Sons Inc., USA.
3. Beaven C R Handbook of the freshwater fishes of India (Narendra Publishing House)
4. Boris, Gomelsky. Fish Genetics. VDMVerlag
5. C.I.F.R.I., Prawn Fisheries Bulletin
6. Chakroff,M., Freshwater Fish Pond Culture and Management, Scientific Publishers
7. Christenson, K. Aquaculture: Introduction to Aquaculture for Small Farmers. Createspace Independent Publishing Platform
8. Daniels R J R Freshwater fishes of Peninsular India (Universities press)
9. Dholakia, A.D. Identification of Prawns/Shrimps of India and Their Culture. Daya Publishing House
10. Elizabeth Gosling. Bivalve Molluscs: Biology, Ecology and Culture Wiley-Blackwell
11. Ghosh, S.., Palanisamy, K. and Pathak, S.C. Shrimp and Freshwater Hatchery Public Relations
12. Division, National Bank for Agriculture and Rural Development, Bombay.
13. Gray, Camillo W. Guide to Shrimp and Prawn Culture in Bangladesh. University of Stirling Institute of Aquaculture
14. Gupta S.K., Gupta P.C. General & Applied Ichthyology. S Chand & Company
15. Hall, C. B., Ponds and Fish Culture, Agro Botanical Publishers
16. Harvey, B. J. and Hoar, W. S. Theory and practice of induced breeding in fishes.

17. Hora, S. L. and Pillay, T.V. R. Handbook on Fish Culture in the Indo-Pacific Region, Fisheries Division, Biology Branch, FAO,
18. Huet, M., Textbook of Fish Culture, Breeding and Cultivation of Fish, Fishing News (Books) Ltd..
19. CAR. Handbook of Fisheries and Aquaculture Reddy,
20. M.S. A Text Book of Aquaculture, Discovery Publishing Pvt. Ltd
21. Jhingran V. G. Fish and Fisheries of India.
22. Kolappan Nisha. Identification of Genetic Relation Between Fish Species Using Sds-Page. Lambert Academic Publishing
23. Kurian, C.V. and Sebastian,V.O. Prawns and prawn Fishery of India. Hindustan Publishing Corporation (India), New Delhi.
24. Lakra W. S., Abidi SAH, Mukherjee SC and Ayyappan S. 2004.Fisheries Biotechnology.
25. Lucas, J.S. Aquaculture: Farming aquatic animals and plants (Fishing News Books)
26. MacKenzie, Simon A. Genomics in Aquaculture Academic Press
27. Michael Bernard New (Editor), Wagner Cotton iValenti(Editor), James H. Tidwell(Editor). Freshwater Prawns: Biology and Farming Wiley-Blackwell
28. Mikhalev, Viktor. Genetics and Fish Breeding.Arcler
29. Nigel Preston (Editor), Dean R. Jerry (Editor)Biology and Culture of Farmed Marine Shrimps. CRC Press
30. Pandian, T.J. (Editor), C.A. Strüssmann (Editor), M.P. Marian (Editor). Fish Genetics and Aquaculture Biotechnology.CRC Press
31. Pandian, T.J. Genetic Sex Differentiation in Fish. CRC Press
32. Pillay, T. V. R.1993. Aquaculture – Principles and Practices. Fishing News Book.
33. Pillay, T.V.R. and M.N. Kutty, Aquaculture: Principles and Practices. Wiley India Pvt Ltd; Second edition
34. Rao, K. L. 1975. India's water wealth.
35. Rath, R.K. Freshwater Aquaculture Scientific Publishers Journals Dept
36. Ravishankar Piska, 1999. Fisheries and Aquaculture. Lahari Publications, Hyderabad.
37. Santhanam R. Fisheries Science, Daya Publishing House, 1990.
38. Selvamani B.R & Mahadevan R.K 2008 Freshwater fish farming (Campus Books International)
39. Singh, B.& A. Dey. Fish and Fisheries. Invincible Publishers
40. Singh, N.P. & B. Santosh. Handbook of freshwater aquaculture. New India Publishing Agency
41. Turner, Bruce. Evolutionary Genetics of Fishes (Monographs in Evolutionary Biology).Springer

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1		H		
CO 2	H			
CO 3			H	
CO 4				H

SPECIALIZATION IV: ANIMAL ECOLOGY AND WILDLIFE BIOLOGY

ZGEB0014: ANIMAL ECOLOGY AND BIOGEOGRAPHY (4 CREDITS: 60 HOURS, L-T-P: 4-0-0)

Course Outcomes (CO)

1. Identify various freshwater fish culture methodologies and their significance. (Applying).
2. Utilize the knowledge on the process of fishery and aquaculture management for development of future entrepreneurship. (Applying).
3. Determine the nutritional requirements in fishery and development of skill on fish feed formulation for a profitable fish farming system. (Creating).
4. Apply the knowledge of the application of modern biotechnological tools and their role in the development of fishery. (Applying)

Module I: Basic Ecological concept (15 hours)

a) Habitat & Niche, Ecological Versatility & Niche dimension.
b) Competitive displacement: Gause's principle of Competitive Exclusion, Predator-Prey relation: Lotka Volterra Model ofInterspecific Competition, Ecological equivalents.
c) Species diversity, Species richness, Global patterns in species richness, Theories of species richness, Invasive species and itseffect on species richness.
d) Ecosystem model

Module II: Habitat and landscape ecology (25 hours)

a) Introduction to Habitat Ecology: Ecology of major habitats- Grasslands, Wetlands, Forests, Physical and anthropogenicfactors influencing habitats.

b) Introduction to Landscape Ecology: Edge, ecotones, Edge effect interspersion and juxtaposition. Habitat fragmentation andits effect on the resident community.
c) Metapopulation concept and its application in designing Nature reserve; Theory of Island Biogeography.
d) Measuring Wildlife habitat: Inventory, evaluation and monitoring of wildlife habitat - availability, quality, palatability of graze and browse. Inventory of unique habitats, their distribution and need for conservation, Animals signs as indicators of habitatuse.

Module III: Principles of Biogeography (10 hours)

History of biogeography. Ecology of dispersal and faunal exchange, barriers, mode of dispersal, origins and radiation; island biogeography: endemism, refugia. Continental drift; dispersal and vicariance biogeography; dispersal mechanisms and dispersal barriers.

Module IV: Indian biogeography (10 hours)

India's biogeographic classification. Case studies of Indian fauna explaining Biogeographic Theories. Biogeographic affinities of the fauna and flora of the Indian sub-continent.

Suggested Readings

1. Smith TM and Smith RL (2012). Element of Ecology (9th edition). Pearson Publication
2. Begon M, Townsend CR and Harper JL (2006). Ecology From individuals to Ecosystems (4th edition). Blackwell Publishing
3. Ricklefs RE and Miller GL (1999). Ecology (4th edition). WH Freeman Publication
4. Mani MS (1974). Ecology and Biogeography in India. Springer Netherlands
5. Cox CB, Moore PD and Ladle R (2010). Biogeography: An Ecological and Evolutionary Approach (9th Edition). Wiley-Blackwell.
6. Huggett RJ (2004). Fundamentals of Biogeography (2nd edition). Routledge London and New York
7. Ladle R and Whittaker RJ (2011). Conservation Biogeography. Wiley Blackwell
8. MacArthur RH (1984). Geographical Ecology: Patterns in the Distribution of Species. Princeton University Press.
9. MacArthur RH and Wilson EO (2001). The Theory of Island Biogeography. Princeton University Press.
10. Mayr E (1969). Principles of Systematic Zoology. Tata McGraw Hill Publ. Co.
11. Mayr E and Ashlock PD (1991). Principles of Systematic Zoology. McGraw Hill International Edition.
12. Simpson GG (1961). Principles of Animal Taxonomy. Columbia University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	M
CO2		H	L	
CO3		M	L	
CO4			H	H

ZGWM0015: WILDLIFE CONSERVATION AND MANAGEMENT (4 CREDITS: 60 HOURS, L-T-P: 4-0-0)

Course outcome (CO)

1. Relate different principles and practices of wildlife management and make use the concepts of conservation (Understanding, applying)
2. Explain the concepts of wildlife management and applying theories on habitat management (Understanding, Applying)
3. Explain about different plant diversity, Phyto resource utilization and their importance, threatened plants of India with respect to Northeast India. (Understanding)

Test the efficacy of conservation efforts of an eco-sensitive zone in (Northeast) India and develop a framework for its management. (Creating**Module I: Conservation Biology (20 hours)**

a) Introduction to conservation biology: Values of biodiversity and conservation ethics, Patterns and process of biodiversity, losses and threats to biodiversity. Geological and present extinctions, changes in species composition and problem of climate change.
b) Strategies for conservation –
   - In situ conservation: International efforts and Indian initiatives; protected areas in India – sanctuaries, national parks,biosphere reserves, sacred groove and Community Reserve. Ecological restoration and its significance
   - Ex situ conservation: Principles and practices; botanical gardens, fields gene banks, seed banks, cryobanks; non-formalconservation efforts.

Module II: Wildlife Management (25 hours)

a) Principles and practices of wildlife management; Management of special habitats: riparian zones, Grasslands, wetlands.
b) Species conservation projects: Tiger, Lion, Rhino, Crocodile, Turtle, Adjutant stork.
c) Management plan for Protected Areas: Principles of planning, objectives, resource surveys, analysis of surrounding region, management zones, theme plans, communications, staff and visitor amenities, monitoring. Financing protected areas; Needfor wildlife management planning

Module III: Plant diversity and Phytoresources (15 hours)

a) Plant Biodiversity: Concept, status in India, utilization and concerns.
b) Forest products: Important timber yielding planting. Timber types,
c) Non-Timber Forest products
d) Plants used as avenue trees for shade, pollution control and aesthetics. e) Threatened plants of India with special referenceto NE India

Suggested Readings

1. Hillis DM (1996) (ed). Molecular Systematics. Sinauer Publ Inc. Dash, M. Fundamentals of Ecology, Tata McGraw Hill
2. Gopal, R. Wildlife Management, Allied International
3. Saharia, V. Wildlife conservation
4. Primack- Essentials of Conservation Biology
5. Dyke- Conservation Biology- Foundation, Concepts, Applications
6. Primack- A primer of Conservation Biology
7. Singh- Textbook of Wildlife Management
8. Bailey- Principles of Wildlife Management
9. Krausman and Cain- Wildlife Management and Conservation
10. B.B. Dutta- A handbook of Plant Resource Utilization and Conservation
11. Kibue- Wildlife Conservation and Utilization
12. Trivedi and Sharma- Plant Resource Utilization and Conservation

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H	M	L
CO2	M	H	
CO3			H

SPECIALISATION I: ENTOMOLOGY

ZGIG0017: INSECT ECOLOGY (4 CREDITS-60 HOURS, L-T-P: 4-0-0)

Course Outcomes

1. Apply the basics of insect ecology to the development of their research (Applying)
2. Acquire knowledge on behavioural ecology, insect association, interactions and population ecology (Applying)
3. Outline and interpret the concepts of ecology, basic principles of distribution and abundance of organisms and their causes and the impact of climate change on insect diversity (Understanding)
4. Explain the life history of some insects (Understanding)
5. Estimate the diversity of insects using different diversity indices (Creating)

Module I (15 hours)

a) Dynamics of insect life system-determinants of insect abundance, population change, birth rate, Death rate, movements; ; Law of minimum, law of tolerance
b) Population growth models, Exponential and logistic model, discrete and continuous growth model, concept of carrying capacity, life tables and their application to insect biology, survivorship curves, case study of insect life tables,

Module II (9 hours)

a) Regulation of insect populations, Population dynamics- Factors affecting abundance- Environmental factors,dispersal and migration, Seasonality in insects. Diapause (Quiescence) -aestivation, hibernation.
b) Dominance of insect-cause of success; Adaptation of insect- aquatic, terrestrial, soil, boring wood

Module III (18 hours)

c) Calculation of some diversity indices: Shannon, Simpson Problem solving in ecology
d) Insect biodiversity, threats to insect biodiversity, impact of climate change on insect communities;
e) Insect plant interaction Pollination Biology with special reference to Bees

Module IV (18 hours)

a) Insect behavior: chemotropism, thigmotropism, hydrotropism, rheotropism, anemotropism, phototropism, thermotropism, geotropism, instinct.Protective behavior: mimicry crypsis, warning coloration. Behavioral defense, chemical defense; Breeding behavior.

Suggested Readings

1. The Insect Structure and Functions, R.F. Chapman, Cambridge University Press
2. Modern Entomology, D.B. Tembhare Himalaya Publishing House
3. Text Book of Applied Entomology Vol- I &Vol- II, K.P. Srivastava, Kalyani Publishers
4. Introduction to General and Applied Entomology, Abhishek Shuklaand Sushilkumar Saxena, Astral International (P) Ltd.
5. Indian Insect Pests, H. Maxwel-Lefroy &F.M. Howlett, Astral International(P) Ltd.
6. A Handbook on Economic Entomology, Abhishek Shukla, Astral International(P) Ltd.
7. Insect Pest Management: EcologicalConcepts, T.V. Sathe & JyotiM.Oulkar, Astral International (P) Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		L	L
CO 2	M		H	H
CO 3	H	M		
CO 4				M
CO5	H	H	H	

ZGPM0035: APPLIED ENTOMOLOGY AND PRINCIPLES OF PEST MANAGEMENT (4 CREDITS-60 HOURS, L-T-P: 4-0-0)

Course Outcomes

At the end of this course students will be able to:

1. Illustrate the classification and life histories of the important household and agricultural and forest pests. (Understanding)
2. Develop the knowledge of Insect's role as a source for commercial products (honey, wax, silk, lac and medicines). (Applying)
3. Apply the latest knowledge of application of modern technique and principles of biological control and Chemical control of pest. (Applying)
4. Adapt the knowledge of use of insects in Forensic Science. (Creating)

Module I (10 hours)

Definition of Insect Pest; Classification of Insect Pest; Major pest of rice, wheat, cotton, vegetables, tea, jute, pulses, stored grain pest- life history, nature of damage and control.

Module II Pest Control (24 hours)

a) Primary control measures: Physical, mechanical, traditional and legislative measure.
b) Chemical Control Measures: Nomenclature and Classification of Insecticides; Mode of action of Insecticides; Advantage and Hazards of Insecticides; LD_{50} and LC_{50}.
c) Biological control measures
d) Autocidal control measures
e) Integrated Pest Management (IPM)

Module III Industrial Entomology and Pest of Medical Importance (16 hours)

a) Apiculture, Sericulture (Muga, Eri, Mulberry and Tasar), Lac culture.
b) Insects of medical importance: Mode of Transmission; Common Vector Insects (Mosquitoes, House flies, Sand flies, Human louse and Tsetse flies)- Morphology with role in disease transmission and control

Module IV Forest Entomology and Forensic Entomology (10 hours)

1. Insect common to forest and their damage, defoliators, borers and sap suckers.
2. Insects of Forensic importance; Carcass condition and incidental attack by insects; Investigation methodology by forensic insects.

Suggested Readings

1. The Insect Structure and Functions, R.F. Chapman, Cambridge University Press
2. Modern Entomology, D.B. Tembhare Himalaya Publishing House
3. Text Book of Applied Entomology Vol- I & Vol- II, K.P. Srivastava, Kalyani Publishers
4. Introduction to General and Applied Entomology, Abhishek Shukla and Sushil Kumar Saxena, Astral International (P) Ltd.
5. Indian Insect Pests, H. Maxwel-Lefroy & F.M. Howlett, Astral International (P) Ltd.

6. A Handbook on Economic Entomology, Abhishek Shukla, Astral International (P) Ltd.
7. Insect Pest Management: Ecological Concepts, T.V. Sathe & Jyoti M. Oulkar, Astral International (P) Ltd.
8. Indian Pest Aphids, T.V. Sathe & B.V. Jadhav, Astral International (P) Ltd.
9. Insect Pest Predators, T.V. Sathe & Y.A. Bhosale, Astral International (P) Ltd.
10. Insect Predators and Pest Management, Vaishali J. Patil & T.V. Sathe, Astral International (P) Ltd.
11. Insect in Vegetables, Dhamo K. Butani & M.G. Jotwani, Astral International (P) Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	L
CO 3	H	M	H

SPECIALIZATION II: CELL AND MOLECULAR BIOLOGY

ZGMB0019: CELL AND MOLECULAR BIOLOGY-II (4 CREDIT; 60 HRS; 4-0-0)

COURSE OUTCOMES

1. Define the cell adhesion molecules and their role in cell junctions. (Remembering)
2. Demonstrating the concept of protein targeting. (Understanding)
3. Make use of various theory of aging for understanding its process. (Applying)
4. Analyze the genetics and physical mapping of mutation. (Analyzing)
5. Estimate the effect of Cyclins and cyclin - dependent kinases in cell cycle regulation. (Evaluating)

Module I (15 hours)

Cell-Cell Signaling: Endocrine, paracrine and autocrine signaling; Receptor Proteins- Cell Surface receptors and intracellular receptors; Cell Surface receptors-G-protein coupled receptors, ion channel receptors, tyrosine kinase-linked receptors and receptors with intrinsic enzymatic Activity; Second messenger System - cAMP and IP3, DAG; MAP kinase cascade, JAK/STATand TGF –β / Smad signaling, NF-kB signaling; Signaling from plasma membrane to nucleus (a) CREB links cAMP signals to transcription (b) MAP kinase. Wnt pathway, Hedgehog pathway and Notch pathway

Module II (10 hours)

Protein sorting and targeting to organelles: Protein traffic through the endomembrane system; Targeting of proteins to the Rough Endoplasmic Reticulum and Golgi complex; Anterograde and retrograde transport; Signal-mediated protein transport to organelles (i) Nucleus (ii) Mitochondria (iii) Peroxisome

Module III (10 hours)

Genetic analysis in Cell Biology: Mutation: type and causes; Isolation and analysis of mutants; Physical and Genetic mapping of mutations; Molecular cloning of genes defined by mutations.

Module IV (15 hours)

a) Cell Cycle: Bacterial cell cycle (Helmstetier - Cooper or I+C+D model); Partition and cytokinesis; Eukaryotic cell cycle – G l, S, G 2 and M phases; Cell cycle checkpoints; Molecular basis of cell cycle regulation(a) Cyclins and cyclin - dependent kinases(b) Regulation of CDK cyclin activity.
b) Cell Death: Apoptosis and necrosis; Apoptosis-its characteristics; Genes involved in apoptosis.

Module V (10 hours)

a) Aging, the biology of senescence: Maximum life span and life expectancy; Causes of aging: (i) General wear and tear andgenetic instability (ii) Free radicals, oxidative damage and antioxidants (iii) Telomerases and aging.
b) Cancer: Tumor cells and onset of cancer; Proto-oncogenesis and tumor suppressor genes; Mutation causing loss of cell cycle;Mutations affecting genuine stability.

Suggested Readings

1. Cooper, G.M., Cell (A Molecular Approach)
2. Sadava, D.E., Cell Biology
3. Karp, G., Cell and Molecular Approach
4. Kish, V.M. and Kleinsmith L.J., Cell and Molecular Biology
5. Gardener, Principles of Genetics
6. Strickberger, Genetics
7. Ram mahabal, Fundamental of Cytogenetics and Genetics

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
1	L				
2		M			
3			H		
4				M	
5					H

ZGIM0020: IMMUNOLOGY II (4 CREDIT; 60HRS; 4-0-0)

Course Outcomes

1. Illustrate the basic organization and expression of the immunoglobulin genes. (Understanding)
2. Make use of non-virulent strain of microorganism for the development of vaccine. (Applying)
3. Examine the properties and role of various cytokines related to diseases. Compare the immune responses to various infectious diseases caused by bacterial, viral and protozoan infections. (Analyzing)
4. Estimate opportunistic agents and therapeutic agents to deal with immunodeficiencies. (Evaluating)
5. Formulate the use of various tumor suppressive drugs for preventing the graft rejection and also to develop various methods for immunization. (Creating)

Module I (20 hours)

Organization and expression of Ig genes: Multigene organization of lg genes; Light-chain multigene family; Heavy chain multigene family; Variable region gene rearrangement, V-J rearrangements in light chain DNA, V-D-J rearrangements in heavy chain DNA, Mechanism of gene rearrangement, Allelic exclusion; Generation of antibody diversity, Multiple germlineV, D and J gene segments; Combinatorial V-J and V-D-J joining; Junctional diversity; Association of heavy and light chain; Expression of Ig genes, Differential RNA processing of heavy chain primary transcripts, Expression of membrane secreted Ig, Simultaneous assembly and secretion of IgM and IgD, Synthesis, assembly and secretion of Ig; Class switching of constant regions

Module II (15 hours)

a) Cytokines: Properties of cytokines, General structure of cytokines, Function of cytokines, Cytokines related diseases, Bacterial septic shock, Bacterial toxic shock and similar diseases, Lymphoid and myeloid cancers, Chagas disease
b) Immune system in health and disease: Immune response to infectious disease; Viral infections (i) Viral neutralization by humoral antibody (ii) Cell - mediated antiviral mechanism (iii) Viral evasion of host defense mechanisms; Bacterial infections
(i) Immune responses to extracellular and intracellular bacteria (ii) Bacterial evasion of host defense mechanism; Protozoandiseases; Diseases caused by helminths.

Module III (15 hours)

a) Vaccines: Active and passive immunization; Designing vaccines for active immunization; Whole organism vaccine (i) Attenuated viral or bacterial vaccines (ii) Inactivated viral or bacterial vaccines; Polysaccharide vaccines; Recombinant vectorvaccines; DNA vaccines; Synthetic peptide vaccines; Multivalent peptide vaccines
b) Immunodeficiencies: Primary and Secondary Immunodeficiencies, lymphoid and myeloid lineage; AIDS: Structure and types,genome organization, replication, opportunistic agents and therapeutic agents

Module IV (10 hours)

a) Tumor immunology: Tumor antigen; Tumor evasion; Immune system against tumors; Therapies.
b) Transplantation immunology: Acute, hyperacute and chronic rejection; Tissue matching (HLA typing); Graft Vs host (GVH)reaction; Xenotransplantation; Immunosuppressive drugs; role of monoclonal antibodies in transplantation.

Suggested Readings

1. Kindt, T.J., Osborne, B.A., Kuby, J., Kuby Immunology
2. Kasper, D.l., Fauci, A.S., Harrison's Infectious Diseases
3. Abbas, A.K., Lichtman, A.H.H., Pillai, S., Cellular and Molecular Immunology
4. Sell, S., Berkower, I., Immunology and Immunopathology and Immunity

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
1	L			
2		M		
3			H	

4				H

SPECIALIZATION III: FISHERY SCIENCE

ZGCP0021: CAPTURE FISHERY AND POST-HARVEST TECHNOLOGY (4 CREDITS-60 HOURS/ L-T-P: 4-0-0)

Course Outcomes

1. Identify the capture fishery resources of the country and the managerial practices for sustainable utilization of these aquatic resources. (Applying)
2. Develop the knowledge of cold-water fishery resources of the country and their applicability in the development of future entrepreneurs in the fishery sector of the region. (Creating)
3. Categorize various fishing gears and crafts used in various water bodies of the country. (Analyzing)
4. Develop new ideas on the development of efficient fishing tools and the skill to predict the possible fish stock in the water bodies and management for sustainable utilization of the resources. (Creating)
5. Develop the skill of fish preservation and processing for long term utilization. (Creating)

Module I (20 hours)

Capture fishery: Fish catch statistics of the world with special reference to India; Riverine Fisheries River Systems in India, their ecology and fisheries (Ganga & Brahmaputra); Reservoir Fisheries: Development, Exploitation and management of Reservoirs with special reference to India–Dams and their effect On fish migration; Beel fisheries of Assam: Fish resources, problems and management;

Module II (10 hours)

Cold water fisheries: Hill stream fisheries of North East India; Mahseer fisheries: prospects and problems with special reference to NE India; Major Estuaries of India and their fisheries; Brackish water Fisheries: Chilka lake. Hilsa fishery–causes of decline and efforts for revival

Module III (10 hours)

a) Craft and Gear used in Fisheries: Traditional and mechanized boats and nets used in catching fish; Population Dynamics: Fish populations and factors affecting the population structures; Estimation of fish yield and control of overfishing, Yield and optimum catch; Fishing crafts and gears used in Inland capture fisheries; Destructive fishing– its impact on fish diversity.
b) Fish oils, Fish Proteins, Fish manure, Fish glue, Fish flour, Isinglass, Fishmeal, Fish Silage, Fish guano, Bone meal; Productionof fish sauce by lactic acid fermentation.

Module IV (20 hours)

Post-harvest technology and fish by-products: Preservation and processing: Methods of preservation Of both finfish and shellfish preservation(Refrigeration and freezing, Drying, Salting, Smoking, Canning, Pickling, pasting and spicing) and associated problems; Rigor mortis and post-mortem changes. Handling and packaging of fish for marketing; product stability and shelf-life. Fish by-products

Suggested Readings

1. Bal, D.V. and Veerabhadra Rao, K. Marine Fisheries. IBH Publications
2. Balakrishnan, N. N. and Thampy, D. M.A textbook of marine ecology.
3. Beaven C R Handbook of the freshwater fishes of India (Narendra Publishing House)
4. Biswas K P A Text Book of Fish, Fisheries and Technology, (Narendra Publishing House)
5. Brody , Fishery by-products technology., AVI, Westport
6. Chandy, M. Fishes, National Book Trust, India;
7. EIRI Board.Hand Book Of Fish Farming & Fishery Products
8. Gopakumar, K., Singh, B.N. and Chitranshi, V.R. Fifty Years of Fisheries Research in India, Fisheries Division Indian Council ofAgricultural Research, New Delhi.
9. Gupta S.K., Gupta P.C .General & Applied Ichthyology.S Chand & Company
10. Jayaram K. C. The fresh water fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka.
11. Jhingran V. G. Fish and Fisheries of India.
12. Jobling M Environmental Biology of Fishes (Chapmen and Hall)
13. Khanna S. S. and H. R. Singh. A textbook of Fish Biology and Fisheries, Narendra Publishing House
14. Kreuzer, R., Fishery products., FAO, Fishing News Books Ltd., England
15. Krishnaveni, G., N.Veerabhadra Rao and K.Veeranjaneyulu Recent Technologies in Fish and Fisheries, Rigi Publication
16. Lagler, K.F. Ichthyology. John Wiley Publication.
17. Nikolsky, G.V. Ecology of fishes. Academic Press.
18. Pandey.Fish and Fisheries.Rastogi Publications

19. Rao, K. L. India's water wealth.
20. Ravishankar Piska. Fisheries and Aquaculture. Lahari Publications, Hyderabad.
21. Ricker, W.E. 1984.Methods for assessment of fish production in freshwaters.Blackwell Publications.
22. Rounsfell, G.A. and Everhart, W.H. Fishery Science: it 's Methods and Applications John Wiley & Sons,
23. Sachindra, N.M. & N.S. Mahendrakar. Fish Processing Byproducts: Quality Assessment And Application Studium press
24. Santhanam,R. Fisheries Science, Daya Publishing House, 1990.
25. Singh, B. A. Dey. Fish and Fisheries. Invincible Publishers
26. Srivastava, C.B.L. A Textbook of Fishery Science and Indian Fisheries, Kitab Mahal.
27. The Wealth of India, Raw Materials Vol. IV, Fish and Fisheries, CSIR, 1962

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3			H	
CO 4			M	
CO 5				H

ZGLF0022: LIMNOLOGY, FISHERY ECONOMICS, ORNAMENTAL FISHERY AND FISH PATHOLOGY (4 CREDITS-60 HOURS/ L-T-P: 4-0-0)

COURSE OUTCOMES (CO)

1: Explain the needs of physico-chemical factors in maintaining a proper productive aquatic ecosystem, an essentialelement in aquaculture and fishery management. (Understanding)
2: Utilize the understanding of fishery economics and laws of the country, various fishery training institutions and their roles and extension program in fishery development. (Applying)
3: Develop the skill on ornamental fish culture and aquarium preparation and maintenance. (Creating)
4: Apply the knowledge acquired on fish pathology and their prophylactic control measures. (Applying)

Module I (15 hours)

Limnology: Physico-chemical factors of fresh water habitat; Nutrients – Availability, Seasonal distribution and availability of phosphorus, Nitrogen and Silicon; Ecological classification of freshwater organisms; Plankton –Distribution, seasonal variation inspace and time, planktonic migration, cyclomorphosis

Module II (15 hours)

Fishery economics and law: Larvivorous fishes in relation to public health; Exclusive Economic Zone(EFZ) and its strategy; Fisheries co-operatives and their role in fish production and marketing; Aquaculture and rural development in India; Fishery education, training and extension; Fishery research Institutes in India; Fishery legislation and their role in fishery development.

Module III (15 hours)

Ornamental fishery: Ornamental fish culture: Ornamental aquarium fishes, Breeding and care of Freshwater aquarium fishes; Aquarium keeping—Design and construction of tanks; species-wise tank size requirement; heating, lighting, aeration and filtration arrangements; decorations; common aquarium plants and their propagation; Maintenance of Natural Colour of fishes in Aquarium.

Module IV (15 hours)

Fish pathology: Fish and Prawn/Shrimp Diseases: Types of Diseases-viral, bacterial, fungal, protozoan and other parasitic diseases; symptoms & control measures; Diagnosis-Histopathological methods; Immunoassay; Biochemical assay; Serological techniques; Role of biopesticides; Application of Monoclonal antibodies; Vaccines and immune stimulants; Drug resistance.

Suggested Readings

1. Agarwal, S.C. Limnology
2. Bond, E. Carl. Biology of fishes.
3. Datta, J. J. Datta Munshi. Fundamentals of Limnology
4. Dholakia, A.D. Ornamental Fish Culture and Aquarium Management. Daya Publishing House
5. Edward,J. Noga. Fish Disease: Diagnosis & Treatment
6. Gerald, A. Textbook of Limnology. The C.V. Morby Co.
7. Hutchinson, G.E.A. Treatise on Limnology. Vol.1. John Wiley & Sons.
8. Kumar, Arvind. Fundamentals of Limnology. APH Publishing Corporation
9. Nikolsky, G.V. Ecology of fishes. Academic Press.

10. Ricker, W.E. Methods for assessment of fish production in freshwaters. Blackwell Publications.
11. Ruttner, F. Fundamentals of Limnology. University of Toronto Press, 1968.
12. Sharma Shailendra &Pawan Kumar Bharti. Limnology and Aquatic Science. Discovery publishing house
13. Smith David J. Aquarium Keeping: Aquarium Keeping Essentials
14. Thornton Kent W., Bruce L. Kimmel, Forrest E. Payne. Reservoir Limnology: Ecological Perspectives
15. Untergasser, D. Handbook of Fish Diseases. TFH Publications
16. Welch, P.S. Limnological Methods. McGraw Hill Book Company, New York.
17. Wetzel, Robert G. Limnology: Lake and River Ecosystems. Elsevier Academic Press

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

SPECIALIZATION IV: ANIMAL ECOLOGY AND WILDLIFE BIOLOGY

ZGRE0025: WILDLIFE RESOURCE MANAGEMENT, LAWS AND TECHNIQUES IN POPULATION STUDY (4 CREDITS: 60 HOURS, L-T-P: 4-0-0)

Course Outcome

1. Define wildlife disease, identify major parasitic diseases in wild animals and assess animal health conditions. (Remembering, Applying).
2. Apply different techniques of wildlife study. (Applying)
3. Discuss about wildlife forensic, various protocols for species identification and trade of wildlife products. (Creating)
4. Develop the prospects of ecotourism in Northeast India, its importance and consequences and recommend mitigation plans to reduce human animal conflict. (Evaluating, Creating)

Module I Species conservation (20 hours)

IUCN categories, criteria for allocation into different categories. Threatened animal species of India with special reference to NE India. Role of Iconic species designation in conservation. Concept and significance of conservation of Flagship (Target) species; overview of conservation problems and issues of fauna of Indian sub-continent.

Module II Natural resource management and conservation (15 hours)

a) Introduction to forestry, principles of forest management, Importance and performance of joint forest management (JFM) Role of Non-Government Organizations (NGO).
b) Conservation movement in India. Concept of stakeholders. International conservation bodies; IUCN, UNDP, Durrell WildlifeConservation trust.
c) Project Grants for Wildlife Conservation

Module III Forest and Wildlife laws of India (5 hours)

Wildlife Protection Act, 1972;The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of forest Rights) Act, 2006.

Module IV Population ecology and Sampling Techniques (20 hours)

a) Demographic and life history parameters, evolution of life history parameters: r & K selection, allometry, aging and sexing,life tables, age and stage structures models, methods of estimation of life history and demographic parameters
b) Sampling designs for population estimation, population estimation methods: Mark-Recapture for Closed Population, Collection Techniques used in wildlife study.

Suggested Readings

1. Caughley G (1978). Analysis Of Vertebrate Populations. John Wiley, Chichester.
2. Hastings A (1997). Population Biology: Concepts And Models. Springer Verlag, New York.
3. Neal D (2004). Introduction to population biology. Cambridge University Press. UK
4. Ricklefs R (2010). The Economy of Nature (6 edition). W. H. Freeman
5. Tokeshi M (1998). Species Coexistence: Ecological and Evolutionary Perspectives.
6. W. J. Ecological Census Techniques Cambridge University Press
7. Patro, L. Biodiversity Conservation and Management
8. Misra, H.N. – Managing Natural Resources- Focus on Land and Water
9. Anderson, Sweeney and Williams- Wildlife and Natural Resource Management

10. Deal, K.H. Environmental Economics and Natural Resource Management
11. Kumar, R. Environmental Laws
12. Muthukrishna- Natural Resource Economics
13. Field, B.C. Economics of Environment
14. Began, M. & Mortimer, M.- Population Ecology
15. Rockwood- Introduction to population Ecology

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	H	
CO2		H	M	
CO3				L
CO4				H

ZGWC0026: TECHNIQUES IN WILDLIFE STUDY WILDLIFE HEALTH, FORENSICS AND CONFLICT (4 CREDITS: 60 HOURS, L-T-P: 4-0-0)

Course Outcome

1. Define wildlife disease, identify major parasitic diseases in wild animals and assess animal health condition. (Remembering, Applying).
2. Apply different techniques of wildlife study. (Applying)
3. Discuss about wildlife forensic, various protocols for species identification and trade of wildlife products. (Creating)
4. Develop the prospects of ecotourism in Northeast India, its importance and consequences and recommend mitigation plans to reduce human animal conflict. (Evaluating, Creating)

Module I: Wildlife Health (20 hours)

a) Introduction to disease and epizootiology, Determinants of disease and disease transmission, Disease and populationdynamics.
b) Assessment of condition, health and nutritional status in free-ranging populations. Disease control operations, Planning andmanagement of wildlife health programmes.

Module II: Techniques for wildlife study, Capture and handling of wild animals (15 hours)

a) Techniques for wildlife study: Radio telemetry and acoustic analysis.
b) Capture and handling of animals - purpose, restraint techniques, different capture methods and animal barriers. Drug immobilization - drug delivery equipment and accessories.Handling and transport of wild animals, designing sledge, crate and holding enclosures.

Module III: Conservation Genetics, Wildlife Forensics and Trade (15 hours)

a) Application of genetics for wildlife conservation; Application of Molecular markers, PCR, DNA Sequencing in wildlife forensics and conservation. Loss of genetic diversity
b) Wildlife Forensics- Overview, various forensic protocols for species identification.
c) Wildlife trade: The Convention on International trade in Endangered Species of Wild Fauna and Flora (CITES)

Module IV: Human-wildlife conflict (10 hours)

a) Causes and management; Impact on ecosystem, lives and livelihood of human
b) Ecotourism: problems and prospects with special reference to northeast India.

Suggested Readings

1. Fowler- Restraint and Handling of wild and Domestic Animals
2. Briscoe, Ballou and Frankhan- Introduction to Conservation Genetics
3. Leeschcke, Temivk and Jain – Conservation Genetics
4. Frankhan, Ballou and Briscoe- Primer of Conservation Genetics
5. Cooper and Cooper- Wildlife Foresnsic Investigations
6. Huffman and Wallacw- Wildlife Forensics – Methods & Applications
7. Sahaipal, Thakar & Goyal – Forensic Examination of Hair of Protected Indian Wildlife Species
8. Linacre and Tobe- Wildlife DNA analysis
9. Rao, G. Textbook on pathology of Wildlife Diseases
10. Jani, R. Basic of Wildlife Health Care Management
11. Ayadi, D.P. Human Wildlife Conflict
12. Wang, J. Human Wildlife Conflict management: Understanding the Fundamentals of Human Wildlife Conflicts in HumanDominated Landscape

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3		L	H	L
CO4				H

ZGBE0027: BIOSYSTEMATICS AND EVOLUTION (4 CREDITS -60 HOURS) (L-T-P:4-0-0)

Course Outcomes

1. Explain the concept of Biosystematics and Taxonomy, ICZN rules and formation of names of taxa (Understanding)
2. Explain the causes of evolution and natural selection. (Understanding)
3. Apply Taxonomy to solve the species problem and Identify species on the basis of taxonomic keys. (Applying)
4. Justify the role of isolating mechanisms in speciation, estimate, construction of evolutionary trees, and measurement of genetic relationship among organisms. (Evaluating)
5. To apply application of knowledge on science involving society and culture

Module I: Biosystematics (10 hours)

Trends in Biosystematics: Chemotaxonomy, Cytotaxonomy, Numerical and Molecular Taxonomy; Dimensions of Speciation; Species Concepts: Subspecies and other intraspecific Categories; Cladistics

Module II: Taxonomy and Nomenclature (10 hours)

Taxonomic Categories. Different Kinds, Hierarchy of Categories; Taxonomic Procedures: Taxonomic collections, Preservations, Process of identification(General Idea); Taxonomic Keys: types, merits and demerits; International Code of Zoological Nomenclature (ICZN):Operative principles, interpretation and application of important rules; Formation of names of various Taxa.

Module III: Evolution (15 hours)

Micro and Macro evolution; Natural Selection-Concept of stabilizing selection, Frequency dependent selection, Balancing selection, Disruption selection; Destabilizing factors-Mutation, Genetic drift, Migration, Meiotic drive; Emergence of Non Darwinian theory of evolution, Neutral theory of evolution (Kimura).

Module IV: Speciation and Molecular basis of evolution (15 hours)

a) Isolation Mechanisms-Isolation Mechanisms and their role in speciation, Models of speciation (Allopatric, sympatric, parapatric)
b) Molecular basis of evolution-Constructing evolutionary trees, measures of genetic relationship among organisms, Molecularclock of evolution, Molecular phylogeny; Origin and
c) C)Evolution of Primates.

Module V: Society and Science (10 hours)

a) Citizen Science: Significance, challenges and drawbacks
b) Ethnozoology: Brief introduction, importance, historical aspects and current trends
c) Citizen science: Case study

Suggested Readings

1. G. G. Simpson. Principle of animal taxonomy; Oxford IBH Publishing Company.
2. V.C Kapoor-Theory and practice of animal taxonomy
3. J.C. Avise. Molecular Markers, Natural History and Evolution, Chapma & Hall, New York.
4. E.O. Wilson, Biodiversity, Academic Press, Washington.
5. E. Mayer & P. Ashlock. Principles of systematic Taxonomy
6. E.O. Wilson. The Diversity of Life (The College Edition),W.W. Northem & Co.
7. Dalela and Sharma. Animal taxonomy and Museology, Jai Prashnath & company.
8. Bugs, Butterflies, Spider, snakes (1998).Kern Preston-Mafham, Nigel Marven & Roblturvey.
9. Dobzhansky,Th.,F.J.Ayala,G.L.StebbinesandJ.M.Valentine.Evolution.SurjectPublication,Delhi.
10. Futuyma,D.J.EvolutionaryBiology,Suinuae Associates,INCPublishers,Dunderland.11.Jha,
11. A.P- Genes and Evolution. John Publication, New Delhi.
12. Ashok Verma, Principles of Animal Taxonomy, Alpha Science International Ltd, Delhi.
13. Ramesh Chandra Tripathi, Biosystematics and Taxonomy, University Book House, Jaipur.
14. Avers, C.J. Evolution Process and Pattern in Evolution Oxford University, Press, New York, Oxford.
15. Ayala, F. J. and Valentine J. W. Evolving the theory and Process of Organic Evolution,
16. Brookfield,A. P. Modern aspects of Evolution. Hutchinson London, Melbourne.

17. Gallow, P. Evolutionary principles.
18. Chapman and Hall. Freeman, S. and Herron, Jon C. Evolutionary analysis Pearson Prentice Hall, New Jersey.
19. Futuyma, D. J. Evolutionary Biology, Sinauer Assoc. Inc. Pub. USA.
20. Meglitsch, P. A. Invertebrate Zoology (3rd edition),Oxford University Press.
21. Minkoff,E. C. Evolutionary Biology, Addison Wesley Pub. Co., London.
22. Wen-Hsiung Li, Molecular Evolution, Sinauer associates Inc.Pub. USA.
23. Burton S. Guttman: Evolutiona beginner 's guide, One world Publications.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			
CO 2		M	H		
CO 3		H			
CO 4				L	H
CO 5			L	H	H
CO 6			L	L	H

ZGCI0028: CELL BIOLOGY AND IMMUNOLOGY- THEORY AND APPLICATIONS (4 CREDITS-60 HOURS) (L-T-P:4-0-0)

COURSE OUTCOMES (CO)

1. Illustrate the operative mechanism of the cell. (Understanding)
2. Examine and analyze the different Cell signaling pathways (Analyzing)
3. Compare the different types of Immunological systems (Evaluating)
4. Demonstrate molecular techniques to understand underlying cellular composition. (Analyzing)
5. Discuss and implement the different analytical techniques in cell biology and immunological process (Creating).

Module I: Cell Organisation (10 hours)

a) Biomembranes-Molecular composition and functional feature of membrane lipid, protein and carbohydrate.
b) Cytoskeletons -Structure and Organisation of Microfilament, Microtubule and Intermediate filament.
c) Cell Motility- Intercellular transport, kinesin-dynein, cilia and flagella.

Module II: Cell adhesion molecule, Cell signaling, Cell cycle (15 hours)

a) Extracellular Matrix and Cell Interaction-Cell walls, Adhesion junctions, Tight junctions, Gap junctions, Plasmodesmata; Cell- Cell Adhesion - Ca++dependent and Ca++ independent Homophilic Cell-Cell Adhesion.
b) Cell division and cell cycle regulation and control of cell cycle; Cyclins and Cyclin Dependent Kinases(CDK), Regulation of CDK-

Cyclin activity, Molecular basis of Cellular Checkpoints

c) Cell-Cell Signalling-Cell Signalling, Cell surface receptors, G-Protein coupled receptors and Second messenger

Module III: Immunology (15 hours)

a) Immune system-innate and adaptive immunity; components and characteristic features, humoral and cell-mediated immunity;
b) Cells and organs of immune system; T cells and B cells-maturation, activation and differentiation;
c) Antigens-immunological properties of antigens, factors influencing antigenicity; Immunoglobulin-structure and function, classes of Ig molecules, Antigen-antibody interactions.

Module IV: Analytical techniques (20 hours)

a) Review of principles of light microscopy; principles and applications of phase contrast and fluorescence microscopy
b) Principles and applications of Transmission and Scanning Electron microscopy
c) Spectroscopy: basic principles and types
d) Theories of Tissue fixation and staining techniques
e) Basic principles of colorimetry
f) Principles and applications of centrifugation techniques: types of centrifugation; Introduction to hydrodynamics
g) Molecular modeling
h) ELISA, RIA, Immunodiffusion

Suggested Readings

1. Cooper, G. M., Cell (A Molecular Approach)
2. Sadava D. E., Cell Biology
3. Kish V. M. and Kleinsmith L. J., Cell and Molecular Biology
4. DeRobertis & DeRobertis: Cell and Molecular Biology (Lee & Febiger, 1987)

5. Karp: Cell and Molecular Biology
6. Lodishet al: Molecular Cell Biology
7. Pollard & Earnshaw: Cell Biology
8. Verma P. S. and Agarwal V.K, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.
9. Verma P.S. and Agarwal V.K, Cell Biology (Cytology, biomolecules and Molecular Biology),S. Chand & Company Ltd.
10. Kuby et al. : Kuby Immunology
11. H.H. Willard, L.L. Merritt Jr. and others, Instrumental Methods of Analysis.6th Edition,1986, CBS Publishers and Distributors.
12. Chatwal G and Anand, S., Instrumental Methods of Chemical Analysis,1989 , Himalaya Publishing House, Mumbai.
13. Williams, B.L. and Wilson, K. ,A Biologist's Guide to Principles and Techniques of Practical Biochemistry , 1975
14. B.B. Straughan and S. Walker Eds., Spectroscopy, Volume 1, Chapman and Hall Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3	M	H	M	
CO 4			H	L
CO 5	L	L	L	H
CO 6		H		

ZGBG0029: MOLECULAR BIOLOGY AND GENETICS (4 Credits-60 hours) (L-T-P:4-0-0)

Course Outcomes

1. Understand the basic concepts of Genetics and Molecular Biology techniques. (Understanding)
2. Analyze the differences in molecular biology and genetic techniques. (Analyzing)
3. Compare and interpret the various patterns of genetic inheritance. (Evaluating)
4. Interpret and discuss different cytogenetics and molecular biology tools (Creating)

Module I: Nucleic Acids (16 hours)

a) Nucleic acids - Molecular Structures of DNA and RNA.
b) DNAReplication-Replication in Prokaryotes and Eukaryotes, Semi conservative nature of DNA replication, Messelsons-Stahl experiment, Enzymes and proteins associated with replication, DNA polymerases, Regulation of eukaryotic genome replication.
c) DNA Damage and Repair Mechanism-Different types of DNA Damage, Direct repair system, Excision repair system, Mismatch repair system, DNA break repair.

Module II: Transcription and Translation (12 hours)

a) Transcription-Basic concept of Prokaryotic and Eukaryotic transcription, Promoters (Pribnow Box, TATAbox, CpGisland), Transcription factors, Initiation, elongation and termination of transcription in Eukaryotes.
b) Post Transcriptional Modification
c) Translation- Genetic Code, Mechanism of Initiation, Elongation and Termination.

Module III: (10 hours)

a) Organisation of genetic material-Nucleosome, Molecular anatomy of eukaryotic chromosome; Genome size and Complexity-

C value paradox, Unique and repetitive DNA, Euchromatin and Heterochromatin

b) Sex Chromosomes - Sex determination, Role of Y chromosome, Dosage Compensation in Drosophila and Human Being, X-

Chromosome inactivation, Sex chromosome anomalies

c) Human Genetics-Normal Human Karyotyping, Autosomal chromosome abnormalities, Principle and Methods of Pedigree Analysis
d) Genomic Imprinting-Imprinting of genes, Epigenetic, Epigenetic regulation by DNA methylation; Somatic Cell Genetics-Cellfusion technology, Chromosome mapping, Application of Somatic Cell Genetics.

Module IV: Genetic Inheritance (10 hours)

a) Concept of gene: Allele, multiplealleles, pseudoallele, complementation tests; Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters
b) Extra Chromosomal Inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

Module V: Bioinformatics (5 hours)

a) Gene Prediction-Finding genes in prokaryotic and eukaryotic genomes, Regulatory sequence analysis; Genome maps andmarkers, Genome variation.
b) Human genome project; Concept and Software used in Gene expression analysis and Microarray.
c) Structural biology-Protein structure prediction and classification.

Module VI: Electrophoretic Techniques (7 hours)

a) Basic principles of Electrophoresis, Agarose gel, native and SDS-PAGE
b) Isoelectric focusing, 2D-PAGE and their uses in protein research
c) Blotting Techniques

Suggested Readings

1. Gardner, Principles of Genetics
2. Strickberger, Genetics
3. Ram Mahabal, Fundamentals of Cytogenetics and Genetics
4. Brooker: Genetics: Analysis and Principles
5. Griffith et al: Modern Genetic Analysis
6. 6.Hartl & Jones: Essential Genetics: A Genomic Perspective
7. Boyer: Modern Experimental Biochemistry and Molecular biology
8. DeRobertis & DeRobertis: Cell and Molecular Biology
9. Hanes, Gel Electrophoresis of Proteins - A Practical Approach
10. Sedgewick R and WayneK.Introduction Computer Science, Princeton University [available online].
11. Blum R and LeBlanc Dee-Ann. Linux for Dummies, WILEY [available online].
12. Kanetkar YP. Let Us C [available online].

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H			
CO 4				H		
CO 5					H	
CO 6						H

ZGAP0030: ANIMAL PHYSIOLOGY (4 CREDITS-60 HOURS) (L-T-P:4-0-0)

Course Outcomes

1. Outline the physiology and mechanism of digestion, absorption by summarizing the role of the different glands and their secretions involved. (Understanding)
2. Build a clear concept of mammalian blood chemistry, clotting mechanism, musculature in vertebrates, molecular mechanism and regulation of muscle contraction. (Applying)
3. Explore the physiology of respiration and analyze the oxygen dissociation curve and regulation of respiration. (Analyzing)
4. Explain the urine formation physiology and compare the osmoregulation in terrestrial and aquatic animals. (Evaluating)
5. Elaborate the dynamics of neural impulse conduction along the axonal axis, at electrical and chemical synapse. (Creating)

Module I Physiology of digestion (10 hours)

a) Glands and secretion of digestives enzymes,
b) Mechanism of digestion, Gastrointestinal hormones
c) Absorption of Carbohydrates, lipids and proteins.

Module II Physiology of Respiration (10 hours)

a) Alveolar ventilation, alveolar-capillary gas exchange, Transport of O2and CO2
b) Oxygen dissociation curve and the factors influencing it,
c) Regulation of respiration.

Module III Mammalian blood chemistry (10 hours)

a) Mammalian blood chemistry and blood groups.
b) Blood clotting mechanism
c) Cardiac cycle and its regulation in mammals.

Module IV Musculature in vertebrates (10 hours)

a) Musculature in vertebrates: Types of muscles, Ultrastructure and chemical composition of skeletal muscles,

b) Molecular mechanism and regulation of muscle contraction, muscle fatigue and rigor mortis.

Module V Physiology of Excretion (10 hours)

a) Ultrastructure of nephron, mechanism of urine formation, excretion of dilute solutes and mechanism of excretion of excesssolutes, counter current mechanism
b) Osmoregulation in different animal groups (aquatic and terrestrial)

Module VI Nerve physiology (10 hours)

a) Neuron: Ultrastructure, types and function,
b) Membrane potential: Resting membrane, membrane potential, action potential, Nernst Equation, Chronaxie, Rheobase,utilization time.
c) Neural impulse induction through an axon, neurotransmitters and synaptic transmission-mode of information transferacross electrical and chemical synapses

Suggested Readings

1. Brooks and Marshall: Essentials of Endocrinology, Blackwell Science.
2. Ganong: Review of Medical Physiology, Lang Medical Publications
3. Guyton and Hall: TextBook of Medical Physiology ,W.B. Saunders
4. Hadley: Endocrinology, Prentice hall. International Edition.
5. Keel et al: Samson Wright 's Applied Physiology, Oxford Press,
6. Larson:WilliamsTextBookofEndocrinology,10thedition.W.B.SaundersCompany,Philadelphia.
7. Murray et al: Harper 's Illustrated Biochemistry, Appleton & Lange
8. Norris: Vertebrate Endocrinology. Lea & Febiger.
9. Turner and Bagnara: General Endocrinology, W. B. Saunders Company Philadelphia.
10. West: Best and Taylor 's Physiological Basis of Medical Practice, Williams and Wilkins,
11. N Arumugam and A Mariakuttikan, Animal Physiology, Saras Publication.
12. N Arumugam, Animal Physiology & Biochemistry, Saras Publication.
13. Dharmalingam, Textbook Of Endocrinology, Jaypee Brothers Medical Publisher
14. VermaP.S, Agarwal V.K and Tyagi B. S, Animal Physiology, S. Chand Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H	H	H	
CO 4	H					
CO 5	M	M	M	M	M	M

ZGEE0031: ECOLOGY AND ENVIRONMENTAL BIOLOGY (4 CREDITS - 60 HOURS) (L-T-P:4-0-0)

Course Outcomes

1. Outline the foundations of Ecology. (Understanding)
2. Identify the effects of abiotic environment on plants and animals to understand the distribution and abundance of life on earth (Applying)
3. Develop solutions to pressing environmental problems that threaten ecological systems at every level (Creating)
4. Analyze the importance of biodiversity and threats to biodiversity. (Analyzing)
5. Design steps to protect and conserve biodiversity. (Creating)

Module I (12 hours)

a) Types of ecosystems–Salient features of aquatic and terrestrial ecosystems and their biotic communities.
b) Ecological energetic and energy flow; Measuring ecosystem productivity
c) Population Ecology-Population density, Growth rate, Natality, mortality, survivorship curves and life tables, Biotic potential

Module II (12 hours)

a) Community Ecology-Types of biotic communities, organization, carrying capacity, r and k-selection.
b) Community Development–Types of community changes, ecological succession-its causes and examples, climax community.
c) Species interactions, Competition theory, Niche, Habitat,
d) Ecological Equivalents, Character displacement; Liebig law of minimum, Shelford's law of tolerance, Significance of limiting

factors, Ecotone and Edge effect.

e) Thermoregulation: Heat balance in animals, Adaptations to temperature extremes, Aestivation, hibernation and Diapause,acclimatization, avoidance and tolerance

Module III (12 hours)

a) Eutrophication in the aquatic ecosystem, Remediation of eutrophication.
b) Acidification in aquatic and terrestrial environment, Consequences and control strategies.
c) Environmental monitoring, Environmental impact assessment and environmental management plan.
d) Biogeochemical cycles–carbon, nitrogen, sulphur cycles, impact of human activity on nutrient cycles.

Module IV (12 hours)

a) Biodegradation and Bioremediation: concept, environmental limitation for bioremediation, bioremediation of ecosystem (Air/water/soil)
b) Wastes in Ecosystem and management: Agricultural wastes and Management, Biomedical wastes and Management,Domestic waste, effects and management for purification and recirculation.
c) Environmental toxicology: Diversity and classification of environmental toxins, Air, Water and soil pollutants, Food additives and contaminants, Pesticides, Metals and Solvents, Radioactive pollution.

Module V Biodiversity (12 hours)

a) Components of Biodiversity (Genetic, Organismal and Ecological), Value of Biodiversity, threats to biodiversity, biodiversityconservation, Mega biodiversity countries, hotspots and heritage sites,
b) IUCN Red list categories. Habitat diversity of Indian wildlife, endemic and Threatened species of northeast India
c) Ethnozoology with special reference to Northeast India

Suggested Readings

1. Asthana, D.K. and Asthana, M. Environmental Problems and Solutions S. Chand and Co., New Delhi.
2. Odum : Basic Ecology (Saunders)
3. Odum : Fundamentals of Ecology (Saunders)
4. Odum. E.P. Fundamentals of Ecology. Nataraj Publishers, DehraDun.
5. Raven, Berg, Johnson : Environment (Saunders College Publishing)
6. Sharma :Ecology and Environment (Rastogi Publication)
7. Smith, R.L. Elements of Ecology. Harper and Row Publishers, New York.
8. Trivedi, P.R. and Gurdeepraj, K. Environmental Biology. Akashdeep Publishing House New Delhi
9. Turk and Turk : Environmental Science
10. VermaP.S. and Agarwal V.K, Environmental Biology(Principles of Ecology)by.,S.Chand Publishing.
11. GuptaS.R.andSinghS.P.,EcologyEnvironmentalScienceandConservation,S.ChandPublishing
12. Manju Yadav, Ecology, Discovery Publishing House
13. Rana S.V.S. ,Essentials of Ecology and Environmental Science, S.V.S. Rana. Publisher, Prentice-Hall of India
14. Anderwartha, H.G.and Birch,L.C.,The distribution and abundance of animals, University of Chicago Press, Chicago London.
15. Beeby, A., Applying Ecology Chapman and Hall Madras.
16. Begon, M.,HarperJ.L.andTownsend,C.R,Ecology–Individuals,populations and communities, Blackwell Science, Cambridge UK.
17. Brewer, R., The science of Ecology, Saunders College of Publishing, New York.
18. Chapman,J.L.andResis,M.J.,Ecology-Principles And Applications,CambridgeUniversityPress, Cambridge UK.
19. Kaeighs, S. C., Ecology with special references to animals and Man, PrenticeHall Inc.
20. Putmann, R. J. and Wratten, S. D., Principles of Ecology,
21. Crown Helm, London. Salanki,J.,Jeffery E. and Hughes G.M., Biological Monitoring of the Environment (A manual of Methods) CAB International, Wallingford UK. Singh M C: Environment Protection and the Law (Ashish Publishing House)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			
CO 2			H	H	
CO 3			M	H	H
CO 4					H
CO 5			L	L	H

ZGEB0032: ENDOCRINOLOGY AND BIOCHEMISTRY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

1. Define the various metabolic pathways and the role of hormone. (Remembering)

2. Explain the basic principles of modern analytical techniques. (Understanding)
3. Analyze the energy production and utilization. (Analyzing)
4. Explain the enzyme kinetics. (Evaluating)

Module I: Basic concepts: Hormone, action and Feedback Mechanism (5 hours)

Hormone: Classification and Chemical nature of hormones Homeostasis: Concept and Feedback system Hormone receptor and target organ concept, Mechanism of hormone action. Hypothalamo- hypophyseal axis

Module II: Endocrine glands-Structure, Hormones, Functions, Axis, Abnormalities (15 hours)

a) Structure of the pituitary gland; pituitary hormones and their functions
b) Structure of thyroid glands, thyroid hormones–biosynthesis and metabolic functions. Role of thyroid hormone in amphibianmetamorphosis
c) Structure of adrenal gland; Synthesis of adreno-cortical and medullary hormones and their functions.
d) Structure of endocrine pancreas and Hormones of Islets of Langerhans.

Module III: Reproductive Endocrinology (10 hours)

a) Testis and ovary –endocrine structure and their functions
b) Reproductive cycle- Oestrous cycle and Menstrual cycle, Role of Hormones in Implantation, Parturition and Lactation
c) Neuroendocrine regulators in insects and mammals

Module IV: Metabolism (13 hours)

a) Carbohydrate metabolism-Glycolysis, Glycogenolysis, Gluconeogenesis, TCA cycle, Cori cycle, Phosphogluconate pathway.
b) Lipid Metabolism-Oxidation of fatty acid, Cholesterol biosynthesis and metabolism, Prostaglandins.
c) Protein metabolism- Amino acid Classification, Amino acid degradation, Decarboxylation, Deamination, Ornithine Cycle.

Module V: Bioenergetics And Enzymes (10 hours)

a) Bioenergetics-Energy producing and utilizing system, Electron transfer system and Oxidative Phosphorylation.
b) Enzymes-Classification of enzymes, General properties of enzymes, Mechanism of enzyme action, Enzyme kinetics, Michaelis-Menten and Lineweaver-Burk Equations; Enzyme inhibition.

Module VI: Basic concepts of biochemistry (10 Hours)

a) Review of concepts of acids and bases, Principle and working of pH meter, Buffer preparation
b) Principle of Laminar-air flow chamber.
c) Principles, types and applications of Chromatography
d) Gas Chromatography, GC-MS, LC – MS / MS, MALDI TOF mass spectrometer
e) Ion Exchange Chromatography, gel permeation, Affinity and reverse phase chromatography
f) HPLC and FPLC

Suggested Readings

1. Brooks and Marshall: Essentials of Endocrinology, Blackwell Science.
2. Ganong: Review of Medical Physiology, Lang Medical Publications
3. Guyton and Hall: Text Book of Medical Physiology ,W.B. Saunders
4. Hadley: Endocrinology, Prentice hall. International Edition.
5. Keel et al: Samson Wright 's Applied Physiology, Oxford Press,
6. Williams TextBook of Endocrinology,10thedition.W.B.SaundersCompany,Philadelphia.
7. Murray et al: Harper 's Illustrated Biochemistry, Appleton & Lange
8. Norris: Vertebrate Endocrinology. Lea & Febriger.
9. Turner and Bagnara: General Endocrinology, W. B. Saunders Company Philadelphia.
10. Berg et al.: Biochemistry, Freeman
11. Boyer: Modern Experimental Biochemistry and Molecular biology
12. DeRobertis & DeRobertis:Cell and Molecular Biology
13. Freifelder: Physical Biochemistry
14. Holme and Peck: Analytical Biochemistry, Tata McGraw Hill
15. Switzer and Garrity: Experimental Biochemistry
16. Biochemistry, Tata-McGraw Hill

Mapping COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	L	L	L			
CO2						L
CO3			M	H	H	

CO4						H

ZGAZ0033: APPLIED ZOOLOGY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

1. Identify methods of silkworm cultivation, maintenance of the farm, seed technology, silkworm rearing and silk reeling. (Applying)
2. Assess the basic life cycle of the honeybee and about beekeeping tools and equipment for honey production and pollination. (Evaluating)
3. Apply the latest knowledge in poultry management. (Applying)
4. Develop an overall idea of fish farming, the scientific management of different species in aquaculture, aquarium keeping and fish diseases. (Applying)
5. Identify the different types of parasites, their life cycles and the diseases caused by them. (Applying)
6. Develop the concepts in Zoology with the core principles of Sustainable Development. (Applying)

Module I (15 hours)

a) **Sericulture:** Types of Silk Worm (Muga and Eri), their host plants, silkworm rearing and management practices. Diseases and Pest of SilkWorm and their management, Biodiversity conservation project through sericulture (Case study- 7Weaves Model)
b) **Apiculture:** Different species of honey bees, bee plants, pollen calendar, bee keeping and management practices, beeproducts, Bee enemies and diseases.
c) **Vermiculture:** species of worms, condition for efficient vermiculture (domestic and commercial level), Economics of Vermiculture

Module II (10 hours)

Aquaculture: Aquarium fish keeping: Ornamental Fishes of India special reference to North East India, common aquarium fishes; Aquarium Maintenance, Fisheries management: Composite fish culture, induced breeding and hybridization; Prawn and Pearl Culture, Exotic and Indigenous food Fishes of NE India, Fish and shellfish diseases and their control measures. Fish genetic resource conservation; Aquaphonics–prospect and future.

Module III: Poultry management (8 hours)

Poultry Rearing / Farming: Housing and equipment; Nutritional Requirements; Poultry diseases; Poultry products: Broilers, meatprocessing and meat products, Poultry by products

ModuleI IV: Parasitology (10 hours)

Introduction to Parasitology: Types of parasites, Types of Host, Zoonosis, Host-parasite Relationship, Sources of Infection, Mode of infection, Pathogenesis.
Vibrio cholera and Clostridium tetani- Life Cycle, mode of transmission, infection and treatment.
Dengue and Bird flu - Life cycle, mode of transmission, infection and treatment.

Module V: Insect pest management, Public Health and Forensic Entomology (12 hours)

a) Concept of Pest, concept of integrated pest management (IPM)
b) Mosquito (Aedes, Culex, Anopheles)-Taxonomy, Biology, Behavior and their control. Life cycle of Calliphora and Scrophaga,determination of death and causes of death.

Module VI: Sustainable Development Goals and Zoology (5 hours)

Concept of Sustainable Development, Background of SDGs, role of a zoologist, SDGs and Zoology (SDGs 1,3,5,6,8,11,12,13,14 and 15), SDG(s)-based projects/dissertations

Suggested Readings

1. Venkitaraman: Economic Zoology, Sudarsana Publishers
2. Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers
3. Shukla And Upadhyaya :Economic Zoology. Rastogi Publishers.
4. Ananthakrishnan,T.N.andK.G.Sivaramakrishnan.Ecological Entomology: Insect life in an odd environment. Scientific Pub.:India
5. David, B. V and T.N. Ananthakrishnan. General and Applied Entomology. 2ndEdition. Tata McGraw-Hill Publ. Co. Ltd.: NewDelhi
6. Fenemore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)
7. Packer, B. Aquaponics System: A Practical Guide to Building and Maintaining Your Own Backyard Aquaponics
8. Jayashree, K.V., C.S. Tharadevi& N. Aurumugam. Apiculture. Saras Publication
9. Chandra Girish. Apiculture & the heHoneyBee (Know About The Species Of Honey Bees, beekeeping, pollination,

beehives,entomology, beekeepers, honey making
10. Arumugam,N.,T.murugan,R.RamPrabhu,J.JohnsonRajeshwar. Applied Zoology.Saras publication
11. Ganga & Chetty. Comprehensive Sericulture 2nd Edition Paperback. Oxford & IBH publication
12. Narasaiah, M.L. Problems and Prospects of Sericulture. Discovery Publishing Pvt. Ltd
13. Sharma,A.K.,K.Jaiswal &R.N. Pandey. Research and Development in Indian Sericulture. Alfa Publications
14. Singh, R.N. & C.M. Bajpeyi. Muga Culture. APH Publishing Corporation
15. Bernstein, S.Aquaponic Gardening: A Step-By-Step Guide to Raising Vegetables and Fish Together New Society Publishers
16. Jadhav and Siddiqui. Handbook of Poultry Production and Management. Jaypee Publications
17. Krishnamurthy. An Advanced Textbook On Biodiversity: Principles and Practice. Oxford & IBH Publishing
18. Johns, J. Worm Farming - Creating Compost at Home With Vermiculture. Creates pace Independent Pub
19. NPCS Board of Consultants & Engineers The Complete Technology Book on Vermiculture and Vermicompost
20. ICAR. Handbook of Integrated Pest Management (IPM) Pub: ICAR, Govt. of India
21. Metcalf, RW.H.Luckmann. IntroductionTo Insect Pest Management. Wiley India Pvt Ltd.
22. https://bloncampus.thehindubusinessline.com/case-studies/figure-out-how-7weaves-can-scale-up-and-go-global/article25933346.ece
23. https://bloncampus.thehindubusinessline.com/case-studies/7weaves-a-promising-model-for-ethical-slow-fashion/article26388043.ece
24. https://bloncampus.thehindubusinessline.com/case-studies/strong-business-model-can-creat-value-for-all/article26388095.ece
25. https://bloncampus.thehindubusinessline.com/case-studies/focussing-on-organic-growth-and-sustainability/article26389036.ece

Mapping COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H					
CO2		H				
CO3			H			
CO4				H		
CO5					H	
CO6						H

ZGEP0034: ETHOLOGY AND POPULATION GENETICS (4 CREDITS- 60 HOURS) (L-T-P: 4-0-0)

Course Outcomes(Co)

1. Define states and events of behaviour. (Remembering)
2. Illustrate the concept of ethology and its significance. (Understanding)
3. Elaborate fitness in terms of evolution (Creating)
4. Apply Hardy Weinberg law for studying population genetics (Applying)
5. Identify sociobiology, social hierarchy, dominance in group living animals. (Applying)
6. Construct behavioral catalog for studying animal behavior. (Creating)

Module I: Basic Concepts of Ethology (10 hours)

a) Concepts of Ethology,
b) Genes and behaviour: Selfish gene concept, Fisher's Runaway theory
c) Evolution and development of behaviour
d) Deception, Mimicry, and Camouflage: Deimatic behaviour, Aposematic behaviour

Module II: Sociobiology (20 hours)

a) Social Behaviour:Properties And Advantages Social Grouping, social group of monkeys;
b) Fitness: Darwinian fitness, individual fitness, kin selection, group, cooperation, reciprocation, altruism, reciprocal altruism,Proximate and Ultimate causations;
c) Parental care in animals(amphibians)

Module III: Learning and Communication (10 hours)

a) Communication in animals-vocal, and aggression tactile, visual and chemical; Territoriality
b) Learning: Introduction and definition, Types-Habituation, trial and error, conditioning, cognition and imprinting; Short and long term memory, neural mechanism of learning

Module IV: Population Genetics (20 hours)

a) Gene frequencies in population - The Hardy-Weinberg principle and analysis of gene frequencies in natural population.

b) Major factors influencing gene frequencies (migration, inbreeding), Effects of selection and mutation on gene frequencies.
c) Gene flow between subpopulations

Suggested Readings

1. Drickamer & Vessey: Animal Behaviour –Concepts, Processes and Methods, Wadsworth
2. Goodenoughet al :Perspectives on Animal Behaviour, Wiley,
3. Grier : Biology of Animal Behaviour, Mosby,
4. John Alcock: Animal Behaviour, Sinauer associates
5. John Krebs, Baron Krebs: An introduction to behavioural ecology, Blackwell scientifics
6. Aubrey Manning: An introduction to animal Behaviour, Cambridge University press

Mapping COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	L	L	L	
CO2	L			
CO3		H		
CO4				H
CO5		H		
CO6			H	

ZGBB0036: BASIC BIOINFORMATICS THEORY
(1 CREDIT: 15 Hours) (L-T-P: 1-0-0)

Objective(s): To gather knowledge on fundamental concepts and methodologies in Bioinformatics, focusing on practical applications and data analysis and equip with the skills to analyze biological data and explore how computational approaches are applied to biological research questions.

COURSE OUTCOMES:

CO1: Explain the key concepts and applications of Bioinformatics in Modern biology. Apply Bioinformatics tools to retrieve and analyze biological data from various databases. (**Understand & apply**)
CO2: Analyze sequence data using alignment techniques to identify similarities and differences. Utilize different bioinformatics tools and software in decoding nucleic acid and protein sequence, their structure and interactions, and correlate these data amongst different species. (**Analyse & apply**).
CO3: Evaluate phylogenetic relationships using tree construction methods and interpret the results. Analyze the evolutionary interrelationship amongst different organisms using sequence alignment tools. (**Evaluate**).
CO4: Exercise the Homology modeling, Molecular Docking. (**Apply & determine**).
CO5: Develop critical thinking skills and ethical awareness for Bioinformatics research. Create a bioinformatics workflow to address a specific biological question, integrating multiple tools and datasets. (**Create**).

Module I: Introduction to Bioinformatics (1 Hours)

Concept and scope of Computational Biology and Bioinformatics. Applications and Importance of Bioinformatics. Key concepts and terminology.

Module II: Biological Databases (3 Hours)

Introduction to Literature Database and Biological Databases; Primary, Secondary and Composite databases; Navigation and data retrieval from Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB); Metabolic pathway database (KEGG, EcoCyc, and MetaCyc); Small molecule databases (PubChem, Drug Bank, ZINC, CSD). Genome visualization- UCSC.

Module III: Data Generation and Data Retrieval (3 Hours)

Generation of data (Gene sequencing, Protein sequencing), Sequence submission tools (BankIt, Sequin, Webin). Data retrieval systems (SRS, Entrez). Sequence analysis (Introduction to GTF, GFF file Formats, FASTA/FLAT file Genbank file analysis, BED files). Gene and Protein data retrieval system and processes.

Module IV: Sequence Alignment and Evolutionary Bioinformatics (3 Hours)

Sequence alignment and its application: Local and Global Alignment, Scoring Matrices (PAM, BLOSUM), Methods of Alignment (Dot matrix, Dynamic Programming), Alignment algorithms (Needleman-Wunsch, Smith-Waterman), Pair wise and multiple sequence alignments (MSA); Introduction to Tools: BLAST, FAST-A, CLUSTAL, and various software and servers; Phylogenetic Analysis using academic software.

Module V: Structural Bioinformatics and Molecular Docking (4 Hours)
Basics of protein structure and function, Homology modeling and structure prediction, structure validation. Tools for structural analysis (SWISS-MODEL, PyMol). Introduction to Molecular Docking, Principles of ligand-receptor interactions, Introduction to Docking software (AutoDock, Swiss Dock).

Module VI: Ethics in Bioinformatics (1 Hour)
Ethical Considerations (Data Privacy and Confidentiality, Handling and Protection of Genetic Data), Ethical Implications of Genome Editing Technologies (CRISPR-Cas9), Ethical Dimensions of artificial Intelligence (AI) and Machine Learning (ML) applications in Bioinformatics.

Suggested Readings

1. Ghosh Z and Mallick B. (2008). Bioinformatics: Principles and Applications, Oxford University Press.
2. Pevsner J. (2009). Bioinformatics and Functional Genomics, II Edition, Wiley Blackwell.
3. Zvelebil, Marketa and Baum O. Jeremy (2008). Understanding Bioinformatics, Garland Science, Taylor and Francis Group, USA.
4. S. Jayanitha, T. Kartheeswaran (2019). Ethical, Legal and Social Issues in Bioinformatics Applications. (Proceedings of the Vavuniya Campus International Research Symposium).
5. Andreas Dress, Michal Linial, Olga Troyanskaya, Martin Vingron. Computational Biology (Print ISSN -1568-2684) by International Society for Computational Biology (Springer).
6. Zhumur Ghosh, Bibekanand Mallick (2008). Bioinformatics: Principles and Applications. Oxford University Press (ISBN: 9780195692303).
7. Jin Xiong (2006). Essential Bioinformatics. Cambridge University Press (ISBN: 9781139450621).

Mapping to the CO of the Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	H				
CO2		H				
CO3			H	H		
CO4				H	H	
CO5					H	H

ZGSL0200: SERVICE LEARNING IN ZOOLOGY

Course Outcomes
1. Develop an understanding about the importance of service to community. (Understanding)
2. Identify the needs of a community. (Applying)
3. Apply skills acquired in Zoology to render service to community. (Creating)
4. Examine what can be learned from the community. (Analyzing)

Module I (5 hours)
Service learning: Definitions; Principles of Service Learning; Awareness of Community; Involvement with Community; Commitment to service

Module II (10 hours)
Aquaculture: Aquarium management - Aquarium fish keeping and breeding using local resources
Sericulture: Eri and their host plants **plantations**; indoor rearing and management practices; marketing and management of produce

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	L
CO 2	L	M
CO 3	L	H
CO 4	M	H

LABORATORY COURSES

ZGPR6004: PROJECT MANAGEMENT, REPORTING AND DOCUMENTATION (30 HOURS) (P/NP)

Course Outcomes

1. Identify qualities of a successful entrepreneur and develop competencies. (Applying)
2. Construct economically and socially sound business ideas. (Creating)
3. Analyze the potentials of a social catalyst and examine case studies. (Analyzing)
4. Assess plans for effective preparation of Detailed Project Report (DPR) and financials of a DPR. (Analyzing)
5. Develop skills for project implementation and management. (Applying)
6. Define concept of market. (Remembering)
7. Distinguish different methods of Bookkeeping and Accountancy. (Analyzing)
8. Adapt effective plans for preparing accurate project report and practicing positive documentation. (Creating)

Objective: Help the student to understand Entrepreneurship, identification of qualities of a successfulentrepreneur & how to develop it

Module I: Entrepreneurship : Concept and Functions

Who is an entrepreneur?

Entrepreneurial competencies(Initiative, Creativity and Innovation, Risk Taking and Risk Management, Problem Solving, Leadership, Persistence, Quality Performance,

Information Seeking, Systematic Planning, Persuasion and Influencing Others,

Enterprise Launching Competencies, Enterprise Management Competencies)

Functions of an entrepreneur (Promotional functions: Innovation, Risk-taking,

Organisation Building, Discovery of an idea, Detailed Investigation, Assembling the Requirements, Financing the Proposition. Managerial functions: Planning, Organizing,

Staffing, Leadership, Supervision, Communication, Motivation, Controlling.

Commercial Functions : Production, Finance, Marketing, Accounting)

Types of entrepreneur (Innovative Entrepreneur, Imitative Entrepreneur, Fabian

Entrepreneurs, Drone Entrepreneurs)

Entrepreneurship: meaning and definition; types of entrepreneurship;

entrepreneur and entrepreneurship

Difference between entrepreneur and employee

Objective: Help the students to generate various business ideas and link the best one with them

Module II: Generation of business ideas and linking

EDP: Meaning, Need, Importance of EDP

Necessity of generating ideas

Ways to generate ideas, Area Assessment Survey – Modes (Desk Research, Field

Work, Market Need Based Opportunities, Ideas from Existing Entrepreneurs)

Linking business ideas with the entrepreneur

Methodology of Opportunity Identification & Profiling Business Ideas (Preparation of Personal Profile, Development of OS (decision making) Framework, Snap Investigation of ideas generated, Evaluation in terms of OS (decision making) Framework and Short-listing of Ideas, Pre-feasibility Studies, Errors in Selection, Final Opportunity Selection)

Preparation of business project plan and business project plan execution (Summary of the Project/Project at a Glance, General Information, Details of the Proposed Project, Market Potential, Manufacturing Process, Production Programme/Sales Revenue, Cost of Manufacturing and Profitability Projections)

Objective: To impart knowledge on social entrepreneurship

Module III: Social entrepreneurship

Who is a social entrepreneur (definition and case study)

Difference between entrepreneurship and social entrepreneurship

Characteristics of social entrepreneur (Social Catalysts, Socially aware, Opportunity- seeking, Innovative, Resourceful, Accountable)

Examples and case study

Objective: To impart knowledge on preparation of DPR

Module IV: Preparation of Detailed Project Report (DPR) and financials of a DPR

Business plan : key questions

Technical arrangement & Production process (Manufacturing process, Sources of technical know how, plant & machinery, Supplier identification & supplier selection, Raw materials, packaging, land requirement, utilities and manpower, financial viability) and Location selection (Layout, built up area etc).
Product and Market (Product description, Capacity, Market study and market demand, Product mix, Branding, Channels of distribution, Advertising and Promotion etc.)
Project cost and means of finance (Land, site development, building and civil works, plant and machinery cost, other fixed assets, technical knowhow fees, preliminary and preoperative expenses, working capital margin, contingency andescalation)
Income analysis (Capital utilisation and income estimate, Expenditure estimate, Profit estimate, income tax estimate, profitability ratios : TC ratio, cash flow estimate, risk analysis, sensitivity analysis etc.)

Objective: Impart knowledge on implementing, managing and monitoring the progress of the selected project

Module V: Project implementation and management
Understanding Total Quality Management (Acceptable Quality Level, Benchmarking, Deming Wheel, ISO 9000,Pareto Analysis, Quality Circles, Measures of Central Tendency and Dispersion, Geometric Moving Average, Statistical Process Control etc.)
Goal Oriented Project Planning (Project Planning Matrix and Product Matrix)
Project Activity Planning and Implementation (Gantt Charts, the Programme Evaluation and Review Technique (PERT) andCritical Path Method (CPM) of project scheduling)
Soft skills for launching and managing a project (Creativity and Problem Solving, Interpersonal Communication, Persuasion and Use of Influence Strategy, Negotiation and Networking, Delegation of Authority and Work Effort, Efficiency Orientation As a Trait, Leadership, Concept of risk and risk taking, Legal Requirements, Types of business organisation)
Managing Business Crisis – Starting and Liquidity Crisis

Objective: To impart the Knowledge of different component of Market

Module VI: Concept of market
Traditional market
Emerging market : E commerce
Analysing the market environment 4
Researching the market and market survey
Marketing mix
Product mix
Promotion mix
Price mix, method of pricing

Objective: To impart knowledge on Book Keeping

Module VII: Bookkeeping and Accountancy
Basic concept of Accounting (Management and financial accounting)
Basic books of accounts (Journal, Purchase book, Purchase return book, Sales book, Sales return book, ledger book, Cash book etc.)
Financial statement: Meaning, Importance
Profit and loss account
Balance sheet
Depreciation and adjustment etc.
Interpretation of financial Statement (Liquidity, Current ratio, Profitability ratio, Inventory turnover ratio, Debtors turnover ratio, ROI etc)
Fund flow Analysis

Objective: To impart knowledge on Documentation and Reporting

Module VIII: Documentation and Reporting
Why to Document
What is a Documentation Report
When and How to prepare the Documentation Report
Typical format of a Documentation report
Layout of the Report
Writing a Report

Mapping COs to syllabus

Course Outcomes	Module1	Module2	Module3	Module4	Module5	Module6	Module7	Module8

CO1	H							
CO2		H						
CO3			H					
CO4				H				
CO5					H			
CO6						L		
CO7							H	
CO8								H

ZGDI6006: DISSERTATION PHASE I (4 CREDITS)

Course Outcomes

At the end of Dissertation phase I students will be able to:

1. Review and analyse scientific papers (Analyzing)
2. Design and perform experiments and prepare work plan (Applying)
3. Formulate hypotheses and choose appropriate methodologies to achieve the desired objectives (Creating)

The dissertation phase I is the preliminary stage where a student selects a research topic on interest in consultation with the assigned supervisor. In this phase the student is learns to identify research gap, formulate objectives and hypothesis, design work plan and experiments and fixes his/her methodologies to achieve the desired objectives.

ZGWP6011: INTRODUCTION TO WILDLIFE PHOTOGRAPHY (30 HOURS, L-T-P: 2-0-0) (P/NP)

Course Outcomes

1. Discuss the history of Photography, moving images and Stock photography Creating)
2. Demonstrate a brief understanding of ethics of journalism, photo journalism and sources (Understanding)
3. Assess the importance of digital technology in photography (Evaluating)
4. To define camera basics and different genres of photography (Remembering)

Learning Objective

1. Through theory and practical assignments, this class provides the students with hands on experiences in photography. Lectures, field studies, guest instructors, student presentation and group work will help you develop the analytical basisand insight to reflect upon and assess the impact of photographs on our ideas of the world.
2. By the end of this course, Students will: Be able to start their career in photography. Will be able to create picture story /Photo Essays and understand the conventions and challenges of telling stories through images
3. Gain personal leadership through challenging, intercultural assignments

Objective: This module will help to understand the students about photography basics

Module I: Introduction to photography

Camera Basics, Types of Camera, Operating a Camera, Exposure, Aperture & Shutter Speeds Light Meter, Depth of Field, Choosing Lenses, Types of lens, Lighting, Flash Photography, Filters, Steady Shooting, Composition in wildlife Photography.

Objective: *This module will help to understand the students about different types of photography in details*

Module II: Different genres of photography

Mobile Photography, **Microscopic photography**, **Macro photography, Drone photography, Wildlife Photography**

Objective: Post production is an important part of photography student will learn post-production in this module

Module III: Post Processing

Enhancing Photographs, Organizing the Picture, Quality Control, Intermediate/advanced use of post-production software like Adobe Photoshop, Lightroom etc

Objective: How to earn the livelihood from selling your images internationally

Module IV: Stock Photography

Introduction to Stock Photography, How to contribute to various stock photo agencies. Causes of rejections, Submitting Guidelines, Meta Data

Objective: This module focuses on photojournalism.

Module V: Ethics in Wildlife Photography

How to prepare for a photo tour (Dress code in wildlife photography, permissions, water bottle, notebook and other accessories) How to remain safe during shooting (How close is too close, keeping antivenom & antiallergen; leach guard, safety of gears used) Ethics in wildlife photography (knowing Schedules of animals in Wildlife (Protection) Act, 1972, not using any bait, not taking any animal out of its habitat without permission, non use of flash, not altering the habitat)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	L	H	
CO 2		M			H
CO 3	H	H	H	L	M
CO 4	H	M	H	M	M

ZGDS6009: DISSERTATION PHASE II (8 CREDITS)

Course Outcomes

At the end of Dissertation phase II students will be able to:

1. Conduct experiments/ field studies using different materials and methods (Analyzing)
2. Collect various types of data and use those data for testing hypotheses (Analyzing, Evaluating)
3. Make use of several statistical tools for data analysis (Analyzing)
4. Create a scientific report based on the study (Creating)

During the dissertation phase II, a student learns how to perform experiment/field study and collect necessary data for data analysis. He/She also learns to use several statistical tools to analyze data and create a dissertation thesis based on original work done during the end semester examination.

ZGTM6010: TEACHING METHODOLOGY AND CLASSROOM MANAGEMENT (30 HOURS: P/NP)

Course Outcome (CO):

1. Define different concepts of teaching skills (Remembering)
2. Create effective teaching instruction (Creating)
3. Evaluate assessments (Evaluate)
4. Make use of ICT(Analyzing)

Module I: Introduction to Core teaching Skills. Micro- teaching.

a) Introduction to Methods, Maxims, Devices and techniques of teaching. Practice teaching on Core teaching Skills in Microteaching mode.
b) Approaches and methods of teaching Science - (i) Lecture, demonstration, explanation, Observation. (ii) Ensuring Problemsolving, laboratory, Project, Heuristic, Discussion for teaching science. (iii) Learning by discovery, group work and team teaching.
(iv) Collaborative strategies, provision in heterogeneous classroom.

Module II: Planning and designing for effective instruction in science.

a) Design of unit and lesson planning approaches to lesson planning, format of lesson plans
b) Teaching aids and laboratories in science, their necessity and importance.
c) Museum, field trips and excursion, their relevance to science. Preparation of simple aids of Science teaching.

Module III: Evaluation of Learners Progress.

a) Concept and importance of assessment & evaluation.
b) Techniques of evaluation (Theory & Practical)
c) Construction of Unit test: Design and blueprint, Item construction, Question wise analysis, Construction of Science question paper including marking scheme.

Module IV: Information and Communication Technology (ICT) Integration in Science teaching.

a) Introduction to ICT
b) Importance of ICT in Science teaching.
c) Exploring various ICT tools for Science teaching.
d) Open Education Resources (OER) and its uses in Science teaching.
e) ICT Integration in Science teaching.

f) Exploring FOSS in Science teaching

Mapping of COs to Syllabus

Course Outcomes	1	2	3	4
CO1	H	M	M	M
CO2		H		
CO3			H	
CO4				H

ZGEE6011: SPECIALIZATION LAB I – ENTOMOLOGY (2 CREDITS)

Course Outcomes

1. Explain and Identify insects of different insect orders
2. Develop the skill required to properly collect and preserve insects (Creating)
3. Compare the different types of legs, antennae and mouthparts of insects (Analysing)
4. Develop a sound knowledge on basic aspects of anatomy of different systems, physiology of internal systems like digestive system, circulatory system, reproductive system and nervous system. (Creating)
5. To Estimate haemolymph, chitin and uric acid in insects (Creating)

Syllabus

1. Insect collection and preservation
2. Different types of mouth parts
3. Different types of antenna
4. Different types of legs
5. Preparation of arolium, empodium and pollen basket
6. Preparation and identification of haemocytes, quantitative count of haemocytes.
7. Detection of chitin in insect cuticle
8. Detection of Uric acid in insects
9. Estimation of haemolymph proteins in insects.
10. Histological study of foregut, midgut and hindgut of insect.
11. Reproductive system of cockroach
12. Prothoracic gland of cockroach
13. Biosensing activity in Butterflies, Honeybees and beetles
14. Identification Of insects of forensic importance and forest defoliator

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14
CO1	H													
CO2	M	H												
CO3		H	H	H	H									
CO4									H	H	H	H	H	H
CO5						H	H	H						

ZGCM6012: SPECIALIZATION LAB I- CELL AND MOLECULAR BIOLOGY (2 CREDIT; 30 HRS, 0-0-2)

Course Outcome

1. To demonstrate the method to study cell morphology. (applying)
2. Demonstrating the method of preparation of histological slides. (applying)
3. Show the method of preparation to study various chromosome. And also demonstrating the pk value of buffer.(analysing)
4. To demonstrate various method of detecting concentration of an unknown sample. (applying)
5. Demonstrating the enzyme end point technoiques. (analyzing)
6. Illustrating various immunological techniques. (analysing)
7. Creating a report on the techniques observed in advanced lab. (creating)

Syllabus

1. Use of occulometer-standardization and measurements of cell height, nuclear diameters and tabular diameters
2. Histology of biological tissues and sectioning by microtome
3. Preparation of salivary gland chromosomes from Drosophila /Chironomous larva and stain with acetocarmine/aceto-orcein/fuelgen
4. Preparation of mammalian chromosomes from bone marrow or testis and stain with Giemsa stain

5. Determination of pK value of buffer
6. Determination of relationship between absorption and various concentration of a solution using a colorimeter, spectrocolorimeter/spectrophotometer.
7. Preparation of standard curve for total cholesterol
8. Quantization of enzymes: End point techniques (alkaline phosphatase), enzyme kinetics.
9. Permanent Slides: Types of cells (squamous, cuboidal, columnar epithelial cells, blood cells, nerve cells, muscle cells), connective tissues of various types, adipose tissue, mitotic & meiotic chromosomes and their different phases.
10. Preparation of emulsions- syringe method and hubbed needle method
11. Immunization routes: Intradermal, Subcutaneous, Intramuscular, Intraperitioneal, Intravenous
12. Bleeding Schedules and collection of blood: cardiac puncture, external jugular vein
13. Separation and preservation of serum: Liquid Storage using preservative and by sterilization
14. Report submission- Visit to advanced lab.

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14
CO1	H													
CO2		H							H					
CO3			H	H	H									
CO4						H	H							
CO5								H						
CO6										H	H	H	H	
CO7														H

ZGFS6013: SPECIALIZATION LAB I- FISHERY SCIENCE (2 CREDITS: 30 HOURS/ L-T-P: 0-0-2)

COURSE OUTCOMES (CO)

1. Identify commercially important fish species of Northeast India. (Applying)
2. Prepare fish bones using various techniques. (Analyzing)
3. Analyze various biological parameters of fish. (Analyzing)
4. Determine various indices of fish. (Evaluating)
5. Create reports on visits to fish landing centres and fish farms. (Creating)

Syllabus

1. Identification of commercially important fish species of north east India representing all fish groups
2. Fish osteology —preparation of fish skeleton (using KOH and Trypsin).
3. Biological Analysis of fish samples for gut contents, maturity stages and fecundity
4. Dissecting out the pituitary gland and preparing the extract, Weberian Ossicle.
5. Determination of length-weight analysis in fishes.
6. Determination of gonado somatic index (GSI), hepatosomatic index(HSI),condition factor(CF), and fecundity.
7. External characters, types of scales, fins, types of teeth, structure of alimentary canal, gill rakers.
8. Visit to fish landing centre and fish farms and make Reports of visit

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8
CO 1	H							
CO 2		H						
CO 3				H				
CO 4			H		H	H	H	
CO 5								H

ZGAW6014: SPECIALIZATION LAB I- ANIMAL ECOLOGY AND WILDLIFE BIOLOGY [2 CREDITS: 30 HOURS, L-T-P: 0-0-2]

Course Outcome

1. Identify different flora and fauna (Applying).
2. Applying ecological sampling techniques (Applying)
3. Create and Analyse animal behavior (Analyzing, Creating)
4. Identify different successional stages (Applying)
5. Evaluate species diversity and similarity between communities (Analyzing)
6. Create field reports by studying different protected areas (Creating)

Syllabus:

1. Identification of species of butterfly, fishes, amphibia, reptilia, aves and mammalia from collection/model/photographs etc.
2. Identification of fish, amphibian and reptiles (local fauna) using Morphometric landmarks.
3. Ecological Sampling techniques: a) point transect, b) line transects, c) belt transect,
4. Behavioural study through Ethogram preparation
5. Time and Activity budgeting using Focal/Scan sampling.
6. Systematic study of common plants: Field and Herbarium techniques.
7. Study of successional stages of various forest communities.
8. Measuring diversity using Diversity:
   a) Diversity Indices: Shannon Weinner Index, Brillouin's index, Simpson index.
   b) Similarity Indices: Morisita's index, Sorenson's coefficient, Sorenson's and Dice index, Jaccard index
   c) Dissimilarity indices: Bray-Curtis, Ochiai index
9. Report Submission: Study of nearby protected areas (forests and grasslands) under various management regimes and makea report

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9
CO1	H	H				H			
CO2			H						
CO3				H	H				
CO4							H		
CO5								H	
CO6									H

ZGEE6015: SPECIALIZATION LAB II – ENTOMOLOGY AND ENVIRONMENTAL BIOLOGY (2 CREDITS, L-T-P: 0-0-2)

Course Outcomes

1. To categorize aquatic, terrestrial and boring insects (Analysing)
2. To Identify different pests of insects, insects of forest importance and forest defoliator (Analysing)
3. To identify major vector species of insects (Analysing)
4. Demonstrate phylogenetic tree (Understanding)
5. Develop a sound knowledge on basic aspects of physiology of different systems (Applying)

Syllabus:

1. Alimentary canal of house fly with crop
2. Bacterial chamber of termite
3. Pharyngeal, labial and thoracic salivary gland of honey bee
4. Sting apparatus of honey bee
6. Identification of aquatic, terrestrial and boring insects with specific adaptive characteristics.
7. Visit to agricultural field/tea garden and forest for on spot study of pest and damage caused by them
8. Preparation of Phylogenetic tree of Insect species
9. Study of Life Cycle of Mosquito, Housefly, Drosophila
10. Collection and identification of economically important insects and various stages of their life history (using uniquerepresentatives)
11. Identification Of Pests (Tea , Jute, Paddy stored grain)
12. Identification and anatomical studies of major vector species of Anopheles, Culex and Ades

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
CO1					H	H					
CO2						M			H	H	
CO3						M		L			H
CO4							H				
CO5	H	H	H	H							

ZGCM6016: SPECIALIZATION LAB II- CELL AND MOLECULAR BIOLOGY (2 CREDIT; 30 HRS; 0-0-2)

Course outcomes:

1. Demonstrating the method of separation of various cell organelles.(Understanding)

2. Illustrating the separation of nuclic acid, proteins, and amino acids. (Applying)
3. Qualitative analysis of carbohydrate, protein, lipid, nuclic acid by various methods. (Analysis).
4. Demonstration the method of lymphocyte count. (Applying)

Syllabus

1. Tissue homogenization and fractionation by differential centrifugation for isolation of mitochondria, nuclei and cytosol
2. Separation of DNA by agarose gel electrophoresis
3. Separation of proteins on Sodium dodecyl sulphate - polyacrylamide gel electrophoresis
4. Separation of amino acids by Thin Layer Chromatography.
5. Detection of Carbohydrate (a) PAS method/(b) Alcian blue method
6. Detection of Proteins (a) Mercury bromophenol blue method/(b) Ninhydrin method
7. Detection of Lipids (a) Phosphomolybic acid method/(b) Copper phthalocyanine method
8. Detection of DNA by Feulgen method and differential detection of DNA and RNA in a cell by Methyl green- Pyronin method.
9. Isolation and vital staining of lymphocytes obtained from spleen and lymph nodes of sensitized animals

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9
CO 1	M								
CO 2		H	H	H					
CO 3					H	H	H	H	
CO 4									H

ZGFS6017: SPECIALIZATION LAB II- FISHERY SCIENCE (2 CREDITS: 30 HOURS/ L-T-P: 0-0-2)

Course Outcomes

1. Evaluate the physicochemical parameters of water samples. (Evaluating)
2. Estimate and determine productivity of water bodies and its biotic components. (Evaluating)
3. Analyze important fish parasites. (Analyzing)
4. Develop efficient fishing tools for sustainable utilization of the resources. (Creating)
5. Create reports on the study of freshwater bodies and fish processing centre. (Creating)

Syllabus

1. Analysis of water samples for various physicochemical parameters–pH, freeCO2, dissolved oxygen, alkalinity, chloride,hardness, nitrates, phosphates, BOD, COD
2. Estimation of primary productivity by light and dark method.
3. Composition and biomass of phytoplankton, Collection, enumeration and biomass of Zooplankton
4. Identification of important fish parasites (external and internal).
5. Identification of fishing gears and fish by products.
6. Fieldwork: Visit to fresh water bodies, study of physico-chemical and biological status and make a report
7. Visit fish processing centers and make a report.

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7
CO 1	H						
CO 2		H	H				
CO 3				H			
CO 4					H		
CO 5						H	H

ZGAW6018: SPECIALIZATION LAB II- ANIMAL ECOLOGY AND WILDLIFE BIOLOGY [2 CREDITS: 30 HOURS, L-T-P: 0-0- 2]

Course Outcome:

1. Apply ecological techniques (Applying)
2. Analyze animal sign (Analyzing)
3. Make use of GPS to create habitat maps (Applying)
4. Make use of wildlife equipment (Applying)
5. Make use of software for sound analysis and species abundance data (Analyzing)
6. Explain and Perform DNA isolation (Understanding, Applying)

7. Create report on conservation practices (Creating)

Syllabus:

1. Ecological census techniques: a) mark recapture b) quadrat sampling c) plotless sampling d) pellet group count
2. Animal sign & marks analysis: Pug mark analysis; Scat/ Dung analysis: (parasite identification)
3. Mapping distribution of endangered animal fauna of Northeast India
4. Demonstration and use of equipment- camera traps, remote drug delivery equipments, tags, collars, radio tracking equipment
5. Analysis of Abundance Data
6. Extraction of DNA from biological sample, PCR amplification
7. Preparation of an area map using on field GPS data.
8. Acoustic analysis of birds /amphibians
9. Report Submission: Preparation of conservation statements-through review of literature or via field visit.

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9
CO1	H								
CO2		H							
CO3			H				H		
CO4				H					
CO5					H			H	
CO6						H			
CO7									H

ZGBE6019: BIOSYSTEMATICS AND ENVIRONMENTAL BIOLOGY LAB (2 CREDITS) (L-T-P:0-0-2)

Course Outcomes

1. Explain taxonomic procedures and identify various fauna. (Understanding)
2. Apply biodiversity indices. (Applying)
3. Determine parameters of the Environment. (Evaluating)
4. Application of biostatistical tools. (Applying)
5. Make use of bioinformatics softwares for genetic analysis. (Applying)
6. Demonstrate survey techniques. (Applying)

Syllabus

1. Collection, preservation, curation and identification of non-chordata and chordate species (only pest and cultured species)
2. Identification with only diagnostic features (specimen or model/diagnostic photograph) of different phyla
3. Survey and application of biodiversity indices on animal species (any one group)
4. Calculation of Pearson correlation coefficient, T-test (One sample t-test, Two sample t- test,Paired t-test); Chi square test, ANOVA, Mann-Whitney test on supplied data.
5. Preparation of Taxonomic key, study of evolution through models/charts.
6. Estimation of CO2, DO, Nitrites, total alkalinity and hardness of water sample.
7. Study of zooplanktons and its role in a pond ecosystem.
8. Analysis of physical parameters of soil.
9. Study of different types of survey techniques

Mapping of COs to Syllabus

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12
CO 1	H	H			H							
CO 2			H									
CO 3				H					H		H	
CO 4						H	H	H				
CO 5												
CO 6										H		H

ZGCI6020: CELL BIOLOGY, GENETICS AND BASIC BIOINFORMATICS LAB (2 CREDITS) (L-T-P:0-0-2)

Course Outcomes

1. Demonstrate laboratory safety protocols. (Understanding)
2. Identify laboratory equipment and their uses. (Remember)

3. Interpret cell division and the stages. (Understanding)
4. Analyze macromolecules using electrophoretic techniques. (Analyzing)
5. Apply bioinformatics tools to archive, retrieve, and analyze biological data. (Analyzing)

Syllabus

1. Use and care and maintenance of common lab equipment (microscope, colorimeter/ spectrophotometer, balance, pH meter, oven, incubator, microtome, electrophoretic apparatus, centrifuge, water bath etc.) and glass wares.

2. Identification of various stages of mitosis and meiosis from prepared slides.

3. Temporary squash preparation of onion root-tip/tadpole tail-tip cells to study stages of mitosis and Grasshopper/ Gryllotalpa testis to study meiotic stage of cell division.

4. Comparison of RBC and WBC in different groups of Vertebrate.

5. Isolation of DNA from any animal source.

6. Agarose Gel electrophoresis of isolated genomic DNA.

7. Detection of Barr body from epithelial cells

8. Pedigree analysis of some human inherited trait

9. Preparation of metaphase chromosome and chromosome banding studies

Mapping of COs to Syllabus

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
CO 1	H									
CO 2		H								
CO 3			H	H						
CO 4					H	H				
CO 5							H	H	H	H

ZGDB6021: DEVELOPMENTAL BIOLOGY AND BIOCHEMISTRY LAB (2 CREDITS: 30 HOURS) (L-T-P: 2-0-0)

Course Outcomes

1. Develop the concepts of mechanisms of embryonic development. (Applying)
2. Categorize different mechanisms of embryological development through experimental techniques. (Analyzing)
3. Assess the effects of various teratogenic agents and environmental estrogens on development. (Evaluating)
4. Appraise the interactions of maternal effect of gene, gap gene, pair-rule gene, and hox- gene in development with respect to Drosophila. (Evaluating)
5. Discuss the various methods of assisted reproductive technology. (Creating).

Syllabus

1. In vivo/in vitro culture and study of chick embryo
2. Study of blastula, gastrula, tail bud and gill stages of frog embryo.
3. Study of developmental stages of Chick embryo from permanent slides.
4. Study of different stages of estrous cycle in mice (photographic).
5. Mini Project: Study of different types of eggs of invertebrates and vertebrates (Field visit or visit to an institution for study) and preparation of project report.
6. Preparation buffers of different pH using Henderson-Hasselbalch Equation And Its Verification using pH meter.
7. Quantitative estimation of amino acid using ninhydrin reagent.
8. Quantitative estimation of total soluble protein by Lowry method.
9. Estimation of glucose in serum by glucose oxidase peroxidase method/tissue by Anthrone reagent
10. Determination of in vitro antioxidant property (of plants extracts).

Mapping COs to syllabus

	E1	E2	E3	E4	E5	E6	E7	E8	E9
CO1	H	H							

CO2			H						
CO3				H					
CO4						H	H	H	H
CO5					H				

ZGEP6022: ETHOLOGY AND POPULATION GENETICS LAB (2 CREDITS: 30 HOURS) (L-T-P: 0-0-2)

Course Outcomes

1. Compare different types of behavior and analyze the methods of behavior sampling. (Evaluating)
2. Identify characteristic features of social organization in primates and analyze inclusive fitness. (Applying)
3. Construct gene frequencies using Hardy Weinberg Law. (Creating)
4. Determine food preferences in fish or insects. (Evaluating)
5. Distinguish behavioral changes in zooplanktons in relation to temperature and chemicals. (Analyzing)

Syllabus

1. Identification of different behavioral types (States and Events) in any group of animals.
2. Preparation of behavioral catalog (Ethogram)
3. Behavioral sampling Techniques: Scan animal Sampling, Focal animal sampling
4. Time and activity budgeting
5. Social organisation in primates
6. Analysis of gene frequencies using Hardy Weinberg Law using case studies.
7. Thermotactic behaviour in Zooplanktons/ Earthworm
8. Chemotactic behaviour in Zooplanktons/ Earthworm
9. Food preference in Tribolium / fish.
10. Study of Deimatic behaviour/ Aposematic behaviour in any group of animals.
11. Analysis of inclusive fitness.

Mapping COs to syllabus

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
CO1	H	H	H	H						H	H
CO2					H						
CO3						H					
CO4									H		
CO5							H	H			

ZGBB6023: BASIC BIOINFORMATICS LAB
(1 CREDIT: 15 Hours) (L-T-P: 0-0-1)

Objective(s): To acquire practical skills in bioinformatics and computational biology techniques and develop critical thinking abilities and ethical reasoning skills necessary for conducting research in the field.

COURSE OUTCOMES:

CO1: Identify different databases and utilise for sequence/structure retrieval. Data visualization of various 3D models and determine molecular structures and their functions.

CO2: Distinguish sequence alignment techniques and comparison and analysis of biological sequences.

CO3: Building 3D protein structures and explore protein structure-function relationships. Solve questions for interactions between proteins and ligands through molecular docking.

CO4: Analyze phylogenetic relationships to investigate evolutionary patterns and understand biological diversity and evolutionary history.

CO5: Develop critical thinking skills through case study evaluation to analyze and evaluate the ethical implications of computational techniques in biology research.

List of Practicals

1. Retrieval of Nucleotide sequences / Protein structure from the databases.
2. To visualize three-dimensional (3D) structure of protein in various models
3. To perform Pair-wise Sequence Alignment using NCBI BLAST (BLASTN) and interpret the output.
4. To perform Sequence Alignment using NCBI Protein BLAST (BLASTP) and interpret the output.
5. To perform Multiple Sequence Alignment (MSA) using Clustal Omega and interpret the output.
6. To build 3D structure of a target protein through Homology Modelling.
7. To perform Phylogenetic Analysis using academic software.

8. To investigate the interactions between protein and ligands through Molecular docking.
9. Ethical Analysis by Case Study Evaluation - To evaluate the ethical implications and assess their impact on societal values, individual rights, and scientific integrity. – *Assignment*.

Suggested Readings

1. Ghosh Z and Mallick B. (2008). Bioinformatics: Principles and Applications, Oxford University Press.
2. Pevsner J. (2009). Bioinformatics and Functional Genomics, II Edition, Wiley Blackwell.
3. Zvelebil, Marketa and Baum O. Jeremy (2008). Understanding Bioinformatics, Garland Science, Taylor and Francis Group, USA.
4. S. Jayanitha, T. Kartheeswaran (2019). Ethical, Legal and Social Issues in Bioinformatics Applications. (Proceedings of the Vavuniya Campus International Research Symposium).
5. Andreas Dress, Michal Linial, Olga Troyanskaya, Martin Vingron. Computational Biology (Print ISSN -1568-2684) by International Society for Computational Biology (Springer).
6. Zhumur Ghosh, Bibekanand Mallick (2008). Bioinformatics: Principles and Applications. Oxford University Press (ISBN: 9780195692303).
7. Jin Xiong (2006). Essential Bioinformatics. Cambridge University Press (ISBN: 9781139450621).

Mapping to the CO of the Syllabus

	Exp 1	**Exp 2**	**Exp 3**	**Exp 4**	**Exp 5**	**Exp 6**	**Exp 7**	**Exp 8**	**Exp 9**
CO1	H	H							
CO2			H	H	H				
CO3		H				H		H	
CO4							H		
CO5									H

SERVICE LEARNING IN ZOOLOGY PRACTICAL

Course Outcomes

1. Demonstrate aquaculture practices and techniques. (Applying)
2. Demonstrate techniques in Sericulture. (Applying)
3. Examine what can be learned from the community. (Analyzing)

Syllabus

1. Identification of local potential aquarium fishes
2. Aquarium making and management
3. Preparation and setting up of aquarium
4. Rearing of Eri silkworm
5. Identification of silkworm pests

Mapping of COs to Syllabus

	E1	E2	E3	E4	E5
CO 1	H	H			
CO 2			H	H	
CO 3	M	M	L	H	M

FOUNDATIONS OF SERVICE LEARNING PRACTICAL (2 CREDITS)(L-T-P: 0-0-2)

Course Outcomes

1. Demonstrate waste management practices. (Applying)
2. Demonstrate proper health and hygiene practices. (Applying)
3. Examine what can be learned from the community. (Analyzing)

Syllabus

1. Identification and segregation of waste in designated bins
2. Composting of biodegradable waste
3. Visit to nearby school and demonstration of personal hygiene habits

4. Awareness Programme on breeding grounds
5. of vectors and their control.

Mapping of COs to Syllabus

Course Outcomes	1	2	3	4
CO 1	H	H		
CO 2			H	H
CO 3	L	M	L	L

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS
MASTER OF ARTS IN ECONOMICS
Course Structure of MA Programme

SEMESTER I						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Core Course	ENML0046	Microeconomic Analysis	4-0-0	4	1533
Theory	Core Course	ENMY0047	Macroeconomic Analysis	4-0-0	4	1533
Theory	Core Course	ENFE0067	Financial Economics	4-0-0	4	1551
Theory	Core Course	ENMM0048	Mathematical Methods in Economics	4-0-0	4	1534
Theory	Department Elective (DE)	ENMB0050	Money and Banking	3-0-0	3	1536
Theory	School Elective (SE)	ENIP0051	Indian Economic Development	3-0-0	3	1537
Theory	Service Learning	ENSL0200	Service Learning	2-0-0	2	
				Total Credits	**22**	
SEMESTER II						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Core Course	ENSM0052	Statistical Methods in Economics	4-0-0	4	1538
Theory	Core Course	ENEO0049	Economics of Development			1535
Theory	Core Course	ENPS0054	Public Economics	4-0-0	4	1539
Theory	Core Course	ENDV0055	Indian Economic Development and Policy	4-0-0	4	1540
Theory	School Elective (SE)	ENPB0056	Public Finance	3-0-0	3	1541
				Total Credits	**23**	
SEMESTER III						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Core Course	ENRM0057	Research Methodology in Economics	4-0-0	4	1542
Theory	Core Course	ENES0058	Environmental Economics and Sustainability	4-0-0	4	1543
Theory	Core Course	ENDI6003	Dissertation Phase I	2-0-0	2	1555
Theory	Discipline Specific Elective (DSE) (Any one)	ENEG0059	Agriculture Economics - Issues and Management	4-0-0	4	1544
Theory		ENBE0070	Behavioural Economics			1553
Theory	Discipline Specific Elective (DSE) (Any one)	ENHE0061	Health Economics	4-0-0	4	1546
Theory		ENOR0065	Operations Research			1550
				Total Credits	**18**	
SEMESTER IV						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Core Course	ENIN0063	International Economics	4-0-0	4	1547
Theory	Core Course	ENPE0064	Population Economics	4-0-0	4	1548
Theory	Core Course	ENDI6004	Dissertation Phase II	4-0-0	4	1555
Theory	Discipline Specific Elective (DSE) (Any one)	ENNE0071	Economy of North East Region	4-0-0	4	1554
Theory		ENLE0069	Labour Economics			1552
Theory		ENEI0062	Economics of Industry			1546
Theory	Discipline Specific Elective (DSE) (Any one)	ENEM0053	Econometric Methods			1539
Theory		ENGE0066	Gender Economics			1550
Theory		ENED0060	Economics of Education			1545
				Total Credits	**20**	
				Total Programme Credits in BA Economics	**83**	

MA Economics - LIST of VALUE ADDED COURSES

SEMESTER II						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Practical	Value-added Course	ENDA6005	Data Analysis with SPSS/STATA	0-0-2	2	

DEPARTMENT OF EDUCATION
MASTER OF ARTS IN EDUCATION
Course Structure of MA Programme

SEMESTER I					
Type of Course	Category	Course Code	Course Title	Credits	Page No.
Theory	DC	EDFE0035	Philosophical Foundations of Education	4(4-0-0)	1576
	DC	EDEP0036	Fundamentals of Educational Psychology	4(4-0-0)	1577
	DC	EDTE0013	Emerging Trends in Education	3(3-0-0)	1559
	DC	EDDE0014	History and Development of Education in India	3(3-0-0)	1561
	Elective Group I				
	DE	EDET0015	Educational Technology	3(3-0-0)	1562
	Elective Group II				
	DE	EDLR0007	Leadership and Social Responsibility	3(3-0-0)	1559
Practicum	DC	EDJG6002	Journaling – A Technique for Personal and Academic Growth	3(3-0-0)	1582
Total Credits				23	
SEMESTER II					
Theory	DC	EDSF0038	Sociological Foundations of Education	4(4-0-0)	1579
	DC	EDRM0034	Research Methodology in Education	4(4-0-0)	1575
	Specialisation Courses: One area of Concentration to be opted (Educational Leadership/Educational Psychology)				
	DC	EDEL0019	Developing Educational Leadership	3(3-0-0)	1563
	DC	EDDL0020	Human Development and Learning	3(3-0-0)	1564
	Elective Group I				
	-	-	-	3(3-0-0)	
	Elective Group II				
	DE	EDPC0037	Peace Education and Conflict Management	3(3-0-0)	1578
Practicum	DC	EDES6003	Educational Seminar I	2	1582
	SE	SWCA6010	Computer Applications for Social Sciences (Lab)	2	1587
	DC	EDEP6016	Experiments in Educational Psychology	2	1586
	Total Credits			23	
SEMESTER III					
Theory	DC	EDCI0039	Curriculum Development and Instruction	3	1580
	DC	EDTP0022	Principles and Techniques of Teaching and Pedagogy	3	1565
	DC	EDTE0023	Teacher Education	3	1566
	DC	EDME0024	Measurement and Evaluation in Education	3	1567
	SPECIALIZATION COURSES				
	Educational Leadership				
	DC	EDOC0029	Organisational Communication	3	1571
	DC	EDFM0026	Financial Management and Accounting	3	1568
	Educational Psychology				
	DC	EDLE0027	Life Span Development and Education	3	1569
	DC	EDLI0028	Learning and Individual Differences	3	1570
Practicum	DC	EDDI6005	Dissertation Phase I	2	1583
	DC	EDES6009	Educational Seminar II	2	1585
	DC	EDTP6010	Teaching Practice	2	1585
		Total Credits		24	
SEMESTER IV					
Theory	**SPECIALIZATION COURSES**				
	Educational Leadership				

	DC	EDEA0030	Educational Administration	3	1572
	DC	EDSR0031	Ethics and Social Responsibility in Education	3	1573
	Educational Psychology				
	DC	EDSP0032	Counselling Skills for Educational Psychologists	3	1574
	DC	EDCA0033	Child and Adolescent Mental Health	3	1574
Practicum	DC	EDDI6007	Dissertation Phase II	4	1583
	DC	EDIN6008	Internship	3	1584
	Total Credits			13	
	TOTAL PROGRAMME CREDITS			83	

LIST OF VALUE ADDED COURSES						
Course Type	**Category**	**Course Code**	**Name of Paper**	**L-T-P**	**Credits**	**Page No.**
Theory & Practicum	Value Added	EDES6011	Education for Sustainable Development	1-0-1	2	1590
		EDTT6012	Teacher and Teaching Skills	1-0-1	2	1590
		EDHW6013	Education for Health and Wellness	1-0-1	2	1591
		EDWE6014	Women Empowerment	1-0-1	2	1592
		EDFL6015	Family Life Education	1-0-1	2	1592
		EDAD6017	Adult Education	1-0-1	2	1593

DEPARTMENT OF ENGLISH

MASTER OF ARTS IN ENGLISH

Course Structure of MA Programme

SEMESTER I					
TYPE	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CREDITS**	**PAGE**
Theory	EGEP0001	Chaucer to Elizabethan Period – Poetry, Drama and Romance	DC	4	1597
	EGLS0002	Literary and Social History of England - Chaucer to Elizabethan Period	DC	3	1598
	EGSD0029	Shakespearean Drama	DC	4	1610
	EGWL0033	World Literature Since 20th Century		2	1612
	Elective I One course to be chosen				
	EGAA0034	Arts and Aesthetics	DE	3	1613
	EGCS0035	Cultural Studies	DE		1614
	EGFS0036	Film Studies			1615
	Elective II One course to be chosen				
	MCML0027	Media Literacy	SE	3	1627
	EDLR0007	Leadership and Social Responsibility	DE		1559
	SWGS0039	Gender studies	SE		1720
	EGET0007	English Language Teaching	SE		1598
Orientation	EGSL0200	Service Learning-Language Communication			1618
Total Credits				19	
SEMESTER II					
Theory	EGRR0008	Restoration to Romantic Period – Poetry and Drama	DC	4	1599
	EGLC0028	Literary Criticism – Plato to F.R. Leavis and Select Twentieth Century Perspectives	DC	4	1609
	EGIL0030	Introduction to Linguistics	DC	4	1610
	EGAL0011	Approaches to Language and Literary Research	DC	3	1600
	Elective I One course to be chosen				
	EGTR0012	Classics in Translation	DE	3	1601
	EGNE0037	North-East Indian Literature in English	DE		1615
	Elective II One course to be chosen				
	SWEM0038	Environment studies and Disaster Management	SE	3	1719
	EDPC0037	Peace Education and Conflict Management	SE		1578
	PCSP0006	Introduction to Social Psychology	SE		1655
	EGWR0038	Women's Writings	DE		1616
Seminar	EGSP6006	Seminar and Presentation	DC	2	1621
Theory	EGSL0200	Service Learning-Language Communication			1618
				23	
SEMESTER III					
Theory	EGVP0015	Victorian to Post-Modern Period – Poetry, Drama & Fiction	DC	4	1603
	EGPL0016	Post-Colonial Literature – Poetry, Drama & Fiction	DC	3	1603
	EGAL0017	American literature – Poetry, Drama & Fiction	DC	3	1604
	EGLT0018	Literary and Critical Theory	DC	4	1605
	EGGN0019	Gender and Literature	DC	2	1605
	Specialisation Course: Language and Linguistics				
	EGLS0020	Linguistics and Stylistics I	DC	3	1606
	Specialization Paper: European Literature				
	EGIM0031	Modern European Literature I	DC	3	1611
	Specialization Paper: African Literature				
	EGAL0039	Colonial and Post- Colonial African Literature I	DC	3	1617
Project	EGPP6003	Project Phase I	DC	3	1619

Practical	EGSL0200	Service Learning-Language Communication(Community Engagement)			1618
Total Credits				21	
SEMESTER IV					
Theory	EGIW0023	Indian Writing in English – Poetry, Drama & Fiction	DC	4	1607
	EGSA0024	South-Asian Literature	DC	4	1608
	Specialization Paper: Language and Linguistics				
	EGLS0025	Linguistics and Stylistics II	DC	3	1608
	Specialization Paper: European Literature				
	EGEL0032	Modern European Literature II	DC	3	1612
	Specialization Paper: African Literature				
	EGPC0040	Colonial and Post- Colonial African Literature II	DC	3	1618
Project	EGPP6004	Project Phase II- Dissertation	DC	8	1620
Practical	EGSL0200	Service Learning-Language Communication(Community Engagement)			1618
Total Credits				19	
Total Programme Credits				82	

VALUE ADDED COURSES						
CourseType	**Category**	**Course Code**	**Name of Paper**	**L-T-P**	**Credits**	**PageNo**
Theory & Practical	Value Added	EGES0138	Effective Communication Skills	1-0-1	2	1621
		EGML0028	Myths in Literature	2-0-0	2	1622
		EGLA6005	Lyrical Analysis	1-0-1	2	1623

DEPARTMENT OF MASS COMMUNICATION

MASTER OF ARTS IN MASS COMMUNICATION

Course Structure of MA Programme

SEMESTER – I					
Type	Category	Course Code	Name	Credits	Page No.
Theory	DC	MCHD0028	History and Development of Communication Media	3	1627
	DC	MCPC0029	Philosophy of Communication	3	1628
	DC	MCTC0030	Theoretical Perspectives of Communication	4	1629
	DC	MCPJ0031	Principles and Practices of Journalism	4	1629
	Elective 1: One Course to Be Opted				
Theory	SE	PCEC0013	Eastern Approaches to Psychology and Counselling	3	1655
	SE	EDET0015	Education Technology	3	1562
	SE	SWEM0038	Environment and Disaster Management	3	1719
	Elective 2: One Course to Be Opted				
Theory	DE	MCML0027	Media Literacy	3	1627
	SE	EDLR0007	Leadership and Social Responsibility	3	1599
	SE	SWGS0039	Gender Studies	3	1720
	SE	EGET0007	English Language Teaching	3	1598
Practicum	DC	MCTP6015	Techniques of Photography and Image Editing	2	1645
Practicum	DC	MCJG6016	Journaling	1	1645
Theory	Service Learning	MCLS0100	Community Media	2	1652
			Total Credits	26	
SEMESTER – II					
Theory	DC	MCID0032	Investigative and Data Driven Journalism	3	1630
Theory	DC	MCTS0033	Theories of Development Communication and Social Change	4	1631
Theory	DC	MCRM0034	Media and Communication Research Methodology	4	1632
Theory	DC	MCDM0052	Digital Media	3	1643
	Elective 1: One Course to Be Opted				
Theory	SE	SWDS0044	Introduction to Disability Studies	3	1725
Theory	SE	PCPD0007	Personality Development		
Theory	DE	MCRC0026	Rural Communication		1626
	Elective 2: One Course to Be Opted				
Theory	SE	PCSP0006	Introduction to Social Psychology	3	1655
Theory	SE	EDPC0037	Peace Education and Conflict Management		1578
Theory	SE	SWEM0038	Environment Studies and Disaster Management		1719
Theory	SE	LSNE0020	North-East Indian Literature in English		
Practicum	DC	MCDI6017	Dissertation Phase - I	2	1646
Practicum	DC	MCAV6018	Audio-Video Production	2	1648
			Total Credits	21	
SEMESTER- III					
Theory	DC	MCML0037	Media Laws, Ethics and Social Responsibility	3	1633
Theory	DC	MCAM0038	Advertising, Marketing and Public Relations	3	1634
Practicum	DC	MCDP6019	Dissertation Phase - II	2	1646
	Specialization: Electronic Media				
Theory	DC	MCAV0039	Audio-Video Editing	3	1534
Theory	DC	MCTV0040	Television and Video Production	4	1635
Theory	DC	MCSM0041	Sound for Media	4	1636
	Specialization: Print Media				
Theory	DC	MCPC0042	Political Communication	3	1637

Theory	DC	MCNR043	News Reporting and Editing	4	1637
Theory	DC	MCHE0044	Health and Environmental Communication	4	1638
	Specialization: Communication for Development				1639
Theory	DC	MCPM0045	Programme Management	3	1639
Theory	DC	MCSA0046	Situation Analysis for Communication Strategy	4	1640
Theory	DC	MCCA0047	Planning Models and Communication Approaches	4	1640
			Total Credits	19	
SEMESTER – IV					
Theory	DC	MCMC0048	Media and Cultural Studies	3	1641
Practicum	DC	MCIP6020	Internship	5	1647
	Specialization: Electronic Media				
Theory	DC	MCFA0053	Film Appreciation	3	1644
Project	DC	MCFP6021	Final Project	5	1647
	Specialization: Print Media				
Theory	DC	MCBJ0050	Business Journalism	3	1642
Project	DC	MCFP6021	Final Project	5	1647
	Specialization: Communication for Development				
Theory	DC	MCPM0051	Project Monitoring and Evaluation	3	1643
Project	DC	MCFP6021	Final Project	5	1647
			Total Credits	16	
			TOTAL PROGRAMME CREDITS	82	

LIST OF VALUE-ADDED COURSES

Course Type	Course Code	Name of Paper	T-L-P	Credits	Page No.
Theory & Practicum	MCCS6122	Communication Skills	1-0-1	2	1649
Theory & Practicum	MCCW6123	Creative Writing	1-0-1	2	1649
Theory & Practicum	MCEM6124	Event Management	1-0-1	2	1650

DEPARTMENT OF PSYCHOLOGY
MASTER OF SCIENCE PSYCHOLOGY (Clinical/Counselling Psychology)
Course Structure

SEMESTER I					
Type of Course	Category	Course Code	Course Title	Credits	Page No.
Theory	Core Course	PCTP0020	Theories of Personality	4	1656
		PCMH0021	Concepts of Mental Health and Illness-I	4	1659
		PCRM0022	Research Method and Statistics in Social Sciences	4	1658
		PCCP0023	Cognitive Psychology	3	1659
	Elective 1: One Course to Be Opted				
	SE	PCEC0013	Eastern Approaches to Psychology and Counselling	3	1655
	SE	EDET0015	Education Technology	3	1562
	SE	SWEM0038	Environment and Disaster Management	3	1719
	Elective 2: One Course to Be Opted				
	DE	MCML0027	Media Literacy	3	1627
	SE	EDLR0007	Leadership and Social Responsibility	3	1559
	SE	SWGS0039	Gender Studies	3	1720
	SE	EGET0007	English Language Teaching	3	1598
	SE	PCGP0024	General Psychology	3	1660
Practicum	DC	PCPP6026	Psychological Assessment-I (Practicum-I)	2	1677
Practicum	DC	PCPG6018	Personal Growth	P/NP	1673
		Total Credits		23	
SEMESTER II					
Theory	DC	PCCM0025	Concepts of Mental Health and Illness-II	4	1661
	DC	PCBP0026	Bio- psychology	3	1662
	DC	PCPT0027	Psychological Testing	4	1663
	Elective 1: One Course to Be Opted				
	SE	PCHT0028	Health Psychology	3	1664
	SE	SWDS0044	Introduction to Disability Studies		1725
	DE	MCRC0026	Rural Communication		1626
	Elective 2: One Course to Be Opted				
	SE	PCSP0006	Introduction to Social Psychology	3	1655
	SE	EDPC0037	Peace Education and Conflict Management		1578
	SE	SWEM0038	Environment and Disaster Management		1719
	SE	LSNE0020	North-East Indian Literature in English		
Practicum		PCPP6027	Psychological Assessment-II (Practicum-II)	2	1678
Field Work		PCFW6028	Field Work	2	1679
	DC	PCFA6019	Psychological First Aid	P/NP	1674
		Total Credits		21	
SEMESTER III (COUNSELLING PSYCHOLOGY SPECIALIZATION)					
Theory	DC	PCFP0029	Foundations of Counseling Psychology	4	1664
	DC	PCCY0030	Child and Youth Counseling	3	1665
	DC	PCDR0031	Disability Studies and Rehabilitation Psychology	4	1666
Practicum	DC	PCRP6020	Research Project Phase-I	4	1674

	DC	PCPR6029	Practicum-III	2	1629
	DC	PCSI6021	Supervised Internship Phase-I	4	1674
	DC	PCIP6022	Summer Internship	P/NP	1675
	DC	PCST6023	Study Tour	P/NP	1676
		Total Credits		21	
SEMESTER IV (COUNSELLING PSYCHOLOGY SPECIALIZATION)					
Theory	DC	PCAT0032	Addiction and Trauma Counselling	3	1667
	DC	PCMF0033	Marriage and Family Counselling	4	1668
Practicum	DC	PCPR6030	Practicum-IV	2	1680
	DC	PCSI6024	Supervised Internship Phase-II	8	1676
	DC	PCRP6025	Research Project Phase-II	6	1677
		Total Credits		23	
SEMESTER III (CLINICAL PSYCHOLOGY SPECIALIZATION)					
Theory	Core Course	PCFC0034	Foundations of Clinical Psychology	4	1669
		PCPG0035	Psychodiagnostics	4	1670
		PCRP0036	Forensic Psychology	3	1670
Practicum		PCRP6020	Research Project Phase-I	4	1674
		PCPR6029	Practicum-III	2	1679
		PCSI6021	Supervised Internship Phase-I	4	1674
Practicum		PCIP6022	Summer Internship	P/NP	1675
		PCST6023	Study Tour	P/NP	1676
		Total Credits		21	
SEMESTER IV (CLINICAL PSYCHOLOGY SPECIALIZATION)					
Theory	Core Course	PCPC0037	Psychotherapy	4	1671
		PCNP0038	Neuropsychology	3	1672
Practicum	Practicum	PCPR6030	Practicum-IV	2	1680
		PCSI6024	Supervised Internship Phase-II	8	1676
		PCRP6025	Research Project Phase-II	6	1677
		Total Credits		23	
		TOTAL PROGRAMME CREDITS		88	

LIST OF ELECTIVES COURSES – MSc Psychology					
Course Type	Category	Course Code	Name of Paper	L-T-P	Page No
Theory	Elective – I (Semester I)	PCEC0013	Eastern Approaches to Psychology and Counselling	3-0-0	1655
Theory	Elective – II (Semester II)	PCSP0006	Introduction to Social Psychology	3-0-0	1655

LIST OF VALUE-ADDED COURSES – MSc Psychology				
Course Type	Course Code	Name of Paper	L-T-P	Page No
Theory & Practicum	PCWO6033	Working for Diversity	2-0-0	
Theory & Practicum	PCSO6034	School Psychology	2-0-0	1681
Theory & Practicum	PCCO6035	Community Mental Health	2-0-0	1682
Theory & Practicum	PCLS6036	Life Skills Education	2-0-0	1683

DEPARTMENT OF PUBLIC ADMINISTRATION
MA PUBLIC ADMINISTRATION
(With Specialisations in Human Rights-HR/ International Relations -IR/ Public Policy-PP)

Course Structure

SEMESTER I					
Type of Course	**Category**	**Course Code**	**Course Title**	**Credits**	**Page No.**
Theory	DC	PASE0001	State and its Elements	3	1687
	DC	PAIA0002	Introduction to the Public Administration	3	1687
	DC	PACD0003	Comparative and Development Administration	3	1688
	DC	PAPP0004	Public Policy	3	1689
	Elective Paper				
	DE	PAEP0005	Engaged Policy and Governance	3	1689
			Elective Group I		
	DE	PAHR0024	Introduction to Human Rights (HR)	3	1702
	DE	PAIR0025	Introduction to International Relations (IR)		1703
Orientation	Mandatory Course	PASL0200	Service Learning		1701
			Total Credits	18	
SEMESTER II					
Theory	DC	PAAP0007	Administrative Theory and Principles	3	1690
	DC	PAIA0008	Indian Administration	3	1691
	DC	PAPP0009	Public Personnel Administration	3	1692
	DC	PARM0010	Research Methodology	3	1693
	ELECTIVE GROUP I				
	DE	PAIC0026	Issues in Contemporary International Relations (HR/IR)	3	1704
	DE	PAPF0027	Policy Formulation- Structures and processes (PP)		1705
	ELECTIVE GROUP II				
	DE	PALM0028	Labour Migration, Citizenship and Governance (HR/IR)	3	1705
	DE	PAOB0012	Organizational Behaviour (PP)		1693
Value Added Course - I	Mandatory	PAEP0021	Environmental Policy and Administration		1700
Theory	Service Learning	PASL0200	Service Learning		1701
			Total Credits	18	
SEMESTER III					
Theory	DC	PABF0013	Budget and Financial Administration in India	3	1694
	DC	PASW0014	Social Welfare Administration	3	1695
	DC	PAEG0015	Environmental Governance	3	1695
	DC	PACA0016	Citizens and Administration	3	1696
	ELECTIVE GROUP I				
		PASE0029	India in South East Asian Politics (HR /IR)	3	1706
		PAPP0030	Public policy in India (PP)		1707
Project	DC	PADP6001	Dissertation – Phase I	3	1698
Value Added Course - II		PADV0031	Data Management and Visualisation		1707
Value Added Course -		PAIG0023	Innovation in Governance		1700

III					
Practical	Service Learning	PASL0200	Service Learning-(Community Engagement)		1701
			Total Credits	18	
SEMESTER IV					
Theory	DC	PADL0017	Decentralization and Local Governance	3	1697
	DC	PAEG0018	E-Governance	3	1698
	ELECTIVE GROUP I				
	DE	PAIO0032	International Organisations and National Interest (HR/IR)	3	1708
	DE	PAPI0033	Policy Implementation (PP)		1708
	ELECTIVE GROUP II				
	DE	PACG0034	China and the Global System (HR/IR)	3	1709
	de	PAPO0035	Policy Analysis (PP)		1710
Project	DC	PADP6005	Dissertation – Phase II	6	1699
Practical	Service Learning	PASL0200	Service Learning-(Community Engagement)		1701
			Total Credits	**18**	
			Total Programme Credits	**72**	

VALUE ADDED COURSES					
Course Type	**Category**	**Course Code**	**Name of Paper**	**Credits**	**Page No.**
Theory & Practical	**Value Added**	PAEP0021	Environmental Policy And Administration	2	1700
		PAIG0023	Innovation In Governance	2	1700
		PADV0031	Data Management and Visualisation	2	1707

DEPARTMENT OF SOCIAL WORK
MASTER OF SOCIAL WORK

Course Structure of MSW Programme

SEMESTER I						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Departmental core	SWHI0035	History, Ideologies and fields of Social Work	3-0-0	3	1715
Theory	Departmental core	SWGD0036	Human Growth and Development	2-0-0	2	1716
Theory	Departmental core	SWIS0037	Introduction to Indian Society, Polity and Economics	2-0-0	2	1717
Theory	Departmental core	SWCS0070	Social Work with Communities and Social Action	3-0-0	3	1718
Theory	School Elective	SWEM0038	Environment and Disaster Management	3-0-0	3	1719
Theory	Departmental Elective	SWGS0039	Gender Studies	3-0-0	3	1720
Practicum	Departmental Core	SWFR6008	Concurrent Field Work	0-0-16	6	1757
SEMESTER II						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Departmental core	SWPF0040	Social Work Practice with Individuals and Families	3-0-0	3	1721
Theory	Departmental core	SWPG0041	Social Work Practice with Groups	3-0-0	3	1722
Theory	Departmental core	SWRS0042	Social Work Research and Statistics	3-0-0	3	1723
Theory	Departmental core	SWWA0043	Social Welfare Administration	3-0-0	3	1724
Theory	Departmental Elective	SWDS0044	Introduction to Disability Studies	3-0-0	3	1725
Theory	Departmental Elective	SWEM0038	Environment and Disaster Management	3-0-0	3	1719
Practicum	Departmental Core	SWFW6009	Concurrent Field Work II	0-0-16	6	1757
Practicum	Departmental Core	SWSL0200	Participatory Service Learning – Rural Practicum	30-0-50 in 10 days	2	1759
SEMESTER III						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Departmental core	SWSJ0045	Social Justice, Human Rights & Para-legal Education	3-0-0	3	1726
Theory	Departmental core	SWES0046	Emerging Social Work Perspectives and Integrated Approach	3-0-0	3	1727
Theory	Departmental core	SWCA0047	Computer Applications for Social Sciences (Lab)	0-0-2	2	1757
Theory	Departmental Elective	SWRT0048	Community Development: Rural, Tribal and Urban	3-0-0	3	1728
Theory	Departmental Elective	SWGC0049	Governance and Community Development	3-0-0	3	1729
Theory	Departmental Elective	SWCS0050	Family Centered Social Work Practice	3-0-0	3	1730
Theory	Departmental Elective	SWPC0051	Social Work Practice with Children	3-0-0	3	1731
Theory	Departmental	SWMS0052	Medical Social Work	3-0-0	3	1732

	Elective					
Theory	Departmental Elective	SWHS0053	Mental Health and Social Work	3-0-0	3	1733
Theory	Departmental Elective	SWOD0054	Organisational Structure, Behaviour and Development	3-0-0	3	1734
Theory	Departmental Elective	SWDO0055	Policies for Development Organisations - Urban, Rural and Tribal Communities	3-0-0	3	1735
Theory	Departmental Elective	SWCP0056	Introduction to Child Psychology and Development	3-0-0	3	1736
Theory	Departmental Elective	SWRC0057	Rights of the Child – Legal Framework, National And International Instruments	3-0-0	3	1737
Project	Departmental Elective	SWRP6020/ -/SWCP6022	Research Project Phase I/ SWAYAM Course 1/ Community Development Project I	2-2-2/3-0-0/2-2-2	3	1759
Internship	Departmental Core	SWFW6010	Continuous Field Work I	0-0-200 In one month	6	1758
SEMESTER IV						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Departmental core	SWSP0058	Social Development and Social Policy	3-0-0	3	1738
Theory	Departmental core	SWPM0059	Project cycle Management and Resource Mobilisation	3-0-0	3	1739
Project	Departmental Elective	SWRP6021/ -/SWCP6023	Research Project Phase II / SWAYAM Course 2/ Community Development Project II	2-2-2/3-0-0/2-2-2	3	1759
Theory	Departmental Elective	SWHP0060	Community Health and Population Management	3-0-0	3	1740
Theory	Departmental Elective	SWDC0061	Community Development Practice with Disempowered Communities	3-0-0	3	1741
Theory	Departmental Elective	SWWE0062	Development Concerns and Women Empowerment	3-0-0	3	1742
Theory	Departmental Elective	SWSN0063	Families With Special Needs	3-0-0	3	1743
Theory	Departmental Elective	SWPW0064	Psychiatric Social Work	3-0-0	3	1744
Theory	Departmental Elective	SWCH0065	Community Health and Services	3-0-0	3	1745
Theory	Departmental Elective	SWHR0066	Human Resource Management: Social Work Perspective	3-0-0	3	1746
Theory	Departmental Elective	SWCI0067	Corporate Social Responsibilities - Concepts & Ideologies	3-0-0	3	1747
Theory	Departmental Elective	SWSP0068	Children with Special Needs	3-0-0	3	1748
Theory	Departmental Elective	SWRP0070	Child Rights and Child Protection	3-0-0	3	1749
Internship	Departmental Core	SWCF6012	Continuous Fieldwork II	0-0-200 In one month	6	1758
Internship	Departmental Core	SWIN6013	Internship	0-0-200 In one month	P/NP	1759
VALUE ADDED COURSES						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory &	Value Added	SWRB6014	Results Based Management of	15-0-15	2	1751

Practicum			Projects and programmes			
Theory & Practicum	Value Added	SWAW6015	Academic Writing, Research Proposal Development and Dissertation Writing Course	15-0-15	2	1751
Theory & Practicum	Value Added	SWWD6016	Working with Diversity	15-0-15	2	1752
Theory & Practicum	Value Added	SWLS6017	Life skills for competency development	15-0-15	2	1753
Theory & Practicum	Value Added	SWFT6018	Family Therapy	15-0-15	2	1754
Theory & Practicum	Value Added	SWCD6019	Introduction to Communication for Development (C4D) for Social Work	15-0-15	2	1755

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES
DEPARTMENT OF ECONOMICS

VISION

To envision excellence in quality education and moulding intellectually competent persons in economics for creating novelideas through innovative teaching and research contributing to the modern society.

MISSION

- Empower the students with critical understanding of economic theory, analytical treatment and empirical interpretations of economic issues.
- Make the students aware of recent and ongoing developments in the field of economics.
- Enhance the skill and efficiency of the students for better employability in competitive job markets.

Programme Outcomes – MA Economics

PO 1: **Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Effective Citizenship**: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

PO 7: **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

Programme Specific Outcomes – MA Economics

PSO 1: **Knowledge of Economic Structure:** Ability to understand theories of basic economic structure and enhanced policy making. It also provides detailed knowledge of Indian Economy especially in post independence period.

PSO 2: **Applications of Mathematical and Econometric Methods:** To acquaint with the basic and applied mathematical and econometric methods to solve real economic problems. This develops skills required for empirical research.

PSO 3: **Growth and Sustainable Development Outlook:** To acquaint with in-depth knowledge of growth and sustainable development policies and strategies.

PSO 4: **Understanding of Trade and Financial Policies:** To equip with the fundamental strategies and principles governing trade and relations across countries.

PSO 5: **Perspective of Sectoral Knowledge:** To equip with the knowledge of sectoral behaviour, sector specific theories and policies.

PSO 6: **Population and Behavioural Studies:** To understand the principles of population and human decision making behaviour guided by cognitive skills.

MAPPING OF COURSES TO POS/PSOS – MA ECONOMICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
1.1	H						M	H		M			M
1.2	H		M					H		M		L	
1.3	M	M						M	H				M
1.4	M			M	L					H	M	H	
1.5		M					M			M	H	L	
1.6			M			H		H		H		M	
2.1	M						M		H		M		H
2.2	H						M	M	H				H
2.3		M			M			H		M		L	
2.4	M		M			H	M		H			M	
2.5			H	M				L			M	H	
2.6		M	H						H				M

3.1		H	M		H		H		M	H			L
3.2	L			H		H				H	H	M	
3.3		H	M		M				M				H
3.4	M		H			M		H		M		H	
3.5		M	M		H			M				H	H
3.6			H	M		M				M		H	M
3.7		M				H			M	H		H	
4.1	H	M			M			H		M	H		
4.2			M	M		L	H			H		M	H
4.3		H	M		M				H				M
4.4	H						M		H				M
4.5			M		H	L				M		H	H
4.6	L	M						H		M	H		
4.7				M		M	M		M	H		H	
4.8			H		M			M		H		M	
4.9	H				M		L			M		H	H

DETAILED SYLLABUS – MA ECONOMICS

THEORY COURSES

ENML0046: MICROECONOMIC ANALYSIS (4-0-0)

COURSE OUTCOMES

1. Describe the detail concepts of microeconomics (Remembering)
2. Illustrate the behaviour of economic agents as well as the behaviour of the firms (Understanding)
3. Apply microeconomic concepts and theories to analyse real-life situations (Applying)
4. Illustrate the interactions of Microeconomics with other branches of Economics (Analyzing)
5. Elucidate the effects of economic policies on microeconomic behaviour and thus on the overall economic activities (Evaluating)
6. Develop ideas and critical insights for analysing real-life economic problems (Creating)

Module I: Choice under Risk and Uncertainty (12 hours)

The von-Neumann-Morgenstern Axioms; Expected Utility Theory; Risk Aversion; Certainty Equivalent and Risk Premium; Reducing Risk – Diversification, Insurance, Information; Comparative Risk Aversion; The Demand for Risky Assets; The State Preference Approach to Choice under Uncertainty

Module II: Imperfect Market Structure: Oligopoly (15 hours)

Basic Market Structure; Non-collusive Oligopoly – Cournot, Bertrand, Stackelberg, Paul Sweezy; Collusive Oligopoly – Cartels, Price Leadership, Single Basing-point Price; The Mark-up Rule

Module III: Factor Pricing and Income Distribution (15 hours)

Review of Factor Pricing under Perfectly Competitive Markets; Factor Pricing Under Imperfectly Competitive Markets; Monopolistic and Monopsonistic Powers; Labour Union and Collective Bargaining; Bilateral Monopoly; Elasticity of Factor Substitution; Technological Progress and Factor Share; Pricing of Fixed Factors – Rents and Quasi Rents

Module IV: The Theory of Public Choice (10 hours)

Pareto Optimality; Social Welfare Functions – Bergson & Samuelson, Arrow; Maximisation of Social Welfare; Compensation Criteria; Arrow's Impossibility Theorem; The Theory of Second Best; Social vs. Private Costs and Benefits

Module V: Market Failures (8 hours)

Externalities and Inefficiency; A Simple Bilateral Externalities; Public Goods and Free Riders Problems; Imperfect Markets; Asymmetric Information and Markets for Lemons; Moral Hazard; Adverse Selection; Signaling

Suggested Readings

1. A. Koutsoyinnis, Modern Microeconomics, International Edition, Macmillan Press Ltd
2. Baumol, W.J., Economic Theory and Operations Analysis, 1982.
3. C. Snyder & W. Nicholson, Fundamentals of Microeconomics, Cengage Learning (India), 2010
4. D. Salvator, Principles of Microeconomics, 5th Edition, OUP
5. Hal R. Varian, Intermediate Microeconomics, a Modern Approach, W.W. Norton and Company/Affiliated East-West Press(India), 8th Edition, 2010
6. Karl E. Case & Ray C. Fair, Principles of Economics, Pearson Education Inc., 8th Edition, 2007.
7. N. Gregory Mankiw, Economics: Principles and Applications, India edition by South Western, a part of Cengage Learning,Cengage Learning India Private Limited, 4th Edition, 2007.
8. R. S. Pindyck, D. N. Rubinfeld & P. L. Meheta, Microeconomics, 7th Edition, Pearson, New Delhi

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		H		H	
CO3	H				M
CO4				M	
CO5		H			
CO6			H		H

ENMY0047: MACROECONOMIC ANALYSIS (4-0-0)

COURSE OUTCOMES

1. Describe the detail concepts of macroeconomics and its related terms. (Remembering)
2. Identify the behaviour of macroeconomic variables and their interdependences in a closed as well as in an openeconomy. (Understanding)
3. Apply macroeconomic variables and concepts in examining the real-life situation (Applying)
4. Evaluate the role of macroeconomic variables in smooth functioning of an economy and its dynamics. (Analyzing)
5. Elucidate the effects of macroeconomic changes and policies on overall growth and development of an economy. (Evaluating)
6. Formulate and develop macroeconomic models and tools for analyzing real-life macroeconomic situations. (Creating)

Module I: Consumption and Investment Functions (12 hours)

Theories of Consumption – Absolute Income, Relative Income, Life Cycle, Permanent Income; Theories of Investment – The Present Value Criterion for Investment, Marginal Productivity of Capital, The Marginal Efficiency of Capital and Investment, Financial Theory of Investment; Lags in Investment; Portfolio Disequilibrium and the Transmission Mechanism

Module II: Money Demand, Inflation and Unemployment (15 hours)

Post-Keynesian Theories of Demand for Money – Friedman, Patinkin, Baumol, Tobin; Determinants of Money Supply; Patinkin's Real Balance Effect; Theories of Inflation; Inflation and Unemployment – Phillips Curve Analysis; Trade-off vs. No Trade-off – Tobin, Friedman; The Inflationary Pressure Curve; Adaptive and Rational Expectations; Okun's Law; Keynesianism vs. Monetarism

Module III: New-Classical Macroeconomics (10 hours)

Main Features of New-Classical Model; Rational Expectation – Barrow's View; Rational Expectations and the Real Business Cycles – Kydland, Prescott; Expectations of Future Variables – Sargent, Muth; Macroeconomic Imbalances; Lucas Aggregate Supply Function; The Rational Expectations Hypothesis and its Critique

Module IV: Cyclical Fluctuation (8 hours)

Characteristics of Cyclical Fluctuation; Business Cycle in Market Economies; Short-Term vs. Long-Term Growth Trend; Theories of Business Cycles – Samuelson, Hicks, Kaldor, Schumpeter; Impact of Recession on Trade Imbalances

Module V: Open Economy Macroeconomics (15 hours)

IS-LM Analysis in Open Economy; Mundell-Fleming Model; Marshall-Lerner Condition; Interest-Rate Differentials; Inflation and Unemployment in the Open Economy; Fiscal Policies with Exchange Rate and Inflation; Floating Exchange Rates with Zero and Perfect Capital Mobility; Exchange Rate Expectations; Exchange Rate Overshooting

Suggested Readings

1. Andrew B. Abel & Ben S. Bernanke, Macroeconomics, Pearson Education, Inc., 7th Edition, 2011
2. Dornbusch, Fischer and Startz, Macroeconomics, McGraw Hill, 11th Edition, 2010.
3. Errol D'Souza, Macroeconomics, Pearson Education, 2009.
4. N. Gregory Mankiw, Macroeconomics, Worth Publishers, 7th Edition, 2010.
5. Olivier Blanchard, Macroeconomics, Pearson Education, Inc., 5th Edition, 2009.
6. Paul R. Krugman, Maurice Obstfeld & Marc Melitz, International Economics, Pearson Education Asia, 9th Edition, 2012.
7. Richard T. Froyen, Macroeconomics, Pearson Education Asia, 2nd Edition, 2005.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1		H			
CO2	M			H	
CO3			H		H
CO4	H				
CO5		H		M	
CO6			H		

ENMM0048: MATHEMATICAL METHODS IN ECONOMICS (4-0-0)

COURSE OUTCOMES

1. Identify the body of basic mathematics that enables economic analysis (Remembering)
2. Explicate the usage of the concepts of mathematics in Economics (Understanding)
3. Apply mathematical techniques to elucidate economic problems (Applying)
4. Assess the role of economic theory and draw inference in context of mathematical techniques (Analysing)
5. Explain the solution concepts for economic problems with a variety of economic applications (Evaluating)

6. Develop or build mathematical models to analyse real economic problems (Creating)

Module I: Optimization with Equality Constraint (12 hours)
Solving Equality Constrained Optimization without Lagrange Multiplier; Lagrange Characterization – Single and Multi- constraint Cases; Complementary Slackness Condition; Sensitivity Analysis; Income Expansion Path

Module II: Optimization with Inequality Constraint and Input-Output Model (13 hours)
Binding and Non-binding Constraints; Solution with One and Two Inequality Constraints; Kuhn-Tucker Method; Mixed Constraints – Solution with Equality and Inequality Constraints; Basic Structure of Input-Output Model; Open and Closed Model; Hawkins-Simon Condition; Static and Dynamic Model

Module III: Difference and Differential Equations (15 hours)
Solution of First Order Difference Equations; Economic Applications; Solution of Second Order Difference Equations – Homogeneous and Non-Homogeneous Equations; Economic Applications of Second Order Homogenous and Non-Homogeneous Equation – Cobweb Market Model, Market Model with Inventory, Determining Dynamic Market Equilibrium Price; Plotting Differential Equation – Phase Diagram

Module IV: Basic Game Theory (20 hours)
Appraisal of Normal Form Games; Games with Perfect Information – Strategic Games, Nash Equilibrium and Existence Properties, Application to Market Equilibrium and Pricing; Extensive Form Games with Perfect Information – Pure Strategy and Nash Equilibrium, Sub-game Perfect Equilibrium, Backward Induction, Bargaining Game (Split-the-Pie); Extensive Form Games with Imperfect Information – Principles for the Equivalence of Extensive Games, Mixed and Behavioural Strategies, Nash Equilibrium; Repeated Games – Finitely Repeated Games and Backward Induction, Infinitely Repeated Games; Dependent Strategies

Suggested Readings

1. Allen, R.G.D., Mathematical Analysis for Economists, Macmillan and Co Ltd.
2. Chiang A.C. & K. Wainwright, Fundamental Methods of Mathematical Economics, McGraw Hill International Edition
3. Hoy, L., Mckenna, Rees & Stengos, Mathematics for Economics, Prentice Hall, 2004.
4. J. M. Henderson and R. E. Quandt, Micro-economic Theory – A Mathematical Treatment
5. K. Sydsaeter & P. Hammond, Mathematics for Economic Analysis, Pearson Educational Asia: Delhi, 2002.
6. T. Yamane, Mathematics for Economist: An Elementary Survey, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2	M			
CO3				H
CO4	H			M
CO5			H	
CO6		M	H	

ENEO0049: ECONOMICS OF DEVELOPMENT (4-0-0)

COURSE OUTCOMES

1. Define the key aspects of economic development. (Remembering)
2. Explain the role of various measurement of economic development. (Understanding)
3. Identify the various theories and approaches to economic development. (Applying)
4. Analyse the uses of various development theories of growth. (Analyzing)
5. Explain the importance of development theories. (Evaluating)
6. Discuss the various key aspects of dualistic development theories and its applicability. (Creating)

Module I: Measurement of Economic Development (10 Hours)
Measurement of economic development – National Income/GDP and Per Capita Income as an Index of Development; Alternative Measures of Development Gap: HDI, GDI and related indices; Structural Changes in the Development Process – Kuznets

Module II: Theories and Approaches to Economic Development (17 Hours)
Evolution in the Concept of Economic Development – Growth to Sustainable Development; Approaches to Development – Income Approach and Criticism; Sen's Capability Approach; Establishment Space in Economic Development; Theories of Economic Development – Karl Marx and Development of Capitalist Economy; Theory of Social Change; Surplus Value and Profit

Module III: Theories of Growth (15 Hours)
Summary of Classical Growth Models – Structural Model and Limitations; A Brief Review of Neo-classical Growth Models – Production Function in Neo-classical Growth; Instability of Growth; Solutions of Instability Problem; The Convergence Debate; Endogenous Growth Models – Arrow, Uzawa-Locus, Romer; The New Economic Geography – Krugman

Module IV: Development Strategies and Dualistic Pattern of Development (18 Hours)
Big Push – Rosenstein-Rodan; Balanced Growth – Nurkse; Unbalanced Growth – Hirschman; Critical Minimum Efforts – Leibenstein; Structural Change Models - Lewis, Fei-Renis; Rural-Urban Migration– The Harris-Todaro Model; Core- Periphery Models; The Process of Cumulative Causation – Myrdal; Neo-Colonial Dependence Model

Suggested Readings

1. Barro & Salai-Martin, Economic Growth, Prentice Hall of India.
2. Basu, K., Analytical Development Economics: Oxford Economic Papers.
3. Meier, G.M., Leading Issues in Economic Development, Oxford Economic Papers.
4. Roy, D., Development Economics, Oxford Economic Papers.
5. Thirlwal, A. P., Growth and Development, Palgrave.
6. Todaro, M.P., Development Economics, Pearson.
7. UNDP, Human Development Reports, Oxford Economic Papers.
8. World Bank, World Development Reports, Oxford Economic Papers.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1		M		
CO2	M	H		
CO3				H
CO4			H	
CO5				H
CO6			H	

ENMB0050: MONEY AND BANKING (3-0-0)

COURSE OUTCOMES

1. Learn basic ideas of monetary theory and the effects of monetary variables on the macroeconomic system.(Remembering)
2. Understand the working of non-banking financial institution and international financial institutions. (Understanding)
3. Develop the ability to understand the role of monetary forces and real forces and their interconnection in shaping and influencing the monetary and related policies both at the national and international levels. (Applying)
4. Understand the working of Indian baking system and the inter connectivity of the banks. (Analyzing)
5. Enable to evaluate the trend of financial reform in the field of financial inclusion. (Evaluating)
6. Understand the various determinant of demand and supply of money and its role in balancing the growth of theeconomy. (Creating)

Module I: Supply and Demand for Money (11 hours)
Money Supply – Theoretical and Empirical Attempts to Define Money; Components of Money Supply; Money Creation by the Banking System; High Powered Money and Money Multiplier; Measures of Money Supply and Liquidity in India; Balance Sheet of Central Bank; Demand for Money; Interest Sensitivity of Demand for Money – A Review of Classical, Keynesian and Monetarist Theories of Demand for Money

Module –II: Theories in Rate of Interest (12)
Term Structure of Interest Rates; Expectations Theory; Liquidity Premium Theory; Structure of Interest Rates in India; Monetary Policy – Targets, Goals and the Trade Offs among Alternate Goals; Lags in Operation; Keynesian and Monetarist Views on Transmission Mechanism; Rules vs. Discretion

Module-III: Banking Structure in India (11 hours)
Central Banking – Main Functions; Policy Tools, Recent Monetary Policy of RBI; Money Aggregates Targeting; Interest Targeting and Inflation Targeting Approaches of RBI; Autonomy of RBI; Commercial Banking – Types of Commercial Banks in India; Credit Creation Process; Major Developments in Commercial Banking in India since Reforms (including Mergers); Recent Developments on Financial Inclusion; Performance of Private and Public Banks

Module –IV: Non-Banking Financial Institutions (11 hours)
Role, Growth and Structure of Non-Banking Financial Institutions (NBFIs) in India; Types and Control of Non-Banking Financial

Companies (NBFCs); International Monetary System: IMF as provider of International Liquidity; Constituents of International Money and Capital Markets

Suggested Readings

1. Bhole, L.M., Financial Institutions and Markets. Tata Mcgraw Hill. 2016.
2. Bofinger, P., Monetary Policy: Goals, Institutions, Strategy and Instruments. Oxford University Press, 2001.
3. Dennis Geoggrey, E.J., Monetary Economics, Longman, 1981.
4. Desai, V., The Indian Financial System and development, Himalaya Publishing House, 2019.
5. Diulio, A. E., Theory and Problems of Money and Banking, International Edition (Schaum's Outline Series), 1987.
6. Fabozzi, F. J. & Franco, Capital Markets Institutions and Instruments, (4th ed.), New Jersey: Prentice Hall, Modigliani, 2009.
7. Gordon, E. & Natarajan, K., Financial Markets & Services, Himalaya Publishing House, 2019.
8. Handa. J., Monetary Economics, 2nd Edition, Routledge, London, 2009.
9. Howells, P. & Bain, K., The Economics of Money, Banking and Finance, Prentice Hall, Pearson Education Ltd., 2002.
10. Khan, M.Y., Indian Financial System, Tata Mcgraw Hill, 2017.
11. Kulkarni, G., Modern Monetary Theory, New Delhi: Macmillan, 1999.
12. Mankiw, N.G., Macro-economics. New York: Macmillan, Worth Publishers, 2008.
13. Mohan, R., Monetary Policy in a Globalized Economy – A Practitioner's View, Oxford University Press concerned, 2009.
14. Walsh, Carl E., Monetary Theory and Policy, Third Edition, The MIT Press Cambridge Massachusetts, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2			M	
CO3		H		
CO4			H	
CO5		M		H
CO6				H

ENIP0051: INDIAN ECONOMIC DEVELOPMENT (3-0-0)

COURSE OUTCOMES

1. Learn the key issues related to the Indian economy. (Remembering)
2. Understand the economic reforms and its impact on Indian economy. (Understanding)
3. Identify the policies and performance in different sector (Applying)
4. Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Analyzing)
5. Explain the economic reform and its impact in Indian economy. (Evaluating)
6. Discuss their understanding of the usefulness of various development policies. (Creating)

Module I: Indian Economic Development: An Overview (10 hours)

Growth and Structure of the Indian Economy – Planned Economic Development, Development Strategy after Independence; Economic Growth, Distribution and Structural Change since Independence; Critical Evaluation of Trendand Issues in Demography – Education, Health, Poverty, Inequality, Unemployment

Module II: Economic Reforms (12 hours)

Economic Reforms Since 1991 – Liberalization, Privatization, Globalization; Major Developments in Post EconomicReforms Period; Critical Evaluation of the Changing Structure of the Indian Economy – Pre and Post-reform Eras

Module III: Sectoral Development (13 hours)

Issues and Concern in Indian Agriculture – Land Reform, Green Revolution, Agricultural Price Policy; Agriculture and WTO; Industrial Development in India – Industrial Growth since 1991, New Industrial Policy and its Impact; Trends in Exports and Imports – Foreign Trade Policy; Assessment of Performance of Service Sector in India in the Contemporary Period

Module IV: Macroeconomic Policies and their Impact in Indian Economy (10 hours)

Financial Sector Reform and Impact of Monetary Policy; Reforms in Banking Sector; Capital Market and its Reform; Reforms in fiscal Policy – Fiscal Responsibility and Budget Management (FRBM) Act; Reform in Indian Labour Market inPost-liberalization Period

Suggested Readings

1. Kapila, U., Economic development and policy in India, Academic Foundation, 2009.

2. Rakesh Mohan, India's Financial Sector and Monetary Policy Reforms, in Shankar Acharya and Rakesh Mohan, Editors,
3. India's Economy: Performances and Challenges: Development and Participation, Oxford University Press, 2010.
4. Pulapre Balakrishnan, The Recovery of India: Economic Growth in the Nehru Era, Economic and Political Weekly, November, 2007.
5. Pulapre Balakrishnan, Ramesh Golait & Pankaj Kumar, Agricultural Growth in India Since 1991, RBI DEAP Study No. 27,2008.
6. Rakesh Mohan, India's Financial Sector and Monetary Policy Reforms, in Shankar Acharya and Rakesh Mohan, editors,
7. India's Economy: Performances and Challenges: Development and Participation, Oxford University Press, 2010.
8. A. Ahsan, C. Pages & T. Roy, Legislation, Enforcement and Adjudication in Indian Labour Markets: Origins, Consequences and the Way Forward, in D. Mazumdar and S. Sarkar, Editors, Globalization, Labour Markets and Inequality in India, Routledge, 2008.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H
CO5			H	
CO6				L

ENSM0052: STATISTICAL METHODS IN ECONOMICS (4-0-0)

COURSE OUTCOMES

1. Define and explain the measures and approaches of various statistical tools and techniques (Remembering & Understanding)
2. Apply statistical distribution and probability theory for estimation (Applying)
3. Analyze the results of hypothesis testing and statistical inferential outcomes (Analysing)
4. Evaluate the underlying assumptions of various analysis tools and techniques and suggest recommendations to the decision making processes (Evaluating & Creating)

Module I: Distribution Theory (15 hours)

Review of Distribution Theory – Discrete and Continuous Distribution; Truncated Distribution – Poisson Only; Compound Distribution – Binomial, Poisson; Random Vectors; Joint Distributions; Variance-covariance Matrix; Transformations of Bivariate Random Variables; Bivariate Normal Distributions

Module II: Probability Theory (15 hours)

Review of Axiomatic Approach to Probability and Baye's Theorem; Expectations of Functions of Random Variables; Conditional Expectation and Distribution; Conditional Variance; Applications; Characteristic Function of a Random Variable

Module III: Sampling Techniques (15 hours)

Basics of Sampling – Random and Non-random sampling; Random Sampling and Estimates of a Population Mean; Ratio Method Estimation – Concept, Bias; Ratio Estimators in Simple Random Sampling and Stratified Random Sampling

Module IV: Statistical Inference (15 hours)

Methods of Constructing Estimators; Theory of Hypothesis Testing – Test Function, Randomized and Non-randomized Tests; Interval Estimation – Confidence Intervals; Relationship with Tests of Hypotheses; Inference on Population Mean – Comparing two Population Means; Inference on Variance – Comparing two Population Variance; Likelihood Ratio Tests and their Properties; Large Sample Theory – Delta Method; Derivation of Large Sample Standard Error

Suggested Readings

1. Johnson N. L. & Kotz. S., Distributions in Statistics Vol-I, II and III, John Wiley and Sons, New York, 1996
2. Rohatgi, V. K., Introduction to Probability Theory and Mathematical Statistics
3. Larsen, R., Marx, M. An introduction to mathematical statistics and its applications, Prentice Hall, 2011.
4. Miller, I., & Miller, M., J. Freund's mathematical statistics with applications, 8th ed, Pearson, 2017

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M		

CO2	M		H	
CO3		M		H
CO4			H	

ENEM0053: ECONOMETRIC METHODS (4-0-0)

COURSE OUTCOMES

1. Define the basic concepts of econometrics and statistics. (Remembering)
2. Explain the concepts of simple linear regression and its associated topics. (Understanding)
3. Apply the regression models estimating regression parameters using OLS. (Applying)
4. Analyse the results of regression models with hypothesis testing and different statistical tests. (Analysing)
5. Evaluate the regression models along with diagnostics and model specification. (Evaluating)
6. Create and design hypothesis of economic problems and advance regression models with qualitative variables.(Creating)

Module I: Linear Regression and Diagnostic Analysis (18 hours)

Overview of the Classical Linear Regression Models - Simple and Multiple; Methods of Estimation-Methods of Moments, Method of Least Squares, Maximum Likelihood Method; Properties of Estimator; Goodness of Fit - R Square and Adjusted R Square; Hypothesis Testing for Regression Coefficients; Analysis of Variance (ANOVA); Problems with Linear Regression - Specification Bias, Autocorrelation, Heteroscedasticity, Multicollinearity; Outliers – Leverage and Influence; Tests for Outliers; Test for Linearity; Tests of Omitted Variables

Module II: Advanced Models in Regression (12 hours)

Use of Instrumental and Dummy Variables; Models with Qualitative Dependent Variables – Probit, Logit and Tobit Probability Models; Simultaneous Equation Models – Nature and Problems; Simultaneity Bias; Structural, Reduced-form and Recursive Models; Identification Problem – Rank and Order Conditions; Identification and Multicollinearity; Over Identified Linear Model – Generalised Method of Moments

Module III: Estimation of Simultaneous Equation Models (10 hours)

Indirect Least Squares (ILS); Method of Instrumental Variables (IV); Two Stage Least Squares (2SLS); Limited-Information Maximum Likelihood Method; Exogeneity and Causality – Weak and Strong Exogeneity, Tests for Exogeneity, Granger Causality

Module IV: Dynamic Econometric Models (10 hours)

Lagged Variables – Meaning and Importance; Distributed Lag Models – Koyck and Almon Approaches; Autoregressive Models – Partial Adjustment Model and Adaptive Expectation Models

Module V: Basics of Time Series Analysis (10 hours)

Stationary and Nonstationary Time Series; Box-Jenkins Approach; Unit Roots Tests – Null and Alternative Hypotheses under Unit Root Tests; Cointegration and Cointegrating Regression

Suggested Readings

1. Dougherty, C., Introduction to Econometrics, 4th ed., Oxford University Press, 2011.
2. Gujarati, D., & Porter, D., Essentials of Econometrics, 4th ed., McGraw-Hill, 2010.
3. Kmenta, J., Elements of Econometrics, Khosla Publishing House, 2008.
4. Maddala, G., & Lahiri, K., Introduction to Econometrics, 4th ed., Wiley, 2009.
5. Maddala, G.S., Introduction to Econometrics, 3rd Ed, Wiley India, 2009.
6. Madnani, G.M.K., Introduction to Econometrics: Principles and Applications, CBS Publishers & Distributors, 2009.
7. Wooldridge, J., Introduction to Econometrics: A Modern Approach, 5th ed., Cengage Learning, 2014.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				M
CO 2				H	
CO 3	H			M	
CO 4		H	M		H
CO 5	H		H		
CO 6		H			

ENPS0054: PUBLIC ECONOMICS (4-0-0)

COURSE OUTCOMES

1. Define the main concepts in public economic policies. (Remembering)
2. Explain the concepts of public goods, public expenditures and taxation. (Understanding)

3. Identify the main issues of budgeting and fiscal policies. (Applying)
4. Evaluate economic concepts of income redistribution. (Analyzing)
5. Explain the evaluation of public investment projects and decision making in the public sector. (Evaluating)
6. Discuss their understanding of the usefulness and problems related to government subsidies and income support (Creating)

Module I: Government Activity and Public Economic Policies (15 hours)
Efficiency, Markets and Governments – Markets, Prices, Efficiency Conditions; Market failure – A Preview of the Basis for Government Activity and the Functions of the Government; Equity vs. Efficiency – Positive and Normative Analysis; Externalities and Government Policy – Market Failures, Externalities and Efficiency; Public Choice Theory – Meaning, Outcomes of Collective Choice; The Choice Process – Unanimity, Majority Rule, Cyclical Voting and the Voting Paradox, Arrow's Theorem

Module II: Theories of Public Goods, Public Expenditures and Taxation (15 hours)
The Theory of Public Goods; Provision of Private Goods and Public Goods – Markets and Government; The Demand for a Pure Public Good; Efficient Output of a Pure Public Good – Partial and General Equilibrium Analysis; Individual Action; Voluntary Cooperation and Efficiency; Local Public Goods; Voting Models of Public Goods; The Theory of Public Expenditure –Tiebout, Samuelson, Buchanan; Theories of Taxation; Tax Neutrality; Direct vs. Indirect Taxes and Equity; Buoyancy and Elasticity Estimates of Taxation; Tax Efforts; The impact of Taxes on Market Prices and Efficiency

Module III: Budgeting, Fiscal Policies and Income Redistribution (15 hours)
Program Budgeting – It's Application; Zero-Based Budgeting; Budgeting Policies; Theory of Fiscal Policy; Fiscal Policy with Special Reference to Under-developed Countries; Federal-Fiscal Relation in India; Income Redistribution – Taxes, Government Expenditures and the Distribution of Income, Welfare, Social Security and the Social Safety Net; Demographic Changes and the Future of Social Security; The Impact of Social Security on Savings and Work Incentives; Government Subsidies and Income Support – The Basis and Trade-off

Module IV: Public Investment Projects and the Public Sector (15 hours)
Public Utilities and Project Evaluation – Cost-Benefit Analysis; Distributional and Political Considerations; Problem of Government Failure – Privatization, Devolution, Rules vs. Discretion; Citizen Decision Making; Public and Private Sectors – Lack of Residual Claimant, Citizens and Rational Ignorance, Collective vs. Individual Consumption, Lack of Revealed Preference; Measuring and Valuing Public/Private Output

Suggested Readings

1. Buiter, W.H., Principles of Budget and Fiscal Policy, MIT Press, 1990.
2. Browning E K & Browning J M, Public Finance and the Price System, Pearson Education, Singapore.
3. Hyman D N, Public Finance: A Contemporary application of Theory to Policy,Thomson South Western
4. Jha, Raghbendra, Modern Theory of Public Finance, Wiley Eastern, Delhi, 1987.
5. Ulbrich, H., Public Finance in Theory and Practice, Thompson South Western.
6. Mukherjee, S., Ghose, A. & Nag, N. N., Analytical Public Finance. Public Economics – Public Choice - Public Policies, NewCentral Book Agency (P), Kolkata
7. Musgrave, Richard A., The Theory of Public Finance, Tata McGraw Hill, N.Y., 1959.
8. Ghosh A & Ghosh C, Public Finance, PHI Learning Private Limited, Delhi.
9. Musgrave & Musgrave., Public Finance in Theory and Practice, McGraw Hill, Singapore.
10. Cullis, John & Jones, Philip, Public Finance and Public Choice, McGraw Hill.
11. Ursula, H., Public Finance, James Nisbet and Co., London, 1968.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2		H	H	
CO3		M		M
CO4			H	
CO5			M	
CO6				H

ENDV0055: INDIAN ECONOMIC DEVELOPMENT AND POLICY (4-0-0)

COURSE OUTCOMES
1. Understand the recent economic reforms in Indian economy since 1991. (Remembering)
2. Explain the sector wise reform ranging from agriculture to service sector and foreign trade as well. (Understanding)

3. Identify the main issues of reform and policy debate and its performance in Indian Economy. (Applying)
4. Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Analyzing)
5. Explain the trends and performance in service sectors. (Evaluating)
6. Discuss their understanding of the usefulness of various development policies. (Creating)

Module I: Economic Reforms Since 1991 (14 hours)
Indian Economy During Reforms – An Assessment; Main Aspects of New Economic Policy and its Relevance; Recent Issuesof Indian Economy – National Institution for Transforming India (NITI Aayog), Demonetization, Goods and Service Tax (GST), The Insolvency and Bankruptcy Code (IBC), Digital India, Make in India

Module II: Sectoral Development and Recent Reforms (18 hours)
Issues and Concern in Indian Agriculture – Agriculture Price Policy, Farm Law, Indian Agricultural Industry Reform; Industrial reform – MSME Development, Impact of Financial Reforms on Industrial Sector; Foreign Trade – Current Position of Balance of Payments of India, Export-Import Policy (EXIM); Foreign Direct Investment (FDI); Service Sector –Reasons for Rapid Service Sector Growth, Information and Communications Technology (ICT), India's Information Technology (IT) and ITES Industry

Module III: Major Issues of Indian Economy (15 hours)
Poverty, Inequality and Inclusive Growth – A Critical Assessment; Employment and Unemployment – Policy Implications;Rural Development – Role of Cooperatives, Agriculture Diversification, Organic Farming; Sustainable Economic Development; Privatization and Disinvestment Debate; Regional Imbalances

Module IV: Performance of Indian Economy (13 hours)
Indicators of Development – Physical Quality of Life Index (PQLI), Human Development Index (HDI), Gender DevelopmentIndices (GDI); Inequality-Adjusted Human Development Index Indicators of India's Economic Performance – Fiscal and Financial Sector Reforms and Recent Changes in the Policy; Recent Changes in Monetary Policy in India and its Impact; Centre State Finance Relations; Finance Commission in India

Suggested Readings
1. Dutt Rudder & K.P.M Sunderam, Indian Economy. S Chand & Co. Ltd. New Delhi, 2017.
2. Mishra S.K & V.K Puri, Indian Economy and – Its Development Experience. Himalaya Publishing House, 2017.
3. Kaushik Basu, The Oxford Companion to Economics of India, Oxford University Press, 2007.
4. Kapila U, Indian economy since independence, Academic foundation, New Delhi
5. Government of India, Economic Survey (Annual), Economic Division, Ministry of Finance, New Delhi.
6. Ahluwalia, I.J. & I.M.D. Little (Eds.), India's Economic Reforms and Development (Essays in honour of Manmohan Singh),
7. Oxford University Press, New Delhi, 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		M		
CO3	M		H	
CO4				H
CO5		H	H	
CO6				M

ENPB0056: PUBLIC FINANCE (3-0-0)

COURSE OUTCOMES
1. Know about Indian tax system and its type and reforms over the years (Remembering)
2. Discuss the various types of grants available and the mechanism of availing those grants (understanding)
3. Develops analytical framework that facilitates the evaluation of public policy and subsequently inform the publicdebate. (Applying)
4. Evaluate the process of budget allocation and discuss the trend of government expenditure (Analyzing)
5. Examining the working of various international financial institution in the context of globalization (Evaluating)
6. Develop administrative skill with the knowledge of government fiscal policy (creating)

Module I: Taxation and Budget: (13 hours)
Indian Tax System; Revenue of the Union; Major Taxes in India; Base of Taxes; Direct and Indirect Taxes; Reforms in Directand Indirect Taxes; Taxes on Goods and Services – GST; Analysis of Central and State Government Budgets; Kinds of Budget; Different Concepts of Budget Deficits; Lack of Flexibility in Central and State Budgets; Shrinking Size of Development Finance Through Budgets; Trends in Public Expenditure; Non Plan Expenditure; Growth of Subsidies Public Debt; Trends in Internal and

External Debt; Crowding out of Private Investment and Activity; Devolution of Resources and Grants; Reports of Finance Commissions in India; Transfer of Resources from Centre and State to Local Bodies; PanchayatiRaj Finances

Module II: Government expenditure and Theories of Public Expenditure (11 hours)
Public Policy and Expenditure Allocation of Resources; Provision of Public Goods; Voluntary Exchange Models; Demand Revealing Schemes for Public Goods; Contributions of Clarks; Groves and Leyard; Tiebout Model; Stabilization Policy; Keynesian Case for Stabilization Policy; Wagner's Law of Increasing State Activities; Wiseman-Peacock Hypothesis; Pure Theory of Public Expenditure; Structure and Growth of Public Expenditure; Criteria for Public Investment; Social Cost- benefit Analysis

Module III: Deficit Financing: Concept and its Relation with Inflation (10 hours)
Deficit Financing in India; Issues Relating to Public Debt; Debt Burden Analysis and Management of Public Debt; Domar's concept of Debt Sustainability; Public Debt in India; Need for Rule Based Fiscal Consolidation; Fiscal Responsibility and Budget Management (FRBM) Act 2003; Recent Amendments to FRBM Act

Module IV: Intergovernmental Grants in Theory and Practice (11 hours)
Growth and Decline of Federal Grants; Purposes of Grants; Correcting Spatial Externalities; Redirecting Priorities; Types of Grants – General Purpose vs. Categorical, and Project grant. Lump-sum or Matching, Open-ended vs. Close-ended, Matching Grants; Various Classification; Efficiency and Equity Effects of Grants; Indifference Analysis of Grants;

Suggested Readings

1. Aronson, J.R., Public finance, New York: McGraw-Hill International, 1985.
2. Atkinson, A.B., & Stiglitz, J.E., Lectures on public economics. New Jersey: Princeton University Press, 2007.
3. Basu, K., & Maertens, A., The new Oxford companion to economics in India, New York: Oxford University Press, 2012.
4. Bhatia, H. L., Public Finance, Vikas Publishing House Private Ltd., 2006.
5. Brown, C.V., & Jackson, P. M., Public Sector Economics, United Kingdom: Wiley-Blackwell, 1990.
6. Buchanan, J. M., & Musgrave, R. A., Public Finance and Public Choice: Two contrasting visions of the state, Cambridge,Massachusetts: MIT Press, 1990.
7. Cullis, J., Jones, P., & Jones, P.R., Public Finance and Public Choice: Analytical perspectives, New York: Oxford University Press, 2009.
8. Musgrave, R.A., & Musgrave, P.B., Public Finance in Theory and Practice, New York: McGraw Hill Book Company, 1989.
9. Rao, M.G., & Sen, T. K., Fiscal Federalism in India: Theory and Practice, Macmillan India, 1996.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1		M		
CO2	H			
CO3		H		
CO4			H	
CO5	H			M
CO6				H

ENRM0057: RESEARCH METHODOLOGY IN ECONOMICS (4-0-0)

COURSE OUTCOMES

1. Describe the different types of research and the needs of research in Economics (Remembering)
2. Identify the essential conditions helpful for the formulation of research hypothesis and evaluate the various tools and techniques of sampling to collect data (Understanding and Applying)
3. Gain knowledge of statistical software for analyzing data and assess the relative importance of various analytical tools and techniques (Analyzing and Evaluating)
4. Formulate logical arguments for a research problem (Creating)

Module I: Basics of Research (10 hours)

Meaning, Types, Characteristics and Scope of a Scientific Research; Steps Involved in Scientific Research; Literature Review and Identification of a Research Gap; Formulation and Types of Hypothesis and/or Research Questions; Objectives; Research Design; Reference and Documentation; Limitations and Ethical Issues in Research

Module II: Sample Design and Data Processing (12 hours)

Nature and Sources of Data; Types of Data – Cross Sectional, Time Series, Pooled; Accuracy of Data; Types of Sampling, Determination of Sample Size, Sampling Procedure; Choice of Sampling Technique; Errors in Sampling; Processing of Data; Validation of Field Work; Editing and Coding; Classification and Presentation

Module III: Data Analysis (15 hours)

Qualitative and Quantitative Analysis; Univariate and Multivariate Analysis; Descriptive and Inferential Analysis; Testing of Hypotheses – Single and Multiple Comparison; Non-Parametric Tests; Test for Randomness; Advanced Data Analysis Techniques; Multidimensional Scaling; Basics of Computer and its use in Research; Introduction to Different Software (Excel, SPSS, STATA, EVIEWS, etc.); Entering Data in Software; Defining and Recoding Variables; Computing new Variables; Data Analysis with Statistical Software (Use Practical Examples)

Module IV: Report Writing and Interpretation of Results (10 hours)

Types of Report; Importance of Report; Steps in Report Writing; Citation Styles; Footnotes and Bibliography; Presentation and Interpretation of Results; Research Findings and Suggested Recommendations

Module V: Statistical Software for Data Analysis (13 hours)

Basics of Computer and its use in Research; Introduction to Different Software (Excel, SPSS, STATA, EVIEWS, etc.); Entering Data in Software; Defining and Recoding Variables; Computing new Variables; Data Analysis with Statistical Software (Use Practical Examples)

Suggested Readings

1. Krishnaswamy, O.R., Research Methodology in Social Science, Himalaya Publishing House, Bombay, 2002.
2. Jerry W. Willis, Foundations of Qualitative Research: Interpretive and Critical Approaches, Sage
3. Tandon, B.C., Research Methodology in Social Sciences
4. Subramanian, N., Introduction to Computers
5. Bruce, B. & Howard, L., Qualitative Research Methods for the social sciences, London: Pearson, 2014.
6. Flick, U., An Introduction to Qualitative Research, Sage Publications, 2014.
7. Bryman Alan, Social Research Methods, Oxford University Press, Oxford

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		M		H	
CO3	H				H
CO4			M		

ENES0058: ENVIRONMENTAL ECONOMICS AND SUSTAINABILITY (4-0-0)

COURSE OUTCOMES

1. Define the basic concepts of environmental economics, including its key principles and methods. (Remembering)
2. Understand the environmental issues in relation to the theory of externalities, public goods, and welfare. (Understanding)
3. Apply environmental principles concerning the choice of instruments for controlling pollution and the relative strength and weaknesses of environmental policies based on command-and-control and market-based instruments.(Applying)
4. Analyze environmental problems using various economic techniques and to assess various environmental policies and issues. (Analysing)
5. Evaluate and examine the methods developed for valuing environmental goods and services for sustainabledevelopment. (Evaluating)
6. Develop and design various approaches to examine issues in the contemporary environmental discourse from and economists' point of view. (Creating)

Module I: Economics of Resources (12 hours)

Economics of Natural Resources; Resources and its Management; Optimal use of Renewable Resources; Common Property Resources and Open Access; Tragedy of Commons; Non-renewable Resources – Economic Issues Relating to use of Non-renewable Resources; Optimal Depletion; Backstop; Exploration and Technological Progress

Module II: Environmental Issues and Regulation (13 hours)

Problems of Market Failure - Public Bads and Externalities; Environment Degradation as Market Failure; Externality – Environmental Damage as Negative Externality; Social Choice of Optimum Pollution; Pigouvian Tax; Coase Theorem; Property Rights; Pollution – Environmental Pollution as a Public Bad; Optimal Pollution; Pollution Control – Market Based Instruments, Emission Fees, Tradable Pollution Permits, Hybrid Instruments, Double Dividend Hypothesis; Environmental Policies in India

Module III: Valuation of Environmental Goods (15 hours)
Ordinary Goods vs. Environmental Goods; Use and Non-use Values; Willingness to Pay and Willingness to Accept; Valuation Methods for Environmental Goods; Direct Methods or Stated Preference Methods – Contingent Valuation;Indirect or Revealed Preference Methods – Hedonic Pricing Method, Travel Cost Method

Module IV: Global Environmental Concerns and Sustainable Development (20 hours)
Climate Change, Loss of Biodiversity, Ozone Depletion, Pollution Havens; Sustainable Development – Concept, Notions and Different Approaches to Sustainability; Measurement of Sustainability; Sustainable Accounting – United Nations' System of Environmental and Economy Accounting; Brundtland Commission; Sustainable Industrialization; EnvironmentalImpact Assessment; Meaning of Resource Conversation; Material Substitution; Recycling – Optimum Recycling; Waste Management; Micro Planning for Eco-preservation – Watershed and Joint Forest Management, Wildlife Management; Role of International Organizations – IPCC, UNEP, Earth System Governance Project

Suggested Readings

1. Bhattacharya, Rabindra N., Environmental Economics: An Indian Perspective, New Delhi: Oxford University Press, 2002.
2. Hanley, N., J.F. Shogren & B. White, Environmental Economics in Theory and Practice, Macmillan, 1997.
3. Kolstad, Charles D., Environmental Economics, Oxford University Press, New Delhi, 1999.
4. Lewis, Lynne, & T. H. Tietenberg, Environmental Economics and Policy, Routledge, 2020.
5. Pearce, DW & R. Turner, Economics of Natural Resource Use and Environment, John Hopkins Press, Baltimore, 1991.
6. Seneca, Joseph J., & Michael K. Taussig, Environmental Economics, New Jersey: Prentice-Hall, 1984.
7. Shankar, U., Environmental Economics, Oxford University Press, New Delhi, 2001.
8. Tietenberg, T., Environmental Economics and Policy, Harper Collins, New York, 1994.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2				
CO 3	M		H	
CO 4		M		M
CO 5		H		
CO 6				H

ENEG0059: AGRICULTURE ECONOMICS – ISSUES AND MANAGEMENT (4-0-0)

COURSE OUTCOMES
1. Draw distinctive features of agriculture resources and production (Remembering)
2. Recognize and identify different market forms and role of government in agriculture credit (Understanding and analyzing)
3. Explain the trade-off between agriculture and non-agriculture to achieve sustainable agricultural development and in sensitizing overall development (Evaluating)
4. Use of economic theories in optimizing the production and distribution of agricultural products (Creating)

Module I: Agricultural Resources and Production (15 hours)
Resources in Agriculture; Land as a Resource; Land Capability; Issues in Utilization of Land; Competition for Agricultural Land; Effects of Urbanization; Land Degradation; Water as a Resource; Institutional Arrangements and Issues in Water Allocation; Managing Disasters – Drought, Flood, Famine; Production Function in Agriculture; Substitutability of Factors; Farm Size and Laws of Return

Module II: Agricultural Markets and Pricing (20 hours)
Role of Marketing in Agriculture; Scope of Agricultural Marketing; Characteristics of Agricultural Commodities; Classification of Markets; Producer's Surplus-Marketable and Marketed Surplus; Marketing Functions, Approaches to Marketing Efficiency Estimators; Marketing Approaches; Market Structure Approaches; Problems in Agricultural Marketing; Suggestions to Improve Agricultural Marketing; Role of Government in Agricultural Marketing

Module III: Agricultural Finance (13 hours)
Function of Prices; Types of Price Instability; Measurement of Instability; Cobweb Model; Problems of Agricultural Credit in India; Need for Agricultural Finance; Requisites of Good Credit System; Classification of Credit or Loss; Institutional Agencies in Agricultural Credit; Co-operative Movement in India; Higher Financing Agencies; Programmes of Rural Development

Module IV: Farm Management (12 hours)

Meaning and Scope; Farm Management-its Relationship with other Sciences; Farm Management Decisions; Law of Diminishing Returns; Principle of Factor and Product Substitution; Equi-marginal Returns; Principle of Comparative Advantage; Types of Farming; Farm Planning- Characteristics and Limitations; Size of Farm- Factor influencing Size of Farm; Farm Efficiency Measures- Physical Efficiency and Financially Efficiency

Suggested Readings

1. Acharya, S.S. & Agarwal, N.L., Agricultural Marketing in India. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 2012.
2. Johl, S.S. & Kapur, T.R., Fundamentals of Farm Business Management, Kalyani Publishers, Ludhiana, 2006.
3. Kahlon, A.S. & Singh, K., Managing Agricultural Finance: Theory and Practice, Allied Publisher Ltd., New Delhi, 1984.
4. Lekhi, R. K. & Singh, J., Agricultural Economics: An Indian Perspective, Ludhiana: Kalyani Publishers, 2015.
5. Penson, Capps, Rosson & Woodward, Introduction to Agricultural Economics, 7th Edition
6. R. S. Despandey & Arora, S., Agrarian Crisis and Farmer Suicide, (eds.), Sage India Publications, 2010.
7. Reddy, S.S. & Ram, P.R., Agricultural Finance and Management, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.
8. Reddy, S.S., Ram, P.R., Sastry, T.V.N, & Devi, I.B., Agricultural Economics, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India, 2015.
9. Soni, R., Leading Issues in Agricultural Economics, New Delhi: Vishal Publishing, 2004

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3	M			H
CO4			M	

ENED0060: ECONOMICS OF EDUCATION (4-0-0)

COURSE OUTCOMES

1. Know Understand the concept of welfare economics and its applicability in education sector (Remembering)
2. Understand the educational financing from the point of view of Economics (Understanding)
3. Gain policy level understanding for improvement of health sector from economics prospective. (Applying)
4. Explore approaches of economic theory to health sector. (Analyzing)
5. The students can evaluate the investment pattern in education and also understand the direct and indirect benefits of education in development of society. (Evaluating)
6. Get an idea on various scopes to do research on education and health sector by applying the different economicstheories. (Creating)

Module I: Economics of Education (15 hours)

Human Capital – Types, Components; Human Capital Theory; Education as an Instrument for Economic Growth; Demand for Education; Supply of Education; Determinants of Demand for Education; Costs of Education – Private Costs, Social Costs; Benefits of Education – Direct, Indirect, Social; Wastage and Stagnation in Education – Causes and Measures; Manpower Planning –Meaning, Techniques of Forecasting

Module II: Education and Budget Allocation (15 hours)

Measurement and Trends; Correlation between Alternative Measures of Wellbeing; The Concept of Knowledge Economy – The Spread of Education across the World; Budgetary Allocations across Space and Time; Institutional Design;Alternative Systems for Service Delivery; The Role of Imperfect Information, Incentives and Contracts

Module III: Education and Planning (15 hours)

Approaches to Educational Planning – Production Function Models, Manpower Requirement Approach, Input-Output Model, Gender Based Approach; Educational Planning in Developing Countries with Special Reference to India; VocationalEducation in India; New Education Policy

Module IV: Discrimination and Inequality in Education (15 hours)

Models of Preference-based and Statistical Discrimination; Effective Policies to Address Historical Inequalities; Evaluating Policy Impact – The Estimation of Treatment Effects in Randomized Experiments and in Observational Data

Suggested Readings

1. Banerjee, A. & Somanathan, R., The Political Economy of Public Goods, 2007.
2. Becker G.S., Human Capital (2nd Edition), National Bureau of Economic Research, New York, 1974.
3. Becker, G., Investment in Human Capital: a Theoretical Analysis, The Journal of Political Economy, 70(5), 9-49, 1962.
4. Benabou, R., Workings of a City, Quarterly Journal of Economics, 108(3), 619-652, 1993.
5. Cohn E. & T. Gaske, Economics of Education, Pergamon Press, London.

6. Galanter, M., Competing Equalities: Law and the Backward Classes in India, University of California Press, 1984.
7. McMohan, W.W., Education and Development: Measuring the Social Benefits, Oxford University Press. 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4		H		
CO5			H	M
CO6				H

ENHE0061: HEALTH ECONOMICS (4-0-0)

COURSE OUTCOMES

1. Learn the detail concepts of health economics and application of economic concept in the health sector.(Remembering)
2. Develop ideas and critical understanding on the health system in the context of Indian scenario. (Understanding)
3. Identify the demand and supply gap in healthcare system to suggest healthcare professionals and policymakers. (Applying)
4. Assess the role of government in health care delivery system and identifying the scope of health financing. (Analyzing)
5. Evaluate the health care programmes and policy to provide decisions concerning the allocation of resources. (Evaluating)
6. Develop or build economic perspective for research problem in health sector. (Creating)

Module I: Basics of Health Economics (18 hours)

Concepts, Definition of Health Economics; Measures of Health Status; Topics in Health Economic Theory – Production Function of Health, Grossman's Model of Demand for Health; Supply-side Health Economics; Theory of Health Behavior;Market of Health Insurance

Module II: Economic Evaluation in Healthcare (18 hours)

Economic Evaluation in Healthcare – Concepts, Importance; Types of Economic Evaluation in Healthcare – Cost Minimization Analysis, Cost Effectiveness Analysis, Cost Benefit Analysis, Cost Utility Analysis; Health TechnologyAssessment – Basic Concept, Importance of HTA in Health Economics

Module III: Public Policy on Health (12 hours)

Public Policy in Health Care Delivery – Role of State, Rationale for Government Intervention in the Health Sector – Publicand Private sector; Health Financing; Concept and Calculating Methods of HALE, QALYs and DALYs

Module IV: Health Sector in India (12 hours)

Overview of Health Care in India; Health System of India – Post Reform Scenario; Health Outcomes; Socio-economic Determinants of Health; Different Dimension of Health - Poverty, Malnutrition, Gender Perspectives in Indian context

Suggested Readings

1. Henderson, J. W., Health Economics & Policy, (3e), Thomson South-Western, Latest Edition, 2007.
2. David Wonderling, Reinhold Gruen & Nick Black, Introduction to Health Economics, Open University Press, 2005.
3. Sherman Folland, Allen Goodman & Miron Stano, Economics of Health and Health Care, Routledge, 8th edition, 2017
4. Jack, W., Principles of Health Economics for Developing Countries, Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1999.
5. World Health Organisation, The economics of the social determinants of health and health inequalities: A resource book.World Health Organisation, 2013.
6. Stephen Morris, Nancy Devlin, David Parkin & Anne Spencer, Economic Analysis in Healthcare, 2nd Edition, Wiley, 2012.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M			
CO3		M	H	
CO4				H
CO5		H		H
CO6			M	

ENEI0062: ECONOMICS OF INDUSTRY (4-0-0)

COURSE OUTCOMES

1. Recall the concepts of micro economics concepts of price, market type, business motives (Remembering)
2. Understand basic models of the behaviour of firms and industrial organization and how they can be applied to policyissues (Understanding)
3. Assess economic situations – particularly those determining the relationships among firms within an industry and the strategies that each firm can adopt –, relate them to concrete problems and provide policy recommendations. (Applying)
4. Understand the minimal cost input factor quantities for a firm and optimal selling prices, supply quantities andresulting profits of firms in different market structures (Analyzing)
5. Discuss the need of competitive environment and the degree competition for a healthy functioning of a market. (Evaluating)
6. Develop the ability to calculate market concentration with different index and understand the relation between competition level and market concentration. (Creating)

Module I: Exploring the Subject Matter of Industrial Economics (15 hours)

Meaning, Scope, Need and Significance of the Study of Industrial Economics; Types and Choice of form of Organization; Business Motives – Alternatives Types of Motives/Goals; Industrial Profile – Private Sector, Large, Medium and Small Scale Industries; Integration; Industrial Combinations – Causes, Mergers and Amalgamations, Diversification

Module II: Theories of Industrial Location (15 hours)

Approaches to Industrial Location Analysis – Alfred Weber's Theory, Sergant Florence's Theory, Market Area Theory,Central Place Theory of Losch; Industrial Imbalances – Causes and Remedies; Government Policy and Approach for Backward Regions in India

Module III: Industrial Efficiency, Productivity and Pricing (15 hours)

Economic Efficiency – Meaning; Factors Determining Efficiency; Productivity – Norms and Measurement; The Competitive Environment; Market Concentration – Meaning and Measurement; Pricing in Practice – Cost-plus Pricing, Variable Cost Pricing, Target Rate of Return Pricing, The Going Rate Pricing, Transfer Pricing

Module IV: Indian Industrial Growth and Finance (15 hours)

Industrial Policy in India- Role of Public and Private Sectors; Trends in Indian Industrial Growth after 1991 Industrial Policy;Role of MSME in India; Sources of Industrial Finance – GDR, ADR; Disinvestment as a Sources of Finance; Choice of Funding – External vs. Internal Sources, Financial Statements – Balance Sheet; Profit and Loss Account; Analysis of Financial Ratios; Project Appraisal and Capital Budgeting

Suggested Readings

1. Barthwal, R.R., Industrial Economics, Wiley Eastern limited, New Delhi, 1985.
2. Cherunilam, F. Industrial Economics: Indian Perspective (3rd Edition), Himalaya Publishing House, Mumbai, 1994.
3. Desai, B., Industrial Economy of India, Himalaya Publishing House, Mumbai, 1999.
4. Divine, P.J. & R.M. Jones et. al., An Introduction to Industrial Economics, George Allen and Unwin Ltd., London, 1976.
5. Government of India, Economic Survey (Annual).
6. Hay, D.A. & Morris D.J., Industrial Economics: Theory and Evidence, Oxford University Press, New Delhi, 1979.
7. Mishra & Puri (latest edition), Indian economy, Himalaya publisher
8. Seth R., Industrial Economics, Ane Books Pvt Ltd.
9. Singh, A & A.N. Sandhu, Industrial Economics, Himalaya Publishing House, Mumbai, 1988.
10. Sivaya, K.V. & Das, V.B.M., Indian industrial economy, Sultan Chand, Latest edition.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2	H	M		
CO3			H	
CO4		H		
CO5			M	H
CO6				H

ENIN0063: INTERNATIONAL ECONOMICS (4-0-0)

COURSE OUTCOMES

1. Define and illustrate the key concepts, principles, models and practical applications of international economics including international trade and international finance. (Remembering & Understanding)
2. Apply the theories and models of international trade for economic growth and global welfare and critically comment on international economic policy. (Applying)

3. Analyse the links between trade, international finance, economic growth and globalization, with a particular emphasis on the experiences of developing countries. (Analysing)
4. Evaluate international trade policies regarding increase in exports, international debt, and international institutions to solve domestic problems like inflation, unemployment and value of currency etc. (Evaluating & Creating)

Module I: International Trade Theory (18 hours)
The Law of Comparative Advantage; Production Frontier with Increasing Costs; Gains from Trade with Increasing Costs; Offer Curves; Terms of Trade; Factor Endowments and the Heckscher-Ohlin Theory; Economies of Scale, Imperfect Competition and International Trade; Stolper-Samuelson Theorem; Specific Factors Model, Leontief Paradox; Technological Gap Model; Product Cycle Theory; The Gravity Model

Module II: International Trade Policy (12 hours)
Trade Restrictions – Tariffs, Partial and General Equilibrium Analysis of a Tariff, Optimum Tariff, Tariff structure; Nontariff Trade Barriers and the New Protectionism; Economic Integrations – Free Trade Areas, Customs Unions, Common Markets, Optimum Currency Area, Economic Union, Political Union; Dumping; Retaliation Against Dumping; International Cartels

Module III: Balance of Payments and Foreign Exchange Markets (10 hours)
Balance of Payments – Current and Capital Account; Foreign Exchange Markets – Types and Functions; Exchange Rates – Absolute and Relative Purchasing Power Parity Theory, Exchange Rate and the Balance of Payments, Portfolio Balance Model and Exchange Rates, Exchange Rate Dynamics; Spot and Forward Rates, Currency Swaps, Futures, and Options; Foreign Exchange Risks – Hedging, Speculation, Interest Arbitrage

Module IV: International Exchange Rate Determination (10 hours)
Exchange Rate Determination – Absolute Purchasing Power Parity Theory, Relative Purchasing-Power Parity Theory; Monetary Approach to Balance of Payments and Exchange Rate – Fixed Exchange Rates, Flexible Exchange Rates;

Module V: International Resources Movements and Managements (10 hours)
International Capital Flows - Foreign Portfolio Investment (FPI), Foreign direct investment (FDI); Its determinants and benefits; International Labor Migration – Motives, Welfare Effects; International Monetary System – Classic Gold Standard, Bretton Woods System, WTO and International Trade; International Debt Crisis; Recycling of Petro-Dollars; Causes of Debt Crisis; Secondary Market for Debt of Developing Countries

Suggested Readings

1. Bhagwati, Jagdish N., International Trade: Selected Readings, Cambridge, Mass: MIT Press, 1987.
2. Chacholiades, M., International Trade: Theory and Policy, McGraw Hill, 1988.
3. Cherunilam, F., International Economics, McGraw Hill India, 5th Edition, 2008.
4. Kindleberger, C.P., International Economics, R.D. Irwin, Homewood, 1963.
5. Krugman, Paul R., & Maurice Obstfeld, International Economics. Harlow: Pearson Education, 2011.
6. Mannur, H.G., International Economics, Vikas Publishing, New Delhi, 2010.
7. Reinert, Kenneth A., An introduction to international economics: new perspectives on the world economy, CambridgeUniversity Press, 2020.
8. Salvatore, D., International Economics, Wiley, 11th Edition, 2013.
9. Sodersten, Bo, & Geoffrey Reed, International Economics. Basingstoke: Macmillan, 2004.
10. Sodersten, International Economics, Basingstoke: Palgrave Macmillan Limited, 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				
CO 2		M		M	
CO 3	M		H		M
CO 4		H		H	
CO 5					H
CO 6				H	

ENPE0064: POPULATION ECONOMICS (4-0-0)

COURSE OUTCOMES
1. Highlight various policies on population control measures (Remembering)
2. Develop the knowledge of the different models, theories about the relationship between population growth and development (Understanding)
3. Develop the ability to relate the changes in social and political economy due to demographical changes. (Applying)
4. By the end of the course the students are expected to learn the two important concepts of Fertility and Mortality and

relate the factors for change in population in a particular region. It gives an idea about calculation of different rates of fertility and mortality. (Analyzing)

5. The students will be in a position to narrate the international and internal migration of India. Identify the factors responsible for internal and international Migration. (Evaluating)
6. Discuss the models of population projection and help in focusing the future policy measures (Creating)

Module I: Population and Development (15 hours)

Demography –Meaning and Scope; Evolution of Population Policy in India – The Shift in Policy from Population Control to Family Welfare, to Women Empowerment; Family Planning Strategies and their Outcomes; Measures of Population Change; Population Structure; Population Distribution; Theories of Population – Malthus, Optimum Theory of Population; Theory of Demographic Transition – Views of Meadows, Enke and Simon; Population and Development – Demographic Dividend

Module II: Distributional Pattern of Population (15 hours)

Population Trends in the Twentieth Century; Population Explosion and its Dynamics; Pattern of Age and Sex Structure in Developed and Less Developed Countries; Determinants of Age and Sex Structure; Demographic Effects of Sex and Age Structure; Economic and Social Implications; Age Pyramids Projections

Module III: Fertility, Nuptiality and Mortality (15 hours)

Fertility – Emerging Issues in Fertility Control; Fertility Analysis; Social Structure and Fertility Change; Nuptiality Concept and Analysis of Marital Status – Single Mean Age at Marriage, Synthetic Cohort Methods, Trends in Age at Marriage; Mortality – Death Rates, Crude Age-specific; Mortality at Birth and Infant Mortality Rate; Sex and Age Pattern of Mortality; Levels and Trends of Mortality rate in Developed and Less Developed Countries; Life Table Construction and Uses; Concepts of Stable Population; Methods of Population Projection

Module IV: Migration and Urbanization (15 hours)

Internal and International Migration Flows; Internal Migration its Effect on Population Growth and Pattern; Factors Affecting Migration; Theories of Migration Related to Internal Migration; International Migration Flows; Dynamics of the International Migration Process; Urbanization Growth and Distribution of Rural-urban Population in Developed and Developing Countries; Population Growth, Employment and Housing in Mega Cities in Developing Countries; Gravity Model

Suggested Readings

1. Amsden, A.H., The Economics of Women and Work, Penguin, Harmondsworth, 1980.
2. Baud, I.S.A., Form of Production and Women's Labour, Gender Aspects of Industrialization in India and Mexico, Sage, N.D.1992,
3. Bhole, L.M. Financial Institutions and Markets, Tata Mcgraw Hill, 2016.
4. Bogue, D.J., Principles of Demography, John Wiley, NY, 1971.
5. Boserup, E. Women's Role in Economic Development, George Allen and Unwin, London, 1970.
6. Chenery, H. & N. Srinivasan (eds.), Handbook of Development Economics, Vol. I & II, Elsevier, Amsterdam, 1989.
7. Chiang, C.L., Life Tables and Mortality Analysis, W.H.O., Geneva, 1974.
8. Coale, A.J. & E.M. Hoover, Population Growth and Economic Development in Low Income Countries: A Case Study of
9. India's Prospects, Princeton University Press, Princeton, 1958.
10. John, R. W., Population: An Introduction to Concepts and Issues, (7th ed.), New York: Wadsworth Publishing Company,2002.
11. King, M. & M.A. Hill (eds.), Women's Education in Developing Countries: Barriers, Benefits and Politics, John Hopkins,
12. Baltimore, 1993.
13. Shryock, H. S. et. al., The Methods and Materials of Demography, New York: Academic Press, 1976.
14. Srinivasan, K., Basic Demographic Techniques and Applications, New Delhi: Sage Publications, 1998.
15. Thompson, W. S. & Lewis, D. T., Population Problems, New Delhi: Tata McGraw Hills Publishing Co., 1976.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3	H			
CO4		M		M
CO5			H	L
CO6				H

ENOR0065: OPERATIONS RESEARCH (4-0-0)

COURSE OUTCOMES

1 Familiar with basic ideas, characteristics and different phases of Operations Research (Remembering)
2. Describe the basic concepts of convex sets and linear programming method (Understanding)
3. Identify situations where linear and non-linear programming problem can be applied (Applying)
4. Perform sensitivity analysis to assess the magnitude of change of a linear programming (Analysing)
5. Develop strong analytical skills and logical argument to work on with complex issues (Evaluating)
6. Formulate linear programming model of a real-world problem and demonstrate the solution process (Creating)

Module I: Basics of Operations Research (10 hours)

Meaning and Definition; Phases of an Operations Research Study; Importance and Scope; Limitations of Operations Research; Operations Research in Decision Making; Application of Operations research

Module II: Assignment and Transportation Problems (15 hours)

Assignment Problem – Concept, Nature, General Formulation; Solution of Assignment Problems – Hungarian Method; Transportation Problem – Concept, Nature, General Formulation; Solution of Transportation Problems – North West Corner Method; Dual Transportation Model; Difference between Transportation and Assignment Problem

Module III: Network Analysis (15 hours)

Basic Concepts; Classic and Modern Network Models – PERT and CPM; Drawing of Network Activity; Critical Path;Determination of Floats – Total Float, Free Float and Independent Float; Social Networking Problems; Pivotal Agents in Social Networks

Module IV: Linear Integer Programming and Models of Inventory (20 hours)

Modeling with Integer Variables; Canonical and Standard forms; Branch and Bound Methods; Applications – Production Planning, Scheduling; Algorithms for Integer Optimization – Cutting Plane Methods, Approximation Algorithms; Problem of the Economic Order Quantity; Problem with Price Breaks; Static Multi-commodity Model with Limited Capacity of the Stock; Dynamic Problems – Basic Concepts

Suggested Readings

1. A. Ravindran, D. T. Phillips & James J. Solberg, Operations Research- Principles and Practice, John Wiley & Sons, 2005.
2. A.M. Natarajan, P. Balasubramani & A. Tamilarasi, Operations Research, Pearson
3. Avriel, Mordecai, Nonlinear Programming: Analysis and Methods, Dover Publishing, 2003.
4. Bazaraa, Mokhtar S. & Shetty, C. M., Nonlinear programming. Theory and algorithms, John Wiley & Sons, 1979.
5. F.S. Hillier & G.J. Lieberman, Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill,2010.
6. J. K. Sharma, Operations Research Theory and Applications, Macmilan
7. Martin J. Osborne, An Introduction to Game Theory, Oxford University Press
8. Ravindran, A., Phillips, D. T., & Solberg, J. J., Operations Research- Principles and Practice (2nd Ed.). New Delhi: Wiley India, 2007.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		M		
CO3	M		H	
CO4		H		M
CO5			M	
CO6			H	M

ENGE0066: GENDER ECONOMICS (4-0-0)

COURSE OUTCOMES

1. Relate the demography concepts to understand the demography of female population (Remembering)
2. Articulate connections between global, regional and local issues and their relation to women's experiences and to human rights. (Understanding)
3. Examine the various gender indices to understand the framework of policy relating to gender issues. (Applying)
4. Explore the factors responsible for gender discrimination in India (Analyzing)
5. Evaluate the role of technology and institutions in addressing the problem of gender inequalities. (Evaluating)
6. Analyze interconnection between good governance, gender budgeting, Democratic decentralization and women empowerment. (Creating)

Module I: Concept and Importance of Gender Economics (15 hours)
Importance of Gender Economics; Women in Patriarchal and Matriarchal Societies and Structures; Gender Bias in the Theories of Values; Distribution and Population; Demography of Female Population; Causes of Declining Sex Ratios and Fertility Rates in LDCs and Particularly India; Women and their Access to Nutrition, Health, Education and Community Resources and their Impact in Female Mortality and Fertility; Gender Planning Frameworks and Tools; Gender Inequality Indices – GII,MPI, WEIA, SIGI, GDI, GEM; Gender Inequalities in India; Gender and National Planning; Theories of Gender Inequality

Module II: Decision Making, Economic Activity and Women (15 hours)
Factors Affecting Decision Making by Women; Property Rights; Access to and Control Over Economic Resources and Assets; Power of Decision Making at Household, Class, Community Level; Economic Status of Women and its Effect in WPR, Income Level, Health and Education in Developing Countries; Concept and Analysis of Women's Work – Visible and Invisible Work, Economically and Socially Productive Work; Female Contribution to National Income

Module III: Labour Market, Technology, Environment and Women (15 hours)
Factors Affecting Female Entry in Labour Market; Supply and Demand for Female Labour in Developed and Developing Countries; Studies of Female work Participation in Agricultural and Non-agricultural Rural Activities; Wage Differentials in Female Activities; Determinants of Wage Differentials – Gender, Education, Skill, Productivity, Efficiency, Opportunity; Structure of Wage Across Regions and Economic Sectors; Impact of Technological Development and Modernization on Women's Work Participation; Women and Environment – Female Activities and Environmental Concerns; International Agreements

Module IV: Social Security, Gender Planning and Development Policies (15 hours)
Effectiveness of Collective Bargaining; Review of Legislation for Women's Entitlement Protection of Property Rights; Schemes for Safety net for Women; Need for Female Labour Unions; Affirmative Action for Women and Improvement in their Economic and Social Status; Gender Mainstreaming in Development Policies; Gender Sensitive Governance – Gender Budgeting, Democratic Decentralization (Panchayats) and Women's Empowerment in India; The Kudumbashree Experience in Kerala, A comparative assessment on Gender policies between developed and developing countries (with special reference to Asian countries); Gender and technology based education institution in development and developingcountries.

Suggested Readings

1. Agarwal, Bina, A Field of One's Own: Gender and Land Rights in South Asia, Cambridge; Press, Cambridge, 1994.
2. Amsden, A.H., The Economics of Women and Work, Penguin, Harmondswosrth, 1980.
3. Beneria, L. & M. Roldan, The Crossroads of Class and Gender, University of Chicago Press, Chicago, 1987.
4. Beneria, Lourdes, GunseliBerik, and Maria Floro, Gender, Development and Globalization: Economics as if all People Mattered, Second Edition, Routledge, London, 2015.
5. Bonnie G Smith, Women's Studies: The Basics, Routledge, London, 2013.
6. Borerup, E., Women's Role in Economic Development, George Alle and Unwin, London, 1970.
7. Government of India, Towards Equality - Report of the Committee on the Status of Women in India, Department of Social Welfare, Ministry of Education and Social Welfare, New Delhi, 1974.
8. Government of India, Shram Shakthi, Report of the National Commission on Self employed Women and Women works in the Informal Sector, Ministry of Human Resource Development, New Delhi, 1987.
9. Irene Tinker, Persistent Inequalities: Women and world development, New York: Oxford University Press, 1990.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2	H			
CO3				H
CO4		H		
CO5		L	H	
CO6				H

ENFE0067: FINANCIAL ECONOMICS (4-0-0)

COURSE OUTCOMES

1. Learn the key concepts of financial economics. (Remembering)
2. Understand the fundamental concept and application of financial field. (Understanding)
3. Identifying the current financial issues and problems to provide better decision-making to investors. (Applying)
4. Illustrate the trading in the stocks market and analyze the complexities of the derivative market. (Analyzing)
5. Evaluate the financial policy and programme to provide financial advice to policymakers. (Evaluating)
6. Use of financial economics concept in solving real life problems.(Creating)

Module I: Investment Theory and Portfolio Analysis (18 hours)
Overview of Investment Evaluation Methods and Evaluation Criteria; Fixed-income Securities; Bond Prices; Spot Prices; Discount Factors; Arbitrage; Yield-to-maturity; Price Sensitivity; Interest Rate Sensitivity and Duration; The Term Structure of Interest Rates; Yield Curves; Spot Rates and Forward Rates; Portfolios of Assets – Measurement of Return and Risk; Effects of Diversification; Optimal Portfolio Choice; Mean-variance Frontier of Risky and Risk-free Asset; Portfolio Weights

Module II: Options and Derivatives (15 hours)
Options and other Derivatives – Concepts, Definitions; Interest Rate Futures; Futures and Hedging; Hedging Strategies; Option Markets – Call and Put Options; Bounds for Option Prices; Put-call Parity; Option Pricing Formula – Binomial Approach; Factors Affecting Option Prices; Option Trading Strategies; Option to Expand; Valuation of Real Option; Pricing of other Derivatives; Numerical Problems for Derivative Pricing

Module III: Corporate Finance (12 hours)
Types of Corporate Financing – Owner's Funds, Debt Funds; Strategy of Corporate Financing and Corporate Value; The role of Capital Market in Explaining Corporate Performance; Portfolio for Corporate Bonds; Corporate Debt and DividendPolicy, The Modigliani-Miller Theorem; Capital Asset Pricing Model and its Use in Corporate Finance

Module IV: Valuation of Financial Assets (15 hours)
Concept of Value; The Time Value of Money and Asset Pricing – The Valuation of Debt Instruments; The Equilibrium Priceand Quantity of Bonds – Loanable Fund Approach, Demand and Supply Approach; Valuing Stock and other Assets – Income Stocks and Growth Stocks; Equilibrium Price and Value of Stock Transactions

Suggested Readings
1. David G. Luenberger, Investment Science, Indian Edition, 2012.
2. Basu, Sankarshan, Hull, John C., Options Futures and Other Derivatives, Pearson Education, Inc, 8th Edition, 2013.
3. Brealey, Richard A., Myers, Stewart, C., Allen, Franklin, & Mohanty Pitabas, Principles of Corporate Finance, Tata McGraw-Hill Education, 10th Edition, 2013.
4. William Sharpe, Gordon Alexander & Jeffery Bailey, Investments, Prentice Hall of India, 6th Edition, 2003.
5. Stephen A. Ross, Randolph W. Westerfield & Bradford D. Jordan, Fundamentals of Corporate Finance, McGraw-Hill, 7thEdition, 2005.
6. Thomas E. Copeland, J. Fred Weston & Kuldeep Shastri, Financial Theory and Corporate Policy, Prentice Hall, 4th Edition,2003.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3			H	
CO4		H		M
CO5			M	
CO6				H

ENLE0069: LABOUR ECONOMICS (4-0-0)

COURSE OUTCOMES
1. Define and relate the main concepts of labour economics. (Remembering & Understanding)
2. Identify the main issues of wage determination. (Applying)
3. Analyse the theoretical issues in labour economics. (Analyzing)
4. Explain the practical applicability of theories related to labour productivity and labour mobility and appraise the key issues of Indian labour market to solve the problems in labour market. (Evaluating & Creating)

Module I: Introduction to Labour Economics (10 Hours)
Concept, Nature and Scope of Labour Economics; Labour Market – Concept, Labour Supply, Labour Demand; Measuring the Labour Force, Workers Preferences, Time and Budget Constraints, Hours of Work Decision; Production Function; Imperfections in the Labour Market.

Module II: Theories of Wage Determination (15 hours)
Theories of Wage – Classical, Neo-classical, Modern; Employment Decision in the Short Run and Long Run; Long Run Demand for Labour; Labour Market Equilibrium – Equilibrium in a Single Competitive Labour Market, Competitive Equilibrium Across Labour Markets, Non-competitive Labour Markets; Wage Determination in Organized and Unorganized Sector; Human Capital Theory of Wage

Module III: Wage Differentials, Labour Efficiency and Discrimination (15 Hours)
Homogenous Workers and Jobs; Heterogeneous Workers and Jobs; The Hedonic Wage Function; Alternative Pay Schemes and Labour Efficiency; Theory of Optimal Fringe Benefits; Labour Efficiency – Education in the Labour Market, Schooling Model; Efficiency Wage Models; Segmentation and Discrimination in Labour Market – Race and Gender in the Labour Market, The Crowding Model, Employer and Employee Discrimination; Measuring Discrimination – The Oaxaca Decomposition; Relation between Wage and Employment; Impact of Trade Union and Collective Bargaining on Employers

Module IV: Labour Productivity, Unemployment and Migration (10 Hours)
Labour Productivity – Concept, Measurement; Wages, Prices and Employment; Unemployment – Frictional, Structural, Demand-deficient Unemployment; Measurement of Unemployment – The Stock-Flow Model; Reducing Unemployment – Public Policies; Labour Mobility; Migration as an Investment in Human Capital; Determinants of Migration; Consequences of Migration; The Economic Benefits of Immigration

Module V: Issues in Indian Labour Market (10 Hours)
Features of Indian Labour Market – Size and Composition in the Organized and Unorganized Labour Market; Major issues in the Indian Labour Market; Labour Productivity in India; Labour Turnover and Absenteeism in India; Women and Child Labour in India; Agricultural and Rural Labour; Labour Market Institutions of Minimum Wage; Employment and Wage Policy in India; Informal Labour and Social Security Measures; Globalization and Labour Market; Labour Statistics in India

Suggested Readings

1. Ashenfelter, Orley & Richard Layard, The Handbook of labour Economics. Vol. 1 and 2, New York: North-Holland, 1986, Vol.3A, 3B and 3C, 1999.
2. Butler, A.D., Labor Economics and Institutions, American Publishing Company, ND, 1972.
3. Datt, G., Bargaining Power, Wages and Employment: An Analysis of Agricultural Labour Market in India.
4. George J. Borjas, Labour Economics, McGrawhill, New York, 2000.
5. Government of India, Reports on The National Commission on Labour.
6. Marshall, F.R., V.M. Briggs, & A.G. King, Labour Economics, Richard D. Irwin Inc., Homewood, Illinois, 1984.
7. McConnell, C.R., S.L. Brue & D.A. Macpherson, Contemporary Labour Economics, McGraw Hill, NY, 2009.
8. Michael Hopkins, Labour market planning revisited, Palgrave Macmillan, 2002.
9. Rees, A., Economics of Work and Pay, Harper and Row, NY, 1973.

ENBE0070: BEHAVIOURAL ECONOMICS (4-0-0)

COURSE OUTCOMES
1. Learn the principles and methods of Behavioural Economics (Remembering)
2. Identify the systematic departures of economic behaviour from the prediction of the neoclassical model(Understanding)
3. Get the idea of how behavioural principles have been applied to economic problems (Applying)
4. Understand the principles behind the behavioural approach for the development of analytical tools in Economics (Analysing)
5. Incorporate psychologically motivated assumptions into economic models (Evaluating)
6. Interpret how behavioural models change the predictions for equilibrium behaviour and their implications for optimal policy (Creating)

Module I: Introduction to Behavioural Economics (10 hours)
Behavioural Economics Meaning, Definitions; Behavioural Economics and the Standard Economic Models; Scope and Methodology of Behavioural Economics; Applications

Module II: Decision-making under Risk and Uncertainty (13 hours)
Preferences and Choice; Anomalies in Expected utility Theory; Alternatives to Expected Utility Theory – Disappointment, Decision-Weighting, Rank-dependent Utility; Role of Reference; Dependent Preference in Risky and Risk Free Choices

Module III: Intertemporal Decision-making (13 hours)
Discounted Utility Model; Alternative Choice Models – Time Preferences, Time Inconsistent Preferences; Utility and Consumption Independence; Independence of Discounting from Consumption

Module IV: Behavioural Game Theory (13 hours)
Nature and Equilibrium of Behavioural Game Theory; Mixed Strategies and Iterated Games; Modelling of SocialPreferences; Inequality Aversion Model; Reciprocity Model

Module V: Basic Behavioural Macroeconomics (11 hours)
Neo-Keynesian Rational Expectation Model; Rational Expectation and Attainment of Business Cycle and Labour Market Equilibrium; Determination of Asset Price; Stability Analysis of Macroeconomic Models

Suggested Readings

1. Peter Diamond & Hannu Vartiainen, Introduction to Behavioural Economics and Its Applications, Princeton UniversityPress, 2012.
2. BD Bernheim, S Della Vigna & D Laibson, Handbook of Behavioural Economics-Foundations and Applications - NorthHolland, 2019.
3. Sanjit Dhami, The foundations of Behavioural Economics, Oxford, 2020.
4. N. Wilkinson & M. Klaes, An Introduction to Behavioral Economics, Palgrave Macmilla, 2012.
5. Paul De Grauwe & Yeumei Ji, Behavioural Macro Economics -Theory and Policy, Oxford University Press, 2019.
6. G. Akerlof, Behavioural Macroeconomics and Macroeconomic Behaviour, Nobel Prize Lecture, 2001.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		M			
CO3			M		H
CO4	M			H	
CO5				H	
CO6			H		H

ENNE0071: ECONOMY OF NORTH EASTERN REGION (4-0-0)

Course Objectives:

This course is designed to expose the students to the overview of North East Economy. It explains the trend and performance of agriculture, industry and service sector in the context of North East scenario. It also includes the evaluation of various developmental policies for structural transformation of the region.

Course/Learning Outcomes

At the end of the course the students would be able to:

1. Define and understanding of macroeconomics policies and their impact of North East Economy. (Remembering)
2. Explain the policies and Performance in Agriculture. (Understanding)
3. Identify the policies and performance in Industry. (Applying)
4. Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Analyzing)
5. Explain the trends and performance in service sectors and the scope of growth of enterprises in the North Eastern region and the role of various policies in it. (Evaluating)
6. Discuss the usefulness of various development policies and the different development initiatives in the North Eastern region along with some of the reasons for its failure. (Creating)

Module I: Overview and Characteristics of North East Economy (20 hours)

North Eastern Region as an economy; Characteristics of the economy; Trend and Pattern of GDP growth in NER; Demographic features of the NE economy; Poverty and Inequality in NER comparison with the Indian economy; Trends of Employment and Unemployment; Recent developments in human resource.

Module II: Agriculture in North East Economy (15 hours)

Agriculture: features and challenges; Growth of Agricultural Sector in NE; Agricultural Finances-Sources and Limitations; Agricultural Policies of NE States; Agriculture-Industry linkage especially in NER, Problems of Agricultural Marketing in NE.

Module III: Industry and Service Sectors in North East Economy (20 hours)

Industry: growth, composition and challenges, Growth of Micro Small and Medium Enterprises (MSME); North East Industrial and Investment Promotion Policy (NEIIPP) 2007 & 2015; Services sector; Trends, growth and challenges; Rural economy, Diversification of rural employment; Infrastructure and regional economic development, Nature and characteristics of Public finance for NER trends and challenges.

Module IV: Structural Transformation and Institutions in North East (20 hours)

Institutions and economic Development; Governance and development-government failure and its correction; Local self-government and development; Community participation and development, community failure; Role of DONER and NEC; New development initiatives in NER, Vision Document 2020 and Act East Policy

Suggested Readings:

1. Banerjee and Kar (1999): Economic Planning and Development of North-Eastern States, Kanishka, ND.
2. Deb, B.J & B. Dutta Ray (2006): Changing Agricultural Scenario in North-East India, Concept Publication, New Delhi
3. Dikshit, K. R and J K Dikshit (Eds.) (2014): North East India Land People and Economy, Springer
4. Maithani, B.P. (1997): Local Self-Government in North-East India: An Appraisal, NIRD, Hyderabad

5. Menon, S. (Ed.) (2007): India's North East Economy-Problems and Prospects, ICFAI Univ. Press, Hyd.
6. Mishra, B. (2006): Fiscal Policy in North-East India, Akansha Publishing House, ND.
7. Nayak. P. (Ed.) (2010): Growth and Human Development in North- East India, Oxford University Press.
8. RBI (2006): Report of the Committee on Financial Sector Plan for North Eastern Region, RBI.
9. World Bank (2007): Development and Growth in Northeast India The Natural Resources, Water, and Environment Nexus

ENDI6003: DISSERTATION PHASE-I (2-0-0)

Course Description:
The MA students would be required to do project work and submit dissertation. The project work is to be related to the specialization area chosen by the student. Dissertation submitted by the students would be evaluated by External Examiners appointed by the University. The work for the MA dissertation is spread over Semester III and Semester IV as Dissertation Phase-I and Dissertation Phase-II respectively. The total dissertation grades are distributed between the two semesters i.e. 2 credits in Semester III and 4 credits in Semester IV equaling 6 credits in total.

Course Objectives:
The aim of the course is to equip the students with presentation skills and develop academic writing skill. Moreover, the students will also be able to apply the statistical research training acquired in the taught element of the program by designing an appropriate research strategy and research methodology to carry out the research.

The Structure of the Course:
In Dissertation Phase-I, the students have to independently think of a research idea and, by the end of the semester, has to defend a research proposal based on the idea i.e. need to present the Synopsis by the end of the third semester. The total credit in Dissertation Phase-I equals to 2 credits.

Structure of Dissertation Phase-I

Sl. No.	Tentative Stages to be completed	Tentative Duration
1.	Research idea or concept note, i.e., Statement of the Problem	First month
2.	Review of Literature	Second month
3.	Research Methodology Sampling, Sample size determination, Selection of sample, Analytical tools to be used, Questionnaire preparation, Preliminary exploration of data i.e. Pilot Survey	Third month andFourth month (3/4 common classes)
4.	Synopsis Presentation Submission of Modified Synopsis to the Head of the Department	Before the commencement of the end semester examination (date will be notified later) Evaluation by the end of Third Semester (Based on Synopsis)
5.	Students have to collect all the required data during the semester break (between 3rd and 4th semester)	

ENDI6004: DISSERTATION PHASE-II (4-0-0)

Course Descriptions:
The MA students would be required to do project work and submit dissertation. The project work is to be related to the specialization area chosen by the student. Dissertation submitted by the students would be evaluated by External Examiners appointed by the University. The work for the MA dissertation is spread over Semester III and Semester IV as Dissertation Phase-I and Dissertation Phase-II respectively. The total dissertation grades are distributed between the two semesters i.e. 2 credits in Semester III and 4 credits in Semester IV equalling 6 credits in total.

Course Objectives:
The aim of the course is to fine-tune the dissertation he/she working in the Phase-I and during the work, the students will also learn how to apply the statistical and econometric tools in their own research.

The Structure of the Course:
In Dissertation Phase-II, the student has to carry out data analysis and write the dissertation and defend it by the end of the fourth semester. The dissertation will include original research question(s) if any, critical review of the relevant literature, analytical tools employed in response to the research questions, data analysis and interpretation. Finally, the students need to submit the dissertation to the university authority maintaining all instructions provided by the university. Under the process, the students will be guided by an assigned supervisor of the department to do the work. The total credit in Dissertation Phase-II

equals to 4 credits.

Structure of Dissertation Phase-II

Sl. No.	Tentative Stages to be completed	Tentative Duration
1.	Validation of data, data entry and preliminary analysis of data(drawing graphs, trend lines, etc.)	First month
2.	Main data analysis	Second month
3.	Dissertation writing and Proof reading	Third and fourth month
4.	Submission and Viva Voce	Evaluation by the end of Fourth Semester

DEPARTMENT OF EDUCATION

VISION:

To build a pool of intellectually competent educational leaders and teacher educators leading on the process of education in general and teacher education in particular which nurtures individual autonomy and social development by ensuring quality with peace across the globe

MISSION:

The Mission of the Department is to facilitate the expression of leaders hidden within the students, developing sound cognitive, affective and psychomotor abilities and making them a sound citizen of the country and world as a whole.

PROGRAM OUTCOMES - MA EDUCATION

PO 1: **Critical Thinking:** To inculcate critical thinking among the students.
PO 2: **Effective Communications:** To generate an ability among the students to communicate their thoughts and ideas from one end to another clearly for making others comfortable in understanding.
PO 3: **Scientific Temper:** To inculcate scientific temper among the students to be judicious and logical in their thinking and presentation.
PO 4: **Effective Citizenship:** To enable the students to possess the qualities of a good citizen and prove to be a productive member of the society.
PO 5: **Ethics:** To create ethical values among the students to be a righteous individual.
PO 6: **Environment and Sustainability:** To create environmental awareness among the students lashing with the sense of sustainability.
PO 7: **Gender Sensitization and social commitment:** To sensitize the students about the gender variability and its utility in harmonious ways of life.
PO 8: **Self-directed and life -long learning:** To create a positive attitude among the learners to havethe zeal for self-directed and life- long learning.

PROGRAM SPECIFIC OUTCOMES - MA EDUCATION

PSO 1: **Educational Foundations and Educational Leadership:** To equip the PG students with foundations of education and inculcating educational leadership among the students.
PSO 2: **Skill Based Competence: To** inculcate some skills relating to teaching, research, leadership,management computer etc.
PSO 3: **Curriculum and Pedagogical Issues:** To make the PG students well aware of the curriculum planning and designing and pedagogy to transact the curriculum effectively and testing the students.
PSO 4: **Ethics and Social Responsibility in Education:** To produce morally upright PG students whoare to contribute in environmental sustainability and social development.

MA List of Courses

1.1 Philosophical Foundations of Education	3.2 Principles and Techniques of Teaching and Pedagogy
1.2 Fundamentals of Educational Psychology	3..3 Teacher Education
1.3 Emerging Trends in Education	3.4 Measurement and Evaluation in Education
1.4 History and Development of Education in India	3.5 Educational Law and Government Policy
1.5 Educational Technology	3.6 Financial Management and Accounting
1.6 Leadership and Social Responsibility	3.7 Life Span Development and Education
1.7 Journaling – a Technique for Personal and Academic Growth	3.8 Learning and Individual Differences
2.1 Sociological Foundations of Education	3.9 Dissertation Phase I
2.2 Research Methodology in Education	3.10 Educational Seminar II
2.3 Knowledge and Curriculum	3.11 Teaching Practice
2.4 Developing Educational Leadership	4.1 Organisational Communication
2.5 Human Development and Learning	4.2 Educational Administration
2.6 Peace Education and Conflict Management	4.3 Ethics and Social Responsibility in Education
2.7 Educational Seminar I	4.4 Counselling Skills for Educational Psychologists
2.8 Computer Applications for Social Sciences (Lab)	4.5 Child and Adolescent Mental Health
2.9 School Visits	4.6 Dissertation Phase II
3.1 Curriculum Development and Instruction	4.7 Internship

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
1.1 Philosophical foundations of Education	H	H	H	L	M	M	M	H	H	H	H	H
1.2 Fundamentals of Educational Psychology	H	H	H	M	L	M	L	H	H	H	H	H
1.3 Emerging Trends in Education	H	M	H	M	M	M	M	H	H	H	H	M
1.4 History and Development of Education in India	H	M	M	M	L	L	M	H	H	H	H	H
1.5 Educational Technology	H	M	H	M	H	H	M	H	H	H	H	H
1.6 Leadership and Social Responsibility	H	H	H	H	H	H	H	H	H	H	H	H
1.7 Journaling	H	H	M	M	H	L	H	H	H	H	H	H
2.1 Sociological Foundations of Education	H	L	H	H	M	M	H	H	H	H	H	M
2.2 Research Methodology and Statistics in Social Sciences	H	H	H	H	H	M	H	H	M	H	M	H
2.3 Knowledge and Curriculum	H	L	M	M	M	L	M	H	M	H	H	H
2.4 Developing Educational Leadership	M	H	M	H	H	M	H	H	H	H	H	H
2.5 Human Development and Learning	M	H	M	M	M	M	H	H	M	H	H	H
2.6 Peace Education and Conflict Management	M	H	H	H	H	H	M	H	H	H	H	M
2.7 Educational Seminar-I	H	H	H	M	H	M	H	H	H	H	H	H
2.8 Computer Application for Social Sciences (Lab)	H	H	H	M	H	H	L	H	H	H	H	H
2.9 School Visits	M	H	M	H	H	H	H	H	H	H	H	H
3.1 Curriculum Development and Instruction	M	M	H	M	M	L	L	H	H	H	H	H
3.2 Principles and Techniques of Teaching and Pedagogy	H	H	H	H	H	H	H	H	H	H	H	H
3.3 Teacher Education	H	H	H	H	H	M	H	H	H	H	H	H
3.4 Measurement and Evaluation in Education	H	M	H	M	H	M	H	H	M	H	H	H
3.5 Educational Law and Government Policy	M	L	M	H	H	M	M	H	H	H	H	H
3.6 Financial Management and Accounting	M	L	L	L	H	L	M	H	L	H	L	H
3.7 Life Span Development and Education	H	L	H	H	M	M	H	H	H	H	H	H
3.8 Learning and Individual differences	H	H	H	M	M	H	H	H	M	H	H	H
3.9 Dissertation Phase-I	H	H	H	H	H	M	H	H	H	H	H	H
3.10 Educational Seminar-II	H	H	H	M	H	M	H	H	H	H	H	H
3.11 Teaching Practice	H	H	H	H	M	L	H	H	H	H	H	H
4.1 Organisational Communication	H	M	M	M	L	M	H	H	H	H	H	
4.2 Educational Administrati on	M	M	H	L	L	M	H	H	H	H	H	
4.3 Ethics and Social Responsibility in Education	H	M	H	H	H	H	H	H	H	H	M	
4.4 Counselling Skills for Educational Psychologists	H	M	H	L	L	M	H	M	H	H	H	
4.5 Child and Adolescent Mental Health	H	H	M	H	H	M	M	H	H	H	H	M
4.6 Dissertation Phase-II	H	H	H	H	H	M	H	H	H	H	H	H
4.7 Internship	H	H	H	H	M	M	H	H	H	H	H	H

DETAILED SYLLABUS
MA EDUCATION DETAILED SYLLABUS

EDLR0007: LEADERSHIP AND SOCIAL RESPONSIBILITY (3-0-0)

COURSE OUTCOMES

1. State the meaning of leadership and the qualities of a true leader. (Remembering)
2. Discuss the concept of leadership and management and the different theories and stylesof leadership. (Understanding)
3. Analyze the role of individual social responsibility and the social responsibility ofeducators. (Analysis)
4. Identify the role of leadership in the decision-making process and find out thetechniques that improves decision making process. (Application)
5. Discuss the role of leadership in policy formulation and find out the effect of leadership in social entrepreneurship. (Application)

Module I: Leadership and Management (13 Lectures)

Understanding Leadership; Its need and function; Styles and Theories of Leadership Styles of leadership (Autocratic, Democratic, Laissez Faire) and Theories of Leadership (Great Man Theory, Trait Theory, Fiedler's Contingency Theory, Hersey and Blanchard's Situational Theory, Tannenbaum and Schmidt Leadership Continuum); Changing roles of Leadership; Concept of Management, functions of Management, Leadership and Management issues; Discipline in Leadership, Leadership-A bridge to improved practice, Ways to improve Staff Achievement; Staff motivation, Performance and Personal Organization .

Module II: Social Responsibility (10 Lectures)

Concept of Social Responsibility, Types of Social Responsibility, Its need, Changing role; Social Engagement; Individual Social Responsibility and Corporate Social Responsibility, Social Responsibility of the Educators.

Module III: Leadership and Decision Making (12 Lectures)

Decision Making process; Types of Decision Making, Key steps in Decision Making, techniques of effective Decision Making; Barriers towards Decision Making, Ways of mitigating Barriers in Decision Making; Importance of Decision Making in Educational Institution, Organisational Behaviour, Leadership and Decision Making.

Module IV: Leadership Implementation and Implantation (10 Lectures)

Leadership and implantation; Leadership roles in Policy Formulation; Complexity of joint actions; Economic theory and program implementation; Implantation as exploration; Volunteerism; social entrepreneurship.

Suggested Readings

1. Bass, B. M. Transformational leadership: Industry, military, and educational impact, Mahwah,NJ: Erlbaum (1998).
2. David, B. Leadership in Organizations There Is a Difference between Leaders and Managers,New York: University Press of America (2009).
3. Friedman, A. A. Beyond mediocrity: transformational leadership within a transactional framework. International Journal of Leadership in Education, 7(3), 203-224 (2004). doi:10.1080/1360312042000213877.
4. Fullan, M. Leadership and sustainability. New Delhi: Sage publication Ltd. (2005).
5. Kouzes, J.M., & Posner, B.Z. The leadership challenge. San Francisco, CA: Jossey- Bass. (2002).
6. Lee G. & Bolman,T. Deal Reframing Organizations Artistry, Choice, and Leadership. San Francisco: Jossey- Bass.(2008).
7. Rogers, C. Transition, self-regulation, independent learning and goal theory. Psychology of Education Review, 36(2), 26-31 (2012).
8. Starratt, R. Ethical Leadership. San Francisco: Jossey- Bass (2004).
9. Williams, M. Leadership for leaders. New Delhi: Vinod Vasishtha (2006).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	H		M	
CO 3		H		
CO 4	M		H	
CO 5		M		H

EDTE0013: EMERGING TRENDS IN EDUCATION (3-0-0)

COURSE OUTCOMES

1. Recall contemporary issues, techniques in education. (Remembering)

2. Explain/ identify/ classify the contemporary issues and techniques in education.(Understanding)
3. Use the new techniques of teaching in practice. (Application)
4. Appraise the present educational institutions regarding the challenges and hurdlesfaced. (Evaluation)
5. Formulate actionable strategies to prevailing problems in the educational system.(Creation)

Module I: Recent Pedagogical and Delivery Techniques (10 Lectures)
Distance Education – Purposes, functions, organization and management of Distance Education Programme; e-learning – Nature, Characteristics, Styles, Arrangement for e-learning in an educational institution; Virtual Classrooms – Modus operandi, Advantages and Limitations. Teleconferencing and; Video conferencing – Meaning, types, Educational Advantages.

Module II: Recent Techniques in Education (10 Lectures)
Language laboratory - Need, Types, Functioning, Uses and Applications; Team Teaching-Meaning, Definition, Objectives, Principles, Types, Organization, Procedure and steps, Advantages and Limitations; Co-operative learning and collaborative learning-Key elements-Implementing the elements.

Module III: Autonomy, Accountability and Accreditation (8 Lectures)
Autonomy-Meaning, Need; Academic, Administrative and Financial Autonomy, Objectives, Salient Features, Advantages of Autonomous colleges; Accountability and Accreditation; Accreditation process, Assessment and Accreditation –NAAC, NBA-ISO, Accreditation and Certification.

Module IV: Challenges in School Education (10 Lectures)
Current student related Challenges: Parental Involvement, Drugs and Violence, School safety. Current Teacher related challenges: Diverse learning needs, Quality and expectations, Pupil- Teacher ratio. Teacher mentee /mentor programs. Current School related challenges- Technology issues, Bullying, harassment and ragging.

Module V: Learning Environment in Educational Institutions (7 Lectures)
The concept of Institutional environment, The classroom learning environment- Disciplinary problems, The effects of the Institutional environment on Academic performance, Punishment and its effects. Creating Trustworthy school environments; Guidance and Counselling.

Suggested Readings

1. Associates, A. F. Leading Academic Change: Essential Roles for Departmental Chairs. San Francisco: Jossey -Bass Publishers (2000).
2. Associates, H. D. Higher Education in the Era of Digital Competition – Choice and Challenges (2000).Modison: WI Atwood Publishing.
3. Association of Indian Universities. Privatization of Higher Education (2003)
4. Association of Indian Universities: Accountability and Autonomy in Higher Education. (1998).
5. Association of Indian Universities: Excellence in Achieving Social Relevance in Higher Education (1993).
6. Chauhan, S.S Innovations in Teaching Learning Process. New Delhi, Vikas Publication (2004).
7. Gandhi, M.M . Autonomy and Accountability in Higher Education- An Indian Perspective. IOSR Journal of Research and Method in Education (2013). Vol. 3, Issue 5 (Nov-December) pp. 33-37. Retrieved from http://www.iosrjournals.org/iosr-jrme/papers/Vol-3%20Issue-5/F0353337. pdf?id=7370.
8. Govindasamy, T. Successful implementation of e-learning: Pedagogical considerations. The internet and higher education (2001), 4(3), 287-299.
9. Haynes, N. M. Creating safe and caring school communities: Comer school development program schools. Journal of Negro Education (1996), 308-314.
10. Hernes, G and Martin, M. (eds) . Accreditation and the global Higher education market (2008). UNESCO: International Institute for Educational Planning. Retrieved from http://unesdoc. unesco.org /images/0016/001635/163514e.pdf. Accessed on 19 July, 2016.
11. Holmberg, B. . Theory and Practice of Distance Education. 2nd Edition. Routledge (2005).
12. Mangal, S.K. Essentials of Educational Technology. Ludhiana, Tandon Publications (2005).
13. McIsaac, M. S. and Gunawardena, C. N. (2005). Distance Education. Retrieved from http:// www. aect.org / edtech /ed1/pdf/13.pdf. Accessed on 19 July, 2016.
14. Mehta, R. Crisis in Higher Education. Delhi : Kalpaz Publications (2004).
15. Ministry of Human Resource Development Department of Secondary and Higher Education (2005). Report of the Government of India Central Advisory Board of Education (CABE) Committee on Autonomy of Higher Education Institutions. Retrieved from http://mhrd.gov. in/sites/upload_files/mhrd/files/document-reports/Autonomy HEI.pdf. Accessed on 19 July, 2016.
16. Narkhede, S. Challenges of higher Education in India. New Delhi: Sarup and Sons (2001).
17. Pollack, I., and Sundermann, C. Creating safe schools: A comprehensive approach. Juvenile Justice(2001), 8(1), 13-20.
18. Purushotham, H.R. Team Teaching: An Alternative to Lecture Fatigue(2009). Edutracks, 9(1),5-7.

19. Singh, A. and G.D.Sharma. . Higher Education in India: The Institutional Context (ed.), NewDelhi: Konarch(1989).

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2	H	H		
CO3	M	H		
CO4	M	M	H	H
CO5				H

EDDE0014: HISTORY AND DEVELOPMENT OF EDUCATION IN INDIA (3-0-0)

COURSE OUTCOMES

1. Recall the characteristic features of education in ancient India, Pre- Independent India and post- Independent India. (Remembering)
2. Explain, compare and draw generalizations about the various educational commissionsand policies. (Understanding)
3. Justify the relevance of different educational features from ancient to post-independent India in present day educational system. (Application)
4. Critically analyze the various policies and commissions in terms of their relevance andimplementation. (Analysis)
5. Trace the contribution of each period to the shaping of the present education system.(Evaluation)
6. Construct ways and means of improving the quality and quantity of Indian educationsystem. (Creation)

Module I: Ancient Indian Education (8 Lectures)

Fundamentals of Ancient Indian Education, Salient features, purpose of studying Vedas, Relevance of Ancient Indian education in the 21st Century. Chief Characteristics of Vedic Educational System; Education in post Vedic (Buddhist) period – features; Female education; Swadhyaya (Self-Education, State patronage and Growth of education, Primary Education (Maktabs), Higher Education (Madrasas), Female Education, Student and Teacher relationship

Module II: Education during Pre Independent India (13 Lectures)

Anglicization of Education 1836-1855- Exponents of Oriental Education, The Anglicists, Macaulay's Minutes and its effect, Wood's Despatch – 1854, India Education Commission regarding Primary, Secondary and University Education, The University Commission (1902), The Hartog Committee (1928-29), The Filtration Theory of Education. Important Development in Education during 1921-1931- Inter University Board, Establishment of new Universities, Teachers Training, Technical Education

Module III: Education during Post Independent India (14 Lectures)

Various Commission and policies in Education - Secondary Education Commission 1953, Education Commission 1964-66, National Policy on Education 1986, Ramamurthy Review Committee 1990, National Commission on Teacher 1983-85, Problems of Indian Education- Wastage and Stagnation, Examination Reform, Inclusive Education and Education of the Marginalized.

Module IV: Current Government Policies (10 Lectures)

DPEP, National policy on ICT, Panchayat Raj Act, Rashtriya Madhyamik Shiksha Abhiyan, Rashtriya Uchchatar Shiksha Abhiyan ,SSA, RTE, NAEP, National Knowledge Commission, NAS, SPQEM, NEP-2020.

Suggested Readings

1. Acharya, P. Indigenous vernacular education in pre-British era: Traditions and problems. Economic and political weekly, 1981-1988. (1978)
2. Dash, M. Education in India: Problems and Perspectives, Eastern Book Corporation (2000)
3. Ghosh, S. C. History of Education in India, Eastern Book Corporation. (2007)
4. Govt. of India, report of the University Education Commission, Vol -I, Simla.(1949)
5. Jain, M. History in the New NCERT Textbooks Fallacies in the IIIC Report, Delhi NCERT. (2003)
6. Lall, M. The Challenges for India's Education System, Chatham House: London (2005)
7. M.H.R.D, Report of the University Education Commission (1948), Ministry of Education, New Delhi, Govt. of India (1948)
8. M.H.R.D. Challenges of Education (1985). A policy perspective, Ministry of Education, New Delhi, Govt. of India (1985)
9. M.H.R.D. Report of the Secondary Education Commission (1952). Ministry of Education, New Delhi, Govt. of India (1952)
10. Mookerji, R. K. Ancient Indian Education: Brahmanical and Buddhist, Delhi, Motilal Banarsidass Publishers. (1990)
11. Naik J.P. The role of govt. of India, Ministry of Education (1963)
12. Nurullah S., Naik J.P. and Oad L.K. . A student history of education in India, Mumbai: McMillan and Co.(1970)
13. Ramchandra, P. and Ramkumar V., Education in India. Eastern Book Corporation. (2005)
14. Rawat, P. L. , History of Indian Education: Ancient to Modern, Delhi Bharat Publication.(1956)
15. http://mhrd.gov.in/sites/upload_files/mhrd/files/document-reports/NPE86-mod92.pdf

16. http://www.teindia.nic.in/Files/Reports/CCR/Yash%20Pal_committe_report_lwb.pdf
17. http://ncte-india.org /ncte_new/pdf/NCFTE_2010.pdf
18. http://www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf
19. MHRD. National Education Policy 2020. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Modul III	Module IV
CO1	H	H	H	H
CO2		H	H	H
CO3	M	H	H	H
CO4		H	H	H
CO5	M	H		
CO6			M	H

EDET0015: EDUCATIONAL TECHNOLOGY (3-0-0)

COURSE OUTCOMES

1. State the nature, scope and approaches of Educational Technology. (Remembering)
2. Describe the teaching models and explain the concept of instructional design. (Understanding)
3. Analyze the different instructional approaches in the process of teaching and learning.(Analysis)
4. Discuss the nature of the process of communication and the application of ICT in the teaching learning process. (Application)
5. Identify the various software and hardware and state its use both in face to face and virtual classroom platforms. (Application)

Module I: Educational and Behavioural Technology (13 Lectures)

Meaning, nature and scope; Historical perspective of Educational Technology; Approaches- Software, hardware and system; Utility and problems of Educational technology in Formal and non-formal education; Behavioural Technology: teacher behaviour and teaching behaviour, teaching skills, Micro Teaching; SSST and FIACS.

Module II: Designing Instructional System (12 Lectures)

Teaching learning process, variables, levels, functions, taxonomies of instructional objective, instructional strategies, PI, PSI, MI, CAI, BMLS.

Module III: Process of Communication and ICT (10 Lectures)

Concept and process of communication, Barriers to communication, Principles of communication,Mass Media and multimedia; Concept and need of ICT.

Module IV: Emerging trends in Educational Technology (10 Lectures)

Distance Education; Open learning system; New technologies- Videotapes, Radio, Teleconferencing, CCTV, INSAT, EDUSAT, Internet, Broadband; Resource centres for Educational Technology: CIET, UGC, IGNOU, NIOS; 3D printing, mobile learning, Gamification, Flipped, blended learning /classrooms, Cloud computing, Massive open online course (MOOCs), Flash notes, Virtual Reality, Wearables, etc.

Suggested Readings

1. Ahalt, S. Ten Emerging Educational Technology. Renci White paper Series, Vol. 3, No. 1 pp.1-18 (2015).
2. Barle David , The Process of Communication, Holt and Rinerhart New York (1960).
3. Bhatia, R.L. and Ahuja, B.N. Educational Technology. New Delhi: Surjeet Publications.
4. Bhatta B.D. and Sharma, S.R. Educational Technology- Concept and Techniques, Kanishka Pub. House New Delhi.(1992).
5. Dale Edgar. Audio Visual Methods in Teaching, Holt Rinehart and Einston, New York.(1961).
6. Das R.C.Educational Technology-A basic Text, Sterling, New Delhi. (1993).
7. Dhand,H., Techniques of Teaching, APH Publishing Corporation.
8. Hooft, M. V. Mobile, Wireless, connected information clouds and learning. Emergingtechnologies for learning. Vol. 3.pp. 30-46.(2008).
9. Jangira N.K. and Ajit Singh. Core Teaching Skills: The Micro Teaching Approach, NCERT, NewDelhi.(1982).
10. Joyce, and B Weil, Models of Teaching, Prentice Hall, New Jersey.
11. Mangal S.K. Foundations of Educational Technology, Prakash Brothers Ludhiana.
12. McIsaac, M. S. and Gunawardena, C. N. (2005). Distance Education. Retrieved from http://www.aect.org /edtech/ed1/pdf/13.pdf. Accessed on 19 July, 2016.

13. Nayak, A.K. Classroom Teaching Methods and Practices: APH, Publishing Corporation.
14. Passi, B.K. Becoming Better Teacher, Micro Teaching Approach, Sahita Mudranalya,Ahmedabad.(1976).
15. Sachdeva, M.S. A New Approach to Educational Technology, Vinod Publications.
16. Sharma R.A. Technological Foundations of Educational Publications Meerut.
17. Sharma, R.A. Technology of Teaching: International Publishing House.(1983)
18. Venkataiah: Educational Technology, APH Publishing Corporation New Delhi.
19. Walia. J.S. Essentials of Instructional Technology; Paul Publishers Punjab.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			H
CO 2		H		M
CO 3		H		
CO 4			H	H
CO 5	H			H

SPECIALISATION: EDUCATIONAL LEADERSHIP

EDEL0019: DEVELOPING EDUCATIONAL LEADERSHIP (3-0-0)

COURSE OUTCOMES

1. Explain the importance of education and describe the educational system andinstitutions (Understanding)
2. Appraise the nature of collaboration and role played by stakeholders in the field ofeducation. (Evaluation)
3. Critically analyze the curriculum content and pedagogy existing in schools. (Analysis)
4. Illustrate the role of leadership in the process of inclusion. (Application)
5. Describe the various features of good leadership in the field of education.(Remembering)

Module I: Education system and Institutions (15 Lectures)

a. Education as an ideal (What is education?; Aims of education); Education as a system; School as a social institution.
b. Decentralisation of Education: Education- a concurrent subject in the Constitution; Structure of the educational system in India; Study of the structure at the state level; Linkages within the system.
c. Roles and responsibilities of the personnel involved: Teacher as an academic leader, Head teacher as a school leader, CRC, BEO, DEO, DIET Principal, SCERT Director, NCERT Director, Panchayati Raj Institutions.
d. Reflecting on one's own experiences of schooling to understand school as a social institution, nature of relationships among the various stakeholders in the school and overarching values as stated by the school

Module II: Stakeholder Collaboration (10 Lectures)

a. Parent, learners, community, teachers as stakeholders: their expectations and roles. Ensuring their participation.
b. Analysis of research on impact of stakeholder participation, challenges and principles for successful collaboration.

Module III: Leadership for Inclusion (10 Lectures)

a. School Culture: Meaning and components; Hidden curriculum.
b. Zones of exclusion. Analysing curriculum-content and pedagogy to critically examine school processes; Identifying school processes that cause exclusion.
c. Synthesizing principles of inclusive institutional culture.

Module IV: Constructing 'Educational Leadership' (15 Lectures)

a. Leadership for quality education, equity and inclusion, continuous professional development of teachers, creation of learning communities, ensuring autonomy of learners, teachers and other staff, contextualisation of the curriculum.
b. Crafting vision and mission for an educational institution. Critical review of the vision based on the parameters of educational aims, ideals of administration and values of democratic society. Assess an educational issue to arrive at strategic principles, action plans, resource management to address the issue.

Suggested Readings

1. Apple, M. W., & Beane, J. A. Democratic schools. Association for Supervision and Curriculum Development, 1250 North Pitt Street, Alexandria, VA 22314 (1995).
2. Batra, S. (2003).From School Inspection to School Support. In Sood, N. (ed). Management of School Education in India. NIEPA: New Delhi. 2. Early, P., and Weindling, D. (2004).
3. Cheney, G. R., Ruzzi, B. B., & Muralidharan, K. A profile of the Indian education system. Prepared for the New Commission on the Skills of the American Workforce.(2005).
4. Dewey, J. Democracy and Education. New York: Macmillan. (1916).

5. Fullan, M. Why Teachers Must Become Change Agents. In Educational Leadership, 50 (6).(1993).
6. Govinda, R. Capacity Building for Educational Governance at Local Levels. Paper presented at the International Consultation on Educational Governance at Local Levels. Held at UNESCO, Paris 27-28 February 2001.(2001).
7. 7. NCERT. position paper on aims of education. New Delhi: NCERT Preamble to the Constitution of India concerning values for teachers.(2006).
8. School as a social institution, Andre Baitelle.
9. Sheshagiri K.M. Decentralisation of Education in India: Reflections from Kerala and Rajasthan.
10. Wren, D. J. (1999). School culture: Exploring the hidden curriculum. Adolescence, 34(135), 593.
11. A Changing Discourse: From Management to Leadership. In Early, P. and Weindling, D. (ed). Understanding School Leadership. Paul Chapman Publications: UK.
12. Senge, P. M. (1990). Organizations as learning communities.
13. Pollard, A. (2002). Reflective Teaching. Continuum: London. Chapters – 1,8,9. 39.
14. Hargreaves, A. (2000).Teachers and Teaching: History and Practice, Vol. 6, No. 2, 2000 Four Ages of Professionalism and Professional Learning.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			M
CO 2		H		
CO 3			H	M
CO 4			H	
CO 5	M			H

SPECIALISATION: EDUCATIONAL PSYCHOLOGY

EDDL0020: HUMAN DEVELOPMENT AND LEARNING (3-0-0)

COURSE OUTCOMES

1. Explain the nature of child and childhood education. (Understanding)
2. Characterize the nature of human growth, maturation and development. (Application)
3. Appraise the nature and theories of development. (Evaluation)
4. Describe an understanding about adjustment mechanism in social context.(Remembering)
5. Classify the differently abled persons and discuss their educational implications.(Analysis)

Module I: Understanding Child and Childhood (10 Lectures)

Importance of understanding child and childhood; capabilities of children belonging to different socio-economic and cultural backgrounds; idea of multiple childhood; nature-nurture debate; language development; learning and acquisition; promoting autonomy in children.

Development of case studies of children belonging to different backgrounds

Module II: Development and Learning (13 Lectures)

Stages of development; growth and maturation; Adolescence: why it is a sensitive period, the importance of recognizing issues related to adolescence; Erikson's stages of psycho-social development; Vygotsky's theory on social constructivism; Piaget's Theory of Cognitive development. Piaget and Vygotsky debate

Developing a personal narrative of experiences of adolescence

Module III: Enabling learning and Understanding learning of differently abled persons (12 Lectures)

Bronfenbrenner's ecological systems; theory of development; social context of learning; enabling school environment; promoting independence of thought and action; parenting at different stages of development; Understanding differently abled persons and their educational implications: ADHD, autism, dyslexia. juvenile delinquency.

Module IV: Psychology of Adjustment and Adjustment Mechanisms (10 Lectures)

Adjustment as a process; a theory of cognitive adaptation. frustration and conflict; causes of maladjustment; contribution of Freud, Adler, Jung and Neo-Freudians to understand maladjustment, adjustment mechanisms. conflicts and defence mechanisms, mental hygiene.

Suggested Readings

1. Arkoff & Abe. ' Adjustment and Mental Health' .New York, McGraw- Hill (1968).
2. Bjorklund, D. 'Child and Adolescence Development-an integrated approach'. Blasi
3. Wadsworth Cengage Learning Publications. (2010).

4. Bronfenbrenner,Urie. 'The ecology of human development'. Harvard University Press
5. Cambridge. (1979).
6. Crow & Crow. 'Understanding Our Behavior '. N.Y. Alfred A Knoff Publications(1956).
7. Erickson, H.Erik. 'Childhood and Society'. W.W. Norton Publication.(1993).
8. Erickson, H.Erik. 'Stages of Psychosocial Development '. Green Verlag, Gmbtt(2005) .
9. Freud S. 'Psychopathology of Everyday Life-The Basic Writings of Sigmund Freud.' New York,
10. Modern Library.(1938).
11. Kostelnik, J.M., Gregory,M.K., Soderman. K.A., & Whiren, P.A. 'Guiding children's social development and learning '. Wadsworth Cengage Learning Publications(2012).
12. Kozulin A.,Gindis, B., Ageyev.,S.V & Miller, M.S. 'Vygotsky's Educational Theory in Cultural
13. context '. Cambridge University Press.(2003).
14. Lahner, George. ' The Dynamics of Personal Adjustment '. New Jersey: Prentice –Hall. (1964).
15. Lerner, J. 'Learning Disabilities-Diagnosis and Teaching Strategies'. Boston HoughtonMifflin.(1985).
16. Lock, A & Strong, T. 'Social Constructionism – Sources and Stirrings in Theory and
17. Practice'. Cambridge University Press (2010).
18. Mangal, S.K. 'Educating Exceptional Children-An Introduction to Special Education' .PHI
19. Learning Private Limited,Delhi(2010).
20. Mangal, S.K. Abnormal Psychology ' N.D-Sterling Publications (revised edition)(1987). '
21. Mangal, S.K. 'Advanced Educational Psychology '. PHI Learning Private Limited,Delhi,(2002).
22. McLounghlin, J.A and Netick, A. . 'Defining Learning Disabilities- A new and co-operative
23. direction '.Journal of Learning disabilities.(1983).
24. Newman,M.B & Newman, R.P. 'Development through Life-A psycho-social approach'.12th
25. edition, Cengage Learning Stamford.(2006).
26. Sinha, AKP, Singh, R.P. 'Manual for Adjustment, Inventory for College Students'. Agra,
27. National Psychology Corporation. (1971).
28. Telford, C.W & Sawrey, J.M. ' The Exceptional Individuals' .New Jersey,Prentice-Hall. (1967).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2		H		H
CO 3			H	
CO 4			H	
CO 5	M			H

EDTP0022: PRINCIPLES & TECHNIQUES OF TEACHING AND PEDAGOGY (3-0-0)

COURSE OUTCOMES

1. Explain the nature of teaching. (Understanding)
2. Mention the theories of teaching and different models of teaching. (Analysis)
3. Distinguish the different methods of teaching. (Application)
4. Narrate the concept of pedagogy in the process of teaching and learning. (Evaluation)
5. Communicate the various Recent Developments in Pedagogy. (Application)
6. Describe the aspects of teaching in connection to various skills. (Analysis)

Module I: Concept and aspects of teaching (10 Lectures)

Teaching: Concept, nature and scope; Teaching competency: Understanding the child, understanding the subject, contextualization, punctuality, regularity, integrity, humility, accountability, humanism, empathy, enthusiasm; Skills of teaching: Explaining, questioning, stimulus variation, reinforcement, achieving closure, etc.; Integration of different teaching skills and Strategies of teaching: Autocratic, Permissive, Democratic. Study the biographies of famous teachers and develop teacher profiles within historical and contemporary perspectives.

Module II: Theories and models of teaching (10 Lectures)

Principles and maxims of teaching; Theories of teaching: behaviourism, cognitivism, constructivism, co-operative approach; Models of teaching: information processing models, social models, behavioural models and personal models Demonstration on models of teaching by students.

Module III: Teaching Methods (15 Lectures)

Teacher-centred methods: lecture, demonstration, team-teaching, mastery learning strategy; Learner-centred methods: programmed learning, personalized system of instruction, problem solving method; Activity-centred methods: seminar,

workshops, peer-tutoring, group discussion, projects, heuristic method, panel discussion, brainstorming, symposium and role-play; Teaching aids: significance, types and uses Classroom teaching practice.

Module IV: Recent developments in Pedagogy (10 Lectures)
Pedagogy: concept and significance; History of pedagogy: Indian, Greek and Roman history of pedagogy; Innovative pedagogy: crossover learning, learning through argumentation, incidental learning, learning by doing, embodied learning; Pedagogical approaches for diversity in societyand its interface with the classroom.
Analysis of teaching in a real classroom situation

Suggested Readings

1. Aggarwal, J. C. Principles, methods and techniques of teaching. Delhi: Vikas Pub House.
2. Anderson. L. W.et al. International Encyclopedia of Teaching and Training Education,Pergmon press.
3. Joyce, B. & Weil, M. Models of teaching. New Delhi: Prentice Hall.
4. Jangira, N. K.Professional Enculturation: Innovative Experiments in Teaching and Training,New Delhi; Bookworth of India.
5. Ashton-Warner, S. Teacher. New York: Simon & Schuster.
6. Hall, G. E. & Quinn, L. F. & Gollnick, D. M. Introduction to Teaching: Making a Difference in Student Learning. Sage Publisher.
7. Puri, U. Teaching Techniques. ND: Pragun.
8. Sharma, B. L. & Saxena B. M. Methods of Teaching. Meerut: R. Lall.
9. Sharma, T. R. & Bhargava, R. Modern Teaching Aids. Agra: HP Bhargav Books.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	H	H
CO 2	H	H	M	H
CO 3	M	H	M	
CO 4	H		H	H
CO 5	M	M	H	H
CO 6	H		M	

EDTE0023: TEACHER EDUCATION (3-0-0)

COURSE OUTCOMES
1. Describe the concept of teacher education. (Understanding)
2. Explain teaching as a profession. (Application)
3. Identify the structure of teacher education programmes. (Application)
4. Illustrate the recent trends of teacher education. (Remembering)
5. Prepare the course structure of Teacher Education with integrated Teacher EducationProgrammes. (Analysis)
6. Distinguish the various aspects of teaching as a profession. (Evaluation)

Module I: Concept and Fundamentals of Teacher Education (13 Lectures)
Meaning, nature and scope of teacher education; Aims and objectives of teacher education; Historical perspectives of teacher education - Kothari Commission, National Commission on Teachers (1983-85), NPE (1986), Revised POA (1992); Recent developments in teacher education - NCF 2005, NKC 2007 & NCFTE 2009. History and status of Teacher Education in North East India. Problems and issues of Teacher Education in N.E. India. Comparative analysis of Teacher education in the past and present.

Module II: Teaching as a Profession (12 Lectures)
Approaches to teacher education: Behaviouristic and constructivist approaches; Modification of teaching behaviour: Simulated teaching, Flanders' Interaction Analysis; Performance appraisal of teacher; Teacher effectiveness; Code of conduct and ethics in teacher education.
Classroom observation and analysis using Flanders' Interaction Analysis.

Module III: Structure of Teacher Education Programmes (10 Lectures)
Role of professional organizations and bodies of Teacher Education; Pre-service and In- service teacher education; Teacher education by open and distance learning; Role of different agencies in quality assurance – MHRD, UGC, NCERT, NCTE, SCERT, NAAC, RIE, SIE, IASE, UGC-HRDC
Analysis of a distance learning teacher education programme

Module IV: Recent trends in Teacher Education (10 Lectures)
Internship, Practice teaching for developing an effective teacher, Integrated Teacher education programme; Action research; ICT in teacher education; preparing teachers for inclusive classrooms; Issues and challenges in teacher education. Analyse the

course structure of an integrated teacher education programme.

Suggested Readings

1. Aggarwal J.C. Teacher education, theory and practices. New Delhi: Doaba Home.
2. Altekur. A.S. Education in ancient India. Banaras: Nand Kishore Bros.
3. Anderson.L.W. et al. International Encyclopedia of Teaching and Training Education.Pergmon press.
4. Biddle, B. J. and Ellena. Contemporary research on teacher-effectiveness.
5. Buch. M.B. First survey of research in Education. Baroda: SERD.
6. Buch.M.B. Second survey of research in Education. Baroda: SERD.
7. Buch.M.B. Reading in in-service education. Sardar Patel Palasane, M.M. University.
8. Dunkin Michael J. The international encyclopedia of teaching and teacher education,Pergmon education forum, Vol 4 no 12, New York.
9. Harvilas, S. and Naik .J.P. A history of education in India. Bombay: Macmillan and co.
10. Hittlilman, D.R. A model for a competency based teacher preparation in Program-teacher education Forum, vol 4 no 12, New York.
11. Jangira N.K. Teacher training and teacher effectiveness an experience in Teaching. New Delhi:National Publishing House.
12. Kumar. T. P. Teacher education. APH Publishing Corporation.
13. NCERT: The Third Indian year book on education. New Delhi: NCERT. 1968.
14. NCTE, Teacher education curriculum (1978): A Framework. New Delhi: NCERT.
15. Shrimali .K.L. Better teacher Education. New Delhi: Ministry of education Govt. of India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H	H	M
CO 2	H	M	H	H
CO 3	H	H	H	H
CO 4	M	M	M	H
CO 5	H	H	H	H
CO 6	H	H	H	M

EDME0024: MEASUREMENT AND EVALUATION IN EDUCATION (3-0-0)

COURSE OUTCOMES

1. Describe the conceptual framework of educational measurement andevaluation.(Applying)
2. Mention different dimensions of educational measurement and evaluation.(Remembering)
3. Explain the concepts of reliability and validity of test scores. (Remembering)
4. Identify the tools and techniques to be used in the process of educational measurementand evaluation (Analyzing)
5. Apply the process of construction and standardization of tools. (Applying)
6. Find out reliability and validity of a tool. (Applying)

Module I: Educational Measurement (7 Lectures)

Overview of measurement and assessment; Types of measurement - psychological and physical; Functions of measurement - Prognosis, Diagnosis, Research; Scales of measurement, Properties and Types - Nominal, Ordinal, Equal interval, Ratio; General problems of measurement; High stakes' testing, Performance and portfolio assessment.

Critical evaluation of the current trends in educational measurement

Module II: Dimensions of Educational measurement and Evaluation (10 Lectures)

Diagnostic, Aptitude, Achievement, Intelligence; Mode of assessment - formal, informal, formative, summative, continuous, terminal, process, product, internal and external; Process of assessment - Teacher-made test, standardized test, Norm reference test and criterion reference test.

Review of Stanford-Binet Test and General Aptitude Test Battery (GATB)

Module III: Reliability and Validity of a Test (8 Lectures)

a. Overview of reliability - Methods of estimating reliability with computation - test retests method, Equivalent forms method, Split half method, Kuder-Richardson method; Inter-rater consistency; Interpreting reliability coefficient; factors influencing reliability measures.
b. Nature of validity, major considerations in validation – content consideration, construct consideration, test-criterion relationship, consideration of consequences; Methods of estimating validity; factors influencing validity; Relationship between reliability and validity.

Practice session on estimating reliability and validity.

Module IV: Tools and techniques for educational measurement (10 Lectures)
Overview of constructing various types of objective tests; Guidelines for writing objective test items; Essay questions: forms, uses, guidelines for constructing, scoring criteria. Interpretive exercises: nature, forms, and uses of the interpretive exercises, Advantages and limitations.
Administration of a group test of intelligence using a standardized tool.

Module V: Standardization of a test (10 Lectures)
Planning the test: Determining the objective and test specification, preparing the preliminary format- writing, arrangement, review and editing of test items; tryout of the test - administration, scoring and item analysis; preparing the final form of the test - selection of items, fixing the time limit, direction to the examinee, preparation of scoring key; administration of the final form of the test- determining validity, reliability, norms, standard scores; manual of the test, interpretation of test results, characteristics and uses of standardized test.
Students will prepare, administer and standardize a test, following the set procedures of standardization of a test.

Suggested Readings

1. Gregory, R. J. Psychological testing: History, principles and application. Delhi: PearsonEducation pvt. Ltd.
2. Kaplan, R.M. & Saccuzzo, D. P. Psychological testing: Principles, applications, and issues. Kundli Haryana: Thomson Wadsworth.
3. Kubiszyn, T. & Borich, G. Educational testing and measurement: Classroom application and practice. Kundli Haryana: John Wiley & Sons, Inc.
4. Linn, R. L. & Gronlund, N. E. Measurement and assessment in teaching. New Delhi: PearsonEducation.
5. Sharma, R. A. Essentials of measurement in education and psychology. Meerut: R. Lall BookDepot.
6. Sidhu, K. S. New approaches to measurement and evaluation. New Delhi: Sterling PublishersPvt. Ltd.
7. Ebel, R. L. & Frisbie, D. A. Essentials of educational measurement. New Delhi: Prentice-Hall ofIndia Pvt. Ltd.
8. Patel, R. N. Educational evaluation theory and practice. Mumbai, India: Himalaya PublishingHouse Pvt., Ltd.
9. Singh, A. K. Tests, measurements, and research methods in behavioural sciences. Patna: Bharati Bhawan Publishers and Distributors.
10. Swain, S. K., Pradhan, C., & Khatoi, P. K. Educational measurement statistics and guidance. New Delhi: Kalyani Publishers.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2		M		H
CO 3	H		H	
CO 4	M			H
CO 5		H	H	
CO 6	H			H

SPECIALISATION: EDUCATIONAL LEADERSHIP

EDFM0026: FINANCIAL MANAGEMENT AND ACCOUNTING (3-0-0)

COURSE OUTCOMES
1. Describe accounts and finance in relation to education. (Application)
2. Illustrate the various processes of taxation regulations related to education. (Evaluation)CO3Work out the double entry accounting. (Analysis)
3. Illustrate the process of budgetary control and Auditing. (Application)
4. Identify the Process of Deduction of Tax and computation of Tax at source.(Remembering)
5. Explain the importance and working of Balance Sheet in accounting. (Evaluation)

Module I: Introduction (8 Lectures)
Evaluation of Financial Accounting; Difference between Accounting and Bookkeeping; Accounting Concepts; Principles, Bases and Policies.

Module II: Journal (8 Lectures)
Double Entry Accounting; Journal; Posting; Ledger.

Module III: Balance Sheet (8 Lectures)
Trial Balance; Final Account – Trading Account, Profit And Loss Account, Receipt And Payment Account; Income Expenditure Accounts; Balance Sheets.

Module IV: Financial Management (10 Lectures)
Decision Making; Meaning and Scope; Cost Analysis; Budgetary Control; Standard Costing; Financial Analysis; Relevant Cost; Management Accounting Framework; Function of Management Accounting; Internal Audit; School Accounting and Auditing; Investment.

Module V: Taxation Management (11 Lectures)
Basic Concepts; Deduction from Gross Total Salaries; Income From House, Property; Profits and Gains of Business and Profession; Capital Gains; Income from other Sources; Set off and Carry Forward of Losses; Assessment of Individuals and Computation of Tax at Source, Assessment of Companies and Fringe Benefit and Service Tax. VAT/ GST.

Suggested Readings
1. Block, S. B., G. A. Hirt, & B. R. Danielsen. Foundations of Financial Management. New York,NY: McGraw-Hill/Irwin.
2. Das, K.R., Sinha, K.M., & Choudhury, P. Theory and practice of bookkeeping and accountancy. Guwahati: lawyers book stall.
3. Lal, J & Srivastva, S. Financial Accounting: Principles & Practices. New Delhi: ChandPublications.
4. Wilson, M. Advanced Accountancy. Chennai: Scitech Publications.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	M	H
CO 2	H	H	H	H
CO 3	H	H	H	M
CO 4	H	H	H	H
CO 5	M	M	M	H
CO 6	H	H	H	M

EDLE0027: LIFE SPAN DEVELOPMENT AND EDUCATION (3-0-0)

COURSE OUTCOMES
1. Recognize the meaning, concept, process, nature, and scope of life, development, lifespan development, and emotions of an individual. (Remembering)
2. Understand the biological bases and anatomical structures controlling human development along with understanding emotional development and its associatedcomponents. (Understanding)
3. Analyze theories of development M1 and issues of human development at variousstages. (Analysis)
4. Apply the principles and knowledge of the theories of development and human anatomy in educating children as well as mitigating bio-psycho-socio-emotional issues.(Application)
5. Evaluate the influence of socialization on the development process of an individual.(Evaluation)
6. Creating models to bring about a balanced emotional development of students.(Creation)

Module I: Introduction to LifeSpan Development (8 Lectures)
Life Span Perspective: Importance of studying Life-Span Development, Characteristics of life-span development, Nature of Development, Scope of Lifespan development. Theories of Development (Brief discussion of all theories), Influence of Socialization and Development.
Analyze the role of education in socialization and development of the child.

Module II: Biological Bases of Human Development and Anatomy of the Nervous system (14 Lectures)
The Evolutionary perspective and Heredity-Environment Correlations, genetic foundation, Conception, effect of Teratogens on Prenatal Development, Neonatal health - Low birth weight, Neonatal Assessment; Neuron: Structure, types and functions. Structure of the nervous system, physiological basis of the action potential (neural response); Structure and function of the brain: fore brain, midbrain, hindbrain, cerebral cortex, temporal, parietal and occipital lobes; prefrontal cortex; The effect of hormones on the nervous system
Debate on heredity and environment: essential factors affecting human development.

Module III: Physical development across lifespan (11 Lectures)
Physical growth during childhood, adolescence and old-age brain development across lifespan, Bio- Psycho- Social health model, aging, biological theories of aging and death.
Discussion on educational implications of stages of physical development.

Module IV: Emotional and Moral Development (12 Lectures)
Development of Emotion, Temperament, Attachment, Love, intimacy, sexuality, self-identity, gender identity and personality across the life span.
Theories of moral development. Changes in moral reasoning (Kohlberg ’s Theory). Development of

values, Religion, Spirituality and Meaning in Life, Fowler 's Theory
'Emotions are springs of human actions'- A group discussion on teachers' role in bringing about balanced emotional development of students.

Suggested Readings

1. Berk, L.E. Child Development. New Delhi: Prentice Hall.
2. Bhaskar, R. Fundamentals of child psychology. Delhi: Swastik Publishers and Distributors.
3. Carlson, N.R. Physiology of behaviour. Boston.
4. Chatterjee,C., Suhita, P., Priyadarshi,C. and Vijayaraghavan, M.(Eds). Discourses on Aging andDying. Los Angeles: Sage.
5. Hurlock, E.B. Child development. New Delhi: Tata McGraw-Hill Publishing Company Limited.
6. Hurlock, E.B. A Life-Span Approach. New Delhi :Tata McGraw-Hill Publishing CompanyLimited.
7. Leukel, F. Introduction to physiological psychology. New Delhi: CPS Publishers.
8. Mallon, B. Dying, death and grief, working with adult bereavement. Los Angeles: Sage.
9. Mishra, A.K. Psychology of Aging. Jaipur: Sublime Publications.
10. Morgan, T.H and Steller, A.(1965).Physiological Psychology. New York: McGraw Hill.
11. Santrock, J.W. Life –Span development. New Delhi: Tata McGraw-Hill.
12. Santrock,J.W. Child Development. New Delhi: Tata McGraw-Hill Edition.
13. Sharma,R. N. and Sharma, R. Child Psychology. New Delhi: Atlantic.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			M
CO 2		H		H
CO 3	H	H		
CO 4	M	H	H	H
CO 5	H			
CO 6				H

EDLI0028: LEARNING AND INDIVIDUAL DIFFERENCES (3-0-0)

COURSE OUTCOMES

1. Recognize the concept, nature, process, laws, types, and methods of learning.(remembering)
2. Understand the relationship of learning with interest, motivation, maturation, andindividual difference. (Understanding)
3. Analyse various factors influencing learning. (Analysis)
4. Apply the laws and theories of learning, use components of learning to solve problems, and utilize the knowledge of individual differences to facilitate adequate provisions. (Application)
5. Evaluate the educational implications of learning and effectiveness of learning styles.(Evaluation)
6. Create a conducive environment of learning. (Creation)

Module I: Understanding Learning (10 Lectures)

Learning: Concept and Scope; Nature of learning: learning as a process and learning as an outcome; Laws of learning; Types of learning: factual, associations, conceptual, procedural, generalizations, principles and rules; Methods of effective learning; Learning curves - Types, features and its educational implications; Plateaus in Learning; Learning styles.
Students analyze their own learning styles.

Module II: Factors Influencing Learning (12 Lectures)

Factors influencing learning - Intellectual, Emotional, Physical and Social; Concept and nature of attention, determinants of attention, relationship with interest; Concept, nature and types of motivation – intrinsic, extrinsic and achievement; Learning and maturation; Learning to think, reason and solve problems
Discuss the role of a teacher in addressing various factors influencing learning.

Module III: Transfer of learning (10 Lectures)

Transfer of learning - Concept, Importance, Nature; Types of transfer of learning; Theories of transfer of learning - Theory of mental discipline, Theory of identical elements, Theory of generalization and theory of ideals; Methods of enhancing transfer of learning.
Developing a narrative of personal experiences on the basis of transfer of learning in various situations.

Module IV: Individual Difference (13 Lectures)

Concept of individual difference; Dimensions of individual difference; Determinants: Role of heredity and environment, their inter-relationship; Types/varieties of individual differences - Physical, mental, motor, emotional, interest and aptitude, attitudes, social and moral development. Individual difference and education; Influence of individual differences on learning

outcomes; Provisions for individual differences in educational institutions; Implications of individual differences for organizing educational programmes Sharing session on the problems and issues related to individual differences as faced by the students.

Suggested Readings

1. Bhatnagar, S. Advanced Educational Psychology. Agra: Bhargava Book House.
2. Chand, T. Educational Psychology. Agra: Bhargava Book House.
3. Crow, R.B. & Crow, A. Educational Psychology. New Delhi: Eurasia Publishing House.
4. Dececee, J. P. The Psychology of Learning & Instruction. New Delhi, Prentice Hall.
5. Dhir, R.N. Educational Psychology. Chandigarh: Abhishek Publication.
6. Driscoll, M. P. Psychology of Learning for Instruction. Boston, Allyn and Bacon.
7. Gagne, R. M. The Conditions of Learning. New York, Rinehart &.Winston.
8. Guilford, J.P. The Nature of Human Intelligence. New York: McGraw Hill.
9. Hall, C & Hall, E. Human relations in education. Routledge.
10. Holt, J. How children fail? Penguin.
11. Hulac, D. M., & Benson, N. Getting Students to Work Smarter and Harder: Decreasing Off-Task Behaviour through Interpersonal Techniques. School Psychology Forum,5(1), 29-36.
12. Judd, C.H. Educational Psychology, Guwahati: Nivedita DK Distributions.
13. Kumar, K. What is worth teaching? Orient Black Swan.
14. Kuppuswamy, B. Advanced Educational Psychology. Jalandhar: Jalandhar University.
15. M. Gauvain & M. Cole, (Eds). Readings on the development of children. New York: W. H.Freeman & Co.
16. Mangal, S. K. Essentials of Teaching Learning and Information Technology. Ludhiana: TandonPublishers.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		H
CO 3		H		
CO 4	H	H	H	
CO 5	H	H	H	H
CO 6		M	M	M

EDOC0029: ORGANISATIONAL COMMUNICATION (4-0-0)

COURSE OUTCOMES

1. Understand the concept, scope, importance, process, types, advantages, and barriers of communication in an organization. (Understanding)
2. Apply skills of presentation utilizing visual aids, implement decision making techniques for effective communication. (Application)
3. Analyse the communicative dimensions of team work and violation of professionalboundaries. (Analysis)
4. Create and draft business letters and design and develop conflict managementstrategies. (Creation)
5. Understand the concept, need, significance, and execution of administrative feedback in organizational communication. (Understanding)
6. Evaluate the modes of effective communication and feedback models in anorganization. (Evaluation)

Module I: Conceptual Framework of Communication (10 lectures)

Concept and functions of Communication; Communication and four senses; Communication process, communication model and its elements; scope of communication

Module II: Organisational Communication (12 lectures)

Relationship between Organisation and Communication; common modes of communication in an organisation: writing, conversation, reading, media, charts, proceedings, T.V. telephone, e-mail and other modes of communication; Formal and informal communication; practical approaches in understanding administrative communication: cross communication, downward communication, upward communication

Module III: Communication Techniques (13 lectures)

Presentation skills, effective use of voice in presentation: articulation, tone, pitch; making effective presentations; use of visual aids in presentation; communication in teams: project teams, quality improvement teams, virtual teams; communicative dimension of team work- roles, norms, decision- making processes and management of conflict.

Module IV: Feedback and professional boundaries (10 lectures)

Feedback, Administrative feedback, models of feedback, assessing the listening skills; maintaining Professional Communication-

professional boundaries, violation and maintaining of boundaries

Suggested Readings

1. Baker, G.S. Fitly Spoken: Developing Effective communication and social skills. NewYork:Paperback.
2. Gillis, T. The IABC Handbook of organisational communication: A guide to internal communication, public relations, Marketing and Leadership. New York: Jossey-Bass.
3. Hardman, E. Active Listening 101: How to turn down your volume to turn up yourcommunication skills.
4. Hargie, O. Skilled Interpersonal Communication: Research Theory and Practice.London: Routledge.
5. Harris, E. T. and Nelson, D. M. Applied Organisational Communication: Theory and practice in a global environment. London: Routledge.
6. Krishnamacharyulu, R. & Lalitha. Business communication: Global Media.
7. Lewis K. L. Organisation change: Creating change through strategies communication. NewYork. Wiley.
8. Miller, K. Organisational Communication: Approaches and Processes: London: WadsworthPublishing.
9. Tourish, D and Hargie, O. Key Issues in organizational communication. London: Routledge.

Mapping of COs to Syllabus

Course Outcomes	ModuleI	Module II	Module III	Module IV
CO 1	H	H		
CO 2		H	H	
CO 3		H	H	
CO 4		H	H	
CO 5				H
CO 6				H

SPECIALIZATION: EDUCATIONAL LEADERSHIP

EDEA0030: EDUCATIONAL ADMINISTRATION (3-0-0)

COURSE OUTCOMES

1. Recognize the nature, scope, objectives, significance, and elements of educationaladministration. (Remembering)
2. Understand the characteristics of successful and democratic administration along with understanding the concept of school, school management, supervision and its features, evaluation and its principles, and role of headmaster and teachers in school management. (Understanding)
3. Apply democratic educational administration in practical situations and the principles ofevaluation in supervisory works. (Application)
4. Analyse the duties of educational administrators/school managers including headmasterand teachers. (Analysis)
5. Evaluate democratic administration, functional basis of supervision, and roles ofeducational administrators. (Evaluation)
6. Utilize creative ways towards infrastructural resource management and supervisory programmes. (Creation)

Module I: Conceptual Framework of Educational Administration (12 Lectures)

Nature and scope of educational administration; Objectives of educational administration; Elements of educational administration; Characteristics of successful administration; Democratic administration.

Module II: School Management (10 Lectures)

Concept of School; Need of school; School management; Headmaster/Principal as the school manager and her/his qualities; Role of teachers and community in school management; Infrastructural resource management.

Module III: Concept of Supervision (12 Lectures)

Meaning of supervision; Difference between supervision and administration; Effective supervision; Functional basis of supervision; Supervision as leadership.Module IV: Evaluation and Supervision (11 Lectures)
Concept of evaluation; Principles of evaluation; Evaluation of supervisory programme; Evaluation of Educational administrative programme; Evaluation as a continuous programme for qualityimprovement.

Suggested Readings

1. Adams,H.P & Duckey,F.G. Basic Principles of supervision.
2. Arif, S., & Sohail, A. What Really Works in Leading a School? International Journal of Learning,16(10), 695-707.
3. Boghossian, P. Behaviorism, Constructivism, and Socratic Pedagogy. Educational Philosophy& Theory, 38(6), 713-722.
4. Cara, C. The Power of One with Many Revisited: Creating Inclusive, Accessible, Collaborative Education for All. International Journal of Learning, 14(8), 221-233.
5. Chandler, L. Design Dynamics and Mastery: A Multi-modal Teaching Tool for Design Students. International Journal of Learning, 14(5), 51-57.

6. Donahoo, S. & Hunter, R. Teaching Leaders to Lead Teachers: Educational Administration in the Era of Constant Crisis. Advances in Educational Administration, Volume 10, 1–4. Elsevier Ltd.
7. English, F. (ed.). Encyclopedia Educational leadership and Administration (Vol.1), Sage Publication: Thousand Oaks.
8. Stanley, A. G. & Samier, E. A.Political Approaches to Educational Administration and Leadership. Routledge: New York.
9. Starratt, R. Centering Educational Administration: Cultivating Meaning, Community, and Responsibility. Lawrence Erlbaum Associates, Publishers: New Jersey
10. Tarc, A. Education as Humanism of the Other. Educational Philosophy & Theory, 37(6), 833- 849.
11. White, R. & Cooper, K. (Ed.). Principals in Succession Transfer and Rotation in Educational Administration. Springer: New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	H	
CO 3	H		M	H
CO 4		H	M	
CO 5	H	H	H	
CO 6		H		H

EDSR0031: ETHICS AND SOCIAL RESPONSIBILITY IN EDUCATION (3-0-0)

COURSE OUTCOMES

1. Recognize the meaning, need, and components of ethics and value, identify the significance of values and morals along with types of ego, and meaning, need, role, andtypes of social responsibility. (Remembering)
2. Understand the theoretical perspectives of ethics and social responsibility, relationshipof educational ethics with gender and leadership, and significance of teaching profession. (Understanding)
3. Evaluate the strategies of social responsibility and role of ethics in a workplace.(Evaluation)
4. Apply the criteria of profession and UGC's code of conduct for teachers. (Application)
5. Analyze the influence of globalization on ethics and developmental activities andimportance of code of conduct. (Analysis)
6. Mitigate the problems encountered in the process of delivering social responsibility.(Creation)

Module I: Educational Ethics (9 Lectures)

Concept of Ethics and educational ethics; Need of ethics in educational settings; Components of ethics; types of values, morals.

Module II: Theoretical Perspectives of ethics (12 Lectures)

Ethical theories: Utilitarianism, Kantian ethics, Natural rights theories; religious ethics; virtue ethics; Kantian vs utilitarian; gender and ethics; ethics and leadership. Concept of ego: psychological, ethical, rational. Moral philosophy.

Module III: Ethics and Social Responsibilities (12 Lectures)

Concept of social responsibility; Need of social responsibility; Types of social responsibility; Social responsibility of educators; Strategies of social responsibility.

Module IV: Professional Development (12 Lectures)

Concept of profession; Criteria for a profession; Teaching as a profession; Workplace and code of conduct, Technology and globalization in relation to professional ethics and developmental activities.

Suggested Readings

1. Hill, I. Curriculum Development and Ethics in International Education: Education forDisarmament, pp 49-58. Retrieved from Disarmament Forum.
2. Raina, R. Situating Ethics in Technology and Science, Economic and Political Weekly, june 5,(vol xlv no 23).
3. Roddick, A. Professionalism and Ethics. In Understanding Facilitation: Theory and Principles (pp 189 - 216).Christine Hogan. London: Kogan Page.
4. Sikand, Y. Deoband's Fatwas on Muslim Women, Economic and Political Weekly. May 22, (vol
5. xlv no 21).
6. Sreekumar, N. Ethics, profession and developmental concerns, Economic and Political.Weekly June 26.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	H	
CO 2		H		M

CO 3			H	H
CO 4				H
CO 5				H
CO 6			H	

SPECIALIZATION: EDUCATIONAL PSYCHOLOGY

EDSP0032: COUNSELLING SKILLS FOR EDUCATIONAL PSYCHOLOGISTS (3-0-0)

COURSE OUTCOMES

1. State the meaning, nature, objectives, scope, process, types, and approaches ofcounseling. (Remembering)
2. Explain various theories of counseling and understand the concept, need, and skills of educational psychologists. (Understanding)
3. Apply the theories and tools and techniques of counseling. (Application)
4. Assess the skills of counseling and role of teacher as a counselor. (Evaluation)
5. Analyze the theories of counseling and various types of guidance. (Analysis)
6. Create the tools and techniques to be used for student counseling and improvise teachers' role in counseling process. (Creation)

Module I: Introduction to Counselling (12 Lectures)

Meaning, nature, objectives and scope of counselling; counselling as a process: factors affecting counselling process, stages of counselling process; types: individual and group; approaches of counselling: Directive, Non-directive and Eclectic Counselling.

Module II: Theories of Counselling (12 Lectures)

Gestalt Counselling; Psychoanalytic Counselling; Cognitive Psychologists; Personality -Cattle's Truth Theory; Behavioral Counselling.

Module III: Introduction to Educational Psychologists (11 Lectures)

Concept of Educational psychologists; need of educational psychologists; educational psychology as a career; key skills for educational psychologists; concept of guidance, need and types of guidance; guidance and counselling services; tools and techniques to be used for student counselling process.

Module IV: Teacher as a Guide and Counsellor (10 Lectures)

Role of teacher as an educational psychologist; guidance worker and counsellor; Counselling skills: Building trust, Listening, Attending, Building rapport, Demonstrating Empathy, Observing; Difference between counsellors, educational psychologists, clinical psychologists.

Suggested Readings

1. Kinra, K. K. Guidance and Counselling, Pearson India (2008).
2. Alam, Shah. Basics of Guidance and Counselling, Global Vision Publishing House (2008).
3. Hansen, J. C. Counseling Process and Procedures. New York: Macmillan.(1982).
4. Madhukar, I. Guidance and Counseling. Authors Press.(2000).
5. NCERT. Guidance and Counseling. Module –I, NCERT, New Delhi (2009).
6. NCERT. Guidance and Counseling, Module –II NCERT, New Delhi (2009).
7. NCERT. Guidance and Counseling. Module –IX NCERT, New Delhi (2009).
8. Oberoi, S.C. Guidance and Counseling. Paperback, R.Lall publishers (2016).
9. Pandey, V.C. Educational Guidance and Counseling. Isha Books(2005).
10. Rao, S.N. Counseling and Guidance, McGraw Hill Education (1993).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	H	
CO 3		H	H	
CO 4				H
CO 5		H	H	
CO 6			H	H

EDCA0033: CHILD AND ADOLESCENT MENTAL HEALTH (3-0-0)

COURSE OUTCOMES

1. Recognize the historical background of mental health, objectives, scope, and need of mental health, factors affecting mental health of children and adolescents, and the characteristics of a mentally healthy person. (Remembering)
2. Explain the factors affecting mental health in childhood, the features of adolescents,and the role of parents and teachers in these regards. (Understanding)
3. Apply solutions to various problems pertaining to mental health of child andadolescents. (Application)
4. Evaluate problem behaviours among children and adolescents. (Evaluation)
5. Analyze the status of mental health of school going children and adolescents and thebest practices in mental health care. (Analysis)
6. Create awareness among the students about mental health of children and adolescentsand develop preventive measures for mental health by designing a mental health system. (Creation)

Module I: Introduction to Mental Health (11 Lectures)
Concept of mental health: Historical background of mental health, objectives, scope, and need of mental health, factors affecting mental health; characteristics of a mentally healthy person; Mental health promotion, preventive intervention & treatment.

Module II: Mental Health as a Primary Health Concern among children (12 Lectures)
Childhood as critical stage of development: Child mental health as a primary health concern, factors affecting child mental health; Children with problem behaviours and developmental difficulties- language difficulties, Autism, Need for a comprehensive mental health system; Integrated approaches to early childhood mental health; Government policies and programs addressing childhood well- being.

Module III: Mental Health as a Concern among Adolescents (12 Lectures)
Concept of adolescents and adolescence, Adolescence as a period and its characteristics, Adolescence as period of stress and storm; Indicators of mental health development among adolescents, Introduction to problem behaviours among adolescents - delinquency, anxiety, conflict, stress, depression, drug abuse, substance abuse, alcoholism, adjustment mechanisms.

Module IV: Education and Mental Health (10 Lectures)
Mental health services in schools; child guidance clinic; Role of parents and teachers in fostering mental health among children and adolescents; promoting psychological well-being among children and adolescents; guidance and counseling.

Suggested Readings

1. Chauhan, S.S. (2010). Advanced Educational Psychology, Noida. Vikas Publishing House Pvt.Ltd.
2. Goswamee, G. (2008) Child Development and Child Care. Guwahati: Arun Prakashan.
3. Hadfield, J.A., (1952) Psychology and Mental Health, A Contribution to developmental Psychology, George Allen & Unwind.
4. Kapur, M. (1995) Mental Health of Indian Children. New Delhi: Sage Publications.
5. NCERT. (2009) Developing Mental Health and Coping Skills, Module 10, NCERT, New Delhi.
6. Nayar, S. U. (2012) Child and Adolescent Mental Health. New Delhi: Sage Publications.
7. Sharma, N. (1999) Understanding Adolescence. New Delhi. National Book Trust, India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H		H	H
CO 3	H		H	H
CO 4		H	H	
CO 5	M		M	H
CO 6	H	H		

EDRM0034: RESEARCH METHODOLOGY IN EDUCATION (4-0-0)

COURSE OUTCOMES
1. Describe the conceptual framework of Research process. (Understanding)
2. Explain the methods and designs in Educational Research. (Analysis)
3. Apply and interpret the tools and techniques of research. (Application)
4. Examine the organization and analysis of data. (Remembering)
5. Analyze the application of statistics in Educational research. (Application)
6. Design and develop the synopsis and thesis writing. (Creation)

Module I: Introduction to Research in Education (13 Lectures)
Meaning and nature of research; Methods of Acquiring knowledge; Types of Research: Fundamental, applied, action research;

Quantitative, Qualitative research; Principles and scope of Research in education; Scientific method and process of research; Preparation of synopsis for any research work in education; Ethics of Research.

Module II: Methods and Designs in Educational Research (14 Lectures)
General steps of research; review of related literature; Concept of Research Design and Types of designs; Methods of Educational Research: Historical, Survey, experimental, case study; Concept of hypotheses, Types and Testing hypotheses, Levels of significance, Fiduciary limits, Type I and Type II Errors.

Module III: Sampling and Tools of Research in Education (16 Lectures)
Concepts of Population and sample; Probability and Non-Probability sampling; Sample size and features of a good sample, Sampling Error; Tools of Research: Achievement Test, Intelligence Test, Observation, Interviews, Questionnaires, Attitude scale; Process of Development of tools; Nature of data and sources of data.

Module IV: Statistics in Educational Research (17 Lectures)
Concept, significance and functions of statistics; Measures of Central Tendency and measures of Variability; Coefficient of correlation: Product moment and rank difference method, Applications of z-test, t-test and f-test, Chi-square, median test, sign test, Report writing.

Suggested Readings

1. Check, J. and Schutt, R.K: Research methods in Education, Sage Publication, New Delhi (2014).
2. Broota, K. D: Experimental Design in Behavioural Research, New Age International Publisher,New Delhi. (2010).
3. Mohanti, B. & Misra, S.: Statistics For Behavioural and Social Science, Sage Publication, IndiaPvt Ltd, New Delhi. (2016).
4. Ferguson, G. A Statistical Analysis in Psychology and Education, Mc Graw Mill, NewYork. (1981).
5. Garrett, H. E. Statistics in Psychology and Education, Vikils, Feiffer and Semen's Ltd, Bombay (1998).
6. Koul, L. Methodology of Research in Education, Vikash Publications, New Delhi (2009).
7. Mangal, S.K and Mangal, S. Research Methodology in Behavioural Sciences, PHI Pvt, Ltd, Delhi (2013).
8. Best, J.W. & Kahn, J. V: Research in Education, PrenticeHall of India, New Delhi. (2006).
9. Edward, A. L. Techniques of Attitude scale construction, Appelton century crofts, Inc, NewYork (1957).
10. Mangal, S.K: Statistics in Psychology and Education, Prentice Hall of India, New Delhi (2002).
11. Cohen, L & Manion, L.: Research Methods in Education, London: Routledge. (1994).
12. Guilford, J.P: Fundamental statistics in Psychology and Education, McGraw Hill Book co NewYork. (1995).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		H		H
CO 3	H		H	
CO 4			H	
CO 5				H
CO6				H

EDFE0035: PHILOSOPHICAL FOUNDATIONS OF EDUCATION (4-0-0)

COURSE OUTCOMES
CO 1: To inculcate awareness about the nature of philosophy and educational philosophy amomg the students
CO 2: To make the students well aware of the Indian philosophical thoughts in education
CO 3: To make the students well aware of the Western philosophical thoughts in education
CO 4: To make the students learn and understand the contribution of Indian and Western Thinkers in the field of education

Module I: Introduction to Philosophy and Educational Philosophy (15 lectures)
Philosophy: Definition, Concept, Branches of philosophy and its educational implications, Functions of philosophy, Knowledge: Concept, nature, types, theories; Education: Narrow and Wider Meaning, nature, Goals of Education in the 21st century, Relationship between philosophy and Education, Functions of Educational Philosophy.
National values as enshrined in the Indian constitution- socialism, secularism, justice, liberty, democracy, equality, freedom with special reference to education.

Module II: Indian Schools of Thought (15 lectures)
Astika and Nastika; Sankhya, Yoga, Vedanta, Buddhism, Jainism, with special reference to vidya; Dayanand Darshan.
Islamic traditions: its educational aims and methods of acquiring valid knowledge.

Module III: Western Philosophical Thought (15 Lectures)

Some major schools; Naturalism, Idealism, Rationalism, Pragmatism, Realism, Existentialism, Marxism and - Their educational implications with special reference to epistemology, axiology and the process of education.

Module IV: Contribution of Thinkers to the development of Educational thought for Social Change (15 Lectures)
Indian: Vivekananda, Tagore, Gandhi, Aurobindo, J. Krishnamurty, and Savitribai Phule
Western: Paulo Freire, Nel Noddings and Wollstonecraft
Social Philosophy of Education – Freedom, Equality, Democracy and Education.

References

1. Bhayrappa, S.L.(1988): Values on Modern Indian Educational Thoughts, NCERT, New Delhi.
2. Brammel, D.T.(1971) : Patterns of Educational Philosophy, Runehart and Winston, New York.
3. Das, A & Das, A. J. (2021, June). Educational Contribution of Savitribai Phule in 21st Century India. International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, (4), pp.1281-1286, URL: www.ijtsrd.com/papers/ijtsrd42547.pdf
4. Delors, Jacques, et al; (1996). Learning: The Treasure within report of the international commission on education for 21st century, UNESCO.
5. Dupius, A.M (1972): Philsophy of Education in Historical Perpective, Thomson Press, New Delhi.
6. Freire, P. (1971). Pedagogy of the oppressed. New York: Herder And Herder.
7. Moore, T. W. (2010). Philosophy of Education: An introduction. Routledge, New York.
8. Radhakrishnan. S. (2008). Indian Philosophy. Vol. 1. 2nd edn. USA: Oxford University Press .
9. Radhakrishnan. S. (2008). Indian Philosophy. Vol. 2. 2nd edn. USA: Oxford University Press .
10. Shivendra, C. S. (2006). Philosophy of Education. Atlantic publishers and Distributers. https://www.google.co.in/books/edition/Philosophy_of_Education/u6UQJ1sWrQoC?hl=en&gbpv=1&dq=functions+of+philosophy+of+education&printsec=frontcover
11. Wollstonecraft, M. (1792). A Vindication of the Rights of Women. https://www.gutenberg.org/ebooks/3420

Mapping of COs to syllabus

COs	MODULE I	MODULE II	MODULE III	MODULE IV
CO1	H	M	M	M
CO2	M	H	M	M
CO3	M	M	H	M
CO4	M	M	M	H

EDEP0036: FUNDAMENTALS OF EDUCATIONAL PSYCHOLOGY (4-0-0)

COURSE OUTCOMES

CO 1: To make the students aware of the nature of educational psychology
CO 2: To learn about the nature of human development and personality as an important segment of any individual
CO 3: To create understanding about the conceptual framework of learning and intelligence
CO 4: To create awareness among the students about concepts of thinking process and creativity of individuals

Module I: Introduction to Educational Psychology (10 Hours)
Educational Psychology: concept, nature, concerns and scope, methods, and functions of educational psychology

Module II: Human Development and Personality (15 Hours)
Human growth and development: Concept, principle, factors influencing development and their relative role; Theories of growth and development; Piaget, Bruner, Erickson and Kohlberg – their educational implications.
Personality: Concept, Nature, Determinants, Theories: Freud, Carl Rogers, Gordon Allport, Max Wertheimer and Kurt Koffka; Assessment-Projective techniques

Module III: Learning and Intelligence (20 Hours)
Learning: Concept, Theories of Learning: trial and error, classical conditioning, operant conditioning Gagne's theory of learning, Carl Roger's theory of learning and field theory of learning; cognitive view point and information processing; Educational implications of the view points on learning;
Intelligence: Concept, Nature, Intelligence Quotient; Theories: Unitary theory, Two factor theory, SOI Model, Gardner's theory of multiple intelligence, Sternberg's Information Processing theory of intelligence; Assessment of Intelligence; Concept of Social Intelligence , Emotional Intelligence- Concept, Characteristics of an Emotionally intelligent person, Importance of Emotional Intelligence, Emotional Quotient.

Module IV: Problem solving, Thinking, Metacognition and Creativity (15 Hours)
Problem Solving: Meaning and Definition, Steps in Problem Solving, Factors affecting Problem Solving, and Strategies for Problem Solving.

Thinking: Definition and concept, nature, Theories, Tools, Types, Training for Development of thinking.
Metacognition: Concept, Strategies to develop students' Metacognition in the classroom
Creativity: Concept, Nature, Theories, The creative process, Assessment of creativity, Strategies to foster and develop creativity.

Suggested Readings

1. Bhatnagar, S. Advanced Educational Psychology, Agra: Bhargava Book House (2002).
2. Chand, T. Educational Psychology, Agra: Bhargava Book House (2002).
3. Cheng, E. C. K. (2021). Developing Metacognitive Teaching Strategies Through Lesson Study. Singapore, Springer. https://www.google.co.in/books/edition/Developing_Metacognitive_Teaching_Strate/tNxFEAAAQBAJ?hl=en&gbpv=0
4. Crow, R.B. and Crow, A. Educational Psychology, New Delhi: Eurasia Publishing House (1964).
5. Dececee, J.P. The Psychology of Learning and Instruction, New Delhi: Prentice Hall (1970).
6. Dhir, R.N. Educational Psychology, Chandigarh: Abhishek Publication (2002).
7. Ewen R. B. An Introduction to the theories of personality, 7th Edition. New York: Psychology press (2010).
8. Guilford, J.P. The Nature of Human Intelligence, New York: McGraw Hill (1967).
9. Judd, C.H. Educational Psychology, Guwahati: Nivedita DK Distributions (2002).
10. Kuppuswamy, B. Advanced Educational Psychology, Jalandhar: Jalandhar University Publications (1963).
11. Mukunda, K. V. What did you ask at school today? A handbook of child learning. Noida, UP: HarperCollins, 371 (2009).
12. Rao, K.R., Parajpe, A.C. and Dalal, A.K. (Ed). . Handbook of Indian Psychology, New Delhi: Cambridge University Press India (2008).
13. Reynolds, W. M and Miller, G. E. . Current perspectives in Educational Psychology. In Handbook of Psychology Vol. VII (ed.) Irving B. Weiner. Canada: John Wiley and Sons, Inc (2003).
14. Rogers, C. Transition, self-regulation, independent learning and goal theory. Psychology of Education Review, 36(2), 26-31 (2012).
15. Sahoo, F.M. Psychology in Indian Context, Agra: Bhargava Book House (2002).
16. Sharma, R.N. Educational Psychology, Guwahati: DVS Publication (2002).
17. Sternberg, R.J. Contemporary Theories of Intelligence. In Handbook of Psychology Vol. VII (ed.) Irving B. Weiner. Canada: John Wiley and Sons, Inc (2003).
18. Swiderski, S. M. Transforming Principles into Practice: Using Cognitive Active Learning Strategies in the High School Classroom. Clearing House (2011), 84(6), 239-243. doi:10.1080/000986 5.2011.590549.
19. Weinstein, C., Acee, T. W., and JaeHak, J. Self-regulation and learning strategies. New Directions For Teaching and Learning (2011), 2011(126), 45-53. doi:10.1002/tl.443.

Mapping of COs to syllabus

COs	M1	M2	M3	M4
CO1	H	M	M	M
CO2	M	H	M	M
CO3	M	M	H	M
CO4	M	M	M	H

EDPC0037: PEACE EDUCATION AND CONFLICT MANAGEMENT (3-0-0)

COURSE OUTCOMES

1. Describe the importance and relevance of peace education (Application)
2. Explain the concept of peace as held by different thinkers and other religious beliefs. (Analysis)
3. Discuss the awareness of the modes and methods for conflict management. (Application)
4. Compare the global issues and peace movements. (Evaluation)
5. Narrate the various methods of conflict Management. (Application)
6. Describe the theories of Peace. (Analysis)

Module I: Understanding peace as a dynamic social reality (16 lectures)

- Basic concepts of Peace and Peace Education; nature, meaning, objectives. Theories of peace – democratic peace and active peace; Role of social organizations: Family, Religion, Mass Media, Community, School
- Some thinkers on harmony: Dalai Lama, Gandhi, Mother Teresa; Concept of peace education; peace teacher, peace method and other enabling practices in an educational setting.

Module II: Conflict management and its methods (7 lectures)

Meaning, types, levels and factors for conflict; methods and modes of conflict resolution - mediation, negotiation, diplomacy, coercive methods; creative peace building, cross cultural methods.

Module III: Global issues and peace movements (7 lectures)

Human rights, population control, non-alignment movement, campaign for nuclear disarmament and role of world organizations in promoting peace.

Module IV: Practicum (30 lecture)

Any two activities to be conducted from the following

1. Field visit to place/organization-government/non-government working towards building peace
2. Exhibition on Peace related themes
3. Strategies to create peace building: Meditation, Yoga, Dramatization, Debate
4. Thematic analysis on documentary based on peace
5. Organise workshop on peace/ awareness programme on social marginalisation.

Suggested Readings

1. Dalai Lama. The joy of living and dying in peace. (ed.) Donald S. Lopez. Jr. Dharamsala: Tibetan and Archives (1998).
2. Diwahar, R. R. and Agarwal, M. (Ed). . Peace education. New Delhi: Gandhi Marg (1984).
3. Doyle, M. W. Liberal peace: Selected essays. London and New York: Routledge (2012).
4. Duckworth, C. Teaching peace: a dialogue on the Montessori method. Journal of Peace Education(2006), 3(1), 39-53.
5. Fountain, S. Peace education in UNICEF. New York: UNICEF (1999).
6. Gat, A. The Democratic peace theory reframed: The impact of modernity. World Politics (2005), 58, pp. 73-100.
7. Girard, K. Preparing teachers for conflict resolution in the schools. Washington, DC: ERIC Clearinghouse on Teaching and Teacher Education (1995).
8. Hopper, B. Peace education and years 1to 10 studies of society and environment key learning Area. Queensland: Queensland School Curriculum Council.(2002).
9. Johan, G. Peace by peaceful means. New Delhi: Sage Publication.(1996).
10. Krishnamurti, J. (n.d). Education and Significance of life. Retrieved from http://www.jkrishnamurti. org /krishnamurti-teachings/view-text.php?tid=51&chid=66876.
11. Layne, C. Kant or Cant: The Myth of the Democratic Peace. International Security, Vol. 19. Issue 2, pp. 5-49.(1994).
12. Montessori, M. Peace and Education. India: The Theosophical Publishing House (1943).
13. Morrison, M. L. Peace Education. Australia: McFarland(2003).
14. Nair, G. Peace education and conflict Resolution in school. Health Administrator Vol. XVII, Number 1:38-42 (1997).
15. Pant, D. and Gulati, S. Ways to peace: a resource book for teachers. New Delhi: National Council of Educational Research and Training (2014).
16. Salomon, G., & Nevo, B. Peace Education: The Concept, Principles, and Practices around the World. London: Lawrence Erlbaum Associates(2002).
17. Sheean, V. Mahatma Gandhi, a great life in brief. New Delhi: Random House.(1955).
18. UNESCO. Peace Education: Framework for Teacher Education. New Delhi: UNESCO (2005).

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M	H	
CO 2	M	H		H
CO 3	H		H	
CO 4	H		H	
CO 5		H		H
CO 6	M			H

EDSF0038: SOCIOLOGICAL FOUNDATIONS OF EDUCATION (4-0-0)

COURSE OUTCOMES

CO 1: To make the students aware of the nature of sociology of education and social institutions

CO 2: To understand and summarize the contributions of different theoretical perspectives on better understanding of the society

CO 3: To assess the various aspects of school as a social institution

CO 4: To create awareness about the cross-national perspectives on the sociology of education and modern Indian society

MODULE I: SOCIOLOGY OF EDUCATION (15 lectures)

Concept and nature of sociology of education; Difference between sociology of education and educational sociology; Social institutions and their functions: Social Groups; Social Organization; Social Stratification; Social Change

MODULE II: THEORETICAL PERSPECTIVE OF EDUCATIONAL SOCIOLOGY (15 Lectures)

Theoretical approaches to educational sociology: Standpoint Theory, theory of social learning by Bandura, Conflict Theory, Structural Functionalism, Symbolic Interaction Theory, Theories of Social Movements- Relative Deprivation, Resource

Mobilization, Political Process Theory

MODULE III: SCHOOL AS A SOCIAL INSTITUTION (15 Lectures)
School as a social institution; School as an organization; Social mobility by means of education; Organisational climate types, classroom climate and its impact; Social aspects of education; Role of schools in modern society; Role of modern mass communication media in education

MODULE IV: CROSS-NATIONAL PERSPECTIVES ON THE SOCIOLOGY OF EDUCATION AND MODERN INDIAN SOCIETY (15 Lectures)
Culture - Conceptual understanding of culture, Role of education in cultural context; Education and cultural change; Modern Indian Society: Globalization, Liberalization, Privatization, Modernization, Westernization; Constitutional Provisions; National Integration and International understanding

SUGGESTED READINGS

1. Below, S. V., Powell, J. J., & Roberts, L. W. Educational Systems and Rising Inequality: Eastern Germany after Unification. Sociology of Education, 86 (4), 362-375. (2013)
2. Binder, A. J. Sociology of Education's Cultural, Organizational, and Societal Turn. Sociology of Education, 86(4), 282-283. (2013)
3. Bose, S. A Contextual Analysis of Gender Disparity in Education in India: Women's Status and Community. Sociological Perspectives, 55(1), 67-91. (2012)
4. Brown, F.J. Educational Sociology, Prentice Hall of India, New Delhi.
5. Clinard, M. B., & Elder, J. W. Sociology in India: A Study in the Sociology of Knowledge. American Sociological Review, 30(4), 581-587. (1965)
6. Damle, Y. B. Sociology in India: its teaching and status. International Social Science Journal, 26(2), 343-348. (1974).
7. Goel, S. K. Education, Training, and Rehabilitation of the Handicapped in India. Retrospect and Prospect. Education & Society, 8(1), 21-29. (1990)
8. Harding, 0. J. Rethinking the Cultural Context of Schooling Decisionism Disadvantaged Neighborhoods: From Deviant Subculture to Cultural Heterogeneity. Sociology of Education, 84(4), 322-339. (2011)
9. Hodkinson, A., & Devarakonda, C. Conceptions of inclusion and inclusive education: A critical examination of the perspectives and practices of teachers in India, Research in Education, (82), 85-99. (2009)
10. MacIver and Page- Society: An Introductory Analysis, Macmillan.
11. Nakamura, T. Sociologization, Pedagogization, and Resocialization: Has the Post-war Japanese Sociology of Education Suffered from the Galapagos Syndrome? International Journal of Japanese Sociology, 22(1), 64-79. (2013)
12. Sharma, C. L. Crisis of Character in India: The Need for Moral Education. Education & Society, 8(1), 64-73. (1990)
13. Smith R. Eliot et al., .Social Psychology. U.S.A.: Taylor and Francis. (2000)
14. Von Below, Powell, J. W., & Roberts, L. W. Educational Systems and Rising Inequality: Eastern Germany after Unification. Sociology of Education, 86(4), 362-375. (2013)
15. Wright, R. The Fourth Sociology and Music Education: Towards Sociology of Integration. Action, Criticism, and Theory for Music Education, 13(1), 12-39. (2014)

MAPPING OF COs TO SYLLABUS

	Module I	Module II	Module III	Module IV
CO 1	H		H	
CO 2		M		
CO 3			H	
CO 4			H	
CO 5				H
CO6				H

EDCI0039: CURRICULUM DEVELOPMENT AND INSTRUCTION (3-0-0)

COURSE OUTCOMES
1. Explain the nature of curriculum. (Application)
2. Describe the basis of curriculum development. (Analysis)
3. Distinguish the approaches of curriculum development. (Evaluation)
4. Mention the process of curriculum development. (Application)
5. Frame about the assessment of curriculum. (Remembering)
6. Distinguish the Factors influencing curriculum implementation. (Understanding)

Module I: Understanding curriculum (6 lectures)
Contemporary definition of curriculum; curriculum criteria, curriculum goals and values, basic principles of curriculum and

instruction Brainstorming session on the issues and trends of school/college curriculum

Module II: Philosophical underpinnings of curriculum (15 lectures)
Curriculum types and Models of teaching: Social, Information Processing, Personalist, and Behavioral,
Child-Centered, Society-Centered, Knowledge-Centered, or Eclectic; Goals and Philosophies of Education across changing education paradigms - Idealism, Realism, Perennialism, Essentialism, Experimentalism, Existentialism, Constructivism and Reconstructivism
Analysis of the philosophical underpinnings of the present day curriculum

Module III: Approaches to curriculum development (10 lectures)
Tagore, Gandhi, Krishnamurthy, Plato, Dewey, Montessori, Don Bosco, Freire.
Detailed discussion on the pedagogical approach of one of the above thinkers

Module IV: Curriculum development frameworks in 21st Century (6 lectures)
NCTE Framework for 21st Century Curriculum and Assessment; UNESCO - A Futures Perspective in the Curriculum, Learning Environment, Skills, Assessment, Professional Development; Curriculum and Future - Concepts from Social Sciences
A review of the NCTE framework for 21st century Curriculum and Assessment

Module V: Curriculum development and assessment (8 lectures)
Developing a curriculum document: Approach and organization, stages of curriculum development, guidelines of statutory bodies with regard to curriculum development – UGC, NCTE, NCF; Curriculum integration: disciplines, media and technology; evaluating and assessing a curriculum; Models of curriculum; Curriculum implementation - Factors influencing curriculum implementation

Suggested Readings

1. Dottrens, R. The Meaning of the Terms Curriculum and Syllabus, in The Primary School Curriculum, (France: UNESCO) pp 79-89.
2. Dewey, J. The School and Society in Society and Education, Introduction by Philip W. Jackson (Chicago: The University of Chicago Press)
3. Pring, R. Curriculum Integration in The Curriculum: Content, Design and Development (ed), (London Institute of Education Bulletin, Spring). pp- 4-8.
4. Tyler Ralph, W. Basic Principles of Curriculum and Instruction. (University of Chicago Press).
5. Vallance, E. Hiding the Hidden Curriculum in Curriculum Theory Network. Stanford University 4:1, pp 5-21
6. Kumar, Krishna. Origins of India's 'Textbook Culture from Comparative Education Review 32(4) pp 452-464.
7. Bruner, J. Folk Pedagogies. In Leach, Jenny and Moon, Bob (eds) Learners and Pedagogy (pp4-20). London: Paul Chapman Publishing in Association with the Open University.
8. Keddie, Nell. Classroom Knowledge in Young, M. F. D. (ed), Knowledge and Control. (London: Collier Macmillan)
9. Coleman, J. The Concept of Equality of Educational Opportunity in Equality and Achievement in Education. (Boulder: Westview Press)
10. Winch, C. Constructing Worthwhile Curricula in Quality and Education (Oxford: Blackwell) pp45-56
11. Akkari, A. Socialization, Learning and Basic Education in Islamic Contexts in Educational Theories and Practices from Majority World (ed), Sage, New Delhi, pp220-244.
12. Bernstein, B. Class and Pedagogies: Visible and Invisible in Karabel and Hasley (ed) Power and Ideology in Education, Oxford University Press
13. Hoare. Q and Smith G. N. On Education in Selection from The Prison Notebook of Antonio Gramsci (ed), India: Orient Longman Pvt Ltd
14. Freire, P. chapter 2 Pedagogy of the Oppressed, New York: Seabury Press
15. Education for Poor: Quality and Relevance? British Journal of Sociology of Education 13(4)
16. Kohlberg, L and Meyer, R. Development as the Aim of Education Harvard Educational review 42(4)
17. Tanner, Laurel N. The Meaning of Curriculum in Dewey's Laboratory School (1896-1904) Journal of Curriculum Studies, 23(2) 101-117
18. Kumar, K. What is Worth Teaching? In What is Worth Teaching. Hyderabad, Orient Longman

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		H	
CO 2	H	H	M	H
CO 3	H	H	M	
CO 4	H		H	H
CO 5	M	M	H	
CO 6	M		M	H

EDJG6002: JOURNALING - A TECHNIQUE FOR PERSONAL AND ACADEMIC GROWTH (1-0-2) – Practicum

COURSE OUTCOMES

1. Recall one's life experiences. (Remembering)
2. Explain clearly and specifically one's life experiences. (Understanding)
3. Develop the skill of writing. (Application)
4. Analyze life experiences at a conscious level and enhance reflective thinking. (Analysis)
5. Synthesize one's thoughts in an organized manner and create a new piece of writing. (Creation)

Journaling is a strategy for making sense of experiences. The objective of journaling is to develop in students a reflection that can be described as an inner dialogue with oneself whereby a person calls forth his or her own experiences, beliefs, and perceptions about an idea; informing and transforming functions of knowledge; and a conscious and systematic mode of thought. This is to nurture in future educational leaders a sense of reflective practice.
Each student is required to maintain a reflective journal, using the Visible Thinking Routine (Harvard), as a critical structure for guiding their journal writing. The students are to submit the journal every Friday. Journaling has to be done six days of the week. At the end of the semester, the student will be awarded a grade/marks after assessing the learning.

Suggested Readings

1. Davies, M. (2011). Concept mapping, mind mapping and argument mapping: what are the differences and do they matter?. Higher education, 62(3), 279-301. Retrieved from http://download.springer.com on 19th July 2016.
2. Dhankar, Rohit (2013). Can reflective practice be taught? Teacher Plus 2013. (http://www. teacherplus.org /cover-story/can-reflective-practice-be-taught).
3. Hubbs, D. L., and Brand, C. F. . The paper mirror: Understanding reflective journaling (2005). Journal of Experiential Education, 28(1), 60-71.
4. Liuolienė, A., and Metiūnienė, R. Students' Learning Through Reflective Journaling
5. Coactivity / Santalka,(2009). 17(4), 32-37. doi:10.3846/1822-430X.2009.17.4.32-37.
6. Lowe, G. M., Prout, P., and Murcia, K. . I See, I Think I Wonder: An Evaluation of Journaling as a Critical Reflective Practice Tool for Aiding Teachers in Challenging or Confronting Contexts. Australian Journal Of Teacher Edu (2013).

Mapping of COs to Syllabus

Course Outcomes	M1
CO1	H
CO2	H
CO3	H
CO4	H
CO5	H

EDES6003: EDUCATIONAL SEMINAR I (0-0-2) – Practicum

COURSE OUTCOMES

1. Develop higher cognitive abilities to respond to new knowledge, critical thinking, and keen observation of research conducted. (Understanding & Evaluation)
2. Develop the abilities to seek clarification, defend the ideas of others, and presenteffectively. (Application & Creation)
3. Develop the feeling of tolerance, co-operation, and respect of the ideas and feelings ofothers. (Understanding)
4. Acquire good manners of putting questions and answering the questions of others effectively and develop emotional abilities. (Analysis & Application)

During the course of the programme, students are expected to present a series of seminars which will address fundamental intellectual, conceptual and practical issues in current educational philosophy and application. They may also deal with other relevant topics such as use of ICT in education, design of new and innovative curricula, methodological issues in education, etc. Students will be assisted through guest lectures, discussions, field work in education related institutions and active engagement with faculty members. During these interactions students will be provided with an opportunity to explore how best to bring new interdisciplinary scholarship, technology and critical thinking into the development of the chosen seminar area. They will also consider alternative pedagogic strategies, teaching techniques and technologies. Students will prepare and present a final paper based on these seminars. The course will be evaluated on the basis of the seminars and the final paper.

Mapping of COs to Syllabus

CO 1	H
CO 2	H
CO 3	H
CO 4	H

EDDI6005: DISSERTATION PHASE-I (0-0-2)

COURSE OUTCOMES

1. Develop the skill to prepare the Research Proposal. (Application)
2. Apply the skill in collection of data in the field. (Application)
3. Develop the ability to analyze the data. (Analysis)
4. Ability to write the report in standard academic formats. (Creation)

Every student shall undertake a research project work under the supervision and guidance of a faculty member. The students are expected to complete the literature review and present a research proposal during the first phase. The dates, mode and components of evaluation and the weightages attached to them shall be published by the department at the beginning of the semester.

Mapping of COs to Syllabus

Course Outcomes	Phase-I
CO 1	H
CO 2	H
CO 3	H
CO 4	H

EDDI6007: DISSERTATION PHASE-II (0-0-4)

COURSE OUTCOMES

1. Develop the skill to prepare the Research Proposal. (Application)
2. Apply the skill in collection of data in the field. (Application)
3. Develop the ability to analyze the data. (Analyzing)
4. Ability to write the report in standard academic formats. (Application)

The students of the final semester will have to compile their research study in the form of a dissertation. Each dissertation has to be systematically structured following proper methodology of educational research. To set the dissertations in a standardized pattern the supervisor should ensure that it follows proper sequence containing following aspects:

Preliminary section

1. Title page
2. Approval sheet
3. Acknowledgments
4. Table of contents
5. List of tables (if any)
6. List of figures (if any)

Main body

1. Introduction
    - Conceptual framework of the theme
    - Some relevant studies
    - Rationale/Justification of the study
    - Statement of the problems
    - Operational terms
    - Statement of the study
    - Objectives of the study
    - Hypotheses
    - Delimitation of the study
2. Review of related literature
3. Method and Procedure of the study
    - Procedures used
    - Methods of gathering data
    - Description of data gathering tools
4. Presentation and Analysis of Data
    - Texts
    - Tables
    - Figures

- Statistical treatment
- Analysis of data gathered and interpretations

5. Conclusion
   - Brief restatement of problems and procedures
   - Major findings and conclusion
   - Educational implications
   - Recommendations for further research

Reference section

1. References (APA sixth edition)
2. Appendix

The supervisor will help students to understand the detailed steps of writing a dissertation. He/ she will ensure that the dissertation is prepared keeping in view Of Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Phase I of the course is carried out in the 3rd semester where the students will work on research proposal, literature review and the first part of the data collection. In the 4th semester they will complete data collection, analysis, and preparation of a research report (Phase II). Students are required to make a presentation of the dissertation submitted to the department on the date set in the academic calendar for the same.

Mapping of COs to Syllabus

Course Outcomes	Phase-II
CO 1	H
CO 2	H
CO 3	H
CO 4	H

EDIN6008: INTERNSHIP (0-0-3)

COURSE OUTCOMES

1. To acquaint the students with the total environment of the school.(Remembering)
2. To learn about the functioning of the school.(Understanding)
3. To observe the administrative and managerial activities.(Remembering)
4. To observe the morning assembly and teaching work in the classroom for having an ideaof teaching work.(Analysis)
5. To prepare lesson plans and teaching aids for conducting classes.(Application)
6. To observe and participate in the co-curricular activities and extracurricular activities.(Application)
7. To organize the co-curricular and extracurricular activities. (Creation)
8. To understand the behaviour of teachers, students, principal, headmaster and othersupporting staff. (understanding)

Activities to be performed:

I. Organization/ observation of morning assembly.
II. Classes to be taught during the day by preparing lesson plans.
III. Unplanned classes to be taken during the day if some teachers are on leave. Observing the class of an effective/ good teacher.
IV. Participating/ organizing co-curricular activities. Participating/ organizing extracurricular activities. Any other specific events of the day.
V. Undertaking action research or case study.
VI. On the basis of daily reports the students are to prepare the final report on the schoolInternship Programme.

EVALUATION:

	Stock of daily reports and Action research	30
	Preparation of final report	10
	Lesson plans	20
	Teaching aids developed	10
	Presentation of final report and viva voce	30
		100

Mapping of COs to Syllabus

CO 1	H

CO 2	H
CO 3	H
CO 4	H
CO 5	H
CO 6	H
CO 7	H
CO 8	H

EDES6009: EDUCATIONAL SEMINAR II (1-0-1) – Practicum

COURSE OUTCOMES

1. Develop higher cognitive abilities to respond to new knowledge, critical thinking, and keen observation of research conducted. (Understanding & Evaluation)
2. Develop the abilities to seek clarification, defend the ideas of others, and presenteffectively. (Application & Creation)
3. Develop the feeling of tolerance, co-operation, and respect of the ideas and feelings ofothers. (Understanding)
4. Acquire good manners of putting questions and answering the questions of others effectively and develop emotional abilities.(Analysis & Application)

Following the previous course of Educational Seminar-I, in the present course of the programme the students are expected to present a series of seminars which will address fundamental intellectual, conceptual and practical issues in current educational philosophy and application. They may also deal with other relevant topics such as use of ICT in education, design of new and innovative curricula, methodological issues in education, etc. Students will be assisted through guest lectures, discussions, field work in education related institutions and active engagement with faculty members. During these interactions students will be provided with an opportunity to explore how best to bring new interdisciplinary scholarship, technology and critical thinking into the development of the chosen seminar area. They will also consider alternative pedagogic strategies, teaching techniques and technologies. Students will prepare and present a final paper based on these seminars. The course will be evaluated on the basis of the seminars and the final paper.

Mapping of COs to Syllabus

CO 1	H
CO 2	H
CO 3	H
CO 4	H

EDTP6010: TEACHING PRACTICE (1-0-1) - Practicum

COURSE OUTCOMES

1. Understand the concept and purpose of teaching practice (Understanding)
2. Develop skill of preparing lesson plan (Creating)
3. Practice various teaching skills in classroom situations (Application)

Module I: Concept of Teaching Practice (10 Lectures)

Introduction to Teaching Practice, Concept of teaching practice Objectives of teaching practice, Concept of Lesson Plan, significance of lesson plan, Approaches for preparing lesson plan, Format of lesson plan, Teaching skills and Micro Teaching

Module II: Preparation of Lesson Plan (20 Lectures)

Preparation of Lesson Plan and Presenting lesson plans, Preparing 10 lesson plans for Secondary / Senior Secondary / UG students Delivering four (4) Lesson Plans in Secondary / Senior Secondary / UG Classes One lesson plan for final practice teaching

Evaluation Scheme:

Internal Assessment	: 40 Marks (Based on Test)
External Assessment	: 60 Marks
Record	: 20 Marks
Final Teaching practice	: 20 Marks
Viva	: 20 Marks

Suggested Readings

1. Bloom, B.S. Taxonomy of Educational Objectives, New York (1956).
2. Passi, B.K. Becoming Better Teacher: Microteaching Approach, Ahmedabad: SahityaMudranalaya(1976).
3. Gage, N.S. “Theories of Teaching” in theories of learning and instruction, Chicago UniversityPress (1968).

4. Jangira, N.K. & Singh, A. Core Teaching Skills: The Microteaching Approach, NCERT, New Delhi(1983).
5. Kapoor, K.C. et.al (Ed.): Teacher Education in the 21st century. Ambala Cantt.:The AssociatePublisher (2008).
6. Mangal, S.K & Mangal, U. Essentials of Educational Technology, PHI Learning Pvt. Ltd, Delhi(2014).
7. Aggarwal, J.C. Essentials of Educational Technology, Innovation in Teaching-Learning, VikasPublishing House Pvt. Ltd. New Delhi (2014).
8. Freeberg, M.J & Drescoli, A. Universal Teaching Strategies, Boston: Allyn and Bacon (1992).
9. Stone, Edgar & Morris, Sidney : Teaching Practice: Problems and Perspectives, London(1972).

Mapping of COs to Syllabus

Course Outcomes	M1	M2
CO 1	H	
CO 2		H
CO 3		H

EDEP6016: EXPERIMENTS IN EDUCATIONAL PSYCHOLOGY

(2 Credits- 60 hours) (L-T-P:0-0-3)

Course Objective:

To help students gain experiential learning of the practical application of the theoretical concepts of psychology to understand human beings

Course outcomes:

CO1: Understand the concept and importance of experiments in educational psychology (Compression)
CO2: Apply the steps of psychological testing in administering the psychological tool. (Application)
CO3: Documenting the entire procedure and then writing the report. (Skill)
CO4: Use inferences drawn from data to make predictions about individuals and thereby improve the teaching leaning process. (Analysis)

MODULE I: INTRODUCTION TO EXPERIMENTS IN EDUCATIONAL PSYCHOLOGY

- Experimental psychology- concept and importance in the understanding of human behaviour
- Steps to be followed while conducting an psychological experiment/ test
- Writing and reporting

MODULE II:

a. PSYCYCHOLOGICAL EXPERIMENT (WITHOUT APPARATUS): ANY TWO

1. Personality- Rorschach Ink blot test/ Thematic Apperception Test (TAT)
2. Intelligence- Cognitive ability test, Raven's progressive matrices
3. Individual differences- Differential ability test

b. PSYCHOLOGICAL EXPERIMENT (WITH APPARATUS): ANY TWO

1. Learning- Paired associate learning
2. Individual difference- Finger dexterity test
3. Intelligence- Matching familiar figure, Koh's pass along test
4. Creativity- Passi test of creativity

Scheme of Evaluation: (100 Marks)

Psychological Experiment with apparatus:	15 Marks
Psychological Experiment without apparatus:	15 Marks
Practical book:	10 Marks
Practical Examination, Reporting & Viva Voce:	60 Marks
Total	**100 Marks**

Suggested Readings

1. Woodworth, R. S. & Schlosberg, H. (1971). Experimental Psychology. New York: published by Holt, Rinehart and Winston.
2. Mohsin, S.M.(2016). Experiments in Psychology. Delhi; published by Motilal Banarsidass Publishers (P) Ltd.

Mapping of Cos

COURSE OUTCOME	MI	MII

1	H	
2	H	H
3	H	H
4		H

SWCA6010: COMPUTER APPLICATION FOR SOCIAL SCIENCES (1-0-1) - Practicum

COURSE OUTCOMES

1. Describe the application of the basics of Word Processing. (Applying)
2. Illustrate the basics of Excel Worksheet. (Applying)
3. Explain the basics of PowerPoint Presentation tools. (Analyzing)
4. Work out data analysis in research using Statistical Analysis Packages. (Applying)
5. Identify and describe the practical aspects of Computer Applications. (Evaluating)

Module I: Basics of Microsoft Office Word Processing (7 lectures)

Word Processing: Meaning, Features, advantages, Structure of a word Processor window, creating document, opening, saving document, Printing, Find and replace, Creating table, Mail Merge-Maindocument data source and merging.

Module II: Basics of Microsoft Office Excel Worksheet (8 lectures)

Worksheet Package: Cells, rows, columns, Range, Structure of a worksheet window, creating, opening and saving, Printing a worksheet document, creating tables, charts, data analysis using formulae in worksheet.

Module II: Basics of Microsoft Office PowerPoint Presentation (5 lectures)

Presentation Package; creating presentations in a presentation package, text tables, charts, Animation, running slide show, saving the slides, Printing the presentations.

Module IV: (Practicum) Using Statistical Packages for Data Analysis (10 lectures)

Qualitative Data Analysis, Quantitative Data Analysis. Statistical Packages for Data Analysis: Statistical Package for Social Sciences (SPSS), Analysis of moment structures (AMOS)

Suggested Readings

1. Foster, JJ. Data analysis using SPSS for Window, Sage Publication, Ltd., London, 1988.
2. Gaur, Ajai S., et al Statistical Methods and Practices in Research. Response Books, New Delhi,2006.
3. Kelle, V., Computer Aided Qualitative Data Analysis: Theory, Methods and Practice, Sage Publication, Ltd., London, 1988.
4. Lincoln, Y.S. and N.K Danzin, Handbook of Qualitative Research, Sage Publication, California,1994.

Full Marks: 50
Internal: 20 Practicum & Viva: 30

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	H	H	H	H
CO 3	H	H	H	H
CO 4	H	H	H	H
CO 5	H	H	H	H

EDSL0200: SERVICE LEARNING (A COMMUNITY-UNIVERSITY ENGAGEMENT PROGRAMME) (1-0-1)

COURSE OUTCOMES

1. Learn the concept of service learning and community engagement. (Remembering)
2. Understand the importance of service learning and community engagement fordeveloping the skills of addressing real life issues in one's own community. (Understanding)
3. Develop the ethics of civic participation. (Applying)
4. Develop an understanding of the importance of communication skills in interacting with community members. (Understanding)
5. Be exposed to and empathize with people who are less fortunate than they are, economically, socially, academically, medically etc. (Applying)
6. Organize awareness programmes, rallies, campaigns, social service etc. (Analysing)

7. Develop the skills of problem solving and reflective thinking. (Analysing)
8. Realize one's potentiality to make a difference in the life of their community members.(Evaluating)
9. Understand and experience the system of inequality that exists in the Educationalsystem. (Evaluating)
10. Applying the pedagogical concepts learned in class in the educational institutions of thecommunity. (Creating)

Module I: Service Learning and Community- University Engagement

Concept of service learning and community-university engagement; History of service learning in the context of Indian Universities; Principles for an effective service learning; Principles of a good service learning pedagogy; Models of Service learning: Project Model, Charity Model, Social Justice Model.

1. Programs of Service learning: Community Engagement, Field Education, Volunteerism, Internship.
2. Benefits of Service learning:For Students, Academic enhancement, Personal/ Professional Growth, Understanding Diversity, Civic learning, Critical reflection, For the University, For the community.
3. Service learning: A means to Inclusive Education: Experiential Learning, Expo populations, Challenge to comfort zones, Reflection sure to diverse on Experiences, Personal growth, Professional growth.

Module II: Practices for Service Learning and Community- University Engagement

By collaborating with the Community Members, Village Panchayats, Parents, Educational Institutions (Heads, Teachers and Students), Anganwadis, Balwadis etc. and following the mentioned Models and Programs of Service Learning students can be engaged with the community welfare in the following ways: (**Any….**)

1. Creating awareness among community members regarding Early childhood care andnutrition.
2. Creating awareness among community members about parenting.
3. Self-participatory internship in a school of one's own choice.
4. Creating awareness among school children and community members and providing
5. training in developing one's life skills.
6. Providing teachers training in pedagogy.
7. Providing training to school teachers in the use of ICT for enhancing students' learning.
8. Providing training to teachers in the preparation of teaching aids by using availablecommunity resources.
9. Creating awareness on Mental Health and strategies for its sustenance.
10. Creating awareness on the importance of Physical health and ways of maintaining one's
11. health.
12. Creating awareness on the importance of education and ways of creating a conduciveenvironment for proper learning.
13. Creating awareness on AIDS.
14. Creating awareness on Population explosion- its effects and ways of population control.
15. Creating awareness on life skills and ways to develop one's life skills.

EVALUATION:

INTERNAL	
Attendance	5
Non-Formal	5
Project presentation and Viva	10
EXTERNAL	
Organization of activities and project report	30

Suggested Readings

1. Brown, Erin Marie Burke. (2015). Service-Learning Challenges and Strategies. Service-LearningInstitute: Viginia Commonwealth University. Downloaded from http://scholarscompass.vcu.edu/service_institute/servicelearning_2015/background_infoma tion/1
2. Centre for Community Engagement. (n.d.). Faculty Toolkit for Service Learning. Middlesex Community College Downloaded from https://www.uml.edu/docs/Faculty_Toolkit_MCC_tcm18-52567.pdf.
3. Cress, Christine M., Collier, Peter J., Reitenauer, Viki L. (2005). Learning Through Serving: A Student Guidebook for Service Across Disciplines. Sterling Virginia.
4. Lavery, S., Chambers, D. and Cain, G. (2018). Service Learning: Enhancing Inclusive Education. Emerald Publishing. United Kingdom.
5. Mittal, Pankaj. Fostering Social Responsibility by Higher Education: COVID-19 and Beyond. https://youtu.be/4Yz1h0DtoBo.
6. Narasimharao, B PanduRanga. (2010). Tertiary Education Institutions for Corporate Education, Need and Relevance of Corporate Education centres. Downloaded from https://www.researchgate.net/publication/216686564.
7. PRIA. (2014). Occasional Paper: Participatory Research in Asia Fostering Social Responsibilityin Higher Education in India. New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6	H	H
CO7	H	H
CO 8	H	H
CO 9	H	H
CO 10	H	H

VALUE ADDED COURSES

EDES6011: EDUCATION FOR SUSTAINABLE DEVELOPMENT (1-0-1)

Objective:

To sensitize students about the growing issues surrounding the globe and make them aware of the most humanitarian and sustainable ways of addressing these issues

Course outcomes:

CO1: *Awareness about the concept of Sustainable Development.*
CO2: *Justify the concept of Education for Sustainable Development and the role of Education in Sustainable Development.*
CO3: *Evaluate the utility and prevalence of sustainable development within self and in the community.*

MODULE I: INTRODUCTION TO SUSTAINABLE DEVELOPMENT (4 hours)

- Concept of Sustainable Development: Its 5 Ps (People, planet, prosperity, peace, and partnership)
- Sustainable Development Goals (SDG)- 17

MODULE II: CURRICULAR FRAMEWORK FOR EDUCATION FOR SUSTAINABLE DEVELOPMENT (4 hours)

- Concept of Education for Sustainable Development (ESD)
- Importance of Education for Sustainable Development
- Pedagogical approaches in ESD
- Contribution of education in the achievement of SDGs

MODULE III: PRACTICAL IMPLICATIONS OF ESD (22 hours) (Any two)

- Design posters and organize awareness rally on any one of the SDGs
- Visiting neighboring areas to collect community related stories/ activities towards the realization of Sustainable Development Goals.
- Surveying ADBU campus on its sustainability norms
- Prepare a photo album on the issues of SDGs

Suggested Readings

1. UNESCO. (2012). *Education for Sustainable Development: Source Book*. Retrieved from https://sustainabledevelopment.un.org/content/documents/926unesco9.pdf
2. UNESCO. (2017). *Education for Sustainable Development Goals: Learning Objectives.* Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000247444?utm_sq=gj34xbfn94#:~:text=Target%204.7%20of%20the%20SDGs,peace%20and%20non%2D%20violence%2C%20global
3. UNESCO. (2018). *Issues and trends in Education for Sustainable Development*. Retrieved from https://www.ensi.org/global/downloads/Publications/433/Issues%20and%20trends%20in%20Education%20for%20Sustainable%20Development.pdf
4. https://www.plymouth.ac.uk/students-and-family/sustainability/sustainability-education/esd

MAPPING OF COURSE OUTCOMES

CO	M1	M2	M3
Co1	H		
Co2		H	
Co3			H

EDTT6012: TEACHER AND TEACHING SKILLS (1-0-1)

COURSE OUTCOMES

1. To create awareness among the students about conceptual framework of teaching skills.(Remembering)
2. To make the students well aware of the sources of teaching skills. (Understanding)
3. To create awareness about the approaches concerning teaching skills. (Applying)

Module I: Introduction to Teaching and Teacher

Concept of teaching; Structure of teaching; Levels and phases of teaching.

Module II: Concept of Teaching Skills

Meaning of teaching skill**;** Significance of teaching skills for a teacher**;** Sources and identification ofteaching skills**;** Social skills for a teacher.

Module III: Micro teaching as an approach

Concept of Micro teaching; Need of micro teaching; Steps of micro teaching; Preparation of micro teaching lesson plan; Teaching practice for teaching skills through micro teaching lesson plans.

Suggested Readings

1. Abraham, P. P. (1974). Effectiveness of Micro Teaching in the development of questioningskill. M.Ed. Dissertation. M. S. University, Baroda.
2. Aggarwal, J.C (2014): Essentials of Educational Technology, Innovation in Teaching-Learning,Vikas Publishing House Pvt. Ltd. New Delhi
3. Allen, D. W. and Fortune, J. C. (1976): An analysis of micro teaching: A new procedure inteacher education. Stanford University, California.
4. Anupam and Kapoor, K. C. (2012). Micro teaching as an approach in Secondary SchoolTeacher. International journal of Education and Research. 1 (5). ISSN 0975-7481.
5. Jangira, N.K. & Ajit Singh (1983): Core Teaching Skills: The Microteaching Approach, NCERT,New Delhi
6. Kapoor, K.C et. al. (Ed) (2008): Teacher Education in the 21st Century, The AssociatedPublishers, Ambala cantt.
7. Kapoor, K.C. (2020): Teaching of Geography for Secondary School Teachers. DVS Publishers,Guwahati.
8. Mangal, S.K & Mangal, U (2014): Essentials of Educational Technology, PHI Learning Pvt. Ltd,Delhi.
9. Passi, B.K. (1976): Becoming Better Teacher: Microteaching Approach, Ahmedabad: Sahitaya.

Mapping of COURSE OUTCOMES

Course Outcomes	Module I	Module II	Module III
CO1	L	H	H
CO2	L	H	L
CO3	L	M	M

EDHW6013: EDUCATION FOR HEALTH AND WELLNESS

Credits: 2

Total Marks: 50 - Internal: 40 % (20 Marks) Total Hours: 30 External: 60% (30 Marks)

Course objectives

After completing the course, students will be able;

1. To acquire the knowledge, about health and physical education
2. To acquire the knowledge about health and safety education
3. To understand the nature of injuries and providing first aid
4. To develop the skills for organising games and sports in educational institution.
5. To acquire the knowledge about yoga

Module-I: concept of Health Education

a. Meaning, Definition, objectives of health education
b. Nutrition, Malnutrition, Personal Hygiene, Health education in schools, Health Services.
c. Food and Nutrition: Meaning, classification, constituents of food, vitamins and their deficiency, Balanced Diets, Diets for obesity and under Weight

Module-II Introduction to Physical & Yoga Education & Wellness Studies

a. Meaning, Definition, Objectives and scope of Physical education
b. Physical fitness: Meaning, definition, components, and benefits
c. Games and sports
d. First Aid: Road Accident, water accident, fire accident
e. Yoga Education: Meaning, Definition and uses of yoga for focussed mind.
f. Selected Asanas and Pranayama: Physical exercises
g. Dimensions of Wellness & Mindfullness.

Practicum:

a. Preparation of first aid kit
b. Health awareness programme
c. Demonstration of Asanas and Pranayama
d. Organizing games
e. Writing about the eminent performers in games and sports

Suggested Readings:

1. Nash, T.N. (2006). Health and Physical education. Hyderabad: Nilkamal publishers
2. Prasad, Y.V. (2006). Methods of teaching physical education. New Delhi: Discovering publishing house
3. Chandra, S.S & Krishanan, P. (2005). Health education and physical education. Delhi: Surjeet Publications
4. Mangal, S.K. (2005). Health and physical education. Ludhiana: Tandon Publication

EDFL6015: FAMILY LIFE EDUCATION

Credits: 2 (1-0-1); Hours: 30
Marks: 50 (Attendance-5, NF-5, Theory-20, Practical-20)

COURSE OUTCOMES:

CO 1: To develop understanding about the concept of Family life education and its core elements (Understanding)
CO 2: To practice abstinence from sex until marriage (Application)
CO 3: To develop the skills of positive parenting (Application)
CO 4: To recognize different types of child abuse and take steps towards its prevention (Analysis)
CO 5: To prepare pamphlets and organize awareness programmes in the community (Creation)

MODULE I: Family Life Education And Its Core Elements (15 Hours)

- Family life education: Concept, principles, objectives and importance
- Role of Individual, Family and Community in Family Life Education
- The benefits of abstinence from sex until marriage
- Positive parenting: building healthy relationship with your kids
- Child abuse and neglect

MODULE II: Practicum (30 Hours)

- Prepare pamphlets related to family life education, child abuse, abstinence from sex until marriage
- Organizing awareness in nearby schools through Role Play concerning to different issues of family life education

Suggested REadings

1. Aggarwal, J.C (2003): Population Education, Delhi: Shipra Publications
2. Kapoor, K.C & Kapoor, A. (2013): Population Education, Guwahati, EBH, Publications
3. National Center for Injury Prevention and Control (2021), Preventing Child Abuse & Neglect, Centers for Disease Control and Prevention; available at https://www.cdc.gov/violenceprevention/pdf/can/CAN-factsheet_508.pdf
4. Chacko, T. (n. d.). Importance of Family Life Education. Indira Gandhi National Open University; available at https://www.egyankosh.ac.in/bitstream/123456789/80000/1/Unit-3.pdf
5. NIH News in Health (Special Issue), A monthly newsletter from the National Institutes of Health, U.S. Department of Health and Human Services, page 1-6; available at https://newsinhealth.nih.gov/sites/nihNIH/files/Special-Issues/Parenting.pdf
6. Abstinence (2019), Alberta Health Services; available at https://teachingsexualhealth.ca/app/uploads/sites/4/Abstinence_Final-1.pdf
7. Maher, B. (n. d.). Why Wait: The benefits of abstinence until marriage, pages 1-14; available at https://downloads.frc.org/EF/EF11B20.pdf
8. What Is Child Abuse and Neglect? Recognizing the Signs and Symptoms (2019). Child Welfare Information Gateway. Children's Bureau/ACYF/ACF/HHS, pages 1-8; available at https://www.childwelfare.gov/pubpdfs/whatiscan.pdf
9. Child Abuse. Indira Gandhi National Open University, pages 29-44; available at https://egyankosh.ac.in/bitstream/123456789/31579/1/Unit-2.pdf
10. Dahiya, A. (2018). Child Abuse: Forms, Factors Responsible, and Protection Issues, World Wide Journal of Multidisciplinary Research and Development, 4(2): 59-62, E-ISSN: 2454-6615; available at http://wwjmrd.com/upload/child-abuse-forms-factors-responsible-and-protection-issues_1518437447.pdf

MAPPING OF COs

	Module I	Module II
CO1	H	
CO2	H	H
CO3	H	H
CO4	H	H

EDWE6014: WOMEN EMPOWERMENT (2 CREDIT) 1-0-1

Course outcomes:

1. To familiarize students with the concept of women empowerment (R)

2. To make students aware on issues related to gender discrimination (U)
3. To analyze issues related to health conditions of Indian women.(An)
4. To organize/perform various activities related to women empowerment (Ap)

Module-1

Concept of Women's Empowerment (15 hrs)

a) Gender discrimination
b) Women's Rights
c) Health conditions and work related issues of women
d) Women empowerment through education

Practicum: (any two) (30 hrs)

I. Visiting women self - help groups.
II. Organizing flash mob, skits in neighboring areas.
III. Reporting on one stop Centre scheme by Government of India.
IV. Releasing a magazine on status of women then and now.

Mapping of Cos to Syllabus

	CO1	CO2	CO3	CO4
Module 1	H	H	H	H
Module 2				H

Process of Evaluation: 50 Marks
Attendance- 5
Non-formal -5
Theory- 20(MCQ)
Practical-20

Suggested Readings

1. Agrawal, S.P. 2001.Women Education in India, Guwahati: Eastern Book House.
2. *Importance of education in empowerment of women in India*. (n.d.). Retrieved November 18, 2022, from https://www.motherhooduniversity.edu.in/pdf/Publications/2016/Khushboo%20Singh.pdf
3. *Ma [education] second semester EDCN 806E [English edition]*. (n.d.). Retrieved November 18, 2022, from https://stage.tripurauniv.ac.in/Content/pdf/Distance%20Education%20Notice/Education%20for%20Empowerment%20of%20Women%20_%20MAEducation%20_806E%20English_21072017.pdf
4. *Role of education in the empowement of women in India - eric*. (n.d.). Retrieved November 18, 2022, from https://files.eric.ed.gov/fulltext/EJ1081705.pdf
5. Seth, Mira. 2001. Women and Development. New Delhi: Sage Publication

EDAD6017: ADULT EDUCATION PRACTICES (2 credits)

COURSE OUTCOMES

CO1: To create understanding about the concept and aims of adult education among the learners
CO2: To make the learners well aware of the Programmes and Policies of Adult Education in India
CO3: To enable the learners to understand the nature curriculum of adult education, its transaction and evaluation

Module-I: Nature and scope of Adult Education (8 Hours)

- Concept of adult education
- Historical background of adult education with special reference to India
- Need of adult education
- Objectives of adult education
- Scope of adult education

Module-II: Adult Education Policies and Programmes in India (7 Hours)

- Adult Education and Five-year Plans in India
- Adult Education and NPE-1986
- Adult Education and Reports of Committees
- Administrative and Resource structure of Adult Education

Module-III: Adult Education Practices (30 Hours) Practical

- Curriculum of Adult Education

- Pedagogy of Transacting the curriculum of Adult Education
- Evaluation of adult learners
- Adoption of the village

Scheme of Evaluation:

Internal:20 Marks
External:30 Marks
Total: 50 Marks 2 Credits

Suggested Readings

1. Colin, J Times (1987): Lifelong Education for Adult an International Handbook, Pergamon Press, New York, USA.
2. Chapra, Rita (1993): Adult Education, Himalaya Publishing House, Bombay
3. Govindappa, K (1988): Adult Education Impact of NLM, CosmoPublication, New Delhi.
4. Kundu, C.L. (1987): Adult Education Principles, Practice and Prospects, Sterling Problems Pvt Ltd, New Delhi.
5. Sura, P.P (1987): Adult Education, Asish Publication House, New Delhi
6. NPE (1986): Adult Literacy NCERT, New Delhi
7. NEP (2020): Foundational Literacy and Numeracy MHRD New Delhi

DEPARTMENT OF ENGLISH

VISION

To be a centre of excellence in learning, teaching and research in the areas of language and literature by imparting personalized education, inculcating human values and thereby contributing to nation building.

MISSION

- To develop critical thinking, creative writing and interpretive ability
- To foster professionalism to face the competitive world by developing language and communicative skills and by maintaining creative literary activity
- To generate sensitivity to culture and ethical issues
- To develop human potential to its fullest by mentoring and upholding human and spiritual values
- To prepare individual to become responsible citizens of tomorrow

PROGRAMME OUTCOMES- MA ENGLISH

PO1: Critical Thinking: Apply theoretical knowledge to make a critical analysis, intervene using innovative frameworks and evaluate and follow up.

PO2: Effective Communication: Engage in inter and intra personal communications, behavioural change communication and proficiency in information Communication Technology.

PO3: Scientific Temper: To build essential skills of life including questioning, observing, testing, hypothesizing, analysing and communicating.

PO4: Effective Citizenship: Demonstrate empathetic social concern and engage in service learning and community engagement programmes for contributing towards achieving local, regional and national goals.

PO5: Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions and accept responsibility for them.

PO6: Environment and Sustainability: Participate and promote sustainable development goals.

PO7: Gender Sensitization and Social Commitment: To imbibe Gender sensitivity and the sense of social responsibility for self and community for the benefit of the society at large.

PO8: Self-directed and Life-long learning: Engage in continuous learning for professional growth and development.

PROGRAMME SPECIFIC OUTCOMES

PSO1: To critically analyse and evaluate the writers of English literature across different ages and continents, their theories, perspectives, models and methods.

PSO2: To enhance competence in critically analyzing scholarly work in the areas of English language teaching, literary research and translation.

PSO3: To develop the technical skills and ethical decision-making appropriate for the holistic professional development in the field.

LIST OF COURSES

1.1 Chaucer to Elizabethan Period - Poetry, Drama and Romance
1.2 Literary and Social History of England-Chaucer to Elizabethan Period
1.3 Shakespearean Drama I- Comedy and History Plays
1.4 Rhetoric and Prosody
1.5 T.S. Eliot
1.6 Thomas Hardy
1.7 Media Literacy
1.8 Leadership and Social responsibility
1.9 Gender Studies
1.10 English Language Teaching
1.11 Seminar and Presentation I
2.1 Restoration to Romantic Period-Poetry and Drama
2.2 Literary Criticism-Plato to F.R. Leavis
2.3 Shakespearean Drama II-Tragedy and Tragi-comedy
2.4 Approaches to Language and Literary Research

2.5 Classics in Translation
2.6 Indian Women Writers
2.7 Environment and Disaster Management
2.8 Peace Education and Conflict Management
2.9 Introduction to Social Psychology
2.10 North-East Indian Literature in English
2.11 Seminar and Presentation II
3.1 Victorian to Post-modern Period- Poetry, Drama and Fiction
3.2 Post-colonial Literature-Poetry, Drama and Fiction
3.3 American Literature-Poetry, Drama and Fiction
3.4 Literary and Critical Theory
3.5 Gender and Literature
3.6 Linguistics and Stylistics I
3.7 Introduction to Modern European Literature I
3.8 Colonial and Post-colonial African Literature I
3.9 Project Phase I
4.1 Indian Writing in English-Poetry, Drama and Fiction
4.2 South-Asian Literature
4.3 Linguistics and Stylistics II
4.4 Introduction to Modern European Literature II
4.5 Colonial and Post-colonial African Literature II
4.6 Project Phase II-Dissertation

MAPPING of COURSES to PO/PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
1.1									H		
1.2									H		
1.3									H		
1.4	L								H	M	
1.5	M								H	M	
1.6	M								H	M	
1.7		H		M	M					H	M
1.8				M	H		M	M		H	H
2.1					L				H		
2.2	H								H	H	L
2.3									H		
2.4		H						L	M	H	
2.5									H	M	
2.6	L						M		H		M
2.7						H			H	M	M
2.8				H	H			L	M	M	H
3.1									H		
3.2	M								H	L	M
3.3									H		
3.4	H								M	H	L
3.5	M				M		H		L	H	L
3.6		M								H	L
3.7									H		
3.8	M						M		H	M	
3.9	H		H					H	H	H	H

4.1									H		M
4.2									H		L
4.3		L							H	H	
4.4									H		
4.5	M						M		H	M	
4.6	H		H					H	H	H	H

DETAILED SYLLABUS - MA ENGLISH

EGEP0001: CHAUCER TO ELIZABETHAN PERIOD - POETRY, DRAMA AND ROMANCE (4-0-0) (CREDITS: 04)

Course Outcomes:

1. Define the fundamental concepts of the three genres of Poetry, Drama and Romance from the age of Chaucer to Elizabethan period (Remembering).
2. List the representative writers and their texts of the fourteenth century (Understanding).
3. Experiment the characteristic features and forms of Poetry, Drama and Romance from the age of Chaucer to Elizabethan period (Applying).
4. Categorize the socio-political background and factors that influenced and shaped the literary texts of the period (Analyzing).
5. Evaluate the given text critically in its literary context, use of various literary devices, thematic and symbolic significance and the use of Language and style (Evaluating).
6. Estimate the given texts as literary works of the corresponding age (Creating).

Module I: Selected Poetry (25 lectures)

a. Geoffrey Chaucer 's ''Prologue'' to The Canterbury Tales
b. Edmund Spenser 's The Faerie Queene (Book III)
c. William Shakespeare's Sonnets No. 18, 29,34
d. Philip Sidney's Astrophel and Stella

Module II: Selected Drama (20 lectures)

a. Christopher Marlowe's *The Jew of Malta*
b. Ben Jonson's *The Alchemist*

Module III: Selected Romance (15 lectures)

Sir Thomas More's *Utopia*

Suggested Readings

1. Texts of Selected Poetry, Drama and Romance.
2. Drabble, Margaret. ed. *The Oxford Companion to English Literature*. Oxford: OUP
3. Ferguson, Margaret. et al. ed. *The Norton Anthology of Poetry*. New York: London.
4. Shakespeare, William. *William Shakespeare Sonnets*, Rupa Publishers
5. Tillyard, E. M. W. *Elizabethan World Picture*. Peregrine Books, 1970
6. Trevelyan, G.M. *English Social History: A Survey of Six Centuries, Chaucer to Queen Victoria.* Penguin, 1987

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6	H	H	H

EGLS0002: LITERARY AND SOCIAL HISTORY OF ENGLAND - CHAUCER TO ELIZABETHAN PERIOD (3-0-0) (CREDITS: 03)

Course Outcomes:

1. Define the different Periods involved in the Literary and Social History of England from the Medieval to Elizabethan age (Remembering).
2. List the chronological changes that intervened in the history of England during fourteenth and early fifteenth century (Understanding).
3. Use the characteristic features, significant changes, development and modes indicating transition from the Medieval life, The Black Death to the Elizabethan theatre in the reading of the given texts (Applying).
4. Identify the various socio-political factors responsible for these developments and their influences in the shaping of the Literature of the period (Analyzing).
5. Explain the various literary and socio-political influences for the literature production at the various stages from the Medieval age to the coming of Elizabethan theatre (Evaluating).
6. Estimate the contextual background involved in the shaping up of various literary works (Creating).

Module I (15 lectures)

a. The Church and Medieval Life
b. Towns and Villages in Medieval England
c. Feudalism
d. The English Manorial System and Medieval Agriculture

Module II (15 lectures)

a. The Black Death and its Aftermath
b. Medieval English Theatre
c. Medieval Romance
d. Fabliau, Lyric, Dream Allegory and Ballad

Module III (15 lectures)

a. Caxton and the Printing Press
b. Renaissance and the Literature: The University Wits, the Elizabethan Prose, the Metaphysical Poetry, etc.
c. Reformation
d. The Elizabethan Theatre

Suggested Readings

1. Abrams, M.H. *A Glossary of Literary Terms*. Prism India.
2. Ashok, Padmaja. *The Social History of England*. Orient Black Swan.
3. Choudhury, Bibhas. *English Social and Cultural History*. PHI, 2009.
4. Peck, John and Martin Coyle. *A Brief History of English Literature*. Palgrave.
5. Sanders, Andrew. *The Short Oxford History of English Literature*. Oxford: OUP.
6. Trevelyan, G.M. *English Social History: A Survey of Six Centuries, Chaucer to Queen Victoria.* Penguin, 1987

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	M	H
CO 2	H	H	H
CO 3		H	H
CO 4	H	H	
CO 5		H	H
CO 6	H	H	

EGET0007: ENGLISH LANGUAGE TEACHING (3-0-0) (CREDITS: 03)

Course Outcomes:

1. Define the vast body of Language teaching methodologies (Remembering)
2. Demonstrate the different approaches to teaching of English as a second language (Understanding)
3. Apply theoretical assumption as well as practical language teaching skills while dealing with second language learners in the classroom (Applying)
4. Analyse the specific issues such as the First and Second Language acquisition, Mother tongue interference in learning a foreign language, TG Grammar, Psychological and Sociological perspectives in Language learning, Role of technology in

language learning (Analysing)

5. Compare and estimate the utility and feasibility of different language teaching methodologies and techniques in different language teaching- learning situations with proper forms of testing (Evaluating)
6. Design as well as adapt on the syllabuses of second language teaching and constructing lesson plans for dealing with language learners of different linguistic backgrounds (Creating)

Module I: Introduction to English Language Teaching (10 lectures)
Introduction, Fundamental concepts of Language Teaching, Historical Perspective of ELT, Language Pedagogy. Elements of the Structure of English Language.

Module II: Methods and Approaches of Teaching English (20 lectures)
Theoretical aspects of Language Acquisition and Learning; Language Skills assessment; Psychological approach to language teaching in a bilingual/ multilingual context; Use of Technology in Language Teaching; Educational Technology; Testing and Evaluation.

Module III: Grammar and Practical Language Skills (10 lectures)
Parts of Speech; Articles and Prepositions; Degrees of Comparison; Direct and Indirect Speech; Sentence patterns; Letter Writing; Report Writing; Reading Comprehension; Listening and Speaking; English Speech Sounds – Vowels and Consonants, Stress and Intonation patterns; Language Games; Vocabulary Expansion; Telephonic Conversation; Teaching English for Academic and Business Purpose.

Module IV: Language through Literature (5 lectures)
Role of Literature in Language Learning; Teaching of Literature; Use of Language Model.

Suggested Readings

1. Ray Mackay, *A Basic Introduction to English Language Teaching*; Oxford, 2018.
2. Penny Ur, *A Course in English language Teaching*, CUP.2010.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H		
CO2	M	H	M	
CO3	H	H	M	M
CO4	H	H	M	M
CO5	M	H	H	M
CO6	H	H	H	H

EGRR0008: RESTORATION TO ROMANTIC PERIOD – POETRY AND DRAMA (4-0-0) (CREDITS: 04)

Course Outcomes:

1. Define various genres of literature, viz. poetry and drama and identify the recurrent themes of the Restoration and Romantic era. (Remembering)
2. Apply the historical onset while reading the texts. (Applying)
3. Analyse the themes critically and compare as well as contrast the different characters of the selected dramas. (Analysing)
4. Interpret the selected literary works and critically evaluate the plot, theme and character of the dramas and the theme and figures of speech in the poems. (Evaluating)
5. Assess and evaluate the selected dramas and poems vis-à-vis their context and socio- political and cultural background. (Evaluating)
6. Invent a new interpretation of the texts. (Creating)

Module I: Selected Poetry (25 lectures)

a. John Dryden: “Mac Flecknoe”
b. Lord Byron: “Love’s Last Adieu”
c. William Wordsworth: “Composed on Westminster Bridge”
d. John Keats: “Ode to a Nightingale”
e. P. B. Shelley: “ To a Skylark”

Module II: Selected Drama (35 lectures)

a. George Etherege: *The Man of Mode*
b. William Congreve: *The Double Dealer*
c. John Dryden: *All for Love*

Suggested Readings

1. Dryden, John. *Mac Flecknoe and Other Poems*.
2. Appelbaum, Stanley. *English Romantic Poetry: An Anthology*.
3. Selected Critical Texts (mentioned in the detailed course)
4. Fisk, Deborah Payne. *The Cambridge Companion to English Restoration Theatre*.
5. Perry, Henry Ten Eyck. *The Comic Spirit in Restoration Drama: Studies in the Comedy of Etherege, Wycherley, Congreve, Van Brugh and Farquhar.*

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H
CO5	H	H
CO6	H	H

EGEP0001: CHAUCER TO ELIZABETHAN PERIOD - POETRY, DRAMA AND ROMANCE (4-0-0) (CREDITS: 04)

Course Outcomes

1. Define the literary form of drama, especially tragedy and tragi-comedy. (Remembering)
2. Interpret the selected literary works, i.e. the Shakespearean tragedy and tragi- comedy and they are able to explain the plot, theme and character of the dramas. (Understanding)
3. Apply critical reading skills to the two very distinct forms of Shakespeare's drama. (Applying)
4. Analyse selected texts for a better understanding of the genius of William Shakespeare. (Analysing)
5. Assess and critically appreciate the selected dramas. (Evaluating)
6. Negotiate with the complexity of ideas winded around plot, theme and character of the selected dramas. (Creating)

Module I: Tragedy (30 lectures)

a. William Shakeaspear: *Macbeth*
b. William Shakespear: *King Lear*

Module II: Tragi-Comedy (30 lectures)

a. William Shakespeare: *TheMerchant of Venice*
b. William Shakespeare: *The Winter's Tale*

Suggested Readings

1. *Shakespearean Tragedy: Lectures on Hamlet, Othello, King Lear and Macbeth,* latest edition*,* Bradley, A.C, 2017, Pinnacle Press.
2. *The Oxford Shakespeare: The Complete Works,* 2nd Edition*,* Wells, Stanley and others, 2005, OUP.
3. *The New Cambridge Companion to Shakespeare,* 2nd Edition, De Grazia and Wells Stanley, 2010, CUP.
4. *English Drama 1586 – 1642: The Age of Shakespeare, Latest Edition,* Hunter, G.K, 1997, OUP.
5. Johnson, Samuel. "Preface to Shakespeare." 131-61, *Indian Edition*, D.J. Enright and Ernst De Chickera ed.

English Critical Texts: 1975, Oxford

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6	H	H

EGAL0011: APPROACHES TO LANGUAGE AND LITERARY RESEARCH (3-0-0) (CREDITS: 03)

Course Outcomes

1. Explain basic concepts of research and its methodologies. (Understanding)
2. Identify research topics and select and define appropriate research problems and parameters. (Remembering)
3. Organize and conduct research in an appropriate manner. (Applying)

4. Analyse literary works from various genres by applying various theories and approaches. (Analysing)
5. Assess and evaluate the various works of literature to write research reports and papers. (Evaluating)
6. Discuss, summarize and critically appreciate the various approaches to language and literary research. (Creating)

Module I: Introduction (10 lectures)
Meaning of Research; Objectives of Research; Motivation in Research; Different types of Research Methods; Research Methods Vs Research Methodology; Difference between Methods and Techniques; Ethics in Research; Review of Literature

Module II: Hypothesis and Data Collection (10 lectures)
Formulation of Hypothesis; Types of Hypothesis; Methods of Testing Hypothesis; Determining Sample design; Methods of Sampling; Methods of Collection of Data (Primary Data and Secondary Data); Processing and Analysis of Data; Types of Analysis

Module III: Critical Approaches to Literature (15 lectures)
Russian Formalism and New Criticism; Feminism and Gay and Lesbian Studies; Psychoanalysis; Marxism; Archetypal Criticism; Narratology; Race Ethnicity and Postcolonial Studies; Structuralism; Post-structuralism; Deconstruction; Ecocriticism; Cultural Studies.

Module IV: Analysis and Report-Writing (10 lectures)
Testing of Hypothesis; Interpretation; Different techniques of Interpretation; Citation and Bibliography; Writing and Presentation of Report

Suggested Readings

1. *The Art of Literary Research*, 4th Edition, Altick, Richard D. & Fenstermaker, John J, 1992, W.W Norton & Company.
2. Correa, Delia Da Souza & Owens, W.R. *The Handbook to Literary Research,* 2nd Edition*,* 2009, Routledge.
3. *Literary Theory,* 3rd Edition, Eagleton, Terry, 2008, University of Minnesota Press.
4. *Research Methodology: Methods and Techniques*, 3rd Edition, Kothari, C. R. & Gaurav Garg, 2013, New Age International.
5. *MLA Handbook for Writers of Research Papers*.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H		H
CO 2	H	H		H
CO 3	H	H	H	H
CO 4			H	
CO 5			H	H
CO 6			H	

EGTR0012: CLASSICS IN TRANSLATION (3-0-0) (CREDITS: 03)

Course Outcomes
At the end of this course students will be able to:
1. Define the history, theories, and methodologies in Translation Studies. (Remembering)
2. Illustrate fundamental questions related to translation of the major poets of classical literatures of Roman, Greek and Sanskrit. (Understanding)
3. Apply various theories and methods of translation. (Applying)
4. Examine critically the translated literary texts, critically analyse the themes and the style of literary expression in the selected texts. (Analysing)
5. Evaluate the high intrinsic quality of the classics and their fundamental importance in shaping ancient literary standards and cultural ideals. (Evaluating)
6. Discuss, summarize and critically appreciate the selected classics in translation. (Creating)

Module I: Introduction to Translation Studies (20 lectures)
Introducing Translation; History of Translation Theories; Significance of Translation in a Multi- Linguistic and Multi-Cultural Society/World; Different Types/Modes of Translation (Semantic, Literal, Literary, Functional, Communicative, Technical); Understanding the dynamics and challenges in Translation.

Module II: Selected Texts (25 lectures)
a. Ovid: *Metamorphoses*- Book I "Creation", Book III "Tiresias", Book IV "Persius and Andromeda", Book VI " Procne and Phiomela" , Book VIII "Daedalus and Icarus", Book IX "Hercules", Book X " Orpheus and Eurydice", Book XI "Troy", Book XII "Achilles", Book XIII "Ulysses"

b. Homer: *Odyssey*
c. Kalidasa: *Abhijnana Shakuntalam*

Suggested Reading:

1. *Translation Studies*, 4th Edition, Bassnett, Susan. 2014, Routledge.
2. *The Theory and Practice of Translation.* New Edition, Nida, E, 1998, Brill.
3. *Introducing Translation Studies,* 3rd Edition, Munday, Jeremy, 2012, Routledge.
4. *Classics in Translation: from Homer to Juvenal,*1st Edition, Jones, Peter V, 1998, Duckworth.
5. Tr. *Metamorphoses of Ovid,1st Edition,* Innes, Mary M, 1975, Penguin.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	H
CO 3	H	
CO 4		H
CO 5	H	
CO 6		H

EGNE0014: NORTH-EAST INDIAN LITERATURE IN ENGLISH (3-0-0) (CREDITS: 03)

Course Outcomes

1. Define the vast body of writings in English from Northeast of India. (Remembering)
2. Interpret the emerging trends of literature from northeast of India in its different genres- poetry, fiction and translation (Understanding)
3. Apply theoretical assumption as well as critical reading skills to the study of vibrant areas of Northeast literature. (Applying)
4. Examine the most significant topics like colonialism, identity and unity, cultural loss, ethnic conflicts, universality in the literature of Northeast region before and after British Colonial Period (Analysing)
5. Explain different literary themes and recurrent issues reflected in the vast body of Northeast writings in English. (Evaluating)
6. Elaborate on the existing critical views on Northeast India's literary texts with reference to the Modern and Postmodern Theories on Literature. (Creating)

Module I: Selected Poetry (15 lectures)

a. Easterine Kire: "Riddu Riddu'' & "Narcissus''
b. Robin Ngangom: "My Invented Land"
c. Nongkynrih Mona Zote: "Rez"

Module II: Selected Fiction/Non-Fiction Writers (30 lectures)

a. Mamang Dai: *The Legends of Pensam*
b. Mitra Phukan: *The Collector's Wife*

Suggested Readings

1. *The Oxford Anthology of Writings from North East India: Poetry and Essays,* Indian Edition, Misra, Tillotama,2010, OUP.
2. *Emerging Literatures from North East India: The Dynamics of Culture, Society and Identity, 1st Edition,*
Zama, Magarat Ch, 1900, SAGE publications.
3. *Dancing Earth: An Anthology of Poetry from North-east India*, 1st Edition, Ngangom, Robin S. & Nongkynrih, Kynpham Singh, 2009, Penguin.
4. *Exploring North-East Indian Writings in English:* 2 volumes, 1st Edition, Swami, Indu, 2010, VDM Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6	H	H

EGVP0015: VICTORIAN TO POST-MODERN PERIOD-- POETRY, DRAMA & FICTION (4-0-0) (CREDITS: 04)

Course Outcomes

1. Define the socio-cultural set up of England from Victorian to Post-Modern era. (Remembering)
2. Illustrate the Victorian, Modern and Post-modern elements and themes prominent in the prescribed texts. (Understanding)
3. Develop and apply theoretical interpretations of the prescribed texts. (Applying)
4. Analyse the various prominent genres of the era, background of the texts and the authors. (Analysing)
5. Assess and evaluate the plot, theme, characters and context of the texts under study. (Evaluating)
6. Construct a critical reading based on historic aspects evident in the texts. (Creating)

Module I: Victorian Period: Poetry, Fiction, and Drama (20 lectures)

a. "Ulysses": Alfred Lord Tennyson
b. *Wuthering Heights*: Emile Bronte.
c. *Playboy of the Western World*: J.M. Synge

Module II: Modern Period: Poetry, Fiction, and Drama (20 lectures)

a. "Wreck of the Deutschland": G. M. Hopkins
b. *Heart of Darkness*: Joseph Conrad
c. *Pygmalion*: G. B. Shaw

Module III: Post-Modern Period: Poetry, Fiction, and Drama (20 lectures)

a. "Digging": Seamus Heaney
b. *The French Lieutenant's Woman*: John Fowles
c. *Waiting for Godot*: Samuel Beckett

Suggested Readings

1. David, Deirdre. *The Victorian Novel*. Cambridge University Press, 2012.
2. Bradbury, Malcolm and James Mc Farlane. *Modernism: A Guide to European Literature*. Penguin Publication, 1978.
3. Hutcheon, Linda. *The Poetics of Postmodernism*. Routledge Publication,1988.
4. Waugh, Patricia. *Metafiction: The Theory and Practice of Self- Conscious Fiction*. Routledge Publication, 1988.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6	H	H	H

EGPL0016: POST-COLONIAL LITERATURE-- POETRY, DRAMA & FICTION (3-0-0) (CREDITS: 03)

Course Outcomes

1. Recall the various critical elements in adherence to the Post-colonial literature. (Remembering)
2. Illustrate the historical context of Post-colonial literature and the use of racist and colonial undertones in the texts under study. (Understanding)
3. Identify the texts on the basis of the historical background, socio-political conditions of the respective time period and establish a connectedness across the commonalities of the theme and structure of the texts under study. (Applying)
4. Analyse the various postcolonial theories and literary concepts from texts written in corresponding time frames and by authors coming from varied socio-linguistic milieu. (Analysing)
5. Evaluate the significance of Post-colonial literature from the historical, socio-political and literary perspective and its evolution within a relevant theoretical framework along with the writer's psyche and contribution towards it. (Evaluating)
6. Formulate the understanding of world literatures from the postcolonial perspective. (Creating)

Module I: Introduction to Post-colonial Studies (8 lectures)

Historical background of Post-colonial Studies, Post-colonial theory, Decolonization, Globalization, Hybridization, identity, culture, 'othering'.

Module II: Selected Texts (10 lectures)

a. *Orientalism*: Edward Said (Selections)
b. *Nation and Narration*: Homi K. Bhabha

Module III: Selected Novels (12 lectures)

a. *The Shadow Lines*: Amitav Ghosh
b. *Foe*: J. M. Coetzee

Module IV: Selected Drama and Poetry (15 lectures)

a. *A Dance of the Forest*s: Wole Soyinka
b. "Vultures": Chinua Achebe
c. "Phenomenal Woman": Maya Angelou

Suggested Readings

1. "The Danger of a Single Story" (Transcript) by Chimamanda Adichie.
2. Benson, Eugene and L. Conolly (Eds). *Encyclopaedia of Postcolonial Literatures in English*. Routledge, 2005
3. Moore-Gilbert, Bartet al (Eds.) *Postcolonial Theory: Contexts*, Practices, Politics. Routledge, 1997
4. Mongia, Padmini. *Postcolonial Theory*. Oxford, 1996
5. Mukherjee, Meenakshi and Harish Trivedi (Eds.) *Interrogating Postcolonialism*. Indian Institute of Advanced Studies, 1996.
6. Ashcroft, Bill et al. *The Empire Writes Back*. Routledge, 2002.
7. Nayar, Pramod K. *Postcolonial Literature: An Introduction*. Pearson Education India, 2008.
8. Young, Robert J.C. *Postcolonialism: A Very Short Introduction*. Oxford UP,2003.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	H	M	M	M
CO 3		H	H	H
CO 4	M	H	H	H
CO 5		H	H	H
CO 6	M	H	H	H

EGAL0017: AMERICAN LITERATURE – POETRY, DRAMA & FICTION (3-0-0) (CREDITS: 03)

Course Outcomes

1. Define intricacies of American literature. (Remembering)
2. Explain diversified range of subjects portrayed in American literature. (Understanding)
3. Organize a comparative study between literature from the conventional European colonial powers and a colonised yet culturally and politically dominant nation like America. (Applying)
4. Discover the colonial experience of America and its post-colonial recuperation (Analysing)
5. Interpret the complexities of race and identity as expressed through the indigenous cultures of the American society in the post-colonial context (Evaluating)
6. Develop a critical perspective towards the contemporary reading of a colonial text (Creating)

Module I: Introduction (10 lectures)

The Colonial Period ("Declaration of Independence", 1776), American Nationalism, Romanticism, Transcendentalism (Selections from Emerson), Selections from *Studies in American Indian Literature* by Paula Gunn Allen

Module II: Drama (10 lectures)

a. *Who is Afraid of Virginia Woolf*: Edward Albee
b. *Death of a Salesman*: Arthur Miller

Module III: Novels (15 lectures)

a. *Moby Dick*: Herman V Melville.
b. *The Scarlet Letter*: Nathaniel Hawthorne

Module IV: Poems (10 lectures)

a. "When Lilacs Last in the Dooryard Bloom'd": Walt Whitman
b. "The Raven": Edgar Allan Poe
c. "The Red Part": Linda Hogan

Suggested Readings

1. Ellmann, Richard (Ed.). *The New Oxford Book of American Verse*. Oxford University Press, 2001.
2. Horton, R W and H.E. Edwards (Eds.).*Backgrounds of America Literary Thought*. Prentice Hall, 1974.
3. Spiller, Robert E. *The Cycle of American Literature*. Macmillan, 1961.
4. Gray, Richard. *History of American Literature*. Blackwell, 2008.

5. Chase, Richard. *The American Novel and its Tradition*. Johns Hopkins Press, 1990.
6. Krasner, David. (Ed.) *A Companion to Twentieth Century American Drama*. Blackwell, 2005.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	M	M
CO 2	H	H	H	H
CO 3	H	M	M	M
CO 4	H	M	H	M
CO 5	H	H	H	H
CO 6	H	M	M	M

EGLT0018: LITERARY AND CRITICAL THEORY (4-0-0) (CREDITS: 04)

Course Outcomes

1. Define contemporary critical theories. (Remembering)
2. Explain the genesis and growth of the modern critical theories in the context of literary texts. (Understanding)
3. Construct awareness of contemporary as well as Indian theories of literary aesthetics and utilize the theories to generate new approaches of looking at literary texts. (Applying)
4. Examine texts on the basis of their understanding of critical theoretical paradigms related to literature (Analysing)
5. Evaluate the texts in terms of their political, social, psychoanalytical, feministic and economic implications. (Evaluating)
6. Develop a more profound critical approach after the study of these theories. (Creating)

Module I: Canonical literary theories and theorists (20 lectures)

a. Deconstruction with reference to "Structure, Sign and Play in the Discourse of the Human Sciences": Jacques Derrida
b. Post- modernism with reference to "The Death of the Author":Roland Barthes
c. Marxist literary theory with reference to *Ideology and the State Apparatuses* (extract):Louis Althusser
d. Post- structuralism with reference to *The Order of Discourse* (extract) : Michel Foucault

Module II: Important texts (10 lectures)

a. "Myth, Fiction and Displacement": Northrop Frye
b. Selections from *Seven Types of Ambiguity*: William Empson
c. Selections from *Culture and Society, 1780-1950*: Raymond Williams

Module III: Critical essays and concepts (30 lectures)

a. "Castration or Decapitation?": Hélène Cixous
b. "Discourse in the Novel" from *The Dialogic Imagination*: M. M. Bakhtin
c. Selections from *Practicing New-historicism*: Stephen Greenblatt
d. "What Makes an Interpretation Acceptable": Stanely Fish
e. "Trans-corporeal Feminisms and the Ethical Space of Nature": Stacy Alaimo
f. Excerpts from *The Natyashastra*: Bharata Muni

Suggested Readings

1. Cuddon, J.A. *A Dictionary of Literary terms and Theories*. Penguin, 1997.
2. Wimsatt, William K and Cleanth Brooks (Eds.).*Literary Criticism: A Short History.* Routledge, 1957.
3. Selden, Raman and Peter Widdowson, *A Reader's Guide to Contemporary Literary Theory.* 5th
4. Edition, University Press of Kentucky, 1993.
5. Alaimo, Stacy and Susan Hekman. Material Feminisms. Indiana University Press, 2008. Project MUSE

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	M	H
CO 2	H	H	H
CO 3	M		H
CO 4	H		H
CO 5	H	H	H
CO 6	H	H	H

EGGN0019: GENDER AND LITERATURE (2-0-0) (CREDITS: 02)

Course Outcomes

1. Define the various thoughts and theories pertaining to feminist writings and feminism. (Remembering)
2. Explain the themes and topics and relate it to real life situations. (Understanding)
3. Develop new ideas by connecting the various topics taught. (Applying)
4. Analyse the various movements related to gender issues and new developments in gender studies in literature. (Analysing)
5. Evaluate the interdisciplinary aspect in various texts. (Evaluating)
6. Discuss the meanings, ideas and thoughts regarding gender and its connection with literature. (Creating)

Module I: Selected Feminist Writings (12 Lectures)

a. "Vindication of the Rights of Woman": Mary Wollstonecraft (Excerpts)
b. "The Laugh of the Medusa": Helene Cixous
c. *The Second Sex*: Simone de Beauvoir (Selections)
d. *The Gender Trouble*: Judith Butler (Selections)

Module II: Selected Fiction (12 Lectures)

a. *Funny Boy*: Shyam Selvadurai
b. *Sunlight on a Broken Column*: Attia Hussain

Module III: Selected Short Story and Poetry (6 Lectures)

a. "The Wife's Letter": Rabindranath Tagore
b. "Purdah": Imtiaz Dharker

Suggested Readings

1. De Souza, Eunice (Ed.) *Nine Indian Woman Poets*. Oxford University Press, 1997.
2. Butler, Judith. *Gender Trouble*: *Feminism and Subversion of Identity.* Roudedge,1990.
3. Chaudhari, Sukanta (Ed.). *Rabindranath Tagore: Selected Short Stories.*Oxford,2000.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2	H	M	M
CO 3	H	M	M
CO 4	H	M	M
CO 5		H	H
CO 6	M	H	H

EGLS0020: LINGUISTICS AND STYLISTICS I (3-0-0) (Credits: 03)

Course Outcomes

1. Define the key concepts of Linguistics. (Remembering)
2. Illustrate the differences between Stylistics and Linguistics. (Understanding)
3. Identify and explain the different levels of language. (Applying)
4. Analyse Linguistics and Traditional Grammar. (Analysing)
5. Recommend Stylistics as an interdisciplinary field of study. (Evaluating)
6. Discuss the different branches of Stylistics. (Creating)

Module I: Introduction to Linguistics (35 lectures)

Definition of Language and its characteristics, Definition, Scope and Goal of Linguistics, Linguistics and Traditional Grammar, Langue and Parole, Competence and Performance, Synchrony and Diachrony, Syntagmatic and Paradigmatic, Sign, Signifier and Signified, Language and Society, Dialect and Idiolect, Standard Language, Register and Style, Bilingualism and Multilingualism, Pidgin and Creole, Language maintenance, Language Shift and Language Death

Module II: Introduction to Stylistics (10 lectures)

Definition, Nature and Scope of Stylistics, Stylistics, Linguistics and Literary Criticism, Major Thinkers in Stylistics, Objectives of this discipline, Stylistics and levels of language, Stylistics and Style, Different branches of Stylistics, Stylistics as an interdisciplinary field

Suggested Readings

1. Toolan, Michael. *Language in Literature: An Introduction to Stylistics.* Routledge, 1998.
2. Simpson, Paul. *Stylistics.* Routledge, 2014.
3. Lyons, John. *Language and Linguistics.* Cambridge University Press, 1981.
4. Bradford, Richard. *Stylistics.* Routledge, 1997.
5. Carter, Ronald and Paul Simpson. *Language, Discourse and Literature: An Introductory Reader in Discourse Stylistics.*

Routledge, 1998.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	H
CO 3	H	H
CO 4	H	
CO 5		H
CO 6		H

EGIW0023: INDIAN WRITING IN ENGLISH – POETRY, DRAMA & FICTION (4-0-0) (CREDITS: 04)

Course Outcomes

1. Define the literature produced in India in English. (Remembering)
2. Illustrate and comment on poetry, drama, short stories and novels produced in India in their various socio-cultural contexts. (Understanding)
3. Identify and explain the various critical theories involved in the production of various indigenous texts. (Applying)
4. Analyse the techniques, style of writing and contribution of various writers to the Indian English literary tradition. (Analysing)
5. Evaluate the Indian writings in English and their representation of the Indian ethos on a global forum and critically interpret the evolution of English language in India (Evaluating)
6. Discuss the selected literary works and find out the commonalities in terms of themes and issues. (Creating)

Module I: Selected Poetry (10 lectures)

a. "Philosophy": Nissim Ezekiel
b. "The Looking Glass": Kamala Das
c. "A River": A.K. Ramanujan
d. "A Poem for Mother": Robin Ngangom
e. "Indian Summer": Jayanta Mohapatra

Module II: Selected Drama & Short Story (15 lectures)

a. *Dance Like a Man*: Mahesh Dattani
b. "The Road to Salvation": Munshi Premchand

Module III: Selected Fiction (20 lectures)

a. *Coolie*: Mulk Raj Anand
b. *Palace of Illusions* : Chitra Banerjee Divakaruni

Module IV: Selected Travel Writing and Non-fiction (15 lectures)

a. *In an Antique Land*: Amitav Ghosh
b. "Language and Spirit" Foreword to *Kanthapura*: Raja Rao

Suggested Readings

1. George, K.M.(Ed), *Contemporary Indian Short Stories in English and Modern Indian Literature.* Sahitya Akademi, 1992.
2. Deshpande, G.P. (Ed.) *Modern Indian Drama*: An Anthology. Goodreads, 2000.
3. Naik, M.K. *A History of Indian English Literature.* Sahitya Akdemi, 1982.
4. Dattani, Mahesh. *Dance Like a Man. Penguin, 2006*
5. Divakaruni, Chitra Banerje*. Palace of Illusions, Doubleday, 2008*

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	M	M	H
CO 2	H	H	H	
CO 3	M	M	M	H
CO 4	H	H	H	H
CO 5	H	H	H	H
CO 6	H	H	H	H

EGSA0024: SOUTH-ASIAN LITERATURE (4-0-0) (CREDITS: 04)

Course Outcomes

1. Define the South Asian literary milieu. (Remembering)
2. Outline the literary, social, political and cultural dynamics of these texts. (Understanding)
3. Apply the knowledge from these texts to assess the socio-cultural aspect of these areas. (Applying)
4. Examine the texts with reference to the classic literary texts that they have studied earlier. (Analysing)
5. Evaluate the overall political and social implications of the area as suggestive in these texts. (Evaluating)
6. Discuss the emotions and aspirations of the writers from South Asia reflected in their writings. (Creating)

Module I: Introduction (20 lectures)

Geo-political conditions, Historical background of South Asian Literature, Imperialism, Colonialism, Nationalism,Orientalism, De-colonization, Specific issues with reference to history, politics and linguistic inventiveness in the literature of South-Asian countries.

Module II: Selected Poetry (10 lectures)

a. 'Love', 'Marriage', 'Children', 'Work', 'Joy and Sorrow' and 'Houses' from *The Prophet*: Khalil Gibran
b. Selected poems from 'Masnavi': Rumi

Module III: Selected Fiction (30 lectures)

a. *Ice Candy Man*: Bapsi Sidhwa
b. *The Kite Runner*: Khaled Hosseini
c. *The Bones of Grace*: Tahmima Anam

Suggested Readings

1. Mukherjee, Surjit. *Translation as Recovery*. Orient Longman, 2018.
2. Narasimhaiah, C.D. *East and West Poetics at Work.* Sahitya Academy, 1994.
3. Walsh, W. *Commonwealth Literature*. Oxford University Press, 1973.
4. Ashcroft, Bill et al. (Eds.) *The Empire Writes Back*. Routledge, 2002.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2	M	H	H
CO 3		H	H
CO 4		H	H
CO 5	H	H	H
CO 6		H	H

EGLS0025: LINGUISTICS AND STYLISTICS II (3-0-0) (CREDITS: 03)

Course Outcomes

1. Define the role of language in the contemporary world. (Remembering)
2. Interpret and stylistically appreciate works of literature. (Understanding)
3. Apply sound, word and sentence structure in transcribing a word or analysing sentence. (Applying)
4. Analyse the structure of a word or sentence linguistically and stylistically and read the various genres critically. (Analysing)
5. Assess and evaluate the structure of language using linguistic and stylistic tools. (Evaluating)
6. Compose phonetically using stress and intonation patterns. (Creating)

Module I: Phonology, Morphology, Syntax and Semantics: Basic Concepts (35 lectures)

Organs of Speech, Vowel and Consonant Sounds, Syllable and Word-Stress, Sentence stress and Intonation, Phonetic and Phonemic transcription, Phonological structure of English language, Morphological structure of English language, Phonemes, Morphemes, Allomorphs and Morphs, Inflectional and Derivational Morphology, Word formation processes in English language, Syntactic Structure of English language, Immediate Constituent Analysis, Semantic level of language, Word-Meaning relations: Synonym, antonym, homonym, hyponym, meronym and polysemy. Layers of Meaning: Deep and Surface Structure

Module II: Reading in Stylistics (10 lectures)

Language and Literature, Levels of language at work, Sentence styles: development and illustration, Interpreting patterns of sound, Techniques of speech and through presentation, Dialogue in drama, Style in poetry: an exploration, A sociolinguistic model of narrative, Exploring metaphors in different kinds of texts, Style variation in narrative, Stylistics and media, An application of cognitive stylistics in poetry, Literature as discourse, Stylistic appreciation of poetry/prose

Suggested Readings

1. Balasubramanian, T. A.*Textbook of English Phonetics for Indian Students*. Macmillan, 1981. Crystal, David. *Linguistics*. Penguin, 1990.
2. Hudson, R.A. *Sociolinguistics*. Cambridge UP, 1980.
3. Lyons, John. *Language and Linguistics: An Introduction*. Cambridge UP,1981.
4. Simpson, P. *Stylistics: A Resource Book for Students*.Routledge, 2004.
5. Trudgill, Peter. *Sociolinguistics*. Penguin, 1990.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2		H
CO 3		H
CO 4	H	H
CO 5	H	
CO 6	H	

EGLC0028: LITERARY CRITICISM: PLATO TO F.R. LEAVIS AND SELECT TWENTIETH CENTURY PERSPECTIVES (4-0-0) (CREDITS: 04)

Course Outcomes:

1. List out the characteristics of a tragic hero according to Aristotle. (Remembering)
2. Compare between Plato and Aristotle's theory of mimesis. (Understanding)
3. Apply the twentieth century perspectives in literary research (Applying)
4. Analyse critically a selected text in the field of Literary Criticism. (Analysing)
5. Explain Coleridge's theory of Imagination. (Evaluating)
6. Discuss the contributions of I A Richards in the field of Literary Criticism. (Creating)

Module I: Literary Criticism: Key Ideas and Concepts – Plato to Dryden (10 lectures)

Plato: Views on Poetry, Theory of Mimesis; Horace: Observations on drama; Longinus: Ideas On the Sublime, Sources of Sublimity in Literature; Philip Sidney: Ideas on "An Apology for Poetry"; John Dryden: ideas (classical, modern, French and English drama) from "An Essay on Dramatic Poesy"

Module II: Literary Criticism and Theory: Key Ideas and Concepts – Johnson to F. R. Leavis and Select Twentieth Century Perspectives (20 lectures)

Samuel Johnson: Views on Shakespeare,; William Wordsworth: Views on Poetry, Poetic Diction;; John Keats: Negative Capability, Egotistical Sublime; Matthew Arnold: The Touchstone Method, High Seriousness, Grand Style; I. A. Richards: The Referential and Emotive Uses of Language, Statement and Pseudo-Statement; Tenor and Vehicle, Stock Response; F.R. Leavis: Enactment, Literary Criticism and Philosophy; Russian Formalism, New Criticism, Marxism and Psychoanalysis

Module III: Selected Critical Texts (30 lectures)

a. *Poetics* : Aristotle
b. *Biographia Literaria* (Chapter 13) : Samuel Taylor Coleridge
c. " Tradition and the Individual Talent ": T. S. Eliot

Suggested Readings

1. Culler, Jonathan. *Literary Theory: A Very Short Introduction*.
2. Abrams, M.H. *A Glossary of Literary Term*s.
3. Cuddon, J.A. *The Penguin Dictionary of Literary Terms and Literary Theory.*
4. Habib, M.A.R. *A History of Literary Criticism: From Plato to the Present.*
5. Enright, D. J, Ernst De Chickera ed. *English Critical Texts: Indian Edition*. Oxford,1975

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1			H
CO 2	H		H
CO 3		H	
CO 4			H
CO 5			H
CO 6		H	

EGSD0029: SHAKESPEAREAN DRAMA (4-0-0)

Course Outcomes

1. Define drama as a literary genre (Remembering).
2. Explain the significant stages in the making of Shakespearean plays-tragedy, comedy, tragic-comedy and history plays (Understanding).
3. Apply the substance of the given criticism in the given plays (Applying).
4. Analyse the content of the given critical readings and their applicability in the given plays (Analysing).
5. Evaluate the theme, plot, literary techniques, characteristic features and creative energy of Shakespeare through the given plays (Evaluating).
6. Compile the content, style and the literary aspects of the given Shakespearean texts (Creating).

Module I: Tragedy and Tragi-comedy (25 lectures)

a) *Hamlet*
b) *Winter's Tale*

Module II: Comedy and History Plays (25 lectures)

a) *The Tempest*
b) *Julius Caesar*

Module III: Shakespearean Criticism (10 lectures)

a) Dollimore. Jonathan. "Introduction: Shakespeare, Cultural Materialism and New Historicism." Political Shakespeare: Essays in Cultural Materialism, edited by Jonnathan Dollimore and Alan Sinfield, Manchester University Press, 1994
b) Neill, Michael. "Post-colonial Shakespeare? Writing Away from the Centre." Post-Colonial Shakespeare, edited by Ania Loomba and Martin Orkin, Routledge, 2002

Suggested Readings List:

1. Texts prescribed in the Course.
2. Bloom, Harold, *Elizabethan Drama*. Infobase Publishing, New York.
3. Dutton, Richard and Howard, Jean. *A Companion to Shakespeare's Works*, Vol.II. Blackwell, Oxford.
4. Greenblatt, Stephen. *Tyrant: Shakespeare on Power*. Vintage, 2019.
5. Haris, Jonathan Gil. *Shakespeare and Literary Theory*. Oxford University Press, 2012.
6. Legatt, Alexander. *Shakespeare's Political Drama*. Rout ledge, London.

CO Mapping:

COs	Module I	Module II	Module III
CO1	H	H	L
CO2	H	H	L
CO3	M	M	H
CO4	M	M	H
CO5	H	H	M
CO6	H	H	M

EGIL0030: INTRODUCTION TO LINGUISTICS (4-0-0)

Objectives:

The aim of this paper is to introduce the students to the different branches of linguistics and its scope. The course will enable the students to have a better understanding of the philosophical and theoretical perspectives governing the studies in languages.

Course Outcomes:

CO 1: Define the basic concepts of linguistics. (Remembering)
CO 2: Understand the theoretical perspectives governing linguistic studies. (Understanding)
CO 3: Identify the levels of language structure. (Applying)
CO 4: Analyse the course of development of language with reference to traditional grammar approaches. (Analysing)
CO 5: Examine the basic phonological and morphological patterns of languages. (Evaluating)
CO 6: Summarize the course of development of language studies. (Creating)

Module I: Theoretical perspectives (30 Hours)

a) Origins of language; the nature of human language; language and cognitive development- the critical period; Language acquisition- Behaviourist Approach, Innateness Hypothesis, Stages in Language acquisition; Sapir-Whorf Hypothesis.
b) Structuralism- the influence of Prague School; American Structuralism; key concepts of structural linguistics- Sign, signifier

and signified, langue and parole, synchrony and diachrony, paradigmatic and syntagmatic relations.

c) Historicism; Functionalism; Generativist approach and Universal Grammar; Cognitive approach and Usage-based theories in linguistics.

Module II: Branches of Linguistics and its key concepts (30 Hours)

a) The branches of linguistics and its scope; the development of grammar- descriptive and prescriptive grammars; language universals.

b) Phonetics and Phonology: The organs of speech, articulatory phonetics, phonemes (IPA) and allophones, phonetic and phonemic transcription; distinctive features and suprasegmental phonology, phonological structure.

c) Morphology: Free and bound morphemes- prefix, suffix, infix and circumfix; content words and function words; inflectional and derivational morphology; word formation processes.

Suggested Readings List:

1. Balasubramanian, T. *A Textbook for English Phonetics for Indian Students*, Macmillan, New Delhi. 2000.
2. Wood, F. T. *An outline history of the English language*, Macmillan, New Delhi. 1941.
3. Yule, George. *The Study of Language*, 4th edition, Cambridge University Press. New Delhi. 2010
4. Fromkin, Victoria. *Introduction to Language*. 7th Edition. Wadsworth Publication. 2003
5. Lyons, John. Language and Linguistics: An Introduction. 19th Edition. Cambridge University Press. 2009

CO Mapping:

COs	Module I	Module II
CO1		H
CO2	H	H
CO3	H	H
CO4	H	
CO5		H
CO6	H	H

EGIM0031: MODERN EUROPEAN LITERATURE I (3-0-0) (CREDITS: 03)

Course Outcomes

1. *Analyse* the specific issues such as the double challenge of truth and liberty, of identity and unity, of cultural loss and recovery, of ethnic specificity and aesthetic universality in the writings of contemporary European writers. (Analysing)
2. *Evaluate* the core issues as depicted in the literature of Modern Europe. (Evaluating)
3. *Develop* critical understanding of various texts. (Creating)

Module I: Major Aesthetic Developments (10 lectures)

Constructivism, Realism, Symbolism, Naturalism, Aestheticism, Futurism, Vorticism, Imagism, Expressionism, Dadaism, Surrealism, Cynicism, Skepticism, Resistance, Despair and Alienation

Module II: Selected Modern European Poetry (10 lectures)

a. "The Albatross": Charles Baudelaire
b. "The Apple Orchard": Rainer Maria Rilke

Module III: Modern European Fiction (25lectures)

a. *Crime and Punishment:* Fyodor Dostoevsky
b. *The Castle*: Franz Kafka

Suggested Readings

1. Abrams, M.H. and, Geoffrey Galt Harpham. *A Glossary of Literary Terms*. Cengage Learning, ,2 015
2. Bloom, Harold. *The Western Canon: The Books and School of the Ages*. Harcourt, 1994.
3. Bradbury, Malcolm and James Mac Farlane (Eds) *Modernism: A Guide to European Literature, 1890-1930.* Penguin, 1976.
4. Cohen, Walter. A *History of European Literature*. Oxford University Press, 2017.
5. Cohen, J.M. *A History of Western Literature.* Transaction Publishing, 2007.
6. Hamburger, Michael. *The Truth of Poetry: Modernist Poetry Since Baudelaire*. Anvil Press Poetry, 2004.
7. Moretti, Franco(Ed.). *The Novel*. Princeton UP, 2006.
8. Nicoll, Allardyce. *British Drama*. Barnes & Noble, 1961.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	H	H

CO 2	H	M	M
CO 3		H	H

EGEL0032: MODERN EUROPEAN LITERATURE II (3-0-0) (CREDITS: 03)

Course Outcomes

1. *Analyse* the modernist issues such as humanism, individualism, meaninglessness of life, liberty and identity, cultural loss and recovery and aesthetic universality in the literature from different nations of Europe. (Analysing)
2. *Evaluate* the overall Western modern philosophy in the works of the various writers of the area. (Evaluating)
3. *Discuss* the changing trends and movements of literature as reflected in the selected texts. (Creating)

Module I: Selected Modern European Poetry (20 lectures)

a. "Lament for a Bullfighter": Federico Garcia Lorca
b. "To his Own Beloved Self": Vladimir Mayakovsky

Module II: Selected Modern European Drama (15 lectures)

a. Accidental Death of an Anarchist: Dario Fo (Italy.
b. The Chairs: Eugene Ionesco (Romania)

Module III: Modern European Fiction (10 lectures)

a. *The Stranger*: Albert Camus
b. *The Tin Drum:* Gunter Grass

Suggested Readings

1. Abrams, M.H. and Geoffrey Galt Harpham. *A Glossary of Literary Terms*. Cengage Learning, 2015.
2. Bloom, Harold. *The Western Canon: The Books and School of the Ages*, Harcourt, 1994.
3. Bradbury, Malcolm and James MacFarlane (Eds). *Modernism: A Guide to European Literature, 1890-1930.* Penguin, 1976.
4. Cohen, Walter. A *History of European Literature*. Oxford University Press, 2017.
5. Cohen, J.M. *A History of Western Literature.* Transaction Publishing, 2007.
6. Hamburger, Michael. *The Truth of Poetry: Modernist Poetry since Baudelaire*. Anvil Press Poetry, 2004.
7. Moretti, Franco(Ed.). *The Novel*. Princeton UP, 2006.
8. Nicoll, Allardyce. *British Drama*. Barnes & Noble, 1961.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H

EGWL0033: WORLD LITERATURE SINCE 20TH CENTURY

Credits: 02 (2-0-0)

Objective: The course aims to introduce the students to literature across the world. The students are expected to develop an understanding of cultural exchange processes as represented through literature from different parts of the world, along with the ability to relate the ideas and contexts of socio-economic development to the historic development of the nations through various literary texts.

Course Outcomes:

1. To *acquaint* with the major literary concepts/movements to comprehend and interpret the prescribed texts of World Literature.
2. To *develop* a consciousness of the illusions pertaining to national identity and the status of an individual in a given geographical area.
3. To *construct* ideas on multiculturalism, disconnect from native land and the challenges face by people in various diaspora contexts.

Module 1: Conceptual background (5 hours)

David Damrosch. "What is World Literature?" in *World Literature Today.*

Module 2: 20th Century World Literature (12 hours)

Fiction:

1. Maxim Gorky: *Mother* (Chapter 1 and 2)
2. Gabriel Garcia Marquez: "A Very Old Man with Enormous Wings"
3. Kunzang Choden: "The Woman Who Lost Her Senses"

Poetry:

1. Yehuda Amichai: "Half the People in the World"

Module 3: Contemporary World Literature (13 hours)

Fiction:

1. Haruki Murakami: *Kafka on the Shore* (Chapter 1-4)
2. Jhumpa Lahiri: "Hell-heaven"
3. Ama Ata Aidoo: "Diplomatic Pounds"

Poetry:

1. Khairani Borokka: "Money for Your English"

Suggested Readings:

1. Damrosch, David." What Is World Literature?". *World Literature Today*, Vol. 77, No. 1, 2003, pp. 9-14. : https://www.jstor.org/stable/40157771
2. Barnes, John R. "World-Literature." *The English Journal*, Vol. 26, No. 9 , 1937, pp. 734-739. https://www.jstor.org/stable/804286
3. Gorky, Maxim. *Mother*, Maple Press, 2015
4. Marquez, Gabriel Garcia, *A Very Old Man With Enormous Wings*, Penguin, 2014.
5. Choden, Kunzang. *Tales in Colour and Other Stories*, Zubaan, 2009
6. Murakami, Haruki. *Kafka on the Shore*, Vintage Books, 2006
7. Aidoo, Ama Ata. *Diplomatic Pounds and Other Stories*, Ayebia Clarke, 2012
8. Lahiri, Jhumpa. *Unaccustomed Earth*, Random House, 2013
9. Almond, Ian. *World Literature Decentered*, Taylor and Francis, 2021
10. Ganguly, Debjani. *Cambridge History of World Literature*, CUP, 2021

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	M	M	H
CO 3	M	H	H

EGAA0034: ARTS AND AESTHETICS

3 credits: 3-0-0

Course Objectives

The objective of this course is to make the students understand the aesthetic concepts from various Western and Indian Philosophies along with their contextual relevance. A philosophical exploration is expected to enhance our understanding of the significance of art and aesthetics in the global culture.

Course Outcomes

CO1: *Remembering* the historical understanding on Western and Indian Aesthetics
CO2: *Understanding* the aesthetic concepts from various Western and Indian philosophers
CO3: *Analyzing* the contextual relevance of aesthetic theories

Module I: Nature of Aesthetics (10 hours)

Definitions of art
Art as Expression
Art and Society
Art and Aesthetics

Module II: Art and Aesthetic Experience (15 hours)

Introduction to Western and Eastern Aesthetics
Immanuel Kant on "Disinterested Delight"
Bharata Muni's "Rasa Theory"

Abhinavagupta on "Rasa"

Module III: Aesthetics and Philosophical Aesthetics (15 hours)
Arindam Chakrabarti: Introduction to *The Bloomsbury Research Handbook of Indian Aesthetics and the Philosophy of Art*, Bloomsbury, 2016.
Renaissance art and Humanism- A study on the works of Albrecht Durer and Leonardo Da Vinci

Suggested Readings

1. Chen, Jingran. "An Analysis of the Multiple Meanings of Art During the Renaissance." *Journal of Education, Humanities and Social Sciences*, 2009.
2. Guo, Zhaodi, and Lin Zhang. "Wisdom and Knowledge: The Outline of Eastern and Western Aesthetic Spirits." *Frontiers of Philosophy in China*, vol. 7, no. 1, 2012, pp. 90–111. *JSTOR*, http://www.jstor.org/stable/44259373.
3. Kant, Immanuel. *The Critique of Judgment (Theory of the Aesthetic Judgment & Theory of the Teleological Judgment)*. Czechia Good Press, 2024.
4. Nanay, Bence. *Aesthetics: A Very Short Introduction*. Oxford UP, 2019.
5. Pande, Suresh Chandra. *The Concept of Rasa With Special Reference to Abhinava Gupta*. Indian Institute of Advanced Study, 2018.
6. Price, David. *Albrecht Durer's Renaissance Humanism, Reformation and the Art of Faith*. University of Michigan Press, 2003.
7. Vatsyayan, Kapila. *Bharata - the Natyashastra*. Sahitya Akademi, 1970.

Mapping of COs to Modules

Cos	Module I	Module II	Module III
CO1	H	H	H
CO2	M	H	H
CO3	M	H	H

EGCS0035: CULTURAL STUDIES
Credit: 3-0-0

Objectives: The course will introduce the students to the basic ideas and theoretical developments under the broader research area of Cultural studies, adding critical perspectives to their understanding. The course will introduce the key ideas, theories and methodologies for practical application of the ideas within popular sites of culture production.

Course Outcomes:
1. To *familiarize* the student to the multi-faceted dynamics of culture, the process of culture production and cultural products
2. To *identify* the core debates within cultural studies.
3. To *develop* habits of independent learning through critical analysis.

Module 1: Origins, Aims and Scope of Cultural Studies (17 hours)
Culture: Definition, Popular culture, culture and power, sites of culture production, product and spaces of culture consumption
Origins of Cultural studies: Early trends, Birmingham Centre for Contemporary Cultural Studies, Stuart Hall's ideas and contribution, Scopes

Module 2: Methods and Methodologies of Cultural Studies (18 hours)
Methods: 'Circuit of Culture' (Representation, Identity, Production, Consumption, Regulation), Language and Discourse, Cultural Materialism, Postcolonialism and Cultural Studies, Media culture and cultural studies.

Module 3: Critical Text (10 hours)

Hall, Stuart. "Encoding/Decoding"

Suggested Readings

1. Nayar, Pramod K. *An Introduction to Cultural Studies*, Second Edition, Viva Books, 2023
2. Williams, Raymond. *Culture and Society 1780-1950*, Anchor Books, 1960
3. Amin, Ash and Nigel Thrift. *Cities: Reimagining the Urban*, London Polity, 2002.
4. Beck, Ulrich. *Risk Society: Towards a New Modernity*, Tr. Mark Ritter, Sage, 1992.

5. Bhaba, Homi K. *The Location of Culture*, Routledge, 1995.
6. Hall, Stuart. "Encoding/decoding." In Stuart Hall, Dorothy Hobson, Andrew Love, and Paul Willis (eds.), *Culture, Media, Language*, pp. 128–38. London: Hutchinson, 1980.

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3
CO 1	H	M	L
CO 2	L	H	H
CO 3	M	H	H

EGFS0036: FILM STUDIES
(3-0-0)

Objectives: This paper enables students to gain skills in the field of cinema via the appreciation of its features as a medium. The course is practically oriented to encourage students to acquire the competence necessary to become engaged viewers/critics/reviewers.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: *Define* the specific features of composition that help create films. (Remembering)
CO2: *Explain* the different methodologies of film analysis. (Understanding)
CO3: *Write* film reviews to generate a repertoire of analyses and interpretations. (Application)

Module I: Introduction to Film Studies (15 Hours)

History of world cinema; Western cinema; Non-western cinema; Art and Technique of film; Script writing; Language of Cinema; Mise en scene; Cinematography; Editing; Sound; Types of cinemas; Different movements of cinema

Module II: **Film Genres (15 Hours)**

Analysis of film scripts; Definition of various film genres; Taxonomies of film genre; Story Idea; Theme; Structure; Film genre as economic strategy; Film genre as Cognition; Rethinking film genres

Module III: Film Criticism (15 Hours)

Critical analysis of films; Different film theories; Classical Film Theories; Post-classical film theories Tools of film criticism; Semiotic approaches; Structuralist approaches, Contextual approaches; Film reviews

Suggested Readings

1. Corrigan, Timothy. *A Short Guide to Writing About Film*. Pearson, 2014.
2. Dix, Andrew. *Beginning Film Studies.* Viva, 2010, pp. 9-100. New Delhi.
3. Nelmes, Jill, editor. *An Introduction to Film Studies*. Routledge, 2003, pp. 152-69. London.
4. Richardson, Michael. "Film Criticism." *The International Encyclopaedia of Surrealism*, 2020.
5. Raghavendra, M. K. *Locating World Cinema: Interpretations of Film as Culture.* Bloomsbury Publishing, 2020. India.
6. *The Language and Style of Film Criticism*. Taylor & Francis, 2011. United Kingdom.

Suggested Films

1. Aamis: Ravening. Directed by Bhaskar Hazarika, 2019.
2. Enemy. Directed by Denis Villeneuve, 2013.
3. In the Mood for Love. Directed by Wong Kar-wai, 2000.
4. No Smoking. Directed by Anurag Kashyap, 2007.

Mapping of COs to Syllabus:

Cos	Module I	Module II	Module III
CO1	H	L	M
CO2	M	H	L
CO3	H	M	L

EGNE0037: NORTH-EAST INDIAN LITERATURE IN ENGLISH (3-0-0)

(Credits: Theory 03)

Objectives: The objective of the course is to introduce learners to the vast body of writings in English from Northeast of India so that they develop an ability to critically interpret different literary themes and recurrent issues reflected in Northeast Indian literature in English.

Course Outcomes

1. *Interpret* the emerging trends of literature from northeast of India in its different genres- prose, poetry, fiction and short-fiction. (Understanding)
2. *Apply* critical theoretical assumption as well as critical reading skills to evaluate vibrant areas of Northeast literature. (Applying)
3. *Examine* the most significant topics like colonialism, identity and unity, cultural loss, ethnic conflicts, universality in the literature of Northeast region before and after British Colonial Period (Analysing)

Module I: Selected Poetry (12 hours)

a) Easterine Kire: "Riddu Riddu''
b) Robin Ngangom: "My Invented Land"
c) Nini Lungalang – "Going Home"
d) Rajendra Bhandari – "I.D. Card of an Unemployed Youth"

Module II: Selected Fiction (20 hours)

a) Mamang Dai: *The Legends of Pensam*
b) Mitra Phukan: *The Collector's Wife*

Module III: Selected Short Stories (13 hours)

c) Janice Pariat – "Boats on Land" (Title Story)
d) Temsula Ao - "The Curfew Man" (from *These Hills Called Home*)

Suggested Readings

1. *The Oxford Anthology of Writings from North East India: Poetry and Essays,* Indian Edition, Misra, Tillotama, 2010, OUP.
2. *Emerging Literatures from North East India: The Dynamics of Culture, Society and Identity, 1st Edition,* Zama, Magarat Ch, 1900, SAGE publications.
3. *Dancing Earth: An Anthology of Poetry from North-east India*, 1st Edition, Ngangom, Robin S. & Nongkynrih, Kynpham Singh, 2009, Penguin.
4. *Exploring North-East Indian Writings in English:* 2 volumes, 1st Edition, Swami, Indu, 2010, VDM Verlag.
5. Swami, Indu. Exploring North East Indian Writings in English (2 Volumes)

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3
1	**H**	**H**	**H**
2	**M**	**H**	**H**
3	**H**	**H**	**H**

EGWR0038: WOMEN'S WRITINGS

Credits: 03 (3-0-0)

Course Objectives: The course intends to equip the student with the ability to acknowledge the diverse experiences of women across time, nations and cultures understand the importance of context for interpreting women's experience.

Course Outcomes

1. *Define* and explain the various thoughts and theories pertaining to feminist writings and feminism. (Remembering)
2. *Analyse* the various movements related to gender and the progress in gender and literature. (Analyzing)
3. *Evaluate* the interdisciplinary aspect in the various texts prescribed. (Evaluating)

Module I: Selected Poetry (12 hours)

Sylvia Plath: 'Daddy'
Anjum Hassan: 'Distant God'
Adrienne Rich: 'Snapshots of a Daughter-in-law'

Amrita Pritam: 'Meeting The Self'

Module II: Selected Fiction (18 hours)
Alice Walker: *The Color Purple*
Monica Ali: *Brick Lane*

Module III: Selected Non-fiction (15 hours)
Mary Wollstonecraft- *A Vindication of the Rights of Woman* (New York: Norton, 1988) chapter.1
Judith Butler: Gender Trouble: Feminism and the Subversion of Identity (New York and London: Routledge, 1990) Chapter 1
Elaine Showalter. A Literature of their Own, Princeton: Princeton UP, 1977 (excerpt)

Suggested Readings
1. Wollstonecraft, Mary. *A Vindication of the Rights of Woman* . Norton, 1988.
2. Woolf, Virginia. *A Room of One's Own* (chaps.1 and 6.). Harcourt, 1957.
3. Beauvoir, Simone de. 'Introduction', in *The Second Sex*, tr. Constance Borde and Shiela Malovany- Chevallier. Vintage,2010, pp.3–18.
4. Sangari, Kumkum and Sudesh Vaid, ed. 'Introduction', in *Recasting Women: Essays in Colonial History* .Kali for Women, 1989, pp. 1–25.
5. Wittig, Monique. *The Straight Mind and Other Essay*s . Beacon P, 1992.
6. Vanita, Ruth and Saleem Kidwai, ed. *Same-sex Love in India: Readings from Literature and History*. St Martin's P, 2000.
7. Mohanty, Chandra Talapade. 'Under Western Eyes: Feminist Scholarship and Colonial Discourses', in *Contemporary Postcolonial Theory: A Reader*, ed. Padmini Mongia . Arnold, 1996, pp. 172–97.

COs Mapping

CO	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H

EGAL0039: COLONIAL AND POST-COLONIAL AFRICAN LITERATURE I (3-0-0) (CREDITS: 03)

Course Outcomes
1. *Analyze* the critical background of the formation of the postcolonial African literature
2. *Evaluate* the various issues such as colonialism, identity , cultural loss, dislocation, displacement, mimicry in the literature of Africa in the post-colonial socio-cultural context.(Evaluating)
3. *Discuss* selected African literary texts from the postcolonial critical perspective to explore their postcolonial socio-cultural implications. (Creating)

Module I: Conceptual Background : Critical Terms (10 lectures)
"Post-colonialism / Postcolonialism, Colonial and Postcolonial Periods in Africa, Negritude, African Feminism, Afrofuturism, Negofeminism, Motherism, Stiwanism, negraille

a. Module II: Fiction (20 lectures)
a. *No Longer at Ease*: Chinua Achebe
b. *Purple Hibiscus*: Chimamanda Ngozi Adichie
c. A Far Cry from Africa: Derek Walcott

Module III: Drama (15 lectures)
a. *The Lion and the Jewel*: Wole Soyinka
b. *The Dilemma of a Ghost:* Ama Ata Aidoo

Suggested Readings
1. Achebe,Chinua. *Arrow of God*.William Heinemann Ltd, 1958.
2. Adichie, Chimamanda Ngozi. *Purple Hibiscus.* Algonquin Books, 2003.
3. Aidoo, Ama Ata. *The Dilemma of a Ghost*. Longman:, 1995.
4. Bell, Bernard W. *The Afro-American Novel and Its Tradition*. University of Massachusetts Press, 1989.
5. Dathorne, O.R. *The Black Mind: A History of African Literature*. University of Minnesota Press, 1974.
6. King, Lovalerieet al. *Contemporary African American Literature: The Living Canon*. Indiana University Press, 2013.
7. Ngugi, MukomaWa. *The Rise of the African Novel*. University of Michigan Press, 2018

8. Soyinka, Wole. *The Lion and the Jewe*l. Oxford UP, 1962.
9. The prescribed texts

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3
1	H	M	M
2	M	H	H
3	M	H	H

EGPC0040: COLONIAL AND POST-COLONIAL AFRICAN LITERATURE II (3-0-0) (CREDITS: 03)

Course Outcomes

1. *Analyze* the additional critical background of the formation of the postcolonial African literature
2. *Evaluate* the issues such as colonialism, identity, cultural loss, dislocation, displacement, mimicry in the literature of Africa in the post-colonial socio-cultural context. (Evaluating)
3. *Discuss* selected African literary texts from the postcolonial critical perspective to explore and map their theoretical background and the body of colonial and post-colonial African literature.

Module I: Conceptual Background: Essays (10 lectures)

a. Leopold Sedar Senghor. "Negritude"
b. Mark Dery. "Afrofuturism"

Module II: Selected Fiction and Poetry (20 lectures)

a. *By the Sea* : Abdulrajak Gurnah
b. *July's People*: Nadine Gordimer
c. *Bound to Violence* : Yambo Ouologeum
d. "On Being Brought from Africa to America": Phillis Wheatley

Module III: Selected Non-Fiction (15 lectures)

a. "On Abolition of the English Department": Ngugi wa' Thiong'o
b. "The African Writer and the English Language": Chinua Achebe.

Suggested Readings

1. Achebe, Chinua. Hopes and Impediments. PenguinBooks,1990.
2. Ngugi, MukomaWa. The Rise of the African Novel, University of MichiganPress. 2018.
3. Fanon, Frantz. The Wretched of the Earth. Translated by Constance Farrington. Penguin Books, 1963.
4. Senghor, Leopold Sedar. "Negritude." Indian Literature Vol. 17, No. 1/2 , 1974, pp. 269-273.https://www.jstor.org/stable/23329885.
5. Dery, Mark. "Black to the Future: Interviews with Samuel R. Dilany, Creg Tate,and Tricia Rose" in Mark Dery ed.Flame Wars: The Discourse of Cyberculture, Duke University Press, 1994.
6. Thiong'o, Ngugi wa. *Decolonising the Mind*, East African Educational Publishers, 1986.
7. Gurnah, Abdulrajak : *By The Sea* , Bloomsbury Publishing , 2021

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2	M	H	H
CO 3	M	H	H

EGSL0200: SERVICE LEARNING- LANGUAGE COMMUNICATION (2-0-0) (CREDIT: 02)

Course Outcomes

1. Describe the nature of Service Learning and the principles of Community University Engagement (Remembering)
2. Understand the importance of engagement with nearby communities and develop a mutual partnership in terms of the sharing of knowledge with the local communities (Understanding)
3. Apply the principles of Community University Engagement in the linguistic study of local communities in terms of spoken English and study of speech expressions (Applying)
4. Analyze the linguistic expressions of the communities and the gap of communication in terms of English language.

(Analyzing)
5. Evaluate the expressions of the communities and summarize the socio-cultural constructs behind the expressions under Service-learning study. (Evaluating)
6. Design a project report on their understanding of Service learning and involvement with the communities. (Creating)

Module I: Understanding Service Learning (15 lectures)
Introduction to Service Learning; Understanding Community University Engagement; Historical Overview of Community University Engagement in India; Principles of Community University Engagement; Forms of Community University Engagement; Community Based Participatory Research; Social Responsibility of Higher Education Institutions of India

Module II: Interaction with Communities (15 lectures)
Foundations of English grammar; English phonetic symbols (vowels and consonants); Common idioms and phrases in English; Understanding the Key concepts of languages: the socio-cultural context; Exploring different speech communities; Learning unique linguistic expressions; Exploring idioms and phrases: the socio-cultural construct that binds them; Basics of translation; Field Visit; Assessment: Assignment writing and Submission

Suggested Readings
1. Abbi, Anvita. *A Manual of Linguistic Fieldwork and Structures of Indian Languages*. Lincom Europa.2001
2. Colina, Sonia. *Fundamentals of Translation*.CUP. 2015
3. Hall Budd. et al. *Strengthening Community University Research Partnerships: Global Perspectives*. University of Victoria,2015
4. Kaye, Berger Catheryn. *A Complete Guide to Service Learning*. Free Spirit Publishing, 2004
5. Rastogi, Pratap. *Art of English Translation*. Ramesh Publishing House,2016

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	
CO 3	H	
CO 4		H
CO 5		H
CO 6		H

EGPP6003: PROJECT PHASE I (1-0-1) (CREDITS: 02)

Course Outcomes
1. Define academic writing, research paper and publication. (Remembering)
2. Identify research topics for sustained and rigorous investigation so that original write-ups can be developed. (Understanding)
3. Estimate and expand their abilities to absorb, synthesize and construct arguments in a close-knit community. (Applying)
4. Analyse the various works of literature to write research reports and papers. (Analysing)
5. Evaluate critically through reading, research, discussion and composition around a particular topic/ theme or subject. (Evaluating)
6. Compose write-ups for scholarly journals by doing analysis of textual evidence. (Creating)

Module I: Conceptualizing, Planning and Preparing a Research Paper (15 lectures)
- Introduction to academic/ research writing
- Avoiding Plagiarism in research
- Selection of a research topic
- Developing an outline of the research paper
- Choosing an appropriate title for the research paper
- Writing an abstract
- Review of Literature
- Developing an argument
- Bringing a critical interpretation into writing
- Drawing inferences/ framing a conclusion
- MLA Handbook 8th Edition
- Referencing and Citation
- Bibliography

Module II: Practical- Writing and editing a Research Paper (15 Lectures)

- Draft of the abstract
- Draft of the literature review
- First draft of the research paper
- Second draft of the research paper
- The final research work

Suggested Reading

1. Correa, Delia Da Souza & Owens, W.R. *The Handbook to Literary Research*. Routledge. 2009
2. Kothari, C. R. & Gaurav Garg. *Research Methodology: Methods and Techniques.* New Age. 2019
3. *MLA Handbook for Writers of Research Papers,* Eighth Edition. MLA. 2016.

Mapping of Course Outcomes

Course Outcomes	MODULE 1	MODULE 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6		H

EGPP6004: PROJECT PHASE II (2-0-6) (CREDITS: 08)

Course Outcomes

1. Define academic writing, dissertation and publication. (Remembering)
2. Identify research topics for sustained and rigorous investigation so that original write-ups can be developed. (Understanding)
3. Estimate and expand their abilities to absorb, synthesize and construct arguments in a close-knit community. (Applying)
4. Analyse the various works of literature to conduct detailed analytical research. (Analysing)
5. Evaluate critically through reading, research, discussion and composition around a particular topic/ theme or subject. (Evaluating)
6. Compose scholarly write-ups by conducting detailed, in-depth analysis of a research area. (Creating)

Module I: Conceptualizing, Planning and Preparing a Research Topic (30 lectures)

- Introduction to Project work and Dissertation writing
- Topic and Proposal
- Literature review
- Perspective/ Theoretical framework
- Chapterisation
- Resources
- Limitation and Scope
- Critical interpretation and Documentation
- MLA Handbook 8th Edition
- In-text Citation
- Bibliography/ Referencing
- Plagiarism

Module II: Practical- Writing and editing a Research Paper (90 Lectures)

- Working Proposal
- Final Proposal
- Abstract
- Outline of the Dissertation
- Draft of the literature review
- First draft of the Chapters
- Second draft of the Chapters
- The final Dissertation

Suggested Reading

1. Correa, Delia Da Souza & Owens, W.R. *The Handbook to Literary Research*. Routledge. 2009
2. Kothari, C. R. & Gaurav Garg. *Research Methodology: Methods and Techniques.* New Age. 2019
3. *MLA Handbook for Writers of Research Papers,* Eighth Edition. MLA. 2016.

Mapping of Course Outcomes

Course Outcomes	MODULE 1	MODULE 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6		H

EGSP6006: SEMINAR AND PRESENTATION

Credit: 02 (1-1-0)

Objectives:

- To enable the students to identify and expand their abilities to absorb, synthesize and construct arguments in research.
- To assess various works of literature to write research reports and papers.
- To compose write-ups for scholarly journals by doing analysis of textual evidence.

Course Outcomes

1. *Identify* research topics for sustained and rigorous investigation so that original write- ups can be developed. (Applying)
2. *Develop* critical reading, research, discussion and composition around a particular topic/ theme or subject. (Creating)

Module I: Introduction to Seminar and Steps of Seminar (5 hours)

a) Introduction to Seminar
b) Research Methodology
c) Formulating a Research Paper
d) Tips and Techniques of a Good Presentation : Presentation - how to present a seminar paper; mode of presentation: essay-type presentation, paper presentation, power point (ppt.) presentation

Module II: Practical (25 hours)

a) Two presentations per period on predetermined and allotted topics
b) Each will be allotted 10-15 minutes for presentation.
c) Followed by a discussion and commentary on the paper presented.

Suggested Readings

1. Correa, Delia Da Souza & Owens, W.R. The Handbook to Literary Research. Routledge. 2009
2. Kothari, C. R. & Gaurav Garg. Research Methodology: Methods and Techniques. New Age. 2019
3. MLA Handbook for Writers of Research Papers, Eighth Edition. MLA. 2016.

Mapping of COs to Syllabus

COs	Module 1	Module 2
CO1	H	H
CO2	H	H

VALUE ADDED COURSES

EGES0138: EFFECTIVE COMMUNICATION SKILLS (1-0-1) (CREDITS: 02)

Course Outcomes

1. Describe the types of communication. (Remembering)
2. Differentiate from a variety of social functions including greetings, introductions and farewells, making and responding to requests, suggestions, invitations and apologies, conducting simple transactions in shops and offices, asking for and giving directions, etc. (Understanding)
3. Illustrate the daily routines in a series of simple phrases and sentences. (Applying)

4. Categorize the form and function of the basic official correspondences. (Analysing)
5. Evaluate formal and informal writings, preparing reports, letters, memorandum, notices, agenda, minutesetc. (Evaluating)
6. Formulate the rationale of descriptive, narrative, expository and argumentative writing. (Creating)

Module I: Communication and Grammar skills (8 lectures)
Language and communication: Differences between speech and writing, Distinct features of speech, Distinct features of writing, Parts of Speech, Person, Gender, Number, Use of Tense, Aspect and Modals, Degrees of comparison, Sentence types, Negation and Relative Clauses, Narration, Voice change, Proverbs, Vocabulary, Proper use of words, Idioms, Accentuation, Intonation, Understanding Various Englishes.

Module II: Developing Communicative Skills (7 lectures)
Introductory, developmental, transitional and concluding paragraphs: Coherence and cohesion, Descriptive, narrative, expository and argumentative writing, Introduction to soft skills, people and social skills, presentation, interaction and effective communication.
Official letter, Paragraph writing, Note-making, Topic Sentence, Telephonic Conversation, Group Discussion regarding job interview & C. V. Writing, formal and informal writings, reports, handbooks, manuals, letters, memorandum, notices, agenda, minutes.

Module III: Self-Learning (15 lectures)
Practice and drill sessions, online learning via tutorials (link to be provided by the teacher in-charge), self- assessment of progress, submission of assessment reports to the teacher.

Suggested Readings
1. English and Soft Skills. S.P. Dhanavel. Orient BlackSwan 2013
2. Fluency in English - Part II, Oxford University Press, 2006.
3. Business English, Pearson, 2008.
4. Language, Literature and Creativity, Orient Blackswan, 2013.
5. The Cambridge Grammar of the English language. Huddleston and Pullam, CUP,2002.

Mapping of Course Outcomes

Course Outcomes	MODULE 1	MODULE 2	MODULE 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6		H	H

EGML0028: MYTH IN LITERATURE (2-0-0) (CREDITS: 02)

Course Outcomes
1. Remember some of the recurrent classical myths in literature (Remembering)
2. Understand that myths have strong metaphoric function (Understanding)
3. Understand how the application of the myth in the select texts throws more light in understanding the complex ideas therein (Applying)
4. Co-relate the original story in the myth to the story in the corresponding literature (Analyzing)
5. Rate the potentiality of the myth in leveraging literary ideas (Evaluating)
6. Adopt the myth as vehicle of thought in creative writings (Creating)

Module I: Myth Concepts (7 lectures)
Myth, mythology, mytheme, archetype, archetypal, archetypal criticism, mythopoeia, myth critics

Module II: Recurring Myths (15 lectures)
Myth of: Zeus (Jupiter/Jove), Venus (Aphrodite), Cupid (Eros), Adonais, Hercules, Odysseus, Achilles, Oedipus, Electra, Helen, Diana, Hera, Orpheus and Eurydice, Hades, Leda and Swan, Trojan War

Module III: Myth in Literature-significance of select myth (8 lectures):
Geoffrey Chaucer: : Myth of Thisbe and Dido in *Legend of Good Women*
P.B.Shelley : Myth of Adonais in "Adonais"
W.B.Yeats : Myth of Leda and Swan in "Lead and the Swan"
T.S.Eliot : Myth of Phiomela, Cleopatra and Tiresias *The Waste Land*

Suggested Readings

1. Frye, Northrop. "Myth, Fiction and Displacement"
2. Graves, Robert (1955). *The Greek Myth*. Penguin, 1992
3. Matyszak ,Philip. *The Greek and Roman Myths – A Guide to the Classical Stories*. Thames and Hudson, 2010.
4. Powell, Barry B. *Classical Myth*. Oxford University Press, 2020
5. Bahun, Sanja. *Myth, Literature, and the Unconscious*. Routledge, 2013.

Mapping of Course Outcomes

Course Outcomes	MODULE 1	MODULE 2	MODULE 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6	H	H	H

EGLA6005: LYRICAL ANALYSIS: SONGS AND POETRY
2 Credits (1-0-1)

Course Outcomes

1. *Define* important concepts related to lyrical analysis of English poetry. (Remembering)
2. *Explain* the usage of such ideas in the context of literary texts. (Understanding)
3. *Develop* lyrical analytical skills (Creating)

Module I: Prosodic Analysis- Key Concepts (6 Hours)

Prosody; Syllable, Foot, Accent, Pitch; Primary and Secondary accent; Rhythm, Rhyme, Metre; Scansion, Figures of Speech

Module II: Lyrical Poetry (8 hours)

Sonnet 18 by William Shakespeare
"Go, Lovely Rose" by Edmund Waller
"I Felt a Funeral, in my Brain" by Emily Dickinson

Module III: Poetic Song Analysis (8 hours)

"Knocking on Heaven's Door" and "Blowin' in the Wind" by Bob Dylan
"Hey Little Man" and "Rumble Jumble" by Lou Majaw
"Time" by Tom Waits

Module IV: Application (8 hours)

"The Impasse of Musical Theory" by I. A. Richards
Apply poetic analysis to any song and present it in class.

Suggested Readings

1. Jonathan Culler, *Theory of the Lyric*, Harvard University Press, 2017
2. Mike Mattison and Ernest Suarez, *Poetic Song Verse*, University Press of Mississippi, 2021
3. Jonathan Wells, *Third Rail: The Poetry of Rock and Roll*, MTV Books, 2007

Mapping of Cos to Syllabus:

COs	Module 1	Module 2	Module 3	Module 4
CO1	H	M	L	L
CO2	H	H	L	L
CO3	L	M	H	M
CO4	L	M	M	H

DEPARTMENT OF MASS COMMUNICATION

VISION:

To be a centre of excellence in teaching, learning and research committed to mould ethical and socially responsible media professionals and entrepreneurs who can deliver professional content for diverse media platforms.

MISSION:

The Department of Mass Communication seeks to:

- Achieve excellence in teaching, learning and research.
- Promote critical thinking and problem-solving skills.
- Equip learners by combining the theoretical aspects with creative innovation and entrepreneurship practices.
- Mould ethical and socially responsible media professionals and entrepreneurs.
- Provide knowledge base and consultancy services to the community in the field of media and communication.

M.A. MASS COMMUNICATION

The M.A Mass Communication programme of Assam Don Bosco University is a two-year (four semesters) programme consisting of theory and practical components, taught and learned through a combination of lectures, hands-on training, seminar, guest lecture, industry-academia interface and project execution. The programme offers specialization in the area of Print Media, Electronic Media and Communication for Development.

PROGRAMME OUTCOMES – MA MASS COMMUNICATION

PO 1: **Critical Thinking**: Gain conceptual and theoretical knowledge and learn to critically think and analyze the dynamics and contemporary phenomenon of mass communication.

PO 2: **Scientific Temper:** Develop logical and creative thinking for the solutions in Print media, electronic media and Communication for development.

PO 3: **Effective Communication**: Develop the communication skills, theoretical and practical knowledge among the students in print, digital and development communication.

PO 4: **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 5: **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Effective Citizenship**: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through service learning and social commitment.

PO 7: **Environment and Sustainability**: Understand the environment issues and promote sustainable development goals.

PO 8: **Self-directed and Life-long Learning**: Engage in higher studies, research and professional work and be a life- long learner in context of media studies.

PROGRAMME SPECIFIC OUTCOME: MA MASS COMMUNICATION

PSO 1: **Understanding Communication and its Concepts:** An ability to define the meaning, purpose of communication and demonstrate the theoretical knowledge in the field of mass communication.

PSO 2: **Application of Knowledge**: Apply communication skills and practices in context of social and cultural milieu of the North-eastern region.

PSO 3: **Developing Critical Aptitude:** An ability to test and analyze research findings by demonstrating critical thinking and problem-solving skills.

PSO 4: **Enhancing Professional Skills:** An ability to develop professional skills and use in the field of print media, electronic media and development communication.

PSO 5: **Creating Multimedia Content:** An ability to create media programmes for varied media audience needs.

MAPPING OF COURSES TO PO/PSO

MA Mass Communication

Sl. No	Name of Paper	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
1.1	History and Development ofCommunication	L	H			L	M		H	M	L	L	M
1.2	Philosophy of Communication	H	M	L	M	H	H		H	H	L	M	M
	Theoretical Perspectives of Communication	H	H	H	M	L			H	H	L	M	
1.3	Principles andPractices of Journalism	H	H	H	H	M	M	L	H	H	H	M	H
1.4	Media Literacy	H	H	H	H	M	H		H	M	L	L	L
1.5	Journaling	H		H	M	M	H		L	L	M	H	L

1.6	Techniques of Photography andImage Editing	H	H	M		M	M		H	M	H	H	H
1.7	Service Learning	H	H	H	H	H	H	H	H	H	H	H	H
2.1	Investigative andData Journalism	H	H	H	H	M	H	L	H	H	H	M	H
2.2	Theories of Development Communication and Social Chang	H	H	M	M	L	L			H	H	L	L
2.3	CommunicationResearch Methodology	H	H	H	L	M	L		M	H	H	H	H
2.4	Digital Media	H	L	L	L	M	L		M	M	L	M	M
2.5	Rural Communication	H	H	H	H	L	N	H	L	H	H	L	L
2.6	Dissertation Phase – I	H	H	H	M	H	L		M	H	M	H	M
2.7	Audio-videoProduction	M	M	H	M	L	L		H	H	M	H	H
2.8	Service Learning – Community Media	H	H	H	H	H	H	M	H	H	H		M
3.1	Media Laws, Ethicsand Social Responsibility	M	H	M	M	H	H	M	H	M	H	H	H
3.2	Advertising, Marketing and Public Relations	H	M	H	H	M	M	M	H	M	H	M	H
3.3	Dissertation Phase – II	H	H	L	L	H	M	L	H	M	H	H	H
	Specialization – Electronic Media												
3.2.1	Audio-VideoEditing	M	H	H	M	M	M	M	H	M	M	H	H
3.2.2	Television and Video Production	M	H	H	M	M	M	M	H	M	M	M	H
3.2.3	Sound for Media	M	H	H	M	M	M	M	H	M	M	H	H
	Specialization – Print Media												
3.3.1	Political Communication	H	H	M	M	H	H	M	H	H	H	H	M
3.3.2	News Reportingand Editing	H	H	H	H	H	H	M	H	H	H	H	H
3.3.3	Health and Environmental Communication	H	H	H	M	H	H	H	H	H	H	H	M
	Specialization – Communication for Development												
3.4.1	Programme Management	H	M	H	H	H	M	L	H	M	M	M	H
3.4.1	Situation Analysisfor Communication Strategy	H	H	H	H	M	H	M	M	H	H	H	H
3.4.1	Planning Modelsand Communication Approaches	H	H	H	H	M	H	H	M	H	H	H	H
4.1	Media and CulturalStudies	H	M	H	H	M	H	M	H	H	H	H	M
4.2	Internship	H	H	H	H	H	H	H	H	H	H	H	H
	Specialization – Electronic Media												
4.2.1	Film Appreciation	H	H	M	M	H	M	L	H	M	M	H	M
4.2.1	Final Project	H	H	H	H	H	H	M	H	M	M	M	H
	Specialization – Print Media												
4.3.1	Business Journalism	H	H	H	H	H	M	M	H	H	H	H	H
4.3.2	Final Project	H	H	H	H	H	H	M	H	M	H	H	H
	Specialization – Communication for Development												
4.4.1	Project Monitoringand Evaluation	H	H	H	H	H	H	M	H	M	H	H	H
4.4.2	Final Project	H	H	H	H	H	H	M	H	M	H	H	H

VALUE ADDED COURSES (MA)

Sl. No	Name of Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
1.1	CommunicationSkills	H	H	H	M	M	L	H	H	H	M	H	L
1.2	Creative Writing	H	H	M	L	M	L	H	H	H	M	H	M
1.3	Event Management	H	H	H	H	H	M	H	M	H	H	H	M

DETAILED SYLLABUS
MA MASS COMMUNICATION

MCRC0026: RURAL COMMUNICATION (3-0-0)

COURSE OBJECTIVES

CO1 Define the meaning and concept of community and rurality (Remembering)CO2 Explain the role of communication in rural development (Understanding) CO3 Apply communication channels for rural development (Applying)
CO4 Analyse the social, economic, political and cultural framework of rural communication (Analysing)CO5 Evaluate the need for media and communication for rural development (Evaluating)
CO6 Design communication programme for rural development (Creating)

Module 1: Rural Communication and Participation (9 Lectures)

Community and Rurality: Concept and Definition, Meaning of Rural Communication, Communication Structure in Rural Settings-Folk and Traditional Media, Radio in Rural Communication, Community Media for Participatory Communication, Media and Communication Habits among Rural Communities, Media Penetration and Changing Rurality, Rural Communication Channels - Village Meetings; Village Market; Village fair, ICT and Rural Governance.

Module 2: Documenting Development in Rural Settings (9 Lectures)

Role of Communication in Rural Development, Documenting and Analysing Rural Development, Communication Agenda, Rural Health and Communication, Crisis and Natural Disaster Communication, Communicating Education and Agriculture, Communication and Extension Activities in Rural Settings.

Module 3: Evaluating Communication Needs in Rural Areas (9 Lectures)

Media and Communication Awareness among the Rural Mass, Assessing the Urban-Rural Divide, Communication Divide-Knowledge and Infrastructure, Need for Media and Communication Literacy, Communication Research in Rural Context-Participatory Action Research-Survey, Natural Resource Management, and Human Rights.

Module 4: Channelizing Development in a Rural Context (9 Lectures)

Contextualising Paulo Freire in the Process of Rural Development and Rural Communication, Context Specific Communication-Local Culture, Tradition, Language and Folk-Art Forms, Intercommunity Communication, Utilising Intra- community Communication Channels, Disseminating Community Specific Information and Disbursing Local Knowledge, Participatory Action and Rural Development.

Module 5: Practicum (9 hours)

As part of this module, students are required to conduct community outreach programmes in rural areas on issues of rural development or design communication programmes for rural development.

Suggested Readings

1. Communication for Rural Development, M. Acunzo, 2014, FAO
2. Communication for Development: Theory and Practice for Empowerment and Social Justice, 3rd Edition, Srinivas RajMelkote, Sage India
3. Communication Efficiency and Rural Development in Africa: The Case of Cameroon, Emmanuel K. Ngwainmbi, 1994, University Press of America
4. Community Communications: The Role of Community Media in Development. F. J. Berrigan, F. J, 1979. UNESCO
5. Framework on Effective Rural Communication for Development, R. D, Castello, 2006, FAO
6. Pedagogy of the Oppressed, P. Freire, 1970, Continuum
7. Strategic Communication for Rural Development. World Bank, F. M. Santucci, 2005

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	M				
CO2		H			
CO3			H		
CO4			M	M	
CO5	H		H		
CO6					H

MCML0027: MEDIA LITERACY (3-0-0)

COURSE OBJECTIVES

1. Define the concept, meaning and characteristics of the media industry (Remembering)
2. Explain the functions of communication (Understanding)
3. Choose appropriate media channels for effective communication (Applying)
4. Distinguish different types of media (Analysing)
5. Assess the emerging trends in the communication industry (Evaluating)

Module 1: Introduction to Media Literacy (12 Lectures)

Understanding media landscape, Meaning and definition, Importance of Media literacy, Media audience, media literacy approach, Types and Role of Media, Ownership Pattern and Control of Mass Media, Communication and Information Industry, Information Society, New Media Culture.

Module 2: Digital Media (7 Lectures)

Information and Communication Technology (ICT), Digital file types: documents, picture, video and audio, Editing Software: Print, Audio and video, creating digital media content with mobile phone.

Module 3: Computer Mediated Communication (8 Lectures)

Internet, Websites, online social media, User Generated Content in social media, SEO, Blogging, Live Streaming, E- Governance, Digital Marketing.

Module 4: Convergence Media (7 Lectures)

E-newspaper and web-edition, Internet and Satellite radio, TV: Internet Television, YouTube Channel, MOJO, Interactive Learning, IT Act, 2000.

Module 5: Confronting Issues (10 Lectures)

Digital divide, Cyber Security, Cyber Crime, Cyber Bullying, Digital Privacy and Piracy, Digital investigation, Misinformation and Disinformation, Propaganda and fake news, Physical and emotional effects of Digital Media.

Suggested Readings

1. Beginners' Guide to Journalism: Effective Guide to Write Well, Influence People and Remain in News, Roy Barun, 2019,V&S Publishing
2. Convergence in Broadcast and Communications Media, John Watkinson, 2001, Routledge
3. Handbook of Journalism and Mass Communication, Virbala Aggarwal, 2012, Concept Publishing Company Ltd.
4. How the Web Was Won, Paul Andrews, 1999, Broadway
5. Media Literacy, James W. Potter, 2013, Sage Publications
6. Navigating Social Journalism: A Handbook for Media Literacy and Citizen Journalism, Martin Hirst, 2018, Routledge.
7. Theories of the Information Society, F. Webster, 2014, Routledge.
8. The Rise of the Network Society, Manuel Castells, 2009, Wiley-Blackwell

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2			H		
CO3		H	M		
CO4				H	
CO5				H	

MCHD0028: HISTORY AND DEVELOPMENT OF COMMUNICATION MEDIA (3-0-0)

COURSE OBJECTIVES

1. Demonstrate an understanding of the history of media and the evolution of the mediated environment(Understanding)
2. Organize a historical survey of media and diachronic analysis of a variety of mediated forms especially in the contextof India (Applying)
3. Identify the rich folk heritage of India and its role in grass-root communication (Applying)
4. Evaluate the relationship between media and development in Indian culture, politics and society (Evaluating)

Module 1: Early history of Communication and the Printing Era (15 Lectures)

Communication in prehistoric era, Development of language and the oral tradition, Development of writing and record keeping, Development of printing in Europe and India, Development of newspapers and magazines, History of the Press in India: Colonial Period, National Freedom Movement, Post-Independence Era, Emergency and Post Emergency Era, Changing Readership, Print

Cultures, Language Press.

Module 2: Development of Electronic Media (15 Lectures)
Development of Radio as a medium of mass communication, History of radio in India, Evolution of AIR Programming, Penetration of radio in rural India, Commercial Broadcasting, FM Radio, Overview of community radio, Development of Television as a medium of mass communication, History of Television in India, Television and the State 's Development Agenda; Prasar Bharati, Doordarshan, Cable and Satellite Television in India; Commercialization of Programming, The Coming of Transnational Television.

Module 3: Development of Visual Media and Folk Media (15 Lectures)
The early years of Photography, Development of film as a medium of communication, History of Films in India, Issues and Problems of Indian Cinema Types of folk media, use of folk media, Advantages of folk media, Folk Media and communication, Role of folk media in promoting – health, education, Women's issues and Community development, Folk vs electronic media.

Suggested Readings

1. The History of the Future: Oculus, Facebook, and the Revolution That Swept Virtual Reality, Blake J. Harish, 2019, HarperCollins.
2. Mass Communication in India, K. J Kumar, 2017, Jaico Publishing House.
3. The Handbook of New Media, L. A Lievrouw and Sonia Livingstone, 2005, Sage Publications
4. Traditional folk media in India: Practice & Relevance, Shyam Parmar, 2016, Bharati Prakashan.
5. The Story of Human Communication: Cave Painting to Microchip, Wilbur Schramm, 1988, Harpercollins College Div.
6. India's Communication Revolution: From Bullock Carts to Cyber Marts, Arvind M. Singhal, 2000, Sage Publications.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2		H	
CO3			H
CO4		H	

MCPC0029: PHILOSOPHY OF COMMUNICATION (3-0-0)

COURSE OBJECTIVES
CO1 Define the concept of communication (Remembering)
CO2 Infer analytical reasoning on communication (Understanding)
CO3 Identify the philosophical and sociological bases of communication (Applying)CO4 Analyse critically the purpose of human communication (Analysing)
CO5 Interpret and decode media contents wisely (Evaluating)
CO6 Discuss the idea of knowledge and psychological understanding of media text (Creating)

Module 1: Concept of Communication (10 Lectures)
Elements of Communication, Process of Communication, Role; Scope and Need of Communication in Society, Barriers to Communication, Types of Communication, Types and Characteristics of Mass Media Audiences, Functions of Mass and Social Communication.

Module 2: Philosophy and Knowledge (20 Lectures)
Epistemology, Ontology, Dialectic – Hegelian and universal, Buddhist philosophy of communication, Positivist and Post-positivist, Locke's account of knowledge, Phenomenology, Hyper-realism, Hegemony, Political economy and Frankfurt School, Marxist Media Theory, Propaganda model.

Module 3: Psychoanalysis of Communication (15 Lectures)
Philosophy of the unconscious, Oedipus concept, Id, Ego, Superego, Sexuality, Idea of myth.

Suggested Readings

1. An Essay concerning human understanding, John Locke, 1997, Penguin
2. Capital, Karl Marx, 2016, Fingerprint Publishing
3. Mythologies, Roland Barthes, 1972, Hill and Wang, Vintage
4. Manufacturing Consent: The Political Economy of the Mass Media, Noam Chomsky, and Edward S. Herman, 2002, Knopf Doubleday Publishing Group
5. The Unconscious, Antony Easthope, 2003, Routledge Publication
6. The Ego and the Id, Sigmund Freud, 1962, Martino Fine Books

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2		H	
CO3	H		
CO4	H	M	
CO5			H
CO6		H	

MCTC0030: THEORETICAL PERSPECTIVES OF COMMUNICATION (4-0-0)

COURSE OBJECTIVES

1. Define the concept of semiotic theory and practice (Remembering)
2. Explain the intersection between communication, in its many forms, and society and culture (Understanding)
3. Apply communication theories and models in communication programmes and research (Applying)
4. Analyse the link between major theoretical understandings of communication and the socio-cultural setting they have developed in (Analysing)
5. Test the various models and theories of communication in real-world situations (Creating).

Module 1: Theories and Models of Communication (15 Lectures)

Normative Theories, Democratic Participation Theory, Shannon-Weaver's Mathematical Model, Aristotle's definition of Rhetoric, Berlo's SMCR Model, Westely and MacLean's Conceptual Model, Newcomb's Model of Communication, George Gebner's Model, Schramm's Interactive Model, Harold D. Laswell, De Fleur Model.

Module 2: Media Effects Theory, Psychological & Sociological Theory (15 Lectures)

Magic Bullet Theory, Two-Step Flow and Multi-Step Flow, Gate-Keeping Theory, Cognitive Dissonance Theory, Selectivity Theory, Cultivation Theory, Uses and Gratification Theory, Media Dependency Theory.

Module 3: Powerful Effects of Media (15 Lectures)

Dominant Paradigm, Spiral of Silence, Diffusion of Innovation, Agenda Setting, Marshall McLuhan's Medium Theory.

Module 4: Semiology and Postmodern Theories (15 Lectures)

Semiotic theory and practice - historical context and doctrinal perspectives in semiotics, Models of the Sign and types of Codes, Structuralism; Formalism and Post-Structuralism.

Suggested Readings

1. A History of Communication Study, Everett M Roger, 1997, Free Press
2. Communication Theory and Models, N Andal, 2004, Himalaya Publishing House
3. Mass Communication Theory: Foundations, Ferment, and Future (6th Ed), Stanley J Baran, J. and Dennis K. Davis, 2015,Wadsworth
4. Mass Communication Theory: An Introduction, Dennis McQuail, 2005, Sage Publications
5. The Medium is the Massage: An Inventory of Effects, Marshall McLuhan, 2008, Penguin Books
6. The Media of Mass Communication, J Vivian, 1999, Boston: Pearson Understanding Media: The Extension of Man, MarshallMcLuhan, 2008, Routledge

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H		
CO2	M	M		
CO3			H	
CO4				H
CO5		M		

MCPJ0031: PRINCIPLES AND PRACTICES OF JOURNALISM (4-0-0)

COURSE OBJECTIVES

1. Define the concept, meaning and function of journalism (Remembering)
2. Explain the role and responsibilities of a journalist. (Understanding)
3. Apply the concepts and techniques of journalism in news reporting (Applying)
4. Analyse the role of news media in society (Analysing)
5. Write, report and edit news stories (Creating)

Module 1: News & News Writing Principles (15 Lectures)
Concept of News, Types of News, News Values, Ethics, Concept of Reporting, Types of Reporting, Qualities of a Reporter, Roles and responsibilities of media journalists, Sources of news, Cultivation of sources, Emerging trends in journalism.

Module 2: News and Features format (12 Lectures)
News format vs. Features Format, Lead writing, Types of lead, Editorial, Feature, Column, Middle, Interviews, Reviews and Special Articles, Letter to Editors, Writing Headlines, Types of Headlines.

Module 3: Organisational Structure and Regulating Bodies (9 Lectures)
Editorial, Advertising, Marketing, Circulation, Accounts and Finance, News Production Hierarchy, Readership, Case study ofnews organisations, Registrar for Newspaper of India (RNI), Journalists' Union, Editors' Guild of India, Audit Bureau of Circulation (ABC), Press Information Bureau, Press Council of India (PCI), News Agencies.

Module 4: Editing and Layout (9 Lectures)
Meaning, Purpose, Tools & Techniques, Media language, Editing Symbols, Style Sheets, copy testing, Proofreading, Page Layout – modular; horizontal; vertical; photo placements; photo-caption; use of artwork; breaking the layout, Agency Copy Editing, Page design – innovations in the edit page.

Module 5: Practicum (15 hours)
Basic of design, Introduction to page layout software, Field reporting and publication

Suggested Readings

1. Beginners' Guide to Journalism: Effective Guide to Write Well, Influence People and Remain in News, Roy Barun, 2019, V&S Publishing
2. Here is the News: Reporting for Media, R. Parthsarathi, 2009, New Delhi: Sterling Publishers
3. News Reporting and Editing, K.M. Srivastava 1995, Sterling Publishers
4. Social Meanings of News – A Text Reader, Dan Berkowitz, 1997, Sage Publication
5. Sociology of News, Michael Schudson, 2003, W.W. Norton & Company
6. The Twenty-First-Century Media Industry, Economic and Managerial Implications in the Age of New Media, John A. Hendricks, 2011, Lexington Books
7. The Rise of the Network Society, Manuel Castells, 2009, Wiley-Blackwell

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H			
CO2			H		
CO3	H	H			H
CO4			H	H	
CO5					H

MCID0032: INVESTIGATIVE AND DATA DRIVEN JOURNALISM (3-0-0)

COURSE OUTCOMES
1. Define the meaning and concept of investigative and data journalism (Remembering)
2. Demonstrate how to conduct news investigation (Understanding)
3. Plan and execute investigative news reporting methodically and ethically (Applying)
4. Analyse different sets of data and information (Analysing)
5. Assess the risk involved in investigative reporting (Evaluating)

Module 1: Basics of Investigative Journalism (10 Lectures)
Concept, meaning and definition of Investigative Journalism, types and history, Sources, Research, Fact checking and editing, Role of investigative reporting in a democratic society, Trends in Investigative Reporting, Investigative techniques,

Case studies, Associations of Investigative Journalists, The soul of the investigative reporter, ethics of investigativereporting.

Module 2: Digital Investigation (8 Lectures)
Understanding Digital Investigation, Computer Assisted Reporting, Web research and data collection, Data Literacy, Data Mining Tools, Open-Source Intelligence Tools (OSINT), Social Media Auditing, Online Fact Checking and Verification.

Module 3: Data Journalism (8 Lectures)
Concept, meaning, definition of Data Journalism, Data-driven Storytelling, Data Acquisition, Data Analytics, Reporting with Data, Public, Private and Open-Source Database, Overcoming Information Overload.

Module 4: Tools and Techniques of Data Driven Journalism (8 Lectures)

Analysis and Design, Tools and Techniques, Challenges with Data: Finding and Cleaning, Statistical Tools and Methods, Open-Source Software.

Module 5: Practicum (11 hours)
Develop an investigative pitch/plan for a major investigative story, Data Visualisation, Online Fact Checking, and Social Auditing.

Suggested Readings

1. Computer-Assisted Reporting: A Practical Guide, Brant Houston, 2003, Routledge
2. Data Literacy: A User's Guide, David Herzog, 2015, Sage Publication
3. Data Smart: Using Data Science to Transform Information into Insight, John Foreman, 2013 Wiley
4. Data Journalism: Past, Present and Future, John Mair, Richard Keeble and Megan Lucero, 2017, Theschoolbook.com
5. Data-Driven Storytelling, Nathalie H. Riche, Nicholas Diakopoulos, Christophe Hunter and Seelagh Carpendale, 2018, AKPeters/CRC Press
6. Investigative Journalism: Proven Strategies for Reporting the Story. William C Gaines, 2007, CQ Press
7. The Functional Art: An Introduction to Information Graphics and Visualization, Alberto Cairo, 2012, New Riders
8. The Investigative Reporter's Handbook: A Guide to Documents, Databases and Techniques. Brant Houston, 2002, Bedford/St. Martins
9. The Data Journalism Handbook, Jonathan Gray Liliana Bounegru, and Lucy Chambers, 2012, Shroff/O'Reilly
10. Visualization Analysis and Design, Tamara Munzner, 2014, AK Peters/CRC Press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H		H		
CO2		H			
CO3	M		H		H
CO4		H		H	H
CO5	H				H

MCTS0033: THEORIES OF DEVELOPMENT COMMUNICATION AND SOCIAL CHANGE (4-0-0)

COURSE OBJECTIVES
1. Define the basic terms related to development & development communication (Remembering)CO2
2. Explain different models and approaches of development (Understanding)
3. Develop communication strategy for development (Applying)
4. Examine role of media in socio-economic development and social change (Analysing)
5. Assess situation for communication intervention (Evaluating)
6. Create advocacy and initiate behaviour change through communication channels (Creating)

Module 1: Introduction to Development (15 Lectures)
Meaning, definition and process of Development, Growth and Development, Characteristics of Developing and Underdeveloped countries, Regional Development, Development Challenges, Emerging Issues in Development.

Module 2: Theories, Models and Approaches of Development (15 Lectures)
Basic Needs Model, Theories and Paradigms of Development – Unilinear, Non-unilinear, Dominant, Alternative and New paradigms of development, Dependency Model, Marxist concept of stages of society, Social Responsibility Theory, Top Down (Trickle Down) Approach, Growth Pole Approach, Bottom Up (Grass Roots) Approach, Neoliberalism, New Millennium Development Goals.

Module 3: Concepts, Theories and Models of Development Communication (15 Lectures)
Origin, Meaning, Concepts, Definition Media and Modernization, ICT and Development, Participatory Communication, Approaches to Communication for Development: Diffusion of Innovation, Magic Multiplier, Development Support Communication.

Module 4: Social and Behaviour Change Communication (15 Lectures)
Concepts of SBCC, Managing information for social change; individual level behavioural change, Models of Change: persuasion model; health belief model; stages of trans-theoretical model; socio-ecological model, Communication planningmodels: ACADA Model; P-Process; COMBI Model and Integrated Communication, Case studies.

Suggested Readings

1. Communication for Development and Civil Society, V.S. Gupta, 2004, Concept
2. Communication for Development in the Third World, Srinivas Melkore & Steeve, 2001, Sage India

3. Communication and Development-The Challenges of the Twenty-First century, VS Gupta, 2000, Concept Publishing
4. Development Theory: Deconstruction/Reconstruction, Nederveen Jan Pieterse, 2001, Vistaar.
5. Development Theory, PW Preston, 1997, BlackwelL
6. Diffusion of Innovations, Everett M. Roger, 2003, Free Press
7. Kiran Prasad, 2009, Information and Communication Technology: Reinvesting Theory and Action, BRPC
8. Media, Communication and Development: Three Approaches, Linje Manyozo, 2012, Sage
9. Media in Development Arena, RK Ravindran, 2000, Indian Publishers Distributors
10. Other Voices: The Struggle for Community Radio in India, Paravala V and Malik K V., 2007, Sage India

Mapping of CO to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		H		
CO3			H	M
CO4			H	H
CO5				H
CO6				H

MCRM0034: MEDIA AND COMMUNICATION RESEARCH METHODOLOGY (4-0-0)

COURSE OBJECTIVES

1. Define meaning, scope, objectives and significance of media research (Remembering)
2. Demonstrate appropriate methods for collecting and analysing research data (Understanding)
3. Apply research methods related to the disciplinary areas of communication and media (Applying)
4. Assess and appraise relevant literature (Evaluating)
5. Conduct research, write research reports and projects (Creating)

Module 1: Meaning and Objectives of Research (15 hours)

Media Research – Meaning; Scope; Objectives and Significance, Research Process, Formulation of Research Problem, Literature Survey, Research Design, Collection of Data, developing a Questionnaire, Aids for Writing Research Reports – Bibliography; Footnote and Reference; Synopsis and Abstracts, Writing of Report; Summary; Executive Summary; Conclusion and Recommendation.

Module 2: Research Methods and Applications (20 hours)

Techniques of Data Collection – Observation; Questionnaire and Interview; Content Analysis, Qualitative Methods - Field Experiments; Ethnography; Focus Groups; Case Studies, Quantitative Research Methods - Experimental Research; Survey Research; Content Analysis, Audience Research in Print and Electronic Media.

Module 3: Statistical Applications in Communication Research (25 hours)

Statistics – Definitions; Uses and Limitations, Classification and Tabulation of Data, Univariate and Bivariate, Diagrammatic and Graphical Presentations, Sampling - Types of Sampling; Guiding Principles of Sampling, Test of Hypothesis – Basics; Probability distribution; normal distribution; t-test; Chi- square test; Measures of Central Tendencies, Measure of Variability, Correlation - Computation of Product Moment; Correlation Coefficient; Spearman's Rank; Coefficient Correlation, Scaling Techniques – Arbitrary; Thurstone; Likert-Scale.

Suggested Readings

1. Communication research for Development: The ISRO Experience, Binod C. Agarwal and S.R. Joshi and Arbind Sinha, 1986,New Delhi: Concept Publishing Company.
2. Media Research Techniques, Asa A. Berger, 1998, Thousand Oaks: Sage Publication.
3. Media Analysis Techniques, Asa A. Berger, 1998, Beverly Hills: Sage Publications. 1998.
4. MLA Handbook for Writers of Research Papers, Joseph Gibaldi and Achtert S. Walter, 1994 New Delhi: Affiliated East-West Press Pvt. Ltd.
5. Research Methodology Methods and Techniques, R. C Kothari, C.R, 2019, New Age International Publishers
6. Mass Media Research: An Introduction, Roger D. Wimmer, 2015, Cengage Learning
7. Writing your thesis, Paul Oliver, 2008, Sage Publications

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2		H	

CO3			H
CO4		H	
CO5	H		

MCML0037: MEDIA LAWS, ETHICS AND SOCIAL RESPONSIBILITY (3-0-0)

COURSE OUTCOMES

1. Define the salient features of media laws and ethics (Remembering)
2. Explain the essential features of the Indian Constitution in the context of press freedom (Understanding)
3. Examine the purpose and role of media professionals in society (Applying)
4. Analyse the legal issues pertaining to the media (Analysing)
5. Evaluate the relative merits and demerits of the ethical questions pertaining to the media (Evaluating)

Module 1: Legal System in India (10 Lectures)

Introduction to the Legal System: Jurisprudence, Sources of law: custom; precedent; statute, Types of law: criminal; civil; tort, History of media laws in India.
Rights, Rules and Laws: Justice and law; laws and society
Judicial Systems in Relation to Media: Basic features of the Indian Constitution, Structure of Judicial System in India – Supreme Court, High Court, Lower courts.
Constitutional Obligations: Freedom of Speech and Expression, Freedom of the Press, Right to Information Act, 2005.

Module 2: Media Laws (15 Lectures)

Laws Related to Media Profession: Introduction to Indian Penal Code, Press Council of India; Press Council Act, 1965, 1978, Cinematographic Act, 1952.
Public Interest Litigation and Defamation: Civil and Criminal law of defamation, Libel and Slander, Public Interest Litigation.
Media Laws relating to Women & Children: Laws relating to Obscenity, Indecent Representation of Women (Prohibition)Act, 1986, The Children Act 1960, Juvenile Justice Act.
Freedom and Accountability of the Media: Freedom and Responsibility, Contempt of Court 1971, Protection of Civil Rights Act 1955, Parliamentary Proceedings Act 1971.

Module 3: Media Ethics (10 Lectures)

Ethics and Journalistic Professionals: Introduction to Ethics, Press Council's Norms of Journalistic Conduct, AIR News Policy for Broadcast Media; Broadcasting Code
Media and Social Responsibility: Media and pressure groups, Prasar Bharati Act 1990, The Broadcast Code Governing AIR
Rights and Duties of Media Professionals: Politics and Elections, Investigative Reporting, Court Reporting

Module 4: Issues in Reporting (10 Lectures)

Media and Conflict Reporting: Conflict Scenario in North-East India, Ethical Issues in Conflict Reporting, International Humanitarian law
Cyber Laws: Information Technology Act 2000, Cyber Crimes, Cyber Crimes relating to Women and Children
Intellectual Property Rights: Copyright Act 1957, Design Act 1911, Trade and Merchandise Marks Act 1958, Patent Act 1970

Suggested Readings:

1. A Compendium of Codes of Conduct for Media Professional, Prabhakar M, et al., 1999, University Book House
2. Ethics, Frankena K. William, 2002, Prentice Hall India
3. Introduction to Ethics, Lillie William, 2003, Allied Publishers
4. Media Law and Ethics, Neelamalar M, 2010, PHI Learning Pvt. Ltd.
5. Media, Ethics and Laws, Singh P.P. et al., 1998, Anmol
6. Media Ethics, Paranjoy Guaha Thakurta, 2011, Oxford University Press
7. Media Laws and Ethics: An Introduction to legal and ethical issues, Vartika Nanda, 2018, Kanishka Publishers
8. Social Media Communication: Concepts, Practices, Data, Law and Ethics, 3rd Edition Jeremy Harris Lipschultz, 2020, Routledge

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2	H			
CO3			H	
CO4		H	H	
CO5		H	H	H

MCAM0038: ADVERTISING, CORPORATE COMMUNICATION & PUBLIC RELATIONS (3-0-0)

COURSE OBJECTIVES

1. Define the key terms related to advertising, public relations and corporate communication (Remembering)
2. Explain the different models and approaches of advertising, public relations and corporate communication (Understanding)
3. Develop public relations and corporate communication strategies for public & private enterprises (Applying)
4. Plan and execute ethically sound and socially responsible advertising strategies and public relations campaigns(Evaluating)
5. Produce multimedia ads for varied audiences (Create)

Module 1: Advertising (15 Lectures)

Need and Impact of Advertising: National and global scenario, Integrated marketing communication, Persuasion, retention and recall, Process of Advertisement Creation: media planning, visualization, copywriting, Brand Management: Concept and evolution, components of brands, image and personality.

Module 2: Corporate Communication (15 Lectures)

Defining corporate communication strategies, corporate communication in public sector, private sector and multi- nationals, strategic corporate communication and management, proactive and reactive media relations, media selection, symmetrical and asymmetrical models in handling crisis, Role of corporate communication in crisis and disaster management, use of media in crisis management.

Module 3: Public Relations (15 Lectures)

Definition and concept: Public relations, External and internal, Vertical and horizontal, Promotion of products and services, Image building, social marketing, Campaigns, Press Conferences and press releases, Conferences and conducted tours, staging of special events, Use of Various Media: Print, electronic, media and web, Outdoor media and exhibitions, Newsletters/brochures/video and audio material, Traditional media.

Suggested Readings:

1. Advertising and Promotion: An Integrated Marketing Communications Perspective, Belch, George E, and Michael A. Belch,2004, McGraw-Hill.
2. Advertising Management, J. Jethwaney and S. Jain, 2012, Oxford University Press
3. Communication in Organisations, Fisher, D., 1999, Jaico Publishing House
4. Corporate Communication: Principles and Practice, Jaishri Jethwaney, 2018, Sage Publications
5. Crisis Communication Strategies: How to Prepare in Advance, Respond Effectively and Recover in Full, 1st Edition, AmandaColeman, 2020, Kogan Page
6. Ogilvy on Advertising, Ogilvy David, 1997, Prion Books, London
7. Public Relations Management, Jethwaney, J and Sarkar, N. N, 2015, Sterling
8. Strategic Brand Management, 4th Edition, Keller, Parmaeswaran and Jacob, 2015, Pearson Education

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H	H	H
CO3		H	H
CO4	H	H	
CO5			H

MCAV0039: AUDIO-VIDEO EDITING (3-0-0)

COURSE OUTCOMES

1. Identify the importance of Sound and Sound SFX (Remembering)
2. Understand the techniques of audio recording and editing (Understanding)
3. Execute video and audio tracks with effects (Applying)
4. Differentiate between the different techniques of Video Editing (Evaluate)
5. Plan, design and create digital video projects incorporating audio and video elements (Creating)

Module 1: Audio Editing (20 Hours)

Configuration of a PC for sound recording, Motherboards, Processor, Sound Card, Graphic card, Monitors, Recorders: Analog, Digital, Tape Based & Tapeless, Digital Audio Workstations (DAW's), Set up an audio editing software, The user interface, Waveform editing, Effects, Audio Restoration, Mastering, Sound design, Creating and recording files, Multitrack sessions, Multitrack session editing, Automation, Video soundtracks, The essential sound panel, The multitrack mixer, Creating music

with sound libraries, Recording and output in the multitrack editor.

Module 2: Video Editing (25 Hours)
Installing video editing software, Optimizing performance of system and software, Performing non-linear editing, Understanding the user interface of the software, Setting up a project, Importing media, organizing media, Mastering the essentials of video editing- using the source monitor; viewing video on a second monitor; using a numerical keyboard; editing from the project panel; navigating the timeline panel; using essential editing commands; setting the duration for still images, Working with clips and markers, Adding transitions, Advanced editing techniques- performing four-point editing; changing playback speed; replacing clips and footage; nesting sequences; multi-camera editing, Putting clips in motion, Editing and mixing audio, Adding video effects, Colour correction and colour grading, Compositing techniques, Creating graphics, Exporting the timeline.

Suggested Readings:

1. Adobe Audition: Operation Manual, 2021, Adobe Press
2. Adobe Premiere Pro: Operation Manual, 2021, Adobe Press
3. Film Art: An Introduction, David Bordwell and Kristin Thompson, 2003, McGraw-Hill (first published 1979)
4. Film Editing: Great Cuts Every Filmmaker Should Know, Gael Chandler, 2009 Michael Wiese Productions
5. Grammar of the Edit Roy Thompson, Christopher J. Bowen, 2014, Focal Press (first published January 1st 2009)
6. In the Blink of an Eye: A Perspective on Film Editing, Walter Murch, August 1st 2001, Silman-James Press
7. Mixing Audio, Bob Katz 8. Mixing Audio, Roey Izhak, 2007, Focal Press
8. Modern Recording Techniques, David Miles Huber, 2005, Focal Press (first published in 1986)
9. Practical Recording Techniques, Fifth Edition 2009, Elsevier

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	
CO2	H	
CO3	H	H
CO4		H
CO5		H

MCTV0040: TELEVISION AND VIDEO PRODUCTION (3-0-1)

COURSE OUTCOMES
1. Identify different genres of television production (Remember)
2. Understand the intricacies and nuances of screenwriting (Understanding)
3. Distinguish various equipment and tools required for television and video production (Analyse)
4. Assess the importance of cinematography in television and video production (Evaluate)
5. Produce television programmes for various audiences (Creating)

Module 1: Writing for Television: (10 Lectures)
Preparing to Think Visually: Diving Into the Screenwriter's Mind, Approaching Screenwriting as a Craft - Mise-en-Scene; Breaking Down the Elements of a Story, Structure of Story & Screenplay: Beginning, Middle, End; Dynamics of Characterization: Character Building, Constructing Dynamic Dialogues, Finalizing the Script: Maintaining an Audience's Trust, Turning Your Story into a Script, Rewriting Your Script, Adaptation and Collaboration: Two Alternate Ways to Work; Intro to Storyboarding/Visual Storytelling & Storyboards; Storyboarding Techniques: Drawing the components of the storyboard, Indicating motion in the storyboard.

Module 2: Genres and Audience (15 Lectures)
Nature of drama in television: Various shows, formats and genres, telecast patterns, audience viewership performance, Building the story, herd culture, Creating niche television programming: Importance of niche content, niche content channels, Differentiation of infotainment, edutainment, entertainment, lifestyle genres, Differentiation of genres, Specialty of different genres, popularity of genres, content on demand.

Module 3 Television and Video Formats (10 Lectures)
Digital Recording Formats SD, HD, 2K, 4K - Editing and compression - Digital sampling and storage - Technical formats of video- PAL, NTSC, SECAM, Digital television formats- ATSC, DVB, ISDB, DTMB, IPTV, Recording formats; "Time Code" in Video Recording.

Module 4: Lighting Equipment and Techniques (15 Lectures)
Understanding of colour, use of colour, Capturing the emotion; Role of light, Lighting techniques - Concept of lighting various planes; Understanding Various types of lights; Lighting accessories, grey card, Metering, Colour temperature meter, Camera

filters, Types of lighting - Studio lighting for three cameras set up, Outdoor lighting, Lighting for documentary, Mood Lighting & Colour Lighting Theory and Practice.

Module 5: Lenses, Camera Movements and Techniques (10 Lectures)
Lenses: Type of Lenses, Power of Lenses, Understanding the shot requirement and usage of a lens, Lens and perspective: Depth of Field, Depth of focus, Focus pulling; Camera Movements, Camera angles, Usage and need of Track and trolly, Crane, Jimmy Jib, Poll Cam, Managing Movements, Single camera Setup, Multi camera setup and Continuity Exercise.

Suggested Readings

1. Before You Shoot: A Guide to Low Budget Film and Video Production, Helen Garvey, 1995, Shire Press
2. Breaking into Film by Kenna McHugh, 1998, Peterson Nelnet Co
3. Camera Terms and Concepts, David Elkins, 1993, Focal Press
4. Fundamentals of Film Directing, David K. Irving, 2010, McFarland & Company
5. How not to write a screenplay: 101 common mistakes most screenwriters make by Denny Martin Flinn, 1999, Lone Eagle
6. Motion Picture Camera and Lighting Equipment, David Samuelson, 1986, Focal Press (first published 1977)
7. Screen Adaptation: A Scriptwriting Handbook, Kenneth Portnoy, September 8th 1998, Routledge (first published 1998)
8. Screenplay: The Foundations of Screenwriting, Syd Field, 2005, Delta (first published 1979)
9. The Camera Assistant, Doug Hart, 1995, Routledge
10. Writing, Directing, and Producing Documentary Films and Videos, Alan Rosenthal, 2007, Southern Illinois University Press(first published in 1990)

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1		H			
CO2	H				
CO3				H	
CO4			H	H	H

MCSM0041: SOUND FOR MEDIA (3-0-1)

COURSE OUTCOMES:
1. Define the key terms related to sound (Remembering)
2. Explain the basic principles of sound production (Understanding)
3. Develop sound recording skills for visual media (Applying)
4. Distinguish between analogue sound and digital sound (Analysing)
5. Assess the acoustic quality of a room for sound production (Evaluating)
6. Produce audio programmes (Creating)

Module 1: Introduction to Sound (15 Lectures)
Understanding sound, Human hearing process, Air pressure, Characteristics of sound: wavelength; amplitude; frequency; phase, Components of sound: pitch; volume; timbre; harmonics; rhythm; tempo; attack; sustain and decay, Propagation of sound waves, Mono and stereo sound, Hi-fi vs low-fi sound, Sound perspective, Sound texture, Natural sound: Ambience; speech; dialogue etc., Sound creation: studio sound; inventing sounds and sound creation in software.

Module 2: Analogue and Digital Sound (17 Lectures)
Meaning of analogue and digital, Analogue sound, Characteristics of analogue sound: phase; frequency response; signal- to-noise ratio, Digital sound, Characteristics of digital sound: sampling; quantization; bit rate; dither; jitter, Compression and audio codec: audio file types/formats; open and proprietary formats, file compression.

Module 3: Sound Recording (15 Lectures)
Microphones: construction and polar pattern, recording practices: location recording; studio recording; equipment for location recording; equipment for studio recording, Music and Sound effects, Creating soundscape, Off-screen; on-screen and non-diegetic sound, Sound for video: news stories; documentaries; internet videos, Audio cable and connectors.

Module 4: Studio Acoustics (13 Lectures)
Meaning and definition of acoustics, Studio acoustics, Noise sources, Sound isolation, Sound absorption, Noise control: acoustic treatment; technical requirement for construction of studio.

Suggested Readings:

1. Digital Audio, Dobrian Christopher (n.d.), Retrieved from https://music.arts.uci.edu/dobrian/digitalaudio.htm
2. Sound Design: The Expressive Power of Music, Voice and Sound Effects in Cinema, Sonnenschein David, 2001, Michael Wiese Productions.

3. The Sound Effects Bible: How to Create and Record Hollywood Style Sound Effects, Viers Ric, 2008, Michael Wiese Productions.
4. Transmedia Directors: Artistry, Industry and New Audiovisual Aesthetics, Vernallis Carol, 2020, Bloomsbury Academic.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H		
CO2			H	
CO3			H	
CO4		H		
CO5				H

MCPC0042: POLITICAL COMMUNICATION (3-0-0)

COURSE OBJECTIVES:

1. Define the key terms in political communication (Remembering)
2. Understand the different techniques of political communication (Understanding)
3. Critically analyse the relationship between media and politics (Analysing)
4. Develop a critical understanding of the role of communication in politics (Evaluating)

Module 1: Introduction to Political Communications (15 Lectures)

Political Communication: Concept, Theoretical Approaches, Theories and Political communication paradigm, Channels of Political Communication, communication and civic engagement.

Module 2: Media and Politics (15 Lectures)

Media Coverage of Politics, Framing, Opinion Polls, Election Coverage, Political Advocacy, The transmission of political information (Print/TV/SM), Media Bias, Campaign Advertising & Political Participation, Case Studies.

Module 3: Media, Power and Ideology (15 Lectures)

Constructing Ideology: Consensus as ideology; manufacturing consent; Ideology & hegemony, Identity formation and political mobilization, State and Information, Political process and Governance in India, Gauging Public Opinion, Public Opinion and Public Policy, Political Polarization.

Suggested Readings:

1. Media, Markets and Democracy, E Baker, 2004, Cambridge University Press
2. Necessary illusions: Thought control in democratic societies, N. Chomsky, 1995, House of Anansi.
3. The Press and American Politics, 3rd Edition, Richard, Davis, 2001, Prentice Hall. Ch. 2-3, pp. 25-86
4. Mediated Politics: Communication in the Future of Democracy, Robert M Entman, (Eds), 2001, Cambridge University Press
5. Manufacturing Consent: The Political Economy of the Mass Media, Edward,Herman and N. Chomsky, 1998, PantheonBooks
6. A Virtuous Circle: Political Communications in Post industrialist Societies, Pippa Norris, 2000, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2	H	H	H
CO3		H	
CO4			H

MCNR043: NEWS REPORTING AND EDITING (3-0-1)

COURSE OUTCOMES

1. Define the meaning and concept of news reporting and editing (Remembering)
2. Understand the organisational structure of a newsroom (Understanding)
3. Develop editing skills for the print media (Applying)
4. Differentiate between news reporting and editing (Analysing)
5. Assess the quality of an editor in publishing a newspaper (Evaluating)
6. Design print media publications (Creating)

Module 1: News Gathering Process (15 lectures)

Principle of News Reporting, Elements of Reporting, Types of Reporting, Role and Importance of Sources, Cultivating, Verifying

and Dealing with Sources of News, Attribution, Qualities of a good Reporter, Ethical aspects of Sourcing news & Reporting, Risk in reporting.

Module 2: Different Formats of News Report (15 lectures)
Factual and Routine news, Analytical News, Interpretative & Descriptive News, Investigative News and research based or in-depth news, Sequential News, Breaking News.

Module 3: The Editing Process (15 lectures)
Structure of a Newsroom, Editorial desk, Functions of Editorial Desk, Nature and need for editing, Principles of Editing, Role, objectives and tools of editing; process of editing; Editing symbols; language in editing; Objectives of copy editing; editing agency copies; handling wire and correspondents' copy; Ensuring News value and other criteria; Checking facts, language, style, clarity & simplicity; Editing/revising press releases and handouts; Relevant graphics for copy, Style sheets and house styles; Photo Editing; Newsroom terminology in electronic editing; Magazine editing, Headline Writing: Principles, types and techniques.

Module 4: Practicum (15 hrs)
News editing: Hard news, soft news, Opinion and Analytical Pieces), News selection and placement; Preparing dummies; Graphics; Use of editing software; Photo editing and caption writing; Production of Lab Journal.

Suggested Readings:

1. News Writers' Handbook by M L Stein, Susan F Paterno, R Christopher Burnett, 2006, Blackwell Publications
2. Practical Newspaper Reporting, David Spark and Harris Geoffrey, 1997, Routledge Publishers
3. Writing and Reporting News: A Coaching Method by Carole Rich, 1993, CENGAGE Publications.
4. News Writing, George Hough, 2006, Kanishka Publishers
5. The Unwritten Rules of Copy Editing, 2nd Edition, Dominic Gettins, 2006, Kogan Page Publications
6. Reporting for Journalists. Chris Frost, 2001, Routledge
7. News Agencies: From Pigeon to Internet, PTI Style Book, M Shrivastava, 2007, New Dawn Press, Modern Journalism: Reporting and Writing, Diwakar Sharma, 2005, Deep and Deep Publications
8. Feature Writing for Journalists. Sharon Wheeler, 2009, Routledge Publications.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2			H	
CO3			H	
CO4	H	H	H	
CO5			H	
CO6				H

MCHE0044: HEALTH AND ENVIRONMENT COMMUNICATION (3-0-1)

COURSE OUTCOMES
1. Define the key terms in health and environment communication (Remembering)
2. Explain different models and approaches of health and environment communication (Understanding)
3. Develop communication strategy for public health and environment protection (Applying)
4. Examine the role of media in social change (Analysing)
5. Assess the situation for communication intervention (Evaluating)
6. Report news on health and environmental issues (Create)

Module 1: Health Communication (15 Lectures)
Introduction to Health Communication: Meaning of health communication, Conceptions of health, Health Communication issues, illness and well-being, Ethics of Health Communication, Health communication in public health, Enhancement of the quality of life, soliciting co-operation from stakeholders, Facilitating adoption process.

Module 2: Theories and Approaches to Health Communication (15 Lectures)
Health communication theories, Health Communication approaches and action areas: Persuasive approaches, Cultural perspectives, Emotional perspectives, public relations and public advocacy, Community mobilization, Planning, implementation and evaluation of public health communication campaign - Health communication planning process, Situation analysis and audience profile, Identifying programme objectives and strategies.

Module 3: Environment Communication (15 Lectures)
Environment journalism: emergence, rise of environment activism, role of the state, developments in India, relevant laws, UN

initiatives, environment protection and the role of Media, Environmental journalism today, Skills for environmental journalism.

Module 4: Environmental Communication and Challenges (15 Lectures)
Media theory basics for the environmental journalist: Objectivity, Framing-News values, Agenda setting, Advocacy journalism, the media as environmental watchdog, Challenges for investigative environmental journalism. Writing an environment feature, environment research.

Suggested Readings:

1. Communicating Health: A Culture-centered Approach, Mohan J Dutta, 2008, Polity
2. Communication, Media and Environment, A Hansen, 2011, Routledge
3. Environment Journalism, H Bodker and I Neverla (Eds), 2013, Routledge
4. Health Communication – From Theory to Practice, Renata Schiavo, 2007, Wiley
5. Health Communication: Richard K Thomas,2006, Springer
6. Health Communication: Strategies and Skills for A New Era, Claudia Parvanta, 2018, Jones and Bartlett Publishers
7. Journal of Health Communication, Tailor & Francis
8. Risk Communication and Public Health, Peter Bennet and Kennet Calman, 2001, Oxford Medical Publications
9. The Routledge Handbook of Environment and Communication, 2015, Routledge.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H		H	
CO2		H		H
CO3		H		H
CO4		M	M	H
CO5		H		H
CO6	H	H	H	H

MCPM0045: PROGRAMME MANAGEMENT (3-0-0)

COURSE OUTCOMES
1. Understand the meaning and concept of project proposal writing (Understand)
2. Identify the principles and approaches of programme management (Analyse)
3. Undertake critical review of C4D projects (Evaluate)
4. Prepare development project management plans and programmes (Creating)

Module 1: Project Formulation and Appraisal (15 Lectures)
Overview of project management, Feasibility and technical analysis, Market and demand analysis, Economic and financial analysis, Formulation of Detailed Project Report (DPR).

Module 2: Project Planning, Writing and Scheduling (15 Lectures)
Meaning and concept of project planning, Need assessment and project feasibility, Rationale, Project components: Executive summary, Statement of need, Project goals, Project description, Budgeting, Organizational information, Materials and equipment, Human resources, Project costing and financing, organisation structures in project.

Module 3: Project Implementation, Budget and Results (15 Lectures)
Project team and competencies, Coordination and communication, Review Mechanism, Tracking project milestones, Report writing, production and supervision of key inputs, capacity strengthening activities/training, team building activities, Advance and contingency planning, Fund management, project-life-cycle, Results-based Management - outputs, outcomes and higher-level goals or impact, Cost-Benefit Analysis (CBA), Sensitivity Analysis, Project management information system, material and equipment,, financial aspects, project Sustainability, Closing a project, Reviewing a project.

Suggested Exercise
Literature Review, Case Study, Field Survey, Project Writing, Project Reviews, PRA

Suggested Readings:

1. Gower Handbook of People in Project Management (Project and Programme Management Practitioner Handbooks), Lindsay Scott and Dennis Lock, 2013, Routledge
2. How to change the world: Social Entrepreneurs and the Power of New ideas, 2004, David Bornstein, OUP USA
3. Integrated Planning Process: Project Design & Proposal Writing, American Red Cross, 2006
4. IDRC. 2010. Resource Mobilisation a Practical Guide for Research and Community Based Organization http://www.idrc.ca/EN/Programs/Donor_Partnerships/Documents/ Donor-partnership-guide-hyperlinked.pdf

5. Impact Assessment of ICT-for Development Projects: A Compendium of Approaches, Richar Heeks and Alemayehu Molla,2009, IDRC. http://www.sed. manchester.ac.uk/idpm/research/publications/wp/di/documents/di_wp36.pdf
6. Results Based Management - https://unhabitat.org/?rbm-handbook=1-1-what-is-resultsbased-management
7. Social Entrepreneurship: What Everyone Needs to Know, Bornstein David and Susan Davis, 2010, Oxford University Press
8. World Bank. 2009. Resource Mobilisation. http://siteresources.worldbank.org/INTBELARUS/Resources/Resource_Mobilisation.pdf

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	
CO2		H	
CO3			H
CO4		H	H

MCSA0046: SITUATION ANALYSIS FOR COMMUNICATION STRATEGY (3-0-1)

COURSE OUTCOMES

1. List the basic models and steps of communication strategy planning (Remembering)
2. Understand the techniques of development communication planning (Understanding)
3. Assess the situation for development communication and intervention (Evaluating)
4. Examine the role of media in socio-economic development and social change (Analysing)
5. Prepare develop communication strategy and plans (Creating)

Module 1: Socio-Ecological Framework and Situation Analysis

Underlying causes of development problems, Socio-Ecological Framework, Situation Assessments: Motivation- Opportunity-Ability (MOA) Model, Case and project feasibility study, SWOT Analysis. Participatory Approach: PRA, Community Mapping, Social Auditing, Transect walk, Auto-photography.

Module 2: Literature Review and Formative Research

Research on current knowledge, attitudes, experiences, practices and beliefs among the participants groups, Understanding Local knowledge, Formative Research, Participatory Research, Participatory Rural/Urban Appraisal (PRA), Participatory Learning and Action (PLA), Most Significant Change (MSC), Appreciative Inquiry, Case study on C4D.

Module 3: Synthesising, Analysing and Reporting Data

Data synthesis, reporting, identifying long-term goals, determining preconditions needed to achieve the goals, linking interventions to results, identifying indicators of results and producing a narrative to summarize changes, issues and challenges.

Suggested Readings:

1. Communication for Development and Civil Society, V.S. Gupta, 2004, Concept
2. Information and Communication Technology: Reinvesting Theory and Action (2Volumes), Kiran Prasad, 2009, BRPC
3. Media, Communication and Development: Three Approaches, Linje Manyozo, 2012, Sage
4. Participatory Communication: Working for Change and Development, S.A. White, 1994, Sage
5. Participatory Communication Paolo Mefalopulos and Thomas, Tufte, 2009, World Bank Working Papers
6. Participatory Communication for Social Change (Communication and Human Values), Jan Servaes, Tom Jacobson andShirley a White, 1996, Sage Publications
7. Participatory Video: Images that Transform and Empower, A Shirley White, 2003, Sage India

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2		H	
CO3		M	H
CO4			
CO5	H	H	H

MCCA0047: PLANNING MODELS AND COMMUNICATION APPROACHES (3-0-1)

COURSE OUTCOMES

1. Identify the steps in communication strategy development (Remembering)
2. Explain the basic principles and development planning models (Understanding)
3. Analyse the relevance of theoretical frameworks of communication for development (Analyse)

4. Critically analyse the key components of communication strategies (Evaluate)
5. Design and implement C4D programmes (Creating)

Module 1: C4D Planning Models (20 Lectures)
Understanding communication planning, Planning Models: ACADA Model, P-Process, COMBI Model and Integrated Communication, Individual Level Behavioural Change Models: Persuasion Model, Health Belief Model, Stages of Trans-theoretical Model, Issues and Challenges of Social and Behaviour Change Communication (SBCC).

Module 2: Communication Approaches (20 Lectures)
Defining Objectives: Programme Objectives, Behavioural Objectives and Communication Objectives, Dialogue-based approaches, Participatory communication, Communication Plan, Audience Mapping, Segmentation, Channels, Message design–Human-Centric Design (HCD), Message appeal, Message Testing, Material production and Toolkits.

Module 3: Communication Intervention and Strategy (20 Lectures)
Identifying key stakeholders, Preparation of Partnership Plan, Management Plan, Operation Guidelines, Levels of Intervention: Macro, Mezzo and Micro levels, Establishing objectives at multiple levels, Key steps leading to change, Logical Frame, Communication strategy: Advocacy: Effective advocacy, Media Advocacy, Celebrity Advocacy, Legal Advocacy & Executive/Legislative and Regulatory Advocacy), Social Marketing, Entertainment Education, Peer Education, Capacity and Capability Strengthening, Project Implementation, Feedback and Review.

Suggested Readings:

1. Community Dialogue Toolkit - Supporting Local Solutions to Local Challenges, https://ccednet-rcdec.ca/en/toolbox/community-dialogue-toolkit-supporting-local-solutions-local
2. Celebrity Advocacy and International Development (Rethinking Development, Dan Brockington, 1st Edition, 2014, Routledge
3. Hands-on Social Marketing: A Step-by-Step Guide, Kline Nedra Weirnriech, 1999, Sage
4. Media, Communication and Development: Three Approaches, First Edition, Linje Manyozo, 2012, Sage Publications
5. Methods to support human-centric design, M. Maguire, 2001, International Journal of Human-Computer Studies, 55(4),pp.587-634
6. Social Marketing-Changing Behaviour for Good, Nancy R. Lee and Philip Kotler, 2015, Sage Publications
7. The Limits of Media Advocacy, Communication, Culture and & Critique 3(1):44-65
8. Theory and Principles of Public Communication Campaign, C.K. Atkin and R.E Rice, 2012, Sage
9. The Role of Message Tailoring in the Development of Persuasive Health Communication Messages, in Christina Beck,Editor, Communication Year Book 33, S.M. Noar, G.G Harington and R.S. Aldrich, 2009
10. Writing Health Communication: An Evidence Based-Guide, Charles Abraham and Marieke Kools, 2011, Sage
11. Writing a communication strategy for development programmes, UNICEF, 2007, https://sites.unicef.org/cholera/Chapter_7_communications/UNICEF_Writing_a_Comm_Strategy_for_Dev_Progs.pdf

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1			H
CO2	H		
CO3	H	H	
CO4			H
CO5	H	H	H

MCMC0048: MEDIA AND CULTURAL STUDIES (4-0-0)

COURSE OBJECTIVES
1. Describe the key concepts of cultural and media studies (Remembering)
2. Understand the cultural dynamics of society with the help of contemporary theory (Understanding)
3. Examine the role of media in mediation of social identity (Analysing)
4. Assess the diverse media and cultural practices (Evaluating)

Module 1: Media and Culture (15 Lectures)
Concept of Culture - meaning; dimensions, Basic theoretical framework - Critical Cultural Theory; Frankfurt School; Chicago School, Mass media and postmodern culture, Culture industries, Popular and mass culture, Multiculturalism and subcultures, Mediated culture, cultural hybridity.

Module 2: Media and Society (15 Lectures)

Media Manufacturing of Culture, Pluralism and Counter-Culture, Mediated Culture, Media & Margins, Media influence on culture, Gender; culture and space, Media and gender.

Module 3: Media, Culture and Identity (15 Lectures)
Identity and Culture, Mediated Identity, Gender, Body and the Culture of Modernity, Contesting Cultures, Techno-Culture, Cyberculture, Media Representations, Under-Representation, Gendered Representation, Visual Pleasure, Internet as a Cultural Platform.

Suggested Readings:
1. Cultural Studies: Texts and Contexts, First Edition, Prantik Banerjee, 2021, Dattsons
2. Communication as Culture, James W. Carey, 2008, Routledge
3. Media and Culture: An Introduction, Campbell, Richard, Martin, Christopher R, and Fabos Bettina, 2011
4. Media and Cultural Studies: Key Works, Gigi Meenakshi Durham and Douglas M. Kellner (eds.), 2006, Blackwell
5. Questions of Cultural Identity, Stuart Hall and Paul Du Gay (ed), 1996, Sage Publications
6. Representation: Cultural Representations and Signifying Practices - Vol. 2 (Culture),1997, Stuart Hall, Sage
7. Sociology of Indian Culture, D.P. Mukerji, 1979, Rawat Publishers
8. What is Cultural Studies? A Reader., John Storey (Ed), John Storey, 2009, Hodder Education

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H		H
CO3			H
CO4	H	H	

MCBJ0050: BUSINESS JOURNALISM (3-0-0)

COURSE OBJECTIVES
1. Describe the key terms related to business and finance (Remembering)
2. Understand different forms of business journalism (Understanding)
3. Write business news articles (Creating)

Module 1: Introduction to Business and Financial System (15 Lectures)
Basic knowledge of financial system and institutions, Gathering, distribution and allocation of revenue vis-à-vis Central Government and State Governments; finance commission/department, Central and State budgets: budget-making exercise, how to read a budget, concept of zero deficit budget, importance of Public Accounts Committee, Introduction to Tax Laws, Essential Commodities Act, MRTP, FERA, SEBI, RBI, IMF, Industry Bodies and other Financial Regulatory Bodies, Economic Policies.

Module 2: Basics of Business Journalism (15 Lectures)
Business journalism: Global and Indian context, types of business journalism, media and new trends in business journalism, international money market and new information technology, commercial database, ethics in business reporting – business journalism, servant or watchdog.

Module 3: Writing Business News (15 Lectures)
Sources of news on business, finance and industry – governments, chambers of commerce and industries, corporate, trading and industrial executives, share markets, commodities markets, money markets etc. Government policy decision, company reports, RBI reports; analysis of decisions, reports and statements, Data visualisation tools and presentation, ethics in business journalism.

Suggested Readings
1. Business Newspapers: Economic Times, Financial Express, Business Standard, Observer of Business and Politics, BusinessLine.
2. Business Journalism: A Critical Political Economy Approach, 1st Edition, Ibrahim Seaga Shaw, 2015, Routledge
3. Indian Economic Yearbook, National, Agarwal, A.N. & Verma H.O. New Delhi
4. Business Journalism: How to Report on Business and Economics, 1st Edition, Keith Yayes, Apress
5. Periodicals: Business India, Business World, Business Today, The Economist, Dalal Street Journal, Advertising & Marketing(A & M), Far Eastern Economic Review, EPW
6. Reporting Technical Information, Kennet Houp & Thomas Pearsall, 1984, Macmillan
7. Writing About Business: The New Knight-Bagehot Guide to Economics and Business Journalism, Revised Edition, TerriThomson, 2000

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2		H	
CO3			H

MCPM0051: PROJECT MONITORING AND EVALUATION (3-0-1)

COURSE OUTCOMES

1. Identify the data-gathering techniques of communication projects (Remembering)
2. Describe the project monitoring and evaluation processes (Understand)
3. Undertake critical analysis of evaluation data (Analyse)
4. Prepare monitoring and evaluation plans, write reports and communicate findings (Create)

Module 1: Programme Monitoring, Evaluation and Promotion (20 Lectures)

Concept of project Monitoring and Evaluation (M&E), Project cycle, Distinction between M&E, evaluation and impact evaluation, Role of logic models, M&E Plan, Different types of evaluations, Monitoring Outcomes and Assumptions, Measurement of progress, Indicators of change, Impact assessment, Stakeholder Analysis Networks Analysis, Social Support & Recognition, Positionality and ethics, Outcome mapping, Strengths and weaknesses, Promotion of changed/adapted behaviour/results, Testimonial Reminders, Repetition.

Module 2: Data-gathering and Analysis (20 Lectures)

Quantitative and qualitative approaches, survey, community dialogues, interviews, data analysis, use of statistical tools, Baseline Data, Information Management, interpretation, data visualisation, assessing validity and reliability and determining generalisability of the data, Learning and accountability.

Module 3: Reporting and Documentation of M&E Data (20 Lectures)

Interpretation of M&E data, understand its uses, data preparation, documentation, Types of Records: Process, Narrative and Summary, Problem-oriented Recording, formulating recommendation, Reporting Project Progress and Findings, practicum, Reflective practice - Learning Lessons, Adapting the Plan, Continuous Improvement Communicating the Results.

Suggested Readings:

1. Can we know better? Reflections for development, Chambers, R, 2017, Rugby: Practical Action Publishing
2. How Change Happens, 2016, Oxford: Oxford University Press
3. Outcome Mapping: Building Learning and Reflection into Development Programs, Earl, S., Carden, F. and Stymulo, T., 2001,IDRC
4. Program Evaluation theory and Practice 2nd Edition, D.M. Mertens and Wilson, A. T., 2019, The Guildford Press
5. Planning, monitoring and evaluation in development organisations: sharing training and facilitation experiences, De Coninck, J. 2008, Sage
6. Ten Steps to a Results-Based Monitoring and Evaluation System, Kusek, J. Z. and Rist, R. C, 2004, The World Bank
7. The use and abuse of the logical framework approach, O. Bakewell and A Garbutt, 2005, Sida
8. The 'Most Significant Change' (MSC) Technique: A Guide to Its Use, R. Davies and J Dart, 2005

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1		H	
CO2	H		
CO3	H	H	
CO4	H		H

MCDM0052: DIGITAL MEDIA (3-0-0)

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective: *The objective of the course is to provide a comprehensive overview of digital media, focusing on its development, impact, and role in contemporary society. Students will explore the global and national contexts of digital media, examining its influence on communication practices, media industries, and society.*

Course Outcomes:

At the end of this course students will be able to:

CO 1 Analyse the evolution, impact and societal implications of digital media. (Analysing)

CO 2 Examine the role of digital media in transforming communication practices. (Applying)

CO 3 Discuss key issues emerging from recent development in digital media. (Understanding)

Module 1: Digital Media and Society (6 Lectures)
Internet as a medium of communication, Types of internet based communication, Forms of computer mediated communication, Virtual communities, Evolution and development of digital media, Medium specifics trends, Effects of digital media, Evolution and development of ICT, Growth and diffusion of ICT, Digital divide and Digital (In)Equality, ICT policies of India, Regulatory body, IT Laws and Rules, Agencies involved in cybersecurity

Module 2: Social Media in Indian Scenario (10 Lectures)
History; definitions and types of Social media, Social media in India, Use of social media, Social media and interactivity, Content sharing, Social media tools and engagement, Fake news on social media, types and characteristics of social media audience, Marketing and social media audience

Module 3: Application of Digital Media (10 Lectures)
Online activism: Definition; Technology and activism; Characteristics of online activism; Online activism and social change, Democracy and digital media: Elections; political parties; politics; Citizen journalism, ICT for development: Education; Health; E-governance; Entrepreneurship, Artificial Intelligence

Suggested Readings

1. Castells, M. (2004). *The Network Society: A Cross-Cultural Perspective* (Edward Elgar, 2004).
2. Fuchs, C., and Sandoval, M. (Eds.). *Critique, Social media and the Information Society* (Routledge, 2006).
3. Gerbaudo, P. *Tweets and the Streets: Social Media and Contemporary Activism.* (Pluto Press, 2018).
4. Lievrouw, L., and Livingstone, S. *Handbook of New Media* (Sage, 2006).
5. Manovich, L. *The Language of New Media* (MIT press, 2001).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2	M	H	H
CO 3		M	H

MCFA0053: FILM APPRECIATION (3-0-1)

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective: *The objective of the course is to provide a comprehensive understanding of film as an art form, cultural product, and means of communication. The course explores the aesthetic, technical, historical, and cultural dimensions of cinema, with a focus on global, national (Indian), and regional (Northeast Indian) contexts.*

COURSE OUTCOMES:
At the end of this course students will be able to:

CO 4 Explain the origin and growth of cinema. (Understanding)
CO 5 Analyse films by using established film theories and film genre. (Analysing)
CO 6 Create well-structured film reviews and critical essays. (Create)

Module 1: Growth and Development of Cinema (6 Lectures)
Meaning of cinema, Beginnings of cinema, Silent Era to Studio era, Indian Cinema: Beginning of cinema in India; Arrival of sound to Post-independence era; Cinema and the Nation

Module 2: Social Context and Film Form (10 Lectures)
Classical Hollywood cinema, German Expressionism, Italian Neo-realism, French New Wave, Indian New Wave and Parallel Cinema, Third Cinema

Module 3: Alternative Visions (10 Lectures)
Auteur theory, Feminist film theory, Queer theory, Film genre: Genre theory; Western film, Film noir, Gangster film

Module 4: Indian Cinema (10 Lectures)
Growth of Bollywood, Liberalisation and Indian Cinema, Overview of Northeast India cinema: Historical development; Key filmmakers; Themes and narratives; Contemporary trends

Module 5: Film Culture (9 Lectures)
Evolution of censorship, Film criticism and cinephilia, Film festivals; Events and communities

Suggested Readings

6. Bordwell, D., & Thompson, K. *Film Art: An Introduction* (McGraw-Hill Education, 2012).
7. Gokulsing, K. Moti & Dissanayake. *Handbook of Indian Cinemas* (Routledge, 2018)
8. Monaco, J. *How to Read a Film: Movies, Media, and Beyond*. (Oxford Univ. Press, 2009).
9. Nichols, B. *Engaging Cinema: An Introduction to Film Studies*. (W. W. Norton & Company, 2010).
10. Ray, Satyajit. *Our Films Their Films* (Orient Publishers, 1993).
11. Stam, Robert. *Film Theory: An Introduction* (Blackwell Publishers, 2000).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M		H	
CO 2		H	H		L
CO 3		L	L		H

MCTP6015: TECHNIQUES OF PHOTOGRAPHY AND IMAGE EDITING (0-0-2)

COURSE OUTCOMES

1. Show working knowledge of digital SLR cameras (Remembering)
2. Demonstrate an understanding of composition and image design process (Understanding)
3. Apply image editing and output techniques (Applying)
4. Analyse and critique one's own artistic output (Analysing)
5. Determine safe and responsible work practices (Evaluating)
6. Create photographic work of acceptable standard (Creating)

Description:
To equip the learners with skills and knowledge about the art of digital photography, to enable the learners to professionally handle DSLR cameras, understand technical concepts from the different shooting modes to aperture and shutter speed; and apply composition techniques from finding effective backgrounds to rule of the thirds., To provide hands-on training on outdoor photography as well as studio photography.
Recommended Assignments:

Suggested Practicum:
Street photography, Landscape photography, Action Photo story, Cityscapes, Studio portrait, Building a Photography portfolio.

Suggested Readings

1. Basics of Digital Images. OIT Academic Computing, PDF.
2. Fundamentals of Photo Composition, Paul R. Comon, Sterling Publications.
3. The DSLR Cinematography Guide, R. Koo, Creative Commons, e-book.
4. Langford's Basic Photography, Michael Langford, Anna Fox and Sawdon Rechard Smith, Focal Press.
5. Understanding Exposure, Bryan Peterson, Amphoto Books.
6. Mastering Digital Cameras, Al Judge, Createspace Independent Pub.

MCJG6016: JOURNALING (0-0-1)

COURSE OUTCOMES

1. Demonstrate the ability to explore different options for handling daily experiences (Understanding)
2. Develop self-awareness, self-learning and communication skills (Applying)
3. Apply contextual and experiential learning in their everyday lives (Applying)
4. Improve creativity and imagination (Creating)

Description
During these 30 hours of the Course, students are required to maintain a daily reflective journal, using the Visible Thinking Routine as a critical structure for guiding their journal writing. Students are required to do journaling once a week and submit the journal to the assigned faculty member every Friday for analysis. Grades will be awarded for this course on the basis of the journal entries and a presentation at the end of the semester.

Suggested Readings

1. The principal's role in mentor programs, B. Brock, 1999, London: Kogan Pag.

2. Visible thinking: Unlocking causal mapping for practical business results, J. M. Bryson, 2004, Chichester, J. Wiley.
3. Journaling During Research, Kay Debra Logan, 2005, Library Media Connection; Vol. 23 Issue 6, p12
4. Journaling: Telling your professional "story," D. Miller, 2003, Library Media Connection
5. Social Behaviour and Personality, Hung-Yuan Lin and Chi-Hsian Chiang, 2013, In international journal, Volume 41, Number1, 2013, pp. 113-122(10) Scientific Journal Publishers.

MCDI6017: DISSERTATION PHASE – I (0-0-2)

Description

Through this practicum students will be taught the different methods for conducting academic research. It will also teach students to conduct review of literature, prepare synopsis outline, format or structure of report. They will also learn how to add Appendices, such as references to sources of data, instruments of data collection; give Bibliography and footnotes.

The Exercise:

During this 60-hours course, students will have to choose a research topic of their choice, conduct a literature review with bibliography, and develop a research proposal which will be submitted in partial fulfilment for the requirement of Master's degree in Mass Communication. Students will also write and present a research paper.

Recommended Readings

1. Introduction to Mass Communication Research, Natziger, Ralph O. and David M. White. Baton Rouge: Louisiana StateUniversity Press, 1981.
2. Mass Media research: An Introduction, Wimmer, Roger D. and Joseph R. Dominick. Belomnt: Wadsworth.
3. MLA Handbook for Writers of Research Papers, Joseph Gibaldi and Walter S. Achtert New Delhi: Affiliated East-West PressPvt. Ltd., 1994.
4. Research Methods – The Basics, Nicholas Walliman, Routledge, 2011
5. Research Methodology Methods and Techniques, C.R Kothari
6. Research Methods in Social Sciences, O.R Krishnaswamy
7. Research Methods in Mass Communication, Stempel, Guido H. (III) and Bruce H. Westley (Ed). Englewood Cliffs: Prentice- hall Inc, 1981
8. Writing Your thesis, New Delhi: Sage Publications, 2008

MCAV6018: AUDIO-VIDEO PRODUCTION (0-0-2)

COURSE OBJECTIVES

1. Show awareness of safe and responsible work practices (Remembering)
2. Demonstrate an understanding of the audio-video production process (Understanding)
3. Experiment with different types of audio and video production tools (Applying)
4. Develop competency in editing and output techniques (Creating)
5. Create different formats of audio and video programmes (Creating)

The Exercise:

Basics of audio editing, Basics of video editing, Principles of scripting, Audio recording techniques and equipment, Radio Talk show, Radio Commercials, Studio recording, Outdoor recording, Hands-on training on Camera techniques and accessories, Framing and Shot sizes, Lighting techniques for video, Commercials, Video Interview, Live recording techniques.

Suggested Readings

1. Single-Camera Video Production, Robert B Musburger and Michael R. Ogden, 2014, Focal Press
2. Techniques of Radio Production, Robert Mcleish, 2015, Focal Press
3. The Videomaker Guide to Digital Video and DVD Production, Stephen Muratore and Matt York, Focal Press.
4. Video Production Handbook, Jim Owens, 2011, Routledge
5. Writing for Radio and Television in India, Krishnan K. Kedia, Cyber Tech Publications.

MCDP6019 DISSERTATION PHASE – II (0-0-2)

Project Description

During this practicum course students will complete data collection, analysis, preparation of research report and submit the final dissertation. The dissertation has to be systematically structured following proper methodology of communication research. Phase - I of the course is carried out in the 2nd Semester where students work upon research proposals, literature review and research methodology. Students will have to ensure that the dissertation is preparedkeeping in view Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Students are required to make a presentation of the dissertation submitted to the department on the date set by the department.

Suggested Readings:

1. Research Methodology: Methods and Techniques, 4th Edition C.R. Kothari and Gaurav Garg, 2019, New Age InternationalPublishers
2. Methodology of Research in Social Sciences, O.R. Krishnaswamy and M. Ranganatham, 2016, Himalaya Publishing House
3. Writing Your Thesis, Paul Oliver, 2014, Sage Publications, New Delhi
4. Research Methods in Mass Communication, III Stempel, Guido H. and Bruce H. Westley, 1988, Prentice-Hall.
5. Mass Media Research: An Introduction, Roger D. Wimmer and Dominick R. Joseph, 2005, Wadsworth Publishing Co. Inc.
6. Writing Successful Reports and Dissertations (Student Success) 1st Edition, Lucinda Becker, 2014, Sage Publications

MCIP6020 INTERNSHIP (5 Credits – 90 hours)

Description

Students will undertake 4-weeks internships in media and communication organizations during the winter vacation between third semester and fourth semester. They will discuss the choice of media and communication organization with their respective mentors and obtain the consent of the head of the department. Before going for the internship, an *Internship Agreement Contact* form from the concerned organization will be submitted by the student to their respective mentors. After completion each student will submit a copy of the *Internship Completion Certificate* to their mentors from the designated authority of the concerned media and communication organization.

The final evaluation will be on the basis of the following criteria:

a. Journal – 30%
b. Portfolio and Presentation – 50%
c. Written evaluation by the employer – 20%

Journal: Each student will keep a daily journal with an entry for each day spent doing work for the internship. This journal should be e-mailed to the mentor at the beginning of each work week. In this journal the students should summarize the activities and assignments on which the student worked. The student should also keep track of the number of hours for each week.

Portfolio: At the end of the internship, each student is required to prepare a professional portfolio that contains examples of the students' work during the internship. The portfolio will additionally contain a written evaluation of the media organization, employer evaluation of the student, a copy of the internship completion certificate, a one-page summary of the internship.

Employer Evaluation: At the end of the internship the supervising employer will be asked to submit a written evaluation of the student's performance.

Student Evaluation: At the end of the internship the student will be asked to submit a written evaluation of the employer.The department will issue the following to the students:

a. Internship Application Form – to be submitted to the mentor prior to internship.
b. Internship Agreement Contract – to be submitted to the mentor prior to internship.
c. Student Evaluation of the Internship – to be included in the portfolio
d. Employer Evaluation of Intern – to be included in the portfolio

Last date of Internship: To be notified by the department

Portfolio Submission and Presentation: To be notified by the department

MCFP6021 FINAL PROJECT(5 Credits – 90 hours)

Project Description:

Each student is required to submit a project based on her/his area of specialization or any other relevant areas of Journalism and Mass Communication/Advertising/Public Relations etc. They are required to choose the topic of their Final Project in consultation and supervision of the teacher/Mentor of the department and duly approved by the Head of the Department. The Final Project has to be submitted (two printed in bound form and a soft copy) as per the schedule duly notified by the department.

Suggested Project:

Designing and publication of newspapers/magazines/publicity posters/brochure

Project Evaluation Criteria

- Project activity assessment: 20%
- Evaluation of final project: 60%
- Viva-Voce: 20%

Last date of project submission: To be notified by the department

Portfolio Submission and Presentation: To be notified by the department

VALUE ADDED COURSES

MCCS6122 COMMUNICATION SKILLS (1-0-1)

COURSE OBJECTIVES

1. Identify the different styles of communication (Remembering)
2. Understand how to develop effective speaking skills (Understanding)
3. Evaluate various communication needs (Evaluating)
4. Develop professional oral & written communication skills (Applying)

Module 1: Basics of Communication (5 Lectures)

Essentials of effective Communication, Types & techniques of communication: Verbal & Non-Verbal Communication, Communication in organization, Communication Network in an Organization: Personal Communication, Internal Operational Communication, External Operational Communication.

Module 2: Oral Communication (13 Lectures)

Language in Communication, Phonetics, Spelling, Pronunciation, and Accent, Speech Drills, Oral Communication Skills: Seeking and giving information/suggestions/advice, Offering and responding to offers, Requesting and responding to requests, Congratulating people, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving, Giving instructions, Seeking and giving permission, Expressing opinions, Group discussion, Seeking explanations, Expressing sympathy, Reading Skills: Skimming and Scanning, Levels of Reading, Reading Comprehension, Academic Reading Tips, Listening and speaking skills, Contextualised speaking.

Module 3: Written Communication (12 Lectures)

Writing Skills, Elements of Writing: Sentence, Phrases and Clauses, Forms of Written Communication, Formal & Informal Writing, Letter Writing, Notices, Summary, Note-making, Job application, Preparing a CV/Resume and Effective Profiling, Preparation of Cover letters, preparing for and Facing a Job Interview, Preparing a Presentation, Preparing Agenda and Minutes for Meetings, Writing Notices and Memos, Drafting an E-mail, Correspondence with Government Authorities/institutions, Office Orders, Enquiries and Replies, audience analysis.

Suggested Readings:

1. Business Communication, Meenakshi Raman and Prakash Singh, 2012, Oxford University Press
2. Oxford English Grammar, Sydney Greenbaum, 1996, Oxford University Press
3. Effective Technical Communication, M. Ashraf Rizvi,2005, Tata McGraw Hill
4. Business Communication, Anjanee Sethi & Bhavana Adhikari, Tata McGraw Hill
5. Working in English, Leo Jones,2001, Cambridge University Press
6. Speaking Personally, Gillian Porter Ladousse,1983, Cambridge University Press
7. Communication Skills. Leena Sen, 2007, PHI Learning
8. English phonetics and phonology paperback with audio CDs (2): A practical course, P. Roach, 2009, Cambridge university press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2		H	
CO3	H		
CO4		H	H

MCCW6123 CREATIVE WRITING (1-0-1)

COURSE OUTCOMES

1. Demonstrate understanding on various forms of creative writing (Understanding)
2. Apply the techniques of creative writing for storytelling (Applying)
3. Write contents for various purposes (Creating).

Module 1: Introduction to Creative Writing (10 lectures)

Writing as an Art, Types of writing, Principles of writing, Characteristics of Good Writing, Elements of Writing: Form, Content, Audience, Style & Structure, Meaning of creative writing, Creative process and abilities for writing, Challenges in Creative Writing.

Module 2: Process and Techniques of Creative Writing (10 lectures)

Finding the ideas, sketching the plot, characterization, conflict, climax, resolution, Action Description, Point of View, Dialogue,

setting atmosphere, Using technology in process of writing.

Module 3: Writing Exercises (10 Hours)
Content Writing, Reviews writings, Blogging, Feature and Opinion Pieces, Creative Writing, Short Story, Poetry, Fiction, Essay, Adventure Story, Reflective Writing, Persuasive Writing – Commercials, Figurative Writing, Travel Writing.

Suggested Readings:

1. Creative Writing – How to Unlock your Imagination, develop your writing skills – and get published, 7th Edition, AdeleRamet, 2007, Howtobooks
2. Creative Writing Course Book, Paul Mills, 2006, Routledge
3. The Cambridge Companion to Creative Writing, South Asian Edition, Morley, 2012, Cambridge University Press
4. The Five Minutes Writer, Margret Geraghty, 2007, HowToBook
5. The Cambridge Introduction to Creative Writing, David Morley, 2007, Cambridge University Press
6. The Psychology of Creative Writing, Scott Barry Kaufman and James C. Kaufman (Ed), 2009, Cambridge University Press
7. Word Power: A guide to creative writing, Julian Birkett, 2016, Bloomsbury Academic India
8. Writing on Both Sides of the Brain: Breakthrough Techniques for People Who Write, Henriette A Klauser, 1987, HarperOne

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	
CO2	H	H	
CO3			H

MCEM6124 EVENT MANAGEMENT (1-0-1)

COURSE OUTCOMES
1. Understand the relevance of event management as a professional skill and career option (Understanding)
2. Demonstrate an in-depth understanding of the intricacies of managing an event (Applying)
3. Examine individual and team orientation in event planning and management (Analysing)
4. Plan and organise an event (Creating)

Module 1: Introduction to Event Management (6 lectures)
Concepts and types of events, Understanding and Introduction to the events landscape, Idea generation, Conceptualisation: Techniques/Methods.

Module 2: Event Planning and Administration (8 lectures)
Developing event vision/mission, objectives and goals, Event proposal, Strategic planning techniques: Action Plans; Event Group Sustainability methodologies, Logistics and operations: Use of work plan structures; time-plans; worksheets; Gantt Charts, Legal frameworks: Licenses and Permissions, Event administration strategies, Resource Mobilisation and techniques, financial management.

Module 3: Event Marketing (8 lectures)
Target Group Segmentations: Concepts and Strategies, Strategic and Integrated Marketing Communications for events, Event Branding, Digital marketing and audience building for events, Marketing plan creation; strategies and implementation, Skills for event managers and planners: negotiation and networking skills; image management; leadership.

Module 4: Post Event Documentation and Evaluation (8 lectures)
Documentation: aims; methods and techniques, Event evaluation methodologies, Audience feedback and review mechanisms, developing event follow-up strategies and action plans, Developing the Event Planners Journal.

Suggested Readings:

1. Event Management and Marketing: Theory, Practical Approaches and Planning, 1st Edition, Anukrati Sharma and ShrutiArora, 2018, Bharti Publications
2. Events Management: An Introduction C. Bladen, J. Kennel, 2012, Routledge
3. Event Marketing: How to Successfully Promote Events, Festivals, Conventions and Expositions, Leonard H. Hoyle, 2002,John Wiley and Sons Inc
4. Event Planning, 2nd Edition, J. Allen, 2009, Wiley
5. Event Planning: The Ultimate Guide, J. Allen, 2000, Wiley and Sons.
6. Planning Special Events, J. S. Armstrong, 2001, Josse Bass Wiley
7. Public Relations Campaigns and Techniques, F.R. Matera & R.J. Artigue, 2000, Allyn & Bacon
8. Special Events: A New Generation and the Next Frontier, 6th Edition, J. Goldblatt, 2010, Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2	H	H	H	H
CO3		H		H
CO4	H	H	H	H

SERVICE LEARNING

MCLS0100: COMMUNITY MEDIA (2-0-0)

COURSE OUTCOMES

1. Define and explain service learning and participatory approach to social development (Remembering)
2. Classify the different types of community media (Understand)
3. Utilise community media for social change and development (Applying)
4. Analyse storytelling formats and content about development issues (Analyzing)
5. Identify opportunities for discussing development issues using community media (Evaluating)
6. Produce content for community media (Creating)

Module 1: Introduction to Service-Learning (5 Lectures)

Concept of Service Learning— definition, principles, models of different Higher Education Institution Service Learning; Service Learning as a medium of social change.

Module 2: Understanding Community and Community Participation (5 Lectures)

Understanding Community, Participatory approach to social development; Principles of community participation; Participatory Rural Appraisal.

Module 3: Community Media and Community Engagement (5 Lectures)

Understanding Community Media, Types, Purpose, Relevance and Significance, Skills, tools and Techniques of community media, Practices of Community Media, Participatory communication, socio-cultural media, Communication for Social and Behaviour Change, ethical issues.

Module 4: Community Practicum and Learning Activities (15 Lectures)

Internship, Community Mobilisation, Awareness/Advocacy campaign, folk performances, community meetings, rural reporting, community radio programmings, community video, case studies.

Suggested Readings:

1. A to Z in Projects Cycle Management: A Results Based Approach, P. J. Lukose, 2015, Media House Publications, New Delhi
2. Community Media: International Perspectives, Kinda K. Fuller, 2007, Plagrave Macmillan
3. Community Media: People's, Places, and Communication Techniques, Kevin Howley, 2005, Kindle Edition
4. Hand Held Vision: The Impossible Possibilities of Community Media, D. D. Halleck, 2002, Fordham University Press
5. Media, Communication and Development: Three Approaches, Linje Manyozo, 2012, Sage India
6. Methods for community participation: A Complete Guide for Practitioners, S. Kumar, 2002, New Delhi: Vistaar
7. Other Voices: The Struggle for Community Radio in India, Vinod Pavarala and Kanchan K Malik, 2007, Sage Publications
8. Participatory Development Practice: Using Traditional and Contemporary Frameworks, A Kelly and P. Westoby, 2018,London: Practical Action Publishing
9. Rural development: putting the last first, R. Chambers. R, 1983, New Delhi: Routledge
10. Service learning in higher education: concepts and practices, B. Jacoby, 2010, Michigan: Jossey-Bass Publishers
11. Service-learning: History, Theory and Issues, B. W. Speck and S. L Hoppe, 2004, Connecticut: Greenwood Publishing Group

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	M			
CO2		M	M	
CO3			H	H
CO4			H	H
CO5			H	H
CO6			H	H

DEPARTMENT OF PSYCHOLOGY

VISION

To be a centre of excellence in teaching, learning, research and in the practice of psychological counselling, thereby promoting community mental health and psychosocial competence in order to foster cohesion in the society.

MISSION

1. Department of psychology and counselling Assam Don Bosco University seeks to:
2. Achieve excellence in teaching, learning, research, practice and extension activities.
3. To nurture and develop the counselling skills of the students.
4. To prepare competent counsellors who are socially committed and culturally sensitive and are bound by the ethics of the profession.
5. To create an environment committed to promoting the application of science of psychological counselling to real world situation.

PROGRAM OUTCOMES – MSC PROGRAMME

PO 1: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: Effective Communication: To build on effective inter and intra personal communications skills including empathy. Open mindedness, mutual respect, Confidence, effective listening, non-verbal communication, clarity and concision.

PO 3: Scientific Temper: To build essential skills of different ways of life including questioning observing, physical reality, testing, hypothesizing, analyzing and communicating

PO 4: Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: Environment and Sustainability: Building a contemporary state of art model using the theories of social sciences for sustainable development of the campus/environment.

PO 7: Gender Sensitization and Social Commitment: To bring about a change in behavior and attitude and to instill empathy in the students to raise awareness about the gender equality concerns and to imbibe the sense of social responsibility for self and community to envisage ethical framework, obligation to work and cooperate with other individuals and organizations for the benefit of the society at large

PO 8: Self-Directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PROGRAM SPECIFIC OUTCOMES – MSC PSYCHOLOGY

PSO 1: Knowledge and Attitude: To develop budding counselling psychologists who will be able to understand and demonstrate behavior, have attitudes in the basic areas of professional counseling.

PSO 2: Research and Analytical Skills: Will be able to demonstrate competence in analysis and critically anlayse scholarly work in areas of research, consultancy and counseling practice.

PSO 3: Application: To equip students with knowledge in the fundamentals of psychology and counseling so that they

PSO 4: understand the application of the field relating to different issues in psychology.

PSO 5: Core Competency Skills: To enhance the core counseling skills, such as active listening, empathy, unconditional positive regard, congruence and so on and empowering the process of human development.

PSO 6: Ethics: To demonstrate the technical skills and ethical decisions appropriate for the holistic professional development in the field.

MAPPING OF COURSES WITH POS/PSOS

Sl. No.	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5
1.1	Theories of Personality	H	H	L	H	H	M	H	H	H	L	H	H	H
1.2	Concepts of Mental Health and Illness-I	M		M		M	H		L	M		M	M	M
1.3	Research Method and Statistics in Social Sciences		H	M	M			M	L	H		H	H	M
1.4	Cognitive Psychology	H	H	H	M	M		H	M	H	H	H	H	M

1.5	Eastern Approaches to psychology and Counseling	M	L	M	L	M	L	L	L	H	M	H	H	M
1.6	General Psychology	M	L	H	L	M	L	M	M	H	M	L	M	M
1.7	Practicum-I	H	L	H	M	H	l	M	M	H	M	H	H	H
1.8	Personal Growth	M	H		M	M	H	M	L		L	L	M	
2.1	Concepts of Mental Health and Illness-II		M	L	L	H	M	H	H	H	L	H		M
2.2	Bio-psychology	H	L	H	L	M	L	L	L	H	M	L	M	H
2.3	Psychological Testing	H	L	H	L	H	L	L	M	M	H	M	L	H
2.4	Health Psychology	H	L	M	L		L	M	M	M	M	L	H	M
2.5	Introduction to Social Psychology	M	H	M	H	M	M	M	L	M	M	M	H	M
2.6	Practicum-II	H	L	H	L	M	L	M	M	H	M	H	M	H
2.7	Field Work	H	H	M	H	M	H	M	H	H	M	H	H	H
2.8	Psychological First Aid	M	M	M	L	M			L	L	L	M	M	M
	Counselling Psychology Specialization													
3.1	Foundations of Counselling Psychology	M	M	M	L	H	L	L	M	H	M	M	H	M
3.2	Child and Youth Counselling	M	L	M		L		M	M	H	M	M	H	M
3.3	Disability and Rehabilitation Psychology	M	H	M	L	H	L	H	M	H	M	H	H	H
3.4	Practicu m-III	H	L	H	L	M	L	M	M	H	M	H	M	H
3.5	Summer Internship ip	H	H	M	H	H	H	M	H	H	M	H	H	H
3.6	Study Tour	M	H	L		M	M	H	H	H	L	H	M	M
3.7	Supervised Internship I	H	H	M		M	M			H	M	H	M	
3.8	Research Project Phase I	M		M					M		H	M		L
4.1	Addiction and Trauma Counselling	H	M	M	L	M	L	M	M	H	M	H	H	H
4.2	Marriage and Family Counselling	M	L	M	M	M		M		L	L	M	H	M
4.3	Practicum-IV	H	L	H	L	M	L	M	M	H	M	H	M	H
4.4	Supervised Internship II	M		L		M			M	L			M	
4.5	Research Project Phase II	H		H		H			M		M	L		M
	Clinical Psychology Specialization													
3.1	Foundations of Clinical Psychology	M	M	M	L	H	L	L	M	H	M	M	H	M
3.2	Psycho diagnostics	M	L	M		L		M	M	H	M	M	H	M
3.3	Forensic Psychology	M	H	M	L	H	L	H	M	H	M	H	H	H
3.4	Practicum-III	H	L	H	L	M	L	M	M	H	M	H	M	H
3.5	Summer Internship	H	H	M	H	H	H	M	H	H	M	H	H	H
3.6	Study Tour	M	H	L		M	M	H	H	H	L	H	M	M
3.7	Supervised Internship I	M	H	M	M	H	L	H	M	H	M	H	H	H
3.8	Research Project Phase I	H		H		H	M		M		M	L		M
4.1	Psychotherapy	H	M	M	L	M	L	M	M	H	M	H	H	H
4.2	Neuropsychology	M	L	M	M	M		M		L	L	M	H	M
4.3	Practicum-IV	H	L	H	L	M	L	M	M	H	M	H	M	H
4.4	Supervised Internship II	M	H	M	M	H	L	H	M	H	M	H	H	H
4.5	Research Project Phase II	H		H		H	M		M		M	L		M

MSc PSYCHOLOGY –DETAILED SYLLABUS

PCSP0006: INTRODUCTION TO SOCIAL PSYCHOLOGY

(3 Credits – 45 hours)

Course Outcomes

1. Define the basic concepts of social psychology in different contexts. (Remembering)
2. Explain different concepts of social processes, social influence, group dynamics and group influence. (Understanding)
3. Apply the theoretical concepts of social psychology into real life settings. (Applying)
4. Analyze the difference between social perception and social cognition as well as prejudice, stereotype, discrimination. (Analyzing)
5. Compare different types of groups and their functional systems. (Evaluating)
6. Discuss various social problems in light of the theoretical concepts of social psychology. (Creating)

Module I: Introduction (8 hours)

Social Psychology - Definition, Nature, Origin and Development, Social Psychology in Indian context.

Module II: Social Processes (12 hours)

Social perception or cognition, interpersonal attraction, social motives, social learning, socialisation and social roles, pro-social behaviour, aggression and violence.

Module III: Social Influences (12 hours)

Persuasion, attitude, prejudice, discrimination and stereotypes - nature and differences among them. Factors in the formation of attitudes, measuring attitudes, factors in attitude change.

Module IV: Group Dynamics and Group Influence (13 hours)

Formation of groups, structure and functions, types, group communication, group norms, conformity behaviour, co-operation and competition, social facilitation, leadership, group effectiveness, decision making, problem solving, group conflict and resolution.

Suggested Readings

1. Baron, R., A., Byrne, D., Social Psychology, New Delhi: Prentice Hall,10th Edition (2006).
2. Mc David and Harai, Social Psychology; Individuals, groups, societies, Harper and Row (1968).
3. Moghaddam, F.M., Social Psychology: Exploring Universals Across Cultures, Freeman and Company (1997).
4. Dalal, Ajit K., A. Misra, Girishwar (Eds)., New Directions in Indian Psychology, Social Psychology, New Delhi: Sage(2001).
5. Eckes, Thomas and Trautner, Hanns M. (Eds.), The Developmental Social Psychology of Gender, Mahwah: Lawrence Erlbaum Associates, Publishers (2000).
6. Hogg, Michael A. and Cooper, Joel (Eds), The Sage Handbook of Social Psychology, Concise Student Edition, Los Angeles: Sage (2007).
7. Misra, Girishwar (Ed.), Applied Social Psychology in India, New Delhi: Sage (1990).
8. Pandey, Janak (Ed.), Psychology in India Revisited – Developments in the Discipline, Vol. 3: Applied Social and Organisational Psychology, New Delhi: Sage (2001)
9. Sharan, A.K. Social Psychology, New Delhi: Commonwealth Publishers (1999).
10. Linda steg, Abraham p. Buunk, applied social psychology: Understanding and managing social problems

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	M	M	M	
CO 3		H	H	H
CO 4			H	H
CO 5		H	H	H
CO 6	H			

PCEC0013: EASTERN APPROACHES TO PSYCHOLOGY AND COUNSELLING

(3 Credits-45 Hours)

Course Outcomes

1. Define the basic terms related to the different eastern approaches of psychology. (Remembering)
2. Classify among Indian/Chinese/Japanese approaches to psychology. (Understanding)
3. Make use of the appropriate Indian/Chinese/Japanese approaches to psychology in applied settings. (Applying)

4. Examine ancient and contemporary eastern approaches of psychology. (Analysing)
5. Recommend the suitable approach in applied settings. (Evaluating)
6. Develop a clear understanding of eastern and western approaches to Psychology. (Creating)

Module I: Introduction (7 hours)
Definitions, nature, differentiation of concepts-eastern, indigenous and Indian psychology; relationship between culture and psychology, emergence of non-western and indigenous perspectives to psychology.

Module II: Major Schools of Indian and Eastern Psychology (20 hours)
Indian approaches to Psychology-Upanishads, Sankhya, Dvaitha and Advaitha schools; current areas of research in Indian psychology. Chinese approaches to psychology - Taoism and Confucianism, Japanese approaches to Psychology -Morita and Naikan therapies.

Module III: Self and Consciousness (10 hours)
Viewpoints of Upanishads, Bhagavadgita, Buddhism and Jainism and other Eastern schools of thought.

Module IV: Indian and other Eastern Approaches to Health and Wellbeing (8 hours)
Yoga, Ayurveda, goals of life-concept of purusharthas, personality development-concept of Ashramas

Suggested Readings

1. Bankart, C. P. (1996). Talking cures: A History of Western and Eastern Psychotherapies. Pacific
2. Grove, CA: Brooks/Cole.
3. Ajaya, S. (1983). Psychotherapy East and West. Honesdale (PA): Himalayan International Institute.
4. Berry, J. W., Poortinga, YpeH. And Pandey, J. (1997). Handbook of cross-cultural psychology, T" Edition, Vol.1 Theory and method. Boston: Allyn and Bacon. (Chapters3,4and8byJ.G.Miller,D. Sinha, P.M. Greenfield)
5. Jones-Smith, E. (2012). Theories of counselling and psychotherapy: An integrative approach.
6. Thousand Oaks, CA: Sage.
7. Garg, Pulin K. K. and Parikh, I. J. (1995). Crossroads of culture: a study in the culture of transience, New Delhi: Sage.
8. Kakar.S.(1982). Shamans, mystics and doctors: A psychological enquiry into India and its healing traditions. Bombay: Oxford University Press.
9. Paranjpe, A. C. (1998). Self and identity in modern psychology and Indian thought. New York: Plenum.
10. Dunn, B. R., Hartigan, J. A., and Mikulas, W. L. (1999). Concentration and mindfulness meditations: Unique forms of consciousness? Applied Psychophysiology and Biofeedback, 24 (3), 147-165.
11. Kuyken, W., Byford, S., Taylor, R. S., Watkins, E., Holden, E., White, K., Barrett, B., Byng, R., Evans, A., Mullan, E., and Teasdale, J. D. (2008). Mindfulness-based cognitive therapy to prevent relapse in recurrent depression. Journal of Consulting and Clinical Psychology, 76(6), 966-978.
12. Segal, Z. (2008). Finding daylight: Mindful recovery from depression. Psychotherapy Networker, (Jan/Feb).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	H
CO 2		H	M	H
CO 3		H	M	H
CO 4	H	M	M	M
CO 5		H		H
CO 6	H			

PCTP0020 THEORIES OF PERSONALITY

(4 Credits- 60 hours)

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:
1. Define personality. (Remembering)
2. Explain the rationale behind the theories of personality. (Understanding)
3. Identify the impact of environment and genetics in development of personality. (Applying)
4. Analyse modifications of self in perceiving environment. (Analysing)
5. Assess the relation between cultural and personality. (Evaluating)
6. Compare and contrast various perspectives of personality. (Creating)

Module I: Introduction to Personality (10 hours)
Definition and Nature of personality; Trait and Type Theories of Personality; Determinants of personality: Biological and socio-

cultural- Hans Eysenk, Gray and Cloninger.

Module II: Classical approaches to Personality Development (20 hours)
Pre- Freudian (Structuralism- any two theorists; Functionalism- any two); Psychoanalytic; Post Freudian (Erikson; Eric Fromm); Neo- Freudian (Adler; Horney; Jung); Ego Psychology (Anna Freud; Hartmann; Rapapport)

Module III: Learning, Cognitive and Humanistic-Existential Approaches (20 hours)
Learning Approaches: Bandura
Cognitive Approaches: Rotter, Mischel
Humanistic–Existential Approaches: Frankl, Rollo May, Maslow, Rogers.

Module IV: Assessment of Personality (10 hrs)
Projective Tests- Ink blot test, Thematic Apperception Test, Sentence Completion TestObjective Tests; MMPI-II, 16PF, EPQ

Suggested Readings
1. Atkinson, R. L., Atkinson, R. C., Smith, E. E., Bem, D. J. and Hilgard, E. R. (1990).
2. Introduction to Psychology. New York: H. B. J. Inc.
3. Sternberg, R. J. (2010). Cognitive Psychology. New York: Cengage Learning
4. Passer, M.W. and Smith, R.E.(2010). Psychology: The Science of Mind and Behavior. New Delhi: Tata McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	M
CO 2	H	H	H	M
CO 3		M	M	
CO 4	M	H	H	H
CO 5	M	H		M
CO 6			M	H

PCMH0021 CONCEPTS OF MENTAL HEALTH AND ILLNESS-I

(4 Credits - 60 hours)

COURSE OUTCOMES
1. Define mental health and illnesses and list categories of mental illness as specified in DSM and ICD (Remembering)
2. Classify and categorise mood disorders, obsessive compulsive and related disorders, anxiety disorders(Understanding)
3. Apply diagnostic criteria of mood disorders, obsessive compulsive and related disorders, anxiety disorders to diagnose individuals with mental illnesses and select the appropriate psychological intervention for different childhood, adolescent and adult mental health related issues (Apply)
4. Analyse the distinction between normality and abnormality. Distinguish clinical features of different mental illnesses. (Analysing)
5. Evaluate Bio Psycho Social models and other models of mental health and illness. (Evaluate)
6. Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Module I: Introduction (10 hours)
Definition of mental illness and mental health. Historical review and changes in the concept of mental illness and mental health. Introduction to classification systems (DSM and ICD)

Module II: Models of Psychopathology (15 hours)
BioPsychosocial, Psychoanalytic, Behavioristic, Cognitive- Behavioral, Humanistic, Diathesis-Stress Model

Module III: Mood Disorders (Symptoms, Etiology and Treatment (15 hours)
Unipolar Depressive Disorders in different population. Bipolar and Related Disorders in different population.

Module IV: Anxiety and Related Disorders (Symptoms, Etiology and Treatment) (10 hours)
Phobias in different population: specific phobia and social phobia. Generalised Anxiety Disorders in different population. Obsessive Compulsive and Related Disorders in different population: Obsessive Compulsive Disorder, Body Dysmorphic Disorder, Hoarding Disorder, Trichotillomania

Module V: Somatic Symptoms and Dissociative Disorders (Symptoms, Etiology and Treatment) (10 hours)
Somatic Symptom Disorder, Functional Neurological Disorder, Factitious Disorder, Dissociative Disorder: Dissociative Identity Disorder, Depersonalisation Disorder, Derealisation Disorder

Suggested Readings

1. Diagnostic and Statistical Manual of Mental Disorders (DSM-5), 2013 American Psychiatric Association.
2. Robert C.Carson, James N. Butcher, Susan Mineka, Jill M. Hooley, Abnormal Psychology, Pearson 13th edition,
3. Sarason, Irwin G. a. Sarason Barbara R. Abnormal Psychology. The Problem of Maladaptive Behaviour. New Delhi: PHI Learning Private Limited, 11th Edition, (2009).
4. Ahuja, Niraj, A Short Textbook of Psychiatry,New Delhi: Jaypee, 6th Edition, (2006).
5. Antony, John D., Mental disorders, Encountered in Counselling, A Textbook of clinicalPsychology Based on DSM IV, Dindigul: Anugraha Publications, (2006).
6. Chaube, S.P., Developmental Psychology, New Delhi: Neelkamal, (2007).
7. Gilbert, Paul, Psychotherapy and Counselling for Depression, Los Angeles: Sage, 3rd Edition (2007).
8. Humphrey, Geraldine M. A. Zimpfer David G. Counselling for Grief and bereavement. 2nd Edition. Los Angeles: Sage, (2008).
9. Korchin, Sheldon, J., Modern Clinical Psychology, Principles of Intervention in the Clinic and Community. New Delhi: CBS Publishers and Distributors, (1986).
10. Kumar Updesh and Mandal Manas K. (Eds)., Suicidal Behaviour, Assessment of People-at- Risk. Los Angeles: Sage, (2010).
11. Patel, Vikram. Where There is No Psychiatrist. A mental health care manual. Glasgow: Gaskell, (2003).
12. Patel, Vikram A. Thara. R. (Eds.). Meeting The Mental Health Needs of Developing Countries. NGO Innovations in India. New Delhi: Sage, (2003).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2			M	M	
CO 3			H		H
CO 4		H			
CO 5		H			
CO 6	H				H

PCRM0022: RESEARCH METHODOLOGY AND STATISTICS IN SOCIAL SCIENCE

(4 Credits- 60 hours)

COURSE/LEARNING OUTCOMES

1. Define the basic concepts of research and recognize the philosophical foundations of research. (Remembering)
2. Understand the steps in conducting research and the major research designs. (Understanding)
3. Analyse the collected data in research using different statistical measures. (Analysing)
4. Apply research design, tools and statistical measures to carry out research in social sciences. (Applying)
5. Compare natural and social sciences as well as the different approaches and research designs most commonly used in social sciences research. (Evaluating)
6. To create a research proposal using indicating appropriate research design method of data collection and statistical computation. (Creating)

Module I: Introduction to Research (10 hours)

Philosophical Foundations of Research. Natural and social science research-characteristics and scientific attitude. Scope of social science research-basic and applied research; Ethical concerns in Counselling research.

Module II: Research designs, approaches and types (12 hours)

Research designs: Descriptive, Exploratory, and Experimental: meaning, scope, characteristics, application in social work setting. Research Approaches: Qualitative and Quantitative Research: meanings, scope, methods, steps, sampling, data collection, analysis, interpretation and reporting. Strengths and weaknesses.

Evaluative research: Programme and projects evaluation: concept, types, steps, reports. Participatory research and action research: concepts, scope, application and steps.

Module III: Steps in Research Process (20 hours)

Problem Formulation: Identifying research issue, formulating research topic and problem, review of literature (library work), theoretical framework, formulating objectives, clarifying concepts, variables- conceptual and operational, formulating hypothesis.

Population and Sampling: Inclusion and exclusion criteria of population, the logic of sampling size and techniques: probability and non-probability sampling.
Tools for data collection: Levels, types of measurements, reliability, and validity of tools.
Constructing tools for data collection: questionnaire, interview schedule, scales. Quantification of qualitative data.
Sources, collection, and analysis of data: Secondary and primary sources. Data collection, data editing, coding, mastersheet, analysis, report writing, using computer for data analysis: coding, analysis- graphs and results.
Professional report writing

Module IV: Introduction to Statistics (18 hours)
Statistics: Definitions, uses, and limitations. Classification, and tabulation of data, univariate and bivariate, diagrammatic and graphic presentations. Measures of central tendencies, Mean, Median, and Mode and their uses. Measures of variability range, variance, and standard deviation.
Correlation: Meaning and computation of coefficient of correlation as product moment, Spearman's Rank Correlations, interpretation of correlations.
Test of Hypotheses: Basics, Probability distribution, normal distribution. t-test, Chi-Square test and ANOVA.

Suggested Readings

1. Ahuja, R. (2001). *Research Methods*, Jaipur:Rawat.
2. Alston, M. Bocoles, W., (2003). Research in Social Workers: An Introduction to the Methods (Indian ed.), Jaipur:Rawat.
3. Baker, T. L. (1994). *Doing Social Research*, Singapore: McGraw Hill.
4. Goode, W. J. and Hatt, P. K. (1981). *Methods in Social Research*, Singapore: McGraw Hill.
5. Gupta, S. C. (1997). *Fundamentals of Statistics*, Delhi: Himalaya Publishing House.
6. Gupta, S.P. (1997). *Statistical Methods*, New Delhi: Sultan Chand and Sons.
7. Jacob, K.K., Methods and Fields of Social Work in India, Asia Publishing, Bombay, 1996
8. Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*, (2nd ed. reprint), New Delhi: New AgeInternational.
9. Laldas, D.K. (2000). *Practice of Social Research*, Jaipur: Rawat.
10. Mikkelsen, B. (2005). *Methods for Development Work and Research-A New Guide for practitioners,* New Delhi: Sage.
11. Sarantakos, S. (2005). Social Research, New York: Palgrave Macmillan.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**
CO 1	H	M	M	
CO 2		H		
CO 3				H
CO 4			H	
CO 5		H		
CO 6		M	H	M

PCCP0023 COGNITIVE PSYCHOLOGY

(4 Credits-60 Hours)

Course Outcomes

1. Define the basic concepts of cognitive psychology, identify major theoretical foundations and recognize the historical background of cognitive psychology. (Remembering)
2. To understand the relationship between mind, brain and behaviour. (Understanding)
3. To analyse the scope and application of cognitive psychology. (Analysing)
4. To use measures of cognitive psychology in research and practice. (Applying)
5. To evaluate different cognitive methods, tools and their appropriate applicability. (Evaluation)CO6 To develop an understanding of the scope and application of cognitive psychology. (Creating)

Module I: Introduction to Cognitive Psychology (10 Hours)
Definition, history of cognitive psychology and emergence of cognitive science, current trends.
The Brain and Cognition: Basic neuroanatomical principles, modern techniques for exploring cognition (EEG, fMRI, PET), cognitive experiments, Emotional Intelligence, Artificial Intelligence.

Module II: Memory Processes (15 Hours)
Sensory Memory, Short Term and Long-Term Memory- types, coding and retrieval;Working Memory: Nature, Theories,

Educational Applications.

Semantic and Episodic Memory: Semantic vs Episodic Memory; Level of Processing and Hierarchical Network model.
Prospective Memory: Types and Common Failures of Prospective Memory in Everyday life. Forgetting: Incidental and Motivated

Forgetting.

Module III: Attention & Perception (20 Hours)
Basic Concepts of Attention: Divided Attention, Selective Attention, Visual Attention and Auditory Attention. Bottleneck and Capacity theories, Automatic and Controlled Processing, Brain and Attention.
Modularity of Perception: Visual Perception (Form and Pattern), Space Perception and Cognition, Auditory Perception, Multimodal Perception, Synesthesia, Perception and Action.
Subliminal Perception; Gestalt Approach of Perceptual Organisation, Time Perception: Fourth Dimension, Pattern Recognition: Bottom Up and Top-Down Approach, Perceptual Learning, Depth Perception.

Module IV: Thinking, Problem Solving and Decision Making (15 Hours)
Types of thinking, Components of thinking: images, concepts, Creativity.Decision Making: Complex, Uncertain Decision Making; Human Problem Solving: Strategies and Heuristics.

Suggested Readings

1. Galotti, K.M. (2013). Cognitive Psychology In and Out of the Laboratory (5th ed.). Sage Publications Inc.
2. Kellogg, R.T. (2007). Fundamentals of Cognitive Psychology. Sage Publication.
3. Matlin, M. W. (2006). Cognition. John Wiley & Sons, Inc.
4. Riegler, G.L.R. (2008). Cognitive Psychology: Applying the Science of the Mind. Pearson Education.
5. Jahnke, J.C., & Nowaczyk, R.H. (1998). Cognitive Psychology. Prentice Hall.
6. Matlin, M. W. (1995). Cognition. Prism Book.
7. Reed, K.S. (2000). Cognition: Theory and Applications. Wadsworth.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	H
CO 2	H	H	M	M
CO 3	H		M	M
CO 4	M	H	H	
CO 5	M	M	M	
CO 6	H			M

PCGP0024: GENERAL PSYCHOLOGY

(3 credits – 45 hours)

Course/Learning Outcomes
1. Define psychology, name the different fields of psychology, list the different areas in which psychology is applicable. (Remembering)
2. Understand how the visual and auditory systems work. (Understanding)
3. Apply the theories of learning to modify behavior and application of different strategies for memory improvement. (Applying)
4. Analyse the strengths and weaknesses of the important theories of psychology. (Analysing)
5. Evaluate the contribution of psychology in different fields. (Evaluating)
6. Create a basic idea of personality and the important theories of personality. (Creating)

Module I: Introduction to Psychology (6 hours)
Introduction - Definition, nature, history, scope, purpose, and sub-fields of psychology Applications of psychology - stress and stress management, coping, well-being, resilience

Module II: Biological Basis of Behavior (10 hours)
Nervous System: Neuron and its structure, types of nervous system,Endocrine system: Hormones and their functioning Sensory systems: Structure and function of eye and ear.

Module III: Cognitive Processes (11 hours)
Learning: Classical Conditioning, Operant Conditioning, Latent, Insight, Observational learning.
Memory: Models of memory - Atkinson & Shiffrin, and Craik and Lockhart, Mnemonics, Forgetting - decay and interference
Intelligence: Spearman's, Sternberg's, and Gardner's theories of intelligence

Module IV: Conative and Affective Processes (10 hours)
Emotion: Definition and theories of emotions (James-Lange, Cannon-Bard and Schachter-Singer).
Motivation: Motivational Cycle, types of motives (sociogenic and psychogenic), theories of motivation (Content theories: Maslow, and Herzberg's 2 factor theory; Process theories: Bandura's self-efficacy theory, and Vroom's expectancy theory).

Module V: Theories of Personality (8 hours)
Trait & Type approaches, Psychoanalytic, Neo-Freudian (Jung, Adler), Existential (Frankl), and Humanistic theories (Rogers).

Suggested Readings:

1. Baron, R. A. & Misra, G. (2014). *Psychology (5th ed.,),* New Delhi: Pearson Education.
2. Ciccarelli, S. K., White, J. N., and Misra, G. (2018). *Psychology*, New Delhi: Pearson Education.
3. Morgan, C. T., King, R. A., Weisz, J. R., and Schopler, J. (2017). *Introduction to Psychology (7th ed.,)*. New Delhi: Tata McGraw-Hill.
4. Nolen-Hoeksema, S., Fredrickson, B. L., Loftus, G. R. and Lutz, C. (2015). *Atkinson and Hilgard's Introduction to Psychology (16th ed.,)*. New York: Harcourt Brace Jovanovich.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**	**Module V**
CO 1	H				
CO 2		H			
CO 3			H		
CO 4		H	H	H	H
CO 5	H				
CO 6					H

PCCM0025: CONCEPTS OF MENTAL HEALTH AND ILLNESS-II

(4 Credits – 60 Hours)

Course Outcomes

1. Define mental illnesses. (Remembering)
2. Classify and categorise developmental disorders, schizophrenia, personality disorders, substance related disorders,eating disorders and neurocognitive disorders. (Understanding)
3. Apply diagnostic criteria categorise developmental disorders, schizophrenia, personality disorders, substance related disorders, eating disorders and neurocognitive disorders to diagnose individuals with mental illnesses. (Applying)
4. Analyse the distinction between normality and abnormality. Distinguish clinical features of different mental illnesses. (Analysing)
5. Explain the causal factors of mental health and illnesses. (Evaluating)
6. Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Module I: Introduction (10 hours)
Causal Factors of abnormal behavior: Causes and Risk Factors for Abnormal BehaviorClinical Assessments and diagnosis and treatment

Module II: Developmental Disorders (Symptoms, etiology and treatment) (15 hours)
Intellectual Disability
Autism Spectrum DisordersADHD
Learning Disabilities

Module III: Major Psychological Disorders (Symptoms, etiology and treatment) (15 hours)
Schizophrenia Spectrum Disorders
Personality Disorders

Module IV: Substance related and eating disorders (Symptoms, etiology and treatment) (10 hours)
Substance Related Disorders
Eating Disorders

Module V: Neurocognitive and Sexual Disorders (Symptoms, etiology and treatment) (10 hours)
Delirium
Dementia
Sexual dysfunctions

Suggested Readings:

1. Barlow D.H. and Durand V.M. (2005). Abnormal Psychology: An Integrated Approach (4th Ed.).Wadsworth: New York. Bennett,P. (2006). Abnormal and Clinical Psychology: An introductory textbook. New York: Open University Press.
2. Carson, R.C., Butcher,J.N.,Mineka,S.& Hooley,J.M. (2008). Abnormal Psychology. New Delhi: Pearson.
3. Kearney, C. A. & Trull, T. J. (2012). Abnormal Psychology and Life: A dimensional approach. New Delhi : Cengage

learning.
4. Kring,A.M.,Johnson,S.L.,Davison G.C. & Neale J.M. (2010). Abnormal Psychology (11th Ed.).NY: John Wiley
5. Diagnostic and Statistical Manual of Mental Disorders (DSM- IV TR), 2000 American Psychiatric Association.
6. Robert C.Carson, James N. Butcher, Susan Mineka, Jill M. Hooley, Abnormal Psychology, Pearson 13th edition.
7. Sarason, Irwin G. a. Sarason Barbara R. Abnormal Psychology. The Problem of Maladaptive Behaviour. New Delhi: PHI Learning Private Limited, 11th Edition, (2009).
8. Ahuja, Niraj, A Short Textbook of Psychiatry,New Delhi: Jaypee, 6th Edition, (2006).
9. Antony, John D., Mental disorders, Encountered in Counselling, A Textbook of clinicalPsychology Based on DSM IV, Dindigul: Anugraha Publications, (2006).
10. Chaube, S.P., Developmental Psychology, New Delhi: Neelkamal, (2007).
11. Gilbert, Paul, Psychotherapy and Counselling for Depression, Los Angeles: Sage, 3rd Edition (2007).
12. Humphrey, Geraldine M. A. Zimpfer David G. Counselling for Grief and bereavement. 2nd Edition. Los Angeles: Sage, (2008).
13. Korchin, Sheldon, J., Modern Clinical Psychology, Principles of Intervention in the Clinic and Community. New Delhi:CBS Publishers and Distributors, (1986).
14. Kumar Updesh and Mandal Manas K. (Eds)., Suicidal Behaviour, Assessment of People-at- Risk. Los Angeles: Sage, (2010).
15. Patel, Vikram. Where There is No Psychiatrist. A mental health care manual. Glasgow: Gaskell, (2003).
16. Patel, Vikram A. Thara. R. (Eds.). Meeting The Mental Health Needs of Developing Countries. NGO Innovations inIndia. New Delhi: Sage, (2003).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	M	M		
CO 3		H	H	H	H
CO 4			H	H	
CO 5		H	H	H	H
CO 6	H				H

PCBP0026: BIO-PSYCHOLOGY

(3 Credits- 45 hours)

COURSE OUTCOMES

At the end of this course students will be able to:

1. Identifying biological bases of behavior. (Remembering)
2. Associating the role of the nervous system with behavior and emotions. (Understanding)
3. Examining the impact of bio chemicals in behavior and mental health at a conceptual level. (Applying)
4. Mapping the biological markers of individual difference. (Analyzing)
5. Reflecting on genetic and chromosomal bases of psychopathology. (Evaluating)
6. Develop conclusions on biological assessment of behavior. (Creating)

Module I: Introduction to Bio-psychology (7 hours)

History and scope; Major theoretical perspectives: Rene Descarte, Phinaes Gage, Charles Darwin. Nature versus Nurture controversy; Sub disciplines and allied fields; Methods in Bio Psychology.

Module II: Neurons and Genetic bases of behavior (10 hours)

Structure of neuron; Nerve impulse and Synaptic transmission; Neurotransmitters; Types of neuron.
Genetic bases of behavior: Structure of a gene, DNA and Chromosomes, Types and Functions of Genes, Genotype and Phenotype.

Module III: Nervous System (10 hours)

Central Nervous System: Brain and Spinal Cord.
Peripheral Nervous system: Division; Role of nervous system in controlling behavior.

Module III: The Endocrine System and behavior (10 hours)

Endocrine glands; Hormones; Role of endocrine system on emotions and behavior.

Module IV: Neuropsychological diseases (8 hrs)

Parkinson's disease, Huntington's disease, Alzheimer's disease, Chromosomal anomalies.

Suggested Readings:

1. Carlson, N. R. (2012). Foundations of physiological psychology. (Sixth Edition). Delhi: Pearson Education.
2. Passer, M.W. and Smith,R.E.(2010).Psychology:TheScienceofMindandBehaviour.NewDelhi: Tata McGraw-Hill
3. Breedlove, S. M., Rosenzweig, M. R., & Watson, N. V. (2007) Biological Psychology: An introduction to behavioral, cognitive, and clinical neuroscience, 5th Edition. Sinauer Associates, Inc., Sunderland, Massachusetts.
4. Green, S. (1995). Principles of biopsychology. UK: Lawrence Erlbaum Associates Ltd.
5. Pinel, J. P. J. (2011). Biopsychology, 8th Edition. Pearson Education, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	
CO 2		H	M	
CO 3		H	H	M
CO 4	H	M	H	H
CO 5	H			H
CO 6	H		M	

PCPT0027: PSYCHOLOGICAL TESTING

(4 Credits - 60 hours)

Course Outcomes

1. Define the basic concepts of psychological testing. (Remembering)
2. Classify the group and individual techniques of psychological testing. (Understanding)
3. Make use of different statistical concepts in data analysis. (Applying)
4. Examine the results of the statistical data analysis. (Analysing)
5. Recommend the suitable tool for data collection/interview in applied settings. (Evaluating)
6. Test the psychometric properties of a tool and develop a psychological tool using appropriate norms of toolconstruction. (Creating)

Module I: Introduction to Psychological Testing (9 hours)

History of Psychological Testing; Definition and Purpose and relevance of Psychological testing, Types of tests, Principles, Applications and Issues, Ethical and Social Considerations in Testing

Module II: Test Construction (15 hours)

Steps in test construction, Item Writing: types of items, General guidelines for item writing, Characteristics of a good psychological test:Objectivity, Standardization, Reliability:Meaning,Types of Reliability and Factor influencing Reliability. Validity: Meaning,Type of validity and Factors influencing validity. Norms: Norm referenced and criterion referenced tests, Types of Norms and Test Scales.

Module III: Assessment of Cognitive Abilities (13 hours)

Measurement of Intelligence:Types of Intelligence tests, Individual intelligence tests, Other broad range intelligence tests, Group intelligence tests, Psychological issues in intelligence testing Longitudinal studies, Problems in cross cultural testing

Module IV: Assessment of Personality (13 hours)

Measurement of Personality: Meaning and Purpose,Tools of Personality Assessment, Measurement of Interests, Values and Attitudes,Projective Techniques:Meaning and Types of Projective Techniques, Classification and Evaluation of Projective Techniques

Module V: Assessment of Aptitude and Achievement (10 hours)

Aptitude and Achievement:Distinction between Aptitude and Achievement Tests, Types of Aptitude tests, Types and selection of standardized Achievement Tests, Achievement test batteries.

Suggested Readings

1. Anastasi, A. and Urbina, S.Psychological testing. N.D.: Pearson Education (1997)..
2. Kaplan, R.M. and Saccuzzo, D.P.Psychological Testing: Principles, Applications, and Issues. Australia: Thomson Wadsworth (2007).
3. Gregory, R.J.Psychological testing: History, principles and applications. New Delhi: Pearson Education (2005).
4. Singh, A.K.Tests, Measurements and Research Methods in Behavioural Sciences. Patna: BharatiAiken, L.R., and Groth Marnat, G. (2006). Psychological Testing and Assessment. Boston, MA: Pearson (12th ed.) (2006).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5

CO 1	H	H			
CO 2			H	M	H
CO 3		H			
CO 4		H			
CO 5		M	H	H	H
CO 6	M	H			

PCHT0028: HEALTH PSYCHOLOGY

(3 Credits 45 hours)

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

1. Define the basic terms related to the field of health psychology. (Remembering)CO2 Learn the approaches to changes in health behavior(Understanding)
2. ake use of psychological research methods, theories, and principles to enhance biopsychosocial approaches forhealth promotion and illness prevention. (Applying)
3. Examine the stressors and its impact on the etiology and course of many health related problems. (Analyzing)
4. Estimate the management of various health related disorders. (Evaluating)
5. Devise policies of health care delivery system beneficial to the public. (Creating)
6. Develop awareness about the stressful impact of disabling/life-threatening illness on the patient and their familymembers as well as the health care providers. (Creating)

Module I: Introduction to Health Psychology (10 Hours)

Definition and emergence of health psychology. Need for health psychology. Research in health psychology: Experiments, Correlational Studies, Prospective and Retrospective Designs, Role of Epidemiology

Module II: Models of Health Behavior (8 Hours)

Health Belief Model, Cognitive Behavioral Approaches, Transtheoretical Model of Behavior Change

Module III: Health conditions and its Psychological Management (15 Hours)

Post Traumatic Stress Disorder, Cancer, COVID-19, Pain

Module IV: Heath Care Services (12 Hours)

Health Care Delivery System: Developing vs. Developed nations. Patient-Provider Communication and Patient in Hospital Setting: Adults, children and children with special needs. CAM treatment (Prayer, Meditation, Guided Imagery) and Placebo Effect. Wellbeing of healthcare providers.

Suggested Readings

1. Taylor, S. E. Health Psychology (8th Edition). New York: McGraw Hill. (2012).
2. Ghosh, M. Health Psychology-Concepts in Health and Well-being. New Delhi: Dorling Kindersley (India) Pvt. Ltd. (2015).
3. Khatoon, N. Health Psychology. New Delhi: Dorling Kindersley (India) Pvt. Ltd. (2012).
4. Taylor, S. E., & Sirois, F. M. Health psychology. Toronto: McGraw-Hill Ryerson. (2012).
5. Baum, A., Revenson, T. A., & Singer, J. E. (Eds.). Handbook of health psychology. Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers. (2001).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3	H			
CO 4			H	
CO 5				H
CO 6				M
CO 7				H

PCFP0029: FOUNDATIONS OF COUNSELLING PSYCHOLOGY

(4 Credits, 60 Hours)

Course Outcomes

1. Define the basic concepts of counselling psychology, identify major theoretical foundations and recognize thehistorical background of counselling psychology. (Remembering)
2. To understand the professional therapist-client relationship in a therapeutic setting. (Understanding)
3. To analyse the scope and application of counselling psychology. (Analysing)
4. To use the therapeutic skills of counselling psychology in practice. (Applying)
5. To evaluate different counselling models, therapeutic skills and their appropriate applicability. (Evaluation)
6. To develop an understanding of counselling skills, therapies and ethical guidelines of counselling practice. (Creating)

Module I: Introduction (10 Hours)
Meaning, Definition & Goals, Historical Background, Mental health development & the guidance movement, Difference between Counselling and other associated helping professions (psychotherapy, psychiatry, social work, guidance), Modern Trends in Counselling.

Module II: Counselling Process (10 Hours)
Settings for counselling, Steps in counselling, Therapeutic relationship: The importance of relationship, components of relationship, Facilitative conditions for the counselling relationship.

Module III: Counselling Approaches & Therapeutic Techniques (25 Hours)
Psychodynamic Approach: Psychoanalytic, Adlerian approach. Humanistic Approach: Existential, Client-Centered, Gestalt Therapy. Behavioural Approach: Operant-Conditioning, Classical-Conditioning.Cognitive Approach: Cognitive Therapy, Rational emotive therapy.
Other Approaches: Narrative Therapy, Expressive Therapy, and Biofeedback.

Module IV: Counselling Practice (15 Hours)
Ethical Issues: Professional Codes, Divided loyalties, Areas of ethnical difficulty, Legal considerations. Conception of a professional Counsellor, Academic preparation, practical skills.
Special Areas in Counselling: Family group consultation – Counselling with families, children as well as parents, Adoption, Marriage & Pre-marital Counselling.
Counselling diverse population: Gender, counselling for geriatric clients, the ethnic minorities, and the physically challenged.

Suggested Readings
1. Ladany, N. & Inman, A. (2008) Handbook of Counseling Psychology, (4th ed.). John Wiley & Sons.
2. Warters, J. (1964): Techniques of Counselling, (2nd ed.), MacGraw Hill Book Company.
3. Steffler, B. (Ed.) (1965): Theories of Counselling, New York: MacGraw Hill Book Company.
4. Alam, Shah (2012). Modern Concept of Guidance & Counseling. Gyananda Prakashan.
5. Bordin, E. S. (1985): Psychological Counselling. Appleton Century Crofts, Inc.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		H	
CO 2		M		H
CO 3	H	H	M	M
CO 4			H	M
CO 5			H	M
CO 6			H	H

PCCY0030: CHILD AND YOUTH COUNSELLING

(4 Credits- 60 hours)

Course/Learning Outcomes
1. Define the basic concepts and goals of child counseling (Remembering)
2. Understand the specific issues faced by children and youth, especially pertaining to education, and career. (Understanding)
3. Apply the skills and techniques of counselling in child and youth-counselor relationship (Applying)
4. Compare and contrast among the major learning styles models and theories in counseling (Analyzing)
5. Appraise the significance of the child-counsellor relationship, and major theories in the counseling process.(Evaluating)
6. Build on the traditional views of learning styles models and improve counselling skills. (Creating)

Module I: Introduction (12 hours)
Definitions and goals of counseling for children and youth; Children and Youth-counsellor relationship, attributes of a counsellor, historical background and contemporary ideas about counselling

Module II: Academic Development (12 hours)
Learning-styles: VAK Model, Kolb's Experiential Model, MBTI Pattern, Honey and Mumford Model, Hemispheric Dominance Model, Gregorc Model, Gardner's Multiple Intelligence Model.
Study skills: reading, writing and note-making skills, studying skills and study habits, time management
Cognitive issues: causes and factors affecting attention, concentration, remembering, forgetting, experimental evidences and cognitive training

Module III: Major Theories in Counselling Children (14 hours)
Learning, Behavioural, Cognitive Behavioural Modification, Expressive therapy (play, art and drawing, drama, metaphor, storytelling)

Module IV: Counselling Children with specific problem (12 Hours)
Children and trauma: child abuse (physical, sexual, emotional), HIV/ AIDS, specific issues in educational settingsTechniques of assessment: Cumulative record, Anecdotal Record, Case Study, Sociometry

Module V: Career Counselling (10 hours)
Basic aspects: Nature, scope and importance of career counselling, role of counselor in career preparation, career decision making, career exploration techniques
Career development theories: Holland, Ginzberg, and Super
Career counselling with diverse population: children, adolescents, college students, women and adults.

Suggested Readings

1. Asch, M. (2000). *Principles of guidance and counselling* (1 ed.). New Delhi: Sarup and Sons.
2. Bowe Frank, G. (2000). *Birth to Five – early Childhood special education*, New York, Delmar Publishers Inc.
3. Butler, G., and Hope, T. (1997). Managing your mind: The mental fitness guide. Oxford University Press.
4. Cohen, L. G., and Spenciner, L. J., (2003). Assessment of Children and Youth with Special Needs. Boston: Allyn and Bacon.
5. Mangal S. K. (2008). Essentials of Educational Psychology, New Delhi, Prentice Hall of India Pvt ltd.
6. Santrock, J.W. (2003). *Educational Psychology*. Boston: McGraw-Hill.
7. Woolfolk, A. (2007). *Educational psychology (10th ed*.). Boston, MA: Allyn and Bacon.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**	**Module IV**	**Module V**
CO 1	H				
CO 2	M			H	
CO 3					H
CO 4		H			
CO 5			H		
CO 6	M	H	M		M

PCDR0031: DISABILITY STUDIES AND REHABILITATION PSYCHOLOGY

(4 Credits - 60 hours)

COURSE OUTCOMES
1. Define the concept of rehabilitation and list the methods of assessment and interventions for various disabilities (Remembering)
2. Illustrate the scope of rehabilitation psychology (Understanding)
3. Plan assessments and interventions for various learning, intellectual and physical disabilities and apply the models of rehabilitation in practice (Applying)
4. Analyse the general functions of rehabilitation psychology (Analysing)
5. Compare and conclude on the prevention and early intervention for various disability (Evaluating)
6. Modify the flaws in the successful implementation of various acts related to disability (Creating)

Module I: Introduction (15 hours)
Definition and models of disability. Definition and functions of rehabilitation (general and specific functions). Historical background of Rehabilitation Psychology. Behavioral problems and adaptive behavior

Module II: Cognitive and Academic disability (18 hours)
Intellectual Disability: review of terminology, diagnostic criteria, causes, prevalence, prevention, assessments, intervention and rehabilitation.
Learning disabilities: diagnostic criteria, types, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Autism Spectrum Disorder: diagnostic criteria, types, causes, prevalence, prevention, assessments, intervention and rehabilitation.
Psychotic disorders: diagnostic criteria, types, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Module III: Physical Disability (15 hours)
Hearing impairment: types, causes, prevalence, prevention, assessments, intervention and rehabilitation. Visual impairment: types, causes, prevalence, prevention, assessments, intervention and rehabilitation. Orthopaedic impairment: types, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Module IV: Legal issues (12 hours)
The Mental Health Act, 2017: historical background and challenges. RPWD Act, 2016: historical background and challenges. RCI Act, 1992 : historical background and challenges. National Trust Act, 1999: historical background and challenges. Issues of certification

Suggested Readings

1. Tom Meehan Chris Lloyd, Robert King,, Handbook of Psychological Rehabilitation, Blackwell Publisher (2007)
2. Sonnenmeier. R, Mirenda. P,Autism spectrum Disorder and AAC (2008)
3. The professional Practice of rehabilitation counselling, Springer Publication company, 2011
4. Jeanne. B. Patterson,Foundations Of Rehabilitation Counselling with Person who are blind or visually impaired,American foundation for the blind, U.S (1997)
5. James K. Luiselli, Dennis C. Russo, Walter P. Christian, Effective Practice for children with Autism: Educational and Behavioural support Intervention that work (2008)
6. KimEtheringon, rehabilitation counselling in physical and mental health, Jessica Kingsley publication
7. David. R. Cox, Speciality Competencies in Rehabilitation Psychology (2002)
8. T. F. Rigger, Handbook of Rehabilitation Psychology.
9. Jules M. Rothstein, Serge H. Roy, Steven L. Wolf, The rehabilitation specialist 's Handbook (2005).
10. Chaturvedi, T.N. Administration for the Disabled: Policy and Organisational Issues. New Delhi : I.I.P.A (1981).
11. Mani, R.D. The Physically Handicapped in India Policy and Programme New Delhi: Ashish Publishing (1988).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	H	
CO 3	M			
CO 4			M	
CO 5				
CO 6				H

PCAT0032 ADDICTION AND TRAUMA COUNSELLING

(3 Credits- 45hours)

COURSE OUTCOMES
1. Define substance related disorders according to the classification of DSM 5/ICD-10. (Remembering)
2. Compare and contrast different psychological interventions for addiction related psychological disorders.(Understanding)
3. Categorize the sources of trauma and trauma intervention. (Analysing)
4. Apply psychological interventions and techniques on trauma victims. (Applying)
5. To evaluate the effectiveness of Psychodynamic approach, CBT, MET, Group intervention in dealing with substance addiction. (Evaluating)
6. Create need based and behavioral management plan for patients with addiction and trauma survivors. (Creating)

Module I: Addiction Counselling (8 hours)
Definition, DSM-V diagnostic category – classification of drugs of abuse, stages of addiction

Module II: Treatment Methodology (15 hours)
Psychodynamic approaches, cognitive-behavioural therapies, motivational enhancement therapy. Problem-oriented treatment, solution-focused treatment, group therapy, family therapy and community based interventions.

Module III: Psychological Trauma (12 hours)
Introduction to Trauma: Definition, types of trauma, historical context of trauma, theoretical contexts of trauma counselling. Ethical perspective on trauma work, trauma and supervision.

Module IV: Trauma Intervention (10 hours)

Assessment in psychological trauma: Methods and intervention, models for trauma intervention, strategies and techniques for counselling survivor of trauma.

Suggested Readings

1. Rasmussen, S. (2000). Addiction treatment: Theory and Practice. London: Sage.2) DSM-V (2013)
2. Wright, H. N. (2003). *The new guide to crisis and trauma counseling*. Gospel Light Publications.
3. Levers, L. L. (2012). *Trauma counseling: Theories and interventions*. Springer Publishing Company.
4. Trauma counselling - Theories and Interventions,LopezLevers, Lisa
5. Spiers, T. (Ed.). (2018). *Trauma: a practitioner's guide to counselling*. Routledge.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	M	H
CO 3			H	H
CO 4			M	H
CO 5		H		
CO 6		H		H

PCMF0033: MARRIAGE AND FAMILY COUNSELLING

(4 Credits – 60 hours)

Course Outcomes

1. Define the basic concepts of marriage and counselling. (Remembering)
2. Classify different developmental and emotional issues in different family life stages. (Understanding)
3. Identify the classical schools of marriage and family counselling. (Applying)
4. Analyse the Bowen's intergenerational approach. (Analysing)
5. Explain different therapeutic approaches of marriage and family counselling. (Evaluating)
6. Discuss the processes of counselling couples with special issues/problems. (Creating)

Module I: Introduction (10 lectures)

Historical evolution of Family and Marriage therapy; Goals of Family therapy; current trends in Family therapy; Fundamental concepts in Family therapy(Cybernetics and Systems theory, Social Constructivism) Stages of marriage, Divorce and remarriage, Marriage and Divorce: Role of Family Courts.

Module II: Family Across a Lifespan (16 lectures)

The family life cycle, stages of family life cycle. Key developmental and emotional issues in different stages: Young adulthood. Newly married, Child bearing, Families with preschool children, Families with school age children. Families with teenage children, Launching stage, Middle aged adult, Retirement

Module III: Classical Schools (12 lectures)

Bowen's Intergenerational Approach; Structural Family Therapy; Strategic Family Therapy; Experiential and Humanistic Family Therapies; Psychoanalytic and Cognitive Behavioural Family therapy.

Module IV: Recent Developments (12 lectures)

Postmodernism, Feminist and contextual work, Solution focused therapy, Narrative therapy, Integrative models. Application and evaluation of Family therapy. Skill development: Genograms. The stages of Family therapy: Planning; Assessment; Disengaging or recontracting.

Module V: Counselling Couples with Special Issues (10 lectures)

Treating sexual abuse and physical abuse issues in family; Counselling of alcoholics and drug-addicts; Counselling the terminally ill and patients with HIV/AIDS.

Data Communications and Networking, 4th Edition, Behrouz A Forouzan, 2007, TMH

Suggested Readings

1. Family Therapy – concepts and methods,7th edition, Nichols, P.M and Schwartz C.R. Allyn and Bacon, Boston,2006, Pearson education, Inc.Press,Inc .
2. Family Therapy: History, Theory, and Practice, 4th Edition, Gladding, S.T. , 2006,Pearson/Merrill Prentice Hall.
3. Essential Skills in Family Counselling, JoEllen Paterson, et al. 2009, New York, New York, Guilford Press.
4. Mastering Competencies in Family Therapy: A Practical Approach to Theory and Clinical Case Documentation ,3rd Edition, Gehart,D.R., 2018,Cengage Unlimited.
5. Transformational Systemic Therapy, 4th Edition, Satir.V. Satir, 2008, Science and Behaviour Books .

6. Patterns of Brief Family Therapy: An Ecosystemic Approach, 5th Edition, Steve de Shazer., 1982, GuilfordPublications.
7. Transformational Systemic Therapy, Satir.V. Satir, 2008, Science and Behaviour Books.
8. The Family Crucible: The Intense Experience of Family Therapy, Napier, A.Y and Whitaker, C. , 1988,

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M				
CO 2		H			
CO 3			M	H	
CO 4					
CO 5	M				H
CO 6		H			

PCFC0034 FOUNDATION OF CLINICAL PSYCHOLOGY

(4 Credits-60 hrs.)

Course Outcomes

1. Definition of clinical psychology, acquire knowledge and understanding the philosophical roots and historical events that have shaped the field of clinical psychology (Remembering)
2. Explore the underlying philosophical assumptions, individual contributors, and various forces that served to shape the emerging field of clinical psychology (Understanding)
3. Demonstrate familiarity with scientific, ethical, legal, and practice-oriented issues in the field (Applying)
4. Acquire a basic understanding of western (and, to an extent, Indian) philosophical thought, to articulate a philosophyof their own, and apply that philosophy to their professional work in field of clinical Psychology (Applying)
5. Think critically about the science of psychology, analyse psychological theory, research, and practice in a historicalcontext, and develop ideas, critiques, and conclusions of their own (Analysis)
6. Adapt and develop a basic understanding about assessment and interventions in the context of clinical psychology (Creating)

Module-I- (12 hours) Basic Introduction to Clinical Psychology

Definition, Historical background: Early & Recent history; Nature and scope of the discipline: Theory and research; Developing a professional identity: Education & training, professional activities, ethical issues and employment settings.

Module – II (12 hours) Major theoretical models in clinical psychology

The role of theory; and theoretical models; Psychodynamic; Cognitive-Behavioural; Humanistic; Family systems.

Module- III (18 hours) Diagnostic Techniques

Nature and purpose of clinical interview, mental status examination; Observing behaviour, clinical judgement; communication strategies, diagnosis and assessment, Behavioural assessment, Psychological Assessment: Cognitive and Personality Assessment and case study

Module- IV (18 hours) Competencies in Clinical Psychology

The core competencies: Assessments, Evaluation, Formulation, Intervention, Communication/consultation, and service delivery, Therapeutic Models (Behavioural approaches, cognitive therapy and cognitive-behaviour therapy, Psychodynamic therapy, Systemic and group approaches, Eclectic and integrative approaches)

Suggested Readings

1. Hecker, J. E., & Thorpe, G. L. (2011). Introduction to Clinical psychology: Science,
2. practice, and ethics, 4th ed. India: Dorling Kindsley.
3. Korchin, J. S.( ). Modern clinical psychology: Principles of intervention in the clinic
4. and community. CBS Publishing
5. Pomerants, A. M. (2008). Clinical Psychology: Science, practice and culture. New Delhi: Sage publication
6. Gregory, R. J. (2000). Psychological testing: History, principles, and applications (3rd Ed.). Boston: Allyn & Bacon.
7. Wolman, B.B. (1965). Handbook of clinical psychology. N.Y: McGraw Hill INC
8. Groth-Marnat, G. (1999). Handbook of psychological assessment, 3rded. New York: John Wiley & Sons, Inc.

Course outcomes (COs) Mapping

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2	M	H	M	M
CO 3	M		H	

CO 4	M	H	H	
CO 5		H	M	H
CO 6	M	H	H	H

PCPG0035: PSYCHODIAGNOSTICS

(4 Credits: 60 hours)

COURSE OUTCOMES

1. Define the concept of assessment (Remembering)
2. Gather the significance and scope of psychological assessment in diagnosis and intervention (Understanding)
3. Apply various approaches of assessment in practice (Applying)
4. Estimate the appropriate assessments for different population as per the diagnoses. (Analysing)
5. Assess the socio-cultural factors in various assessments aiding in the diagnoses. (Evaluating)
6. Design psychopathology formulation which will impede the process of effective therapeutic sessions. (Creating)

Module I: Introduction to psychological assessment (15 hours)

Traditional approaches to assessment. Stages in psychological assessment. DSM 5 and ICD-10: Similarities and differences. Screening and Diagnostic tools

Module II: Clinical Interviewing (15 hours)

Types of Clinical Interview. Rapport formation and communication strategies. Diagnostic Interviewing. Interviewing with children and cultural issues

Module III: Intellectual and Neuropsychological assessment (15 hours)

Theories of intelligence, issues and controversies. Tests batteries: WAIS, WISC, MISIC, BKT. Approaches to neuropsychological assessment. Test batteries: Halstead-Reitan, Luria-Nebraska, PGI-BBD, AIIMS Comprehensive Neuropsychological Battery

Module IV: Behavioral and Personality Assessment (15 hours)

Development of Behavioral Assessment. Functional Analysis and other methods of behavioral assessments (Questionnaires, Self-monitoring, Analogue techniques etc.). Objective methods of personality assessments: MMPI-2, MCMI-III, EPQ-R. Projective methods of personality assessments: Rorschach, TAT, Projective drawings

Suggested Readings

1. Hecker,J.E., & Thorpe,G.L. (2005). Introduction to clinical psychology: Science, practice, and ethics (Low Price Edition). Delhi: Pearson Education.
2. Pomerantz, A.M. (2008). Clinical Psychology: Science, practice, and culture. Sage Publications: New Delhi
3. Trull,T.J., & Phares,E.J. (2001). Clinical psychology: Concepts, methods, and profession (6th ed.). Belmont,CA: Wadsworth/Thomson
4. Arun Kumar, (ed.), Clinical Psychology, Anmol Publication Pvt. Ltd., 2000.
5. Freedman, A.M., Kaplan, H.I. and Sadock, B.J., Comprehensive Text Book of Psychiatry (IIIrd Edition) Vol. 1.2. William and wilkins, Batrmore, London, 1989.
6. Anastasi, A., & Urbina, S. (2005). Psychological Testing. 7th ed. Pearson Education: New Delhi, India.
7. Barlow, D.H. & Durand, V.M. (2005). Abnormal psychology: An Integrative Approach (4th ed.). Wadsworth/Thompsons. Belmont CA.
8. Butcher J.N; Mineka Susan; and Hooley Jill M. (2014) Abnormal Psychology (15th Ed.) Dorling Kindersley Pvt. Ltd. of Pearson Education. New Delhi, India.
9. Sundberg, N.D., Winebarger, A.A.& Taplin, J.R. (2002). Clinical psychology: Evolving theory, practice and research. Prentice-Hall. New Jersey.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2			H	
CO 3			H	
CO 4		H		H
CO 5		H		
CO 6		H		H

PCRP0036 FORENSIC PSYCHOLOGY

(3 credits – 45hours)

Course Outcomes

1. Define forensic psychology and the role of a Forensic Psychologist. (Remembering)
2. Illustrate on the nature of crime. (Understanding)
3. Examine the social, psychological theories of crime. (Analysing)
4. Apply the methods of forensic psychological investigation. (Applying)
5. Explain the concept of Juvenile delinquency, sexual offenders and serial offenders. (Evaluating)
6. Create an idea about the importance of Forensic psychological assessment into practice. (Creating)

Module I: Introduction (11 hours)

Meaning, nature and definition of Forensic Psychology, Historical background, training of a Forensic psychologist, Ethical concerns in Forensic Psychology.

Module II: Theories of crime (12 hours)

Need for scientific understanding of crime, psychoanalytical conceptualization of crime, Eysenck's biosocial theory of crime social learning theory of crime, frustrated induced criminality, Neuropsychological theories of crime

Module III: Juvenile offenders and Sexual offenders (10 hours)

Nature and definition of Juvenile offenders, sexual offenders and serial offenders, Social risk factors, Psychological risk factors, family background, Intelligence and delinquency

Module IV: Forensic Psychological Investigation methods (12 hours)

Methods in Forensic Investigation-Polygraph, Brain electrical Oscillations Signature, Narcoanalysis, Applicability of Rorschach Inkblot Test, MMPI-II, Draw-a-Person Test in forensic settings.

Suggested readings

1. Nagel.Y.K.,Srivastava K.,Gupta A (2014) Handbook of Forensic Psychology. Author house UK ltd 1663 Liberty Drive. Bloomington, IN 47403. USA
2. Horton N.A., Heritage.C.L.(2010). Handbook of forensic Neuropsychology. Springer Publishing company. New York

Mapping of COs to Syllabus

Course Outcomes	Module-1	Module-2	Module-3	Module-4
CO1	H			
CO2	H	H		
CO3	H		H	
CO4			H	
CO5	M			H
CO6				H

PCPC0037: PSYCHOTHERAPY

(4 Credits – 60 hours)

Course Outcomes

1. Define psychotherapy. (Remembering)
2. Classify and categorise major disorders with respect to psychotherapy. (Understanding)
3. Apply psychotherapeutic concepts and constructs to diagnose and intervene individuals with mental illnesses.(Applying)
4. Analyse the distinction among different types of psychotherapy. (Analysing)
5. Evaluate the applicability different types to psychotherapy to mental health and illnesses. (Evaluating)
6. Create a psychotherapeutic intervention plan for patients on the basis of clinical features, diagnosis criteria andtherapist competence. (Creating)

Module I: Introduction (8 hours)

Historical background of psychotherapy; Principles and goals of psychotherapy; Professional training and ethics in clinical practice

Module II: Psychodynamic Psychotherapy (10 hours)

Psychoanalysis: Background and basic principles Psychoanalytic theory since Freud
Psychodynamic psychotherapy in contemporary clinical psychology

Module III: Humanistic, Experiential and Family Therapies (12 hours)

Humanistic psychotherapy
Eclectic treatment combinationsFamily therapy
Group therapy

Module IV: Cognitive Behavioural Interventions (15 hours)
Behaviour therapy techniques
Cognitive modification procedures
Cognitive behaviour therapy: specific applications in various psychological disordersDialectic Behaviour therapy

Module V: Relaxation Therapies (15 hours)
Progressive muscular relaxation
Autogenic training
Biofeedback
Eye Movement desensitization and reprocessing

Suggested Readings:
1. Encyclopaedia of Psychotherepy (2002). Academic Press
2. Beck, J.S (1995). Cognitive therapy: Basic and beyond. New York: Guilford Press.
3. Ellis, A. (1970). The essence of rational psychotherapy: A comprehensive approach to treatment. New York: Institutefor Rational Living.
4. Walen, S.R., Digiuseppe, R., & Dryden, W. (1992). A practitioner's guide to rational emotive therapy. Oxford University Press. Inc.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	M	M		
CO 3		H	H	H	H
CO 4			H	H	
CO 5		H	H	H	H
CO 6	H				H

PCNP0038: NEUROPSYCHOLOGY

(3 Credit-45 hours)

Course outcomes (COs)
1. Define the basic concepts of Neuropsychology and naming different biological systems involved in Neurologicaldisorders. (Remembering)
2. Explain the neuropsychological basis of human behaviour. (Understanding)
3. Identify the difference and relation among brain structures, neurological and endocrine systems. (Applying)
4. Classify the sub-systems of the central nervous system of the brain. (Analysing)
5. Compare different neuropsychological systems causing Neuro-pathology. (Evaluating)
6. Discuss the major theoretical perspective, develop the awareness of the neuropsychological basis of behaviour andcan able to formulate rehabilitation. (Creating)

Module-I: Foundation of neuropsychology (15 hours)
Brief history of Neuropsychology, Role of neuropsychology in clinical practice, Early Hypothesis, Localization theory, integrated theory of brain functions,
Major structures and functions of human Brain: Cerebral cortex, Frontal, temporal, parietal and occipital lobes functions and syndromes, Neuro-transmitters.

Module-II: Brain Damage and Neuroplasticity (12 hours)
Causes of Brain damage, Neuropsychological diseases (Stroke, Tumours, Epilepsy, Dementia, Traumatic Brain injury), Animal models of human neuropsychological diseases, Neuro-plastic responses to nervous system damage: Degeneration, Regeneration, Reorganization, and recovery, Neuroplasticity.

Module-III: Neuropsychological Assessments and Diagnosis (12 hours)
General Considerations in Neuropsychological testing, Rationale of the neuropsychological examination, appropriate referrals for neuropsychological evaluation, Psychometric issues in neuropsychological assessment:

Preliminary screening of neuropsychological functioning: Orientation (Arousal), Sensation and Perception, Attention/Concentration, Motor Skills, Verbal Functions/Language, Visuo-spatial Organization, Memory, Judgment/Problem Solving.

Module-IV: Neuro-Psychological Rehabilitation (6 hours)
Basic concepts and models of Neuropsychological rehabilitation (Cognitive, Behavioural, Emotional and Psychosocial),Challenges

ethics and guidelines of Neuro-psychological rehabilitation.

Suggested Readings:

1. Boller, F. &Grafman, J, (1988) Handbook of neuropsychology. New York: Elsevier.
2. Heilman, K.M. & Valenstein, E. (1993). Clinical Neuropsychology. New York: Oxford University Press.
3. Kolb, B., & Whisaw, I.Q. (1990). Fundamentals of human Neuropsychology. New York: Freeman, W.H
4. Pinel, J.P. (2006). Biopsychology. Pearson Education, Inc.
5. Walsh, K. W. (1978). Neuropsychology: A clinical approach. Churchill Livingstone.
6. Rosenzweig, M. R., Breedlove, S. M., & Leiman, A. L. (2002). Biological psychology: An introduction to behavioral,cognitive, and clinical neuroscience. Sinauer Associates.
7. Lezak, M. D., Howieson, D. B., Loring, D. W., & Fischer, J. S. (2004). Neuropsychological assessment. Oxford University Press, USA.
8. Hersen, M. (2004).Comprehensive Handbook of Psychological Assessment: Intellectual and neuropsychologicalassessment (Vol. 1); Personality assessment (Vol. 2); Behavioral assessment (Vol. 3). NY: Wiley

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	M
CO 2	M	H	H	M
CO 3	H	M	H	H
CO 4	M	H	H	M
CO 5	M	H	M	H
CO 6	H	H		H

PCPG6018 PERSONAL GROWTH I (P/NP)

(2 Credits - Workshop and assignment mode)

Course Outcomes

1. Understand the basic principles of psychology (Remembering)
2. Understand personality traits, values, skills and interests. (Understanding)
3. Gain self-awareness and emotional awareness (Applying)
4. Set specific, achievable short- and long-term goals (Analysing)

Module I: Introduction (15 lectures)

Self esteem, Self awareness, Emotional well being, Self-Motivation

Module II: Introduction (15 lectures)

Critical thinking, Personality development, Communication styles

Suggested Readings

Psychology of Success: Finding Meaning in Work and Life, 5th Edition, Denis Waitley, 2010, McGraw-Hill

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H	M	
CO 3	M	H	H	H
CO 4			H	

PCFA6019: PSYCHOLOGICAL FIRST AID (P/NP)

(2 Credits - Workshop and assignment mode)

Course Outcomes

1. Remember the basic concepts of psychological first aid. (Remembering)
2. Understand the steps of psychological first aid. (Understanding)
3. Gain self-awareness and awareness about emergency care. (Applying)
4. Plan specific, achievable remedial measures (Analysing)

Module I: Introduction (15 lectures)

Definition, Phases, emergency psychological care, mental hygiene.

Module II: Introduction (15 lectures)

Critical thinking, planning emergency psychological intervention.

Suggested Readings

Psychology of Success: Finding Meaning in Work and Life, 5th Edition, Denis Waitley, 2010, McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H	M	
CO 3	M	H	H	H
CO 4			H	

PCRP6020 RESEARCH PROJECT PHASE I (4 Credits)

Course outcomes

1. Knowledge of the major theoretical approaches and findings in psychology. (Remembering)
2. Demonstrate knowledge about the research methods used in psychology,. (Understanding)
3. Apply the knowledge for preparing research design, and data analysis. (Applying)
4. Critically analyse information related to the study of behaviour and mental processes, and use the critical assessmentin forming conclusions and arguments. (Analysing)
5. Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on aset of criteria. (Evaluating)
6. Develop the understanding of how to prepare a research proposal. (Creating)

Every student shall undertake a research project work under the supervision and guidance of a faculty member. The student may choose the topic of research and start the preliminary work by the end of the second semester. The students are expected to complete the Literature Review followed by a Literature Review presentation and the Proposal presentation during the Phase I. Students are expected to complete the data collection before the fourth semester.

In Phase II, students are expected to complete the data collection, data analysis and interpretation, and submission of final report. Submission of final copy of the dissertation will be followed by presentation of the research and viva voce examination.

The thesis is to be submitted to the department before the date notified. The mode and components of evaluation of Phase I and Phase II of the research project and the weightages attached to them shall be published by the Department at the beginning of the semester. There shall be a viva voce examination on the research project.

Mapping of COs to Syllabus

Course Outcomes	RESEARCH PROJECT PHASE I
CO 1	H
CO 2	M
CO 3	H
CO 4	H
CO 5	M
CO 6	H

PCSI6021 SUPERVISED INTERNSHIP I

(4 Credits)

Course outcomes

1. Remembering the personal integrity, accountability, professional deportment and concern for the welfare of others. (Remembering)
2. Understanding of Psychological disorders, empathy, reflective practice, and self-care. (Understanding)
3. Applying scientific, theoretical, contextual approach to the discipline (Applying)
4. Analyse the symptom severity and clinical features of disorders. (Analysing)
5. Determine ethical and Legal guidelines of practice (Evaluating)
6. Develop effective work skills, including cognitive and expressive skills, self-directed learning & continuing education. (Creating)

Module I: Introduction

Analysing the situation: Need of counselling, space for counselling, information to clients, documentation, organizing supervision.

Module II: Internship

Taking in clients: first interview, documentation of the case, definition of counselling goals, building the counselling relationship, process of counselling, using skills of counselling, concluding counselling, documentation of the whole counselling process, evaluation; working in a team–role of counselling, resources and challenges, role in the team, case management: discussion, supervision. Evaluation of the internship will be based on the documentation, reports from the organisation, report of the supervisor and the presentation and the viva voce examination of the student at the end of the period of Internship.

Module III: Phases of Supervised Internship

The Supervised Internship is divided into two phases; Phase I and Phase II. Each of these phases consists of 45days (100 hours) of intensive practical learning programs in counselling setting under trained supervisors. The phases of the internship spread across the 3rd and 4th semester of Masters Degree program. The total credit for the supervised internship is divided equally across the final year semesters of the Master's Degree program.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	H
CO 2	H	H	
CO 3	M	H	H
CO 4		H	H
CO 5	H	M	M
CO 6	M	H	H

PCIP6022 SUMMER INTERNSHIP (Pass/Non-Pass)

Students are required to undergo a summer internship of two weeks' during the semester break between the second and third semesters. It is a P/NP course and shall be recorded in the third semester. The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in class room courses to the "real world" of social service agencies, medical institutions, the criminal justice system, business, and industry. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills. The summer internship enriches the students' academic experience while making a valuable contribution to the community and utilizing the vacation optimally.

Course Outcomes

1. Define the clinical features of psychological disorders. (Remembering)
2. Demonstrate fundamental knowledge and comprehension of the major concepts, theoretical perspectives, historical trends, and empirical findings in psychology. (Understanding)
3. Develop Scientific reasoning and critical thinking, including effective research methodology in solving problemsrelated to behavior and mental processes. (Applying)
4. Analyse ethically and socially responsible behaviors for professional and personal settings, including development ofvalues that build diverse communities. (Analysing)
5. Determine their basic area of interest to work further/specialize in clinical setting. (Evaluating)
6. Develop the competence in writing case studies, and interpersonal communication skills. (Creating)

Students are required to undergo a summer internship of two weeks' during the semester break between the second and third semesters. It is a P/NP course and shall be recorded in the third semester. The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in class room courses to the "real world" of social service agencies, medical institutions, the criminal justice system, business, and industry. During the internship, students can explore

career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills. The summer internship enriches the students' academic experience while making a valuable contribution to the community and utilizing the vacation optimally.

Mapping of COs to Syllabus

Course Outcomes	SUMMER INTERNSHIP(P/NP)
CO 1	H
CO 2	H
CO 3	M
CO 4	H
CO 5	H
CO 6	M

PCST6023 STUDY TOUR (Pass/Non-Pass)

COURSE OUTCOMES

1. Define mental illnesses and rehabilitation. (Remembering)
2. To understand counselling in real life setting. (Understanding)
3. To apply theoretical principles in order to understand the functioning of various mental health settings (Applying)
4. Distinguish clinical features of different mental illnesses. (Analysing)
5. Explain the importance of different models of mental health and illnesses in assessment. (Evaluating)
6. Develop practical knowledge about different psychological practice and rehabilitation setting. (Creating)

Module I: Introduction

During the programme the students shall undertake a study tour, along with the faculty members, to a place approved by the department. The places are to be so chosen as to be of educational benefit to students. During the tour, the focus shall be to visit and interact with NGOs, hospitals, state/national/ international organisations involved in psychological counselling.

Module II: Documentation and Evaluation

A report of the learning outcomes shall be submitted to the department at the end of the tour. The Study Tour shall be a Pass/No Pass course.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	H
CO 2	H	
CO 3		H
CO 4	H	
CO 5	H	M
CO 6	H	

PCSI6024: SUPERVISED INTERNSHIP II

(8 Credits)

Course Outcomes

1. Remembering and identifying intervention. (Remembering)
2. Understanding dynamics of history taking and therapeutic approach to psychological counselling. (Understanding)
3. Apply the, theories skills and ethics in counselling. (Applying)
4. Analyse the trial and error essence of a counselling relationship and client needs. (Analysing)
5. Evaluate ethico-legal situations. (Evaluating)
6. Creating facilitative environment for clients in practice. (Creating)

Module I: Introduction

Analysing the situation: Need of counselling, space for counselling, information to clients, documentation, organizing supervision.

Module II: Internship

Taking in clients: first interview, documentation of the case, definition of counselling goals, building the counselling relationship, process of counselling, using skills of counselling, concluding counselling, documentation of the whole counselling process, evaluation; working in a team–role of counselling, resources and challenges, role in the team, case management: discussion, supervision. Evaluation of the internship will be based on the documentation, reports from the organisation, report

of the supervisor and the presentation and the viva voce examination of the student at the end of the period of Internship.

Module III: Phases of Supervised Internship

The Supervised Internship is divided into two phases; Phase I and Phase II. Each of these phases consists of 45days (100 hours) of intensive practical learning programs in counselling setting under trained supervisors. The phases of the internship spread across the 3rd and 4th semester of Masters Degree program. The total credit for the supervised internship is divided equally across the final year semesters of the Master's Degree program.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2	M	M	M
CO 3	H	H	M
CO 4	M		H
CO 5	H		H
CO6	M	H	

PCRP6025: RESEARCH PROJECT PHASE II (6 Credits)

Course outcomes

1. Knowledge of the major theoretical approaches and findings in psychology. (Remembering)
2. Demonstrate knowledge about the research methods used in psychology. (Understanding)
3. Apply the knowledge for preparing research design, and data analysis. (Applying)
4. Critically analyse information related to the study of behaviour and mental processes, and use the critical assessment in forming conclusions and arguments. (Analysing)
5. Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on aset of criteria. (Evaluating)
6. Develop the understanding of how to prepare a research proposal. (Creating)

Every student shall undertake a research project work under the supervision and guidance of a faculty member. The student may choose the topic of research and start the preliminary work by the end of the second semester. The students are expected to complete the Literature Review followed by a Literature Review presentation and the Proposal presentation during the Phase I. Students are expected to complete the data collection before the fourth semester.

In Phase II, students are expected to complete the data collection, data analysis and interpretation, and submission of final report. Submission of final copy of the dissertation will be followed by presentation of the research and viva voce examination.

The thesis is to be submitted to the department before the date notified. The mode and components of evaluation of Phase I and Phase II of the research project and the weightages attached to them shall be published by the Department at the beginning of the semester. There shall be a viva voce examination on the research project.

Mapping of COs to Syllabus

Course Outcomes	RESEARCH PROJECT PHASE I
CO 1	H
CO 2	M
CO 3	H
CO 4	H
CO 5	M
CO 6	H

PCPP6026: PSYCHOLOGICAL ASSESSMENT-I (PRACTICUM-I)

(2 credits – 60 hours)

Course/Learning Outcomes

1. Define the important concepts of psychology research, and assessment techniques. (Remembering)
2. Understand the importance and steps associated with planning and conducting an experiment. (Understanding)
3. Apply the basic concepts of research and assessment techniques in measuring important psychological constructs associated with positive psychology. (Applying)
4. Categorize different types of intelligence assessment techniques. (Analyzing)
5. Evaluate the importance of different types of assessment techniques and measurement tools. (Evaluating)
6. Design and conduct an experiment. (Creating)

Module I: Introduction to Practicum (9 hours)
Primary modes of psychological enquiry: Experimental method, Observation, Survey, and InterviewPsychometric Properties: reliability, validity, standardization, sources of error

Module II: Experiment (14 hours)
Memory drum or Maze learning (offline)/serial positioning effect or cluster learning (virtual): Basic concepts, purpose, development, administration, scoring, interpretation

Module III: Positive Psychology - I (12 hours)
General well-being scale or psychological well-being: Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module IV: Positive Psychology - II (12 hours)
Brief-cope or Coping appraisal or behavior questionnaire: Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module V: Intelligence tests (13 hours)
Binet-Kamat Test of Intelligence (offline)/Draw-a-person (online): Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Suggested Readings

1. Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.
2. Baumgardner, S. R., and Crothers, M. K. (2010). *Positive psychology*. Upper Saddle River, N.J.: Prentice Hall.
3. Kaplan, R. M. & Saccuzzo, D. P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.
4. Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.) New Delhi: New Age International.
5. Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (2017). *Introduction to Psychology (7th ed.,)*. New Delhi: Tata McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	M
CO 2		H			
CO 3			H	H	
CO 4					H
CO 5	H	M	M	M	M
CO 6		H			

PCPP6027: PSYCHOLOGICAL ASSESSMENT-II (PRACTICUM-II)

1. Define the basic terms related to aptitude, personality, projective techniques, positive emotions, posttraumaticgrowth and clinical rating scales.
2. Classify the various types of psychological tests on the basis of their use. (Understanding)
3. Make interpretations and draw conclusions based on the norms given in the manual. (Applying)
4. Examine the details of the rating scale/ test, the aim, applications, procedure of administration and results.(Analysing)
5. Estimate the purpose and importance of each of these tests. (Evaluating)
6. Test the administrator's decision-making process to select a particular test for assessment of a given psychological condition. (Creating)

Module II: Assessment of Personality: Projective Tests (20 Hours) (Offline/Online Classes):
House Tree Person Test (HTP)/ Picture Completion Test (PCT)/Human Figure Test: Basic concepts, psychometric properties of the test, administration, scoring, results and interpretation.

Module III: Assessment of Positive Emotion (10 Hours) (Offline/Online Classes):
Positive and Negative Affect Schedule (PANAS)/Multidimensional Emotional Questionnaire (MEQ): Basic concepts (Definition, Protective Factors of Mental Health & Resilience), psychometric properties of the test, administration, scoring, results and interpretation.

Module IV: Assessment of Posttraumatic Growth (10 Hours) (Offline/Online Classes):
Posttraumatic Growth Inventory: Basic concepts (Definition, Barbara Fredrickson's Broaden-Build Theory), psychometric properties of the test, administration, scoring, results and interpretation.

Module IV: Clinical Assessment Scales (20 Hours) (Offline/Online Classes):

Beck's Depression Inventory/State-Trait Anxiety Inventory: Basic concepts, psychometric properties of the test, administration, scoring, results and interpretation.

Suggested Readings

1. Baron,R.A. Psychology.(1995). 3rd edition. Delhi: Prentice Hall.
2. Morgan, C.T, King, R.A., Weisz,J.R., and Schopler,J. (2004). Introduction to Psychology, 7th edition,24threprint.New Delhi:TataMcGraw-Hill.
3. Gregory, R.J. (2006). Psychological Testing: History, Principles, and Applications (4 th Ed.).New Delhi: PearsonEducation.
4. Baron, Robert A. and Byrne, D. (2001) .Social Psychology 8 th Edition (Reprint).New Delhi : Prentice-Hall of India PvtLtd.
5. Carson,R.C., Butcher,J.N and Mineka,S.(2004). Abnormal psychology. 13th Edition. New Delhi: Pearson Education

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	M		
CO 2	M	H	H	H
CO 3	H	H	H	H
CO 4	H	H	H	H
CO 5		M		M
CO 6				H

PCFW6028: FIELD WORK

(2 Credits)

Course Outcomes

1. Define counselling and mental illnesses (Remembering)
2. Understand the value of supervision (Understanding)
3. Apply the theoretical principles to individuals at various setups (Applying)
4. Distinguish clinical features of different mental illnesses. (Analysing)
5. Evaluate the models of mental health and illness. (Evaluate)
6. Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Module I: Introduction

The field work practice in the second semester shall focus upon the area of concentration chosen by the students. The students will be placed in the field for a minimum of eight days. The fieldwork setting shall be NGO's, hospitals, clinics and schools. The students are expected to apply all the skills and techniques of counselling whenever applicable depending upon the organization and their service. The students should be involved in the activities of the institution and fulfil the responsibilities as requested by the agency supervisor

Module II: Record and Documentation

Students shall prepare a daily report of the fieldwork activities and submit it to the concerned faculty supervisor. The faculty supervisor shall provide the necessary feedback and guidance to the students.

Module III: Evaluation

At the end of the semester the students shall submit a summary report of the cases taken and activities done during their placement. The students shall also appear for the viva voce examination at the end of the semester.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2	H	H	
CO 3	H	M	
CO 4	H		M
CO 5		M	M
CO 6		H	H

PCPR6029: PRACTICUM-III

(2 credits – 60 hours)

Course/Learning Outcomes

1. Define the basic concepts of disability, intelligence and personality assessment. (Remembering)
2. Extend the theoretical knowledge of disability, personality and intelligence theories and assessment techniques into practice. (Understanding)
3. Make use of the important measurement tools to learn administration and scoring. (Applying)
4. Examining test scores and interpretation of results. (Analyzing)
5. Evaluate the importance of personality, intelligence and disability assessment. (Evaluating)
6. Construct conclusion from the results of psychological assessment. (Creating)

Module 1: Disability Assessment (20 hours)
Indian scale for assessment of autism (ISAA)/WHO Disability Assessment Schedule (WHODAS 2.0): Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module 2: Intelligence (20 hours)
Bhatia battery of performance test of intelligence (offline) or Vineland Social Maturity scale (online): Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module 3: Personality assessment (20 hours)
Rorschach Inkblot Test (offline) or Eysenck Personality Inventory (online): Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

(*Note.* Owing to the importance of Rorschach in psychological testing if it is not possible to conduct this practical due to the mode of conduction of classes, the department will try to make sure that students have the knowledge of this test by conducting workshop on this topic.)

Suggested Readings
1. Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.
2. Anastasi, A., & Urbina, S. (1997). *Psychological testing (*7th ed.). Prentice Hall/Pearson Education.
3. Gregory, R. J. (2005). *Psychological testing: History, principles and applications*. New Delhi: Pearson Education.
4. Kaplan, R. M. & Saccuzzo, D.P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.

Mapping of COs to Syllabus

Course Outcomes	**Module I**	**Module II**	**Module III**
CO 1		H	
CO 2	H		
CO 3			H
CO 4		H	
CO 5			H
CO 6	H		H

PCPR6030: PRACTICUM-IV

(2 Credits, 60 hours)

COURSE/LEARNING OUTCOMES (COs)
At the end of this course students will be able to:
1. Define the basic terms related to cognitive functioning, personality, projective techniques and clinical rating scales & choose a suitable method of psychological test to administer on a subject (Remembering)
2. Classify the various types of psychological and neuropsychological tests on the basis of their use. (Understanding)
3. Make interpretations and draw conclusions based on the norms given in the manual. (Applying)
4. Examine the details of the rating scale/ test, the aim, applications, procedure of administration and subject results. (Analysing)
5. Recommend the use of a suitable psychological assessment for a particular disorder. (Evaluating)
6. Test the administrator's decision making process to select a particular test for assessment of a givenpsychological disorder. (Creating)

Module I: Neuropsychological screening and test batteries for assessing cognitive functioning and rule out neuropathology (20 hours)
Introduction to Neuropsychological assessments; importance and purpose; various types of Neuropsychological tests; administration, scoring, results and interpretation the tests
The Bender Visual-Motor Gestalt Test (BVGT) (Online/offline)/Rey-Osterrieth complex figure Test (ROCF) (Online/offline
Gesell Drawing test of intelligence (Online/offline)/Mini Mental Status Examination (MMSE)PGI- BBD battery (offline)

Module II: Assessment of personality (22 hours)
Objective and Projective tests for assessing personality and psychopathology. Definition of Personality; Measurement of Personality; Various types of Personality tests, administration, scoring, results and interpretation.
Minnesota Multiphasic Personality Inventory -2 (MMPI-2) (offline)Sacks sentence completion test (SSCT) (online/offline)
Thematic Apperception Test, other techniques (TAT) (online/offline)

Module-III (18 hours)
Rating scales for assessing the severity of Psycho-pathology and Evaluation of Impairment
Introduction to Clinical Rating Scales; Purpose of various rating scales; administration, scoring, results and interpretation;
Hamilton Anxiety Rating Scale (HAM-A) (Online/offline)
Hamilton Depression Rating Scale(HDRS) (Online/offline)Barratt Impulsiveness scale (BIS) (offline/Online)

Note: A total of 6 practical were decided for the MSc 4th semester practicum course instead of 9 in both online/offline mode. A combination of online and offline mode of practicum mentioned in the syllabus should be included under the 6 practical (Syllabus has clearly mentioned practical to be conducted in the online/offline mode of classes).

Suggested Readings

1. Baer, L., & Blais, M. A. (2010). Handbook of clinical rating scales and assessment in psychiatry and mental health (pp.7-35). New York: Humana Press.
2. Bellack, A.S. and Hersen, M. (Ed.s) (1998) Behavioral assessment A Practical Handbook (4th ed.). MA: Allyn and Bacon.
3. Exner, J. E. (2002). The Rorschach, basic foundations and principles of interpretation (Vol. 1). John Wiley & Sons.
4. Goldstein, G. and Hersen, M. (Ed.) (2000) Handbook of Psychological Assessment. (3rded). Oxford: Elsevier science.
5. Hersen, M. (2004).Comprehensive Handbook of Psychological Assessment (Vol. 4). Industrial and Organizational assessment. New York, NY: Wiley.
6. Schutte, N. S., & Malouff, J. M. (1996). Sourcebook of Adult Assessment Strategies. Behaviour Research and Therapy, 10(34), 846-847.

Course Outcomes (COs) mapping

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6	M	H	H

VALUE-ADDED COURSES

PCSO6034: SCHOOL PSYCHOLOGY

(2 credits- 30 hours)

Course Outcomes

1. Gain knowledge about the concept of School Psychology. (Remembering)
2. Understanding the process of school counseling. (Understanding)
3. Analyze the needs of school children in the new digital world. (Applying)
4. Apply principles and concepts of counseling in school set up. (Analyzing)
5. Evaluate the gaps in the current scenario. (Evaluating)
6. Create a comfortable environment for children in need of intervention. (Creating)

Module 1: Introduction (5 hrs)
Historical background of school psychology, Definition nature and scope of School Psychology, Role of a School Psychologist as a Professional

Module 2: Guidance and Counseling in School setting (15 hrs)
Definitions, Ethics and Legal aspects, Characteristics of an effective counselor, Basic Counseling Skills- Active listening, reflecting, paraphrasing, questioning, confronting, Counseling process- Building, maintaining and terminations counselor's relationships.

Module 3: Tools and Techniques Practice (10 hrs)
Objective tools: Checklist, rating scales, self report inventories and other standardized tools.
Subjective Tools: Observation, anecdotal records, cumulative Records, Interview and case history

Techniques for group intervention: Group tasks, Group discussion, debriefing and interpretation, summary making.
Techniques for individual intervention: role plays, individual assignments, feedback charts
Importance of Record Keeping

Suggested Readings:

1. Rao, Ramakrishna & Parnajpe, Anand (2008). Handbook of Indian Psychology. New Delhi: Cambridge University Press India Pvt. Ltd.
2. Thomas, Murray R. (1990) Counseling and Life – Span Development. New Delhi: Sage Publications,
3. Herr, Edwin (1974) Vocational Guidance and Human Development (Ed.). Boston: Houghton Mifflin,
4. Wallace & Lewis (1986). Becoming a Professional Counselor. New Delhi: Sage Publications,
5. Shrivastava, K.K. (2004) Principles of Guidance and Counseling. New Delhi: Kanishka Publishers.
6. Anastasi, A. (1977). Psychological Testing. (5th Ed.) New York: MacMillanPublishing Co. Inc.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	H
CO 2	H	M	H
CO 3	M	M	H
CO 4		H	H
CO 5		H	H
CO 6		H	H

PCCO6035: COMMUNITY MENTAL HEALTH

(2 credits- 30 hours)

Course Outcomes

1. Gain knowledge about the underlying principles of Community Mental Health. (Remembering)
2. Understand current trends of practice and intervention. (Understanding)
3. Apply basic intervention skills in their community projects. (Applying)
4. Analyze gaps in the current functioning of Community Mental Health at regional levels. (Analyzing)
5. Evaluate intervention techniques in multicultural set ups. (Evaluating)
6. Organize awareness programmes for communities. (Creating)

Module 1: Introduction (2 hours)

Basic Principles of Community Mental Health, Counseling Skills, Counseling in Multicultural set up

Module 2: Mental Health Issues (6 hours)

Intellectual disability, Addiction, Developmental disorders, Suicide

Module 3: Identification, Assessment and Intervention (7 hours)

Identification of Mental Health Issues, Assessment of Mental Health Issues, Psycho-education, Evidence Based Practices (Behavior Therapy, Cognitive Behavior Therapy, Rational Emotive Behavior Therapy)

Module 4: Practical (15 hours)

Community Mental Health Projects

Suggested Readings:

1. Community Mental Health; Challenges for the 21st century. (2006). Rosenberg, J. & Rosenberg, S. Rotutledge
2. Ethics in Community Mental Health Care. (2002). Backlar, Patricia & Cutler, David L. (Eds.). Springer US.
3. Community Mental Health and Behavioral-Ecology; A Handbook of Theory, Research, and Practice.(1982). Editors: Jeger, A.M., Slotnick, R.S. (Eds.). Springer US
4. Community Mental Health: Putting Policy Into Practice Globally.(2012).Graham Thornicroft , Atalay Alem, Robert E. Drake, Hiroto Ito, Jair Mari, Peter McGeorge, R. Tara, Maya Semrau (Ed.). Wiley-Blackwell

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	M	H
CO 2	H	H	H	H
CO 3		M	H	H
CO 4			H	H
CO 5			H	H
CO 6			H	H

PCLS6036: LIFE SKILLS EDUCATION

(2 credits-30 hours)

Course Outcomes:

1. Choose and gain knowledge about themselves, develop consciousness of self, self-confidence, feelings of mattering, manage personal emotions (Remembering)
2. Able to relate and work with others, practice collaborations, controversy with civility, engage across difference, be committed to ethical action (Understanding)
3. Apply self-knowledge, practice self-worth, congruence, commitment, identify passions and develop common purpose (Applying)
4. Able analyse academic knowledge and integrate into all aspects of living (Analysing)
5. Learn to evaluate and improve upon personal leadership strengths and weaknesses (Evaluating)
6. Create effective change and practice collective efficacy, develop critical thinking/ decision making skills, common purpose and a sense of connectedness within one's communities. (Creating)

Module –I: Introduction (5 hours)

- Definition and Importance of Life Skills
- Livelihood Skills, Survival Skills and Life Skills
- Life Skills Education, Life Skills Approach, Life Skills Based Education
- Life Skills Training - Implementation Models
- Life Skills Education in the Indian Context

Module-II: Social Skills and Negotiation Skills (8 hours)

Introduction

Life Skills: Generic, Problem Specific and Area Specific Skills

- Self-Awareness
  - Definition, Types of Self
  - Self Concept, Body Image, Self Esteem
  - Techniques used for Self Awareness: Johari Window, SWOT Analysis
- Empathy
  - Sympathy, Empathy & Altruism
- Effective Communication
  - Definition, Functions, Models, Barriers
- Interpersonal Relationship
  - Definition, Factors affecting Relationships

Module-III: Coping Skills (5 Hours)

Coping with Emotions

Coping Skills

- Coping & Emotions
  - Definition, Characteristics, Types
  - Classification: Wheel Model, Two-Dimensional Approach
  - Coping Strategies
- Coping with Stress

Definition, Stressors

- Sources of Stress
- The General Adaptive Syndrome Model of Stress
- Coping Strategies

Module-IV: Practical (12 hours)

Life Skills in Specialized Areas

- Peer Education
- Life Skills for Disaster Preparedness
- Life Skills for Corporate Sector
- Life Skills for Special Population

- Life Skills for Geriatric and Palliative Care
- Life Skills in Practice in Educational Settings

Suggested Readings:

1. Dahama O.P., Bhatnagar O.P, (2005). *Education and Communication for Development,* (2nd Edn.), Oxford& IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Debra McGregor, (2007).Developing Thinking; Developing Learning - A guide to thinking skills in education, Open University Press, New York, USA
3. Duffy Grover Karen, Atwater Eastwood, (2008). (8th Edn.), *Psychology for Living- Adjustment, Growth and Behaviour Today*, Pearson Education Inc, New Delhi.
4. Hockenbury (2010). Discovering Psychology, Worth Publishers. New York
5. Nair .V. Rajasenan, (2010). *Life Skills, Personality and Leadership*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
6. Nair. A. Radhakrishnan et al., (2010). *Life Skills Assessment Scale*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.
7. Stella Cottrell, (2005). Critical Thinking Skills: Developing Effective Analysis and Argument, Palgrave Macmillan Ltd., New York
8. Nair. A. Radhakrishnan, (2010). *Life Skills Training for Positive Behaviour*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu. s
9. RGNIYD. (2008). Facilitators *Manual on Enhancing Life Skills. Tamil Nadu*
10. Family Health International, NACO, USAID (2007), *Life Skills Education tool kit for Orphans and vulnerable children in India*

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module
CO 1	H	M	M	M
CO 2	M	H		H
CO 3	M		H	
CO 4	H			H
CO 5			H	
CO 6	M		H	H

DEPARTMENT OF PUBLIC ADMINISTRATION

VISION:
Our unwavering commitment is to emerge as a distinguished centre of excellence in the domain of Public Administration, embodying unparalleled standards in learning, teaching, and research. Through the provision of bespoke experiences, we strive to instill profound human values, ultimately fostering nation-building.

MISSION:
- Strive for academic excellence by delivering high-quality education, research, and practical training in Public Administration, fostering a deep understanding of theoretical frameworks and practical applications.
- Cultivate and nurture visionary leaders with the skills to navigate complex public sector challenges, promoting effective governance and upholding the highest standards of ethical conduct in public service roles.
- Encourage cutting-edge research initiatives that address contemporary societal issues, while fostering strong ties with the community and relevant stakeholders to drive positive societal development.
- Provide a personalized learning environment, catering to individual needs and aspirations, maximizing student potential for growth, success, and lifelong learning in the field.
- Enhance global awareness and prepare students to contribute effectively in an interconnected world, while dedicating efforts to contribute significantly to nation-building through competent and socially responsible public administrators driving positive change and sustainable development.

MA PUBLIC ADMINSTRATION -PROGRAM OUTCOMES (POs)

PO 1: Academic Excellence: Strive for academic excellence by delivering high-quality education, research, and practical training in Public Administration, fostering a deep understanding of theoretical frameworks and practical applications.

PO 2: Leadership Development: Cultivate and nurture visionary leaders who possess the skills and knowledge to navigate complex public sector challenges, promoting effective governance and public service.

PO 3: Research and Innovation: Encourage and support cutting-edge research initiatives that contribute to the advancement of knowledge in Public Administration, generating innovative solutions for contemporary societal issues.

PO 4: Personalized Learning: Provide a personalized and student-centric learning environment, catering to individual needs and aspirations, thereby maximizing the potential for growth and success.

PO 5: Ethical and Responsible Governance: Emphasize the importance of ethical conduct and responsible governance practices, preparing graduates to uphold the highest standards of integrity in their public service roles.

PO 6: Community Engagement: Foster strong ties with the community and relevant stakeholders, encouraging collaboration and knowledge exchange, resulting in a positive impact on societal development.

PO 7: Comprehensive Approach: Foster an interdisciplinary perspective and global awareness, promoting lifelong learning among students and faculty, to produce competent and socially responsible public administrators who can drive positive change, sustainable development, and contribute significantly to nation-building efforts in an interconnected world.

MA PUBLIC ADMINSTRATION -PROGRAMME SPECIFIC OUTCOMES (PSOs)
PSO 1: To foster a comprehensive comprehension of governance structures, processes, and institutions at the local, national, and international levels.
PSO 2: To enable students to gain an in-depth understanding and analytical proficiency in one of the specialized areas, including Human Rights, International Relations, or Public Policy, empowering them to address complex challenges within their chosen field.
PSO 3: To develop and enhance technical skills necessary for comprehensive professional advancement within their respective areas of specialization. This will equip graduates to make well-considered and responsible decisions in their professional endeavours.
PSO 4: To create avenues for sharing the outcomes of academic and disciplinary learning, encouraging students to engage in scholarly research and publish research materials that contribute to the advancement of knowledge in the field.

Mapping of Courses with POs/PSOs:

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO 4
DC Courses		H		M		H		H	M		M
DC 1	M		H		M		H		H	H	
DC 2		H		H	H		M	M		H	
DC 3	H		H		M			H			H
DC 4	M	H		H		H		H	M		M
DC 5	H		H		M	H		H		H	
DC 6		H		H		H	H		H		H
DC 7	H		H		H		H	H		M	
DC 8		H		M		H		H	M		M
DC 9	M		H		M		H		H	H	
DC 10		H		H	H		M	M		H	
DC 11	H		H		M			H			H
DC 12	M	H		H		H		H	M		M
DC 13	H		H		M	H		H		H	
DC 14		H		H		H	H		H		H
DC 15	H		H		H		H	H		M	
DC 16			H		M			H		H	
DE Courses		H		M		H		H	M		M
DE 1 HR	M		H		M		H		H	H	
DE 1 IR		H		H	H		M	M		H	
DE 2 HR/IR	H		H		M			H			H
DE 2 PP	M	H		H		H		H	M		M
DE 3 HR/IR	H		H		M	H		H		H	
DE 3 PP		H		H		H	H		H		H
DE 4 HR/IR	H		H		H		H	H		M	
DE 4 PP		H			H		H				H
DE 5 HR/IR			H			H			H		
DE 5 PP			H			H			M		H
DE 6 HR/IR	M			H		M		H		M	
DE 6 PP		H			H				H		H
SE 1		H		M		H		H	M		M
Value Add 1	M		H		M		H		H	H	
Value Add 2		H		H	H		M	M		H	
Value Add 3	H		H		M			H			H

DETAILED SYLLABUS

PASE0001: STATE AND ITS ELEMENTS

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Trace the evolution and emerging perspectives of the State (Remembering & Understanding)
2. Understand the relationship between State, Society and Public Administration (Understanding)
3. Analyze the origin and changing role of the state (Analyzing)
4. Evaluate the Interface between Citizens and Administration (Applying)

Module – I (15 hours)

Evolution and Perspectives of the State: Origin of the State, the Theory of Divine Origin, Force Theory, Matriarchal and Patriarchal Theory, Social Contract Theory, Evolutionary Theory; Elements and Functions of State; Changing Role of the State; Liberal and Marxist Perspective of the State, Neo-liberal Perspective, and Gandhian Perspective; Autonomy of the indirect economy, and kindness economy.

Module - II (10 hours)

Concepts: Liberty, Equality, Justice, Rights, and Sovereignty, Contemporary Issues, Political Culture & Political Development, Political Socialization. Understanding concepts of Public, Common Good, Welfare, Public Interest, Morality, Empathy, Efficiency and Effectiveness.

Module – III (10 hours)

Governmental structure: Various Forms of Government: Monarchy, Democracy, Oligarchy, Authoritarianism, and totalitarianism; Parliamentary & Presidential, Unitary & Federal.

Module - IV (10 hours)

Relationship between State, Society and Public Administration; People's Struggle for Democracy- Case Studies, Interface between Citizens and Administration; Political Parties, Pressure Groups, Electoral Reforms; Digital economy; Self-reliant theory.

Suggested Readings

1. An Introduction to Political Theory, Gauba · 2009 Publisher: Macmillan Publishers India Limited
2. Political theory ideas and concepts by Sushila Ramaswamy, 2010, Publisher: PHI Learning
3. Institutional Theory in Political Science: 2nd Edition, B. Guy Peters, 2005
4. Political Theory: An Introduction, by Rajeev Bhargava, Ashok Acharya, Pearson Education India
5. Political Man, The Social Bases of Politics (Classic Reprint), 2017
6. Rawls, R.H. - A Theory of Justice
7. Sharma, U., Sharma, S.K. - Principles & Theory of Political Science

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	L	L	H
CO 3	H	L	L	L
CO 4	L	L	L	H

PAIA0002: INTRODUCTION TO THE PUBLIC ADMINISTRATION

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Understand the meaning, nature and scope of Public Administration (Remembering & Understanding)
2. Comprehend the changing paradigms of Public Administration (Understanding)
3. Analyse the events that gave shape to the discipline (Analyzing)
4. Evaluate the concept of Good Governance and its implications (Applying)

Module – I (10 hours)

Meaning, nature, scope and significance of Public Administration; Relation with other disciplines of social sciences;

Module – II (10 hours)

Evolution of the discipline and its present status; Ecology, Public and Private Administration.

Module III (15 hours)
New Public Administration; Public Choice Theory; New Public Management; State vs. Market Debate.

Module IV (10 hours)
Recent Developments in Public Administration; Challenges of Liberalization, Privatization and Globalization; Good Governance: concept and application; Good Governance indexes.

Suggested Readings
1. Henry, Nicholas - Public Administration And Public Affairs
2. Nigro, Felix, A. - Modern Public Administration
3. Dixit Manoj (et. al) - Public Administration
4. Awasthi & Maheshwari - Public Administration
5. Sharma & Sharma - Public Administration
6. Bhattacharya, M. - New Horizons of Public Administration
7. Bhambri, C.P. - Public Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	M	M
CO 3	M	H	L	L
CO 4	L	M	L	H

PACD0003: COMPARATIVE AND DEVELOPMENT ADMINISTRATION

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES
At the end of this course students are able to:
1. Understand the Concept, Nature, Scope and Significance of Comparative Public Administration (Remembering & Understanding)
2. Understand the ecological impact on the Public Administration (Understanding)
3. Analyze the problems of Comparative Research and development administration (Analyzing)
4. Evaluate the Changing pattern of Development Administration (Applying)

Module – I (15 hours)
Concept, Nature, Scope and Significance of Comparative Public Administration; Comparative Studies –Influence of Globalization; Public Administration and its Environment. Approaches to the study of Comparative Administration: Institutional, Behavioral, Structural-Functional, Ecological and Systems Approaches

Module – II (10 hours)
Fred Riggs's Typology of Societies and Features; Problems of Comparative Research; Salient Features of the administrative systems of UK, USA, France and Japan

Module – III (15 hours)
Genesis of Development Administration; Development Administration: Meaning, characteristics, Traditional Administration versus Development Administration; Administration of Development and Development of Administration; Politics of Development Administration.

Module – IV (05 hours)
Temporal and Spatial Dimensions of Development Administration; Changing pattern of Development; A critique of Development Administration

Suggested Readings
1. Arora, R.K.- Comparative Public Administration
2. Chaturvedi, T.N.- Comparative Public Administration
3. Chatterjee, S.K. - Development Administration
4. Sapru, R.K.- Development Administration
5. Riggs, F.W.- The Ecology of Public Administration
6. Sharma, S.K. - Development Administration in India
7. Bhattacharya, Mohit – Bureaucracy & Development Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	H	H	H	M
CO 4	L	L	L	H

PAPP0004: PUBLIC POLICY

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. CO1: Understand the public policy process (Remembering & Understanding
2. CO2: Understand the Models and Trends of Public Policy in India (Understanding)
3. CO3: Analyze the issues related to Policy formulation; Implementation and evaluation (Analyzing)
4. CO4: Evaluate the public policies in India (Applying)

Module – I (10 hours)

Public Policy: Articulation, significance and approaches; Public Policy Process

Module – II (10 hours)

Public Policy and Globalization; Public Policy process in India; Models and Trends of Public Policy in India

Module-III (10 hours)

Policy formulation; Implementation; evaluation

Module –IV (15 hours)

Environmental Policy in India; Education Policy in India; Public Health Policy in India; MSME Policy of India.

Suggested Readings

1. Anderson, James E. - Public Policy making, Praeger, New York, 1975
2. Dror, Y. - Public Policy Making Re-examined, Chancellor, Pennsylvania, 1968
3. Sahani, P. - Public Policy Conceptual Dimensions, Kitab Mahal, Allahabad, 1987
4. Saigal, Krishna - Public Policy Making in India: An Approach to Optimisation, Vikas, New Delhi, 1983
5. Madan, K.D. et. al - Public Policy making in Government; Publication Division, Ministry of Information and Broadcasting, New Delhi, 1982
6. Bertcih, Garg, K. Robert P. Clark and David M. Wood - Comparing Political System : Power and Policy in Three Worlds, Macmillan, New York, 1986
7. Sapru, R.K. - Public Policy Formulation, Implementation and Evaluation; Sterling, New Delhi, 2000

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	L	L
CO 2	L	H	L	L
CO 3	M	M	H	L
CO 4	L	L	L	H

PAEP0005: ENGAGED POLICY AND GOVERNANCE

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Understand the concept of Participatory Governance (Remembering & Understanding)
2. Understand the Pitfalls in Participatory Governance (Understanding)
3. Analyze the issues related to Community engagement at the Grassroots Level (Analyzing)
4. Evaluate Issues of local Engagement and Participation (Applying)

Module I (10 hours)

Participatory Governance: An Overview; The Rationale of Participation: Concepts and Challenges; New Governance Paradigm: The Emerging Partnerships/Engagement Initiatives

Module II: (10 hours)

Democracy, Social Inclusion and Development: Democracy and Development; Political Regimes, Political Participation and Social Inclusion; Innovations and Pitfalls in Participatory Governance

Module III: (10 hours)
Engaged Governance: Government Transparency in Policy Decisions; Engaging the Community at Grassroots Level; Electronic Platforms for Receiving and Implementing Public Input

Module IV: (15 hours)
Participatory Local Governance: Participatory Governance Toolkits; Measuring Engagement or Participation; Issues in Engagement and Participation; Case Studies a) Kudumbashree in Kerala, India b) Grameen Bank in Bangladesh c) Participatory Budgeting, Brazil d) Watershed Development Programme in Raleganssiddhi, India

Suggested Readings

1. Alexander, Jeffrey C. 2006. The Civil Sphere. New York: Oxford University Press.
2. Baiocchi, G., P. Heller, et al. 2011. Bootstrapping Democracy: Transforming Local Governance and Civil Society in Brazil. Stanford; Stanford University Press.
3. Barber, Benjamin. 1984. Strong Democracy: Participatory Politics for a New Age. Berkeley: University of California Press.
4. Boulding, C. and B. Wampler 2010. "Voice, Votes, and Resources: Evaluating the Effect of Participatory Democracy on Well-being." World Development 38(1): 125-135.
5. Bowler, S. and T. Donovan 2002. "Democracy, Institutions and Attitudes About Citizen Influence on Government." British Journal of Political Science 32(02): 371-390.
6. Diamond, L. J. 1999. Developing Democracy: Toward Consolidation. Baltimore, MD: Johns Hopkins University Press.
7. Fung A., E. Wright, et al. 2003. Deepening Democracy: Institutional Innovations in Empowered Participatory Governance. London: Verso Books.
8. Grindle, Merilee, 2007, Going Local: Decentralization, Participation, and the Promise of Good Governance. Princeton University Press.
9. Heller, P. 2000. "Degrees of Democracy: Some Comparative Lessons from India." World Politics 52(4): 484-519.
10. Isaac, T.M. Thomas and Patrick Heller. 2003. "Democracy and Development: Decentralized Planning in Kerala." In Deepening Democracy: Institutional Innovations in Empowered Participatory Governance. The Real Utopias Project IV. London: Verso.
11. Pateman, Carole. 1970. Participation and Democratic Theory. Cambridge: Cambridge University Press.
12. Sen, Amartya. 1999. Development as Freedom. Oxford: Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PAAP0007: ADMINISTRATIVE THEORY AND PRINCIPLES (Core Course)

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:
1. Trace the evolution theories o Public Administration (Remembering & Understanding)
2. Understand the principles of Public Administration (Understanding)
3. Analyze the State of Administrative Theory in 21st Century (Analyzing)
4. Evaluate the theory and practice of public administration (Applying)

Module – I (15 hours)
Classical Perspectives: Woodrow Wilson: The Politics Administration-Dichotomy; Scientific Management: Taylor and the Movement; Classical Theory: Fayol, Urwick, Gulick and others; Bureaucratic Theory: Weber and his critics. Human relations perspectives/post-classical theorists: Elton Mayo and others; Mary Parker Follett; Behavioural approach: Chester Barnard, Chris Argyris, Douglas McGregor, Rensis Likert; Organizational development and system approach.

Module – II (10 hours)
Administrative Behaviour: Decision making – Herbert Simon; Communication; Control; Leadership Theories; Theories of Motivation: Abraham Maslow, Frederick Herzberg. Emerging theories: Geoffrey Vickers-Appreciative System; Warren Bennis-Changing Organizations; New Organisational Culture, Pertinence of Critical Theory, State of Administrative Theory in 21st Century

Module-III (10 hours)
Basic Principles: Organization; Hierarchy; Unity of Command; Span of Control; Authority and Responsibility; Coordination; Centralization and Decentralization.

Module –IV (10 hours)
Delegation; Supervision; Line and Staff; Accountability and Control: Concept; Legislative Control; Executive Control; Judicial Control; Citizen and Administration; Role of Civil Society; People's participation; Right to information

Suggested Readings

1. Henry, Nicholas - Public Administration And Public Affairs
2. Taylor, Frederick W. - The Principles of Scientific Management
3. Etzioni, Amitai - Modern Organizations
4. Bendix R., Max Weber - An Intellectual Portrait
5. Blau, Peter H. - Bureaucracy in Modern Society
6. Nigro, Felix, A. - Modern Public Administration
7. Dixit Manoj (et. al) - Public Administration
8. Sahni, Pardeep (et. al) - Administrative Theory
9. Awasthi & Maheshwari - Public Administration
10. Sharma & Sharma - Public Administration
11. Bhattacharya, M. - New Horizons of Public Administration
12. Bhambri, C.P. - Public Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	L	L
CO 2	L	H	L	L
CO 3	L	H	L	L
CO 4	M	M	M	H

PAIA0008: INDIAN ADMINISTRATION

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES
At the end of this course students are able to:
1. Trace the evolution of Indian Administration (Remembering & Understanding)
2. Understand the Structure & Functions of Public Administration in India (Understanding)
3. Analyze the role of District Administration in 21st Century (Analyzing)
4. Evaluate the Relationship between Police and Public (Applying)

Module – I (10 hours)
Evolution of Indian Administration: Mauryan, Mughal & British Period and British Legacies to Indian Administration.

Module – II (10 hours)
Central Administration: Structure & Functions of Central Secretariat: Cabinet Secretariat, Cabinet Secretary, Prime Minister's Office (PMO)

Module-III (10 hours)
State Administration: Structure & Functions of State Secretariat, Chief Secretary; State Secretariat Vs Directorate; Divisional Administration & The Divisional Commissioner.

Module –IV (15 hours)
District Administration; District Collector: Powers, Functions & Role, Law and Order in DM-SSP & Commissionery System, Relationship between Police and Public.

Suggested Readings

1. Maheshwari, S.R. - Indian Administration
2. Singh, Hoshiar - Indian Administration
3. Arora, R.K. & Goel. Rajni - Indian Public Administration
4. Johari, J.C. - Indian Govt & Politics
5. Maheshwari, S.R. - State Administration

6. Avasthi, A. & Avasthi, A.P. - Indian Administration
7. Fadia, B.L. & Fadia, Kuldeep - Public Administration in India
8. Singh, Hoshiyar and Singh, Mohinder - Public Administration in India
9. Basu, D.D. Introduction to the Constitution of India
10. Johari, J.C. - The Constitution of India
11. Ramchandran, Padma – Public Administration in India
12. Charabarty, Bidut& Chand, Prakash – Indian Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	H	H
CO 3	L	L	L	H
CO 4	L	L	L	H

PAPP0009: PUBLIC PERSONNEL ADMINISTRATION

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Trace meaning, nature, scope and significance of Public Personnel Administration (Remembering & Understanding)
2. Understand the recruitment process in civil services (Understanding)
3. Analyze the Role of Civil services in Developing Countries (Analyzing)
4. Evaluate the issues related to Administrative Ethics and Reforms (Applying)

Module – I (05 hours)

Public personnel administration: meaning, nature, scope and significance

Module – II (10 hours)

Civil Services – Structure, Recruitment and training; Promotion; Pay and service conditions; Position Classification; Public Service Commissions; Union and state.

Module-III (20 hours)

Role of Civil services in Developing Countries. Civil Services-Citizenry Interface: Civil Society and Administration; Technology and Changing Nature of Public Services; Ethics and Accountability

Module –IV (10 hours)

Generalist and Specialist; Minister-Civil servant relationship; Administrative Ethics; Administrative Reforms.

Suggested Readings

1. Yoder, Dale - Personnel Management & Industrial Relations
2. Flippo, Edwin B. - Principles of Personnel management
3. Davar, Rustom S. - Personnel Management & Industrial Relations
4. Second Administrative Reforms Commission Report.
5. Monappa, Arun & Mirza, S.Saiyadain - Personnel Management.
6. Stahl, O Glenn - Public Personnel Administration
7. Hays, S.W. & Kearney, R.C. - Public Personnel
8. Goel, S.L. - Public Personnel Administration
9. Sinha, V.M. - Public Personnel Administration
10. P. N. Parashar- History and Problems of Civil Services in India
11. Yogendra Narain- Civil Services: Challenges And Resolutions
12. Abhay Prasad Singh & Krishna Murari - Constitutional Government and Democracy in India
13. S.K. Das - The Civil Services in India
14. Lohit Matani, Vishal - An Introduction to Civil Services
15. S.N. Singh - Politician Civil Servant Relationship and Public Administration in India
16. Sandeep Sharma- Indian Civil Service And Public Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L

CO 3	L	L	H	L
CO 4	L	L	L	H

PARM0010: RESEARCH METHODOLOGY

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Trace the role of Research in Theory-building (Remembering & Understanding)
2. Understand the Scientific Methods in Social Science Research (Understanding)
3. Analyze the role Sampling and Sampling Techniques (Analyzing)
4. Evaluate trends of Research in Public Policy and Governance; (Applying)

Module – I (15 hours)

Social Science Research: Meaning, Objectives, Scope and Importance of Social Science Research, Normativity and Objectivity in Social Science Research; Distinction between Method and Methodology; Role of Research in Theory-building; Types of Research: Quantitative Research, Qualitative Research, Applied Research, Basic Research, Problem Oriented and Problem Solving.

Module – II (10 hours)

Scientific Methods in Social Science Research; Problem Formulation and Hypothesis; Identification of Variables, Concepts and Operationalization of Concepts; Hypothesis and Procedure of Hypothesis Testing and Estimation; Data: Sources-Primary and Secondary, Methods of Data Collection.

Module-III (15 hours)

Sampling and Sampling Techniques; Scales of Measurement: Measures of Central Tendency and Dispersion, Mean, Mode and Median, Standard Deviation, Correlation; Tools of Data Collection: Observation, Questionnaire, Interview Schedules; Processing and Analysis of Data; Research Design and Research Report Writing; Citation Pattern and Bibliography

Module –IV (05 hours)

Trends of Research in Public Policy and Governance; Ethics of Research in Public Administration; Use of Computers in Social Science Research.

Suggested Readings

1. L. Nagar and R. K. Das, Basic Statistics, New Delhi: Oxford University Press, 2000.
2. C. R. Kothari, Research Methodology: Methods and Techniques, New Delhi: Vishwa Prakashan, 1990.
3. David Dooley, Social Research Methods, (4th ed.), Upper Saddle River, NJ: Prentice Hall, 2001.
4. David E. Gray, Doing Research in the Real World, London: Sage Publications, 2004.
5. E. R. Babbie, The Basic of Social Research, (4th ed.), Australia: Thomson, 2007.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PAOB0012: ORGANIZATIONAL BEHAVIOUR

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Understand the concepts and approaches to organizational behaviour (Remembering & Understanding)
2. Understand the concepts of Attitude, Personality and Motivation (Understanding)
3. Analyze the Stress Management and Organizational Change (Analyzing)
4. Evaluate resistance to Change (Applying)

Module I (10 hours)

Concepts and Approaches: Organisational Behaviour (OB) - Meaning and Concept, Traditional and Modern Approaches to OB; Typologies of Organisation, Genesis, Needs and Goals of OB; Challenges of Organisational Behaviour

Module II (15 hours)
Attitude, Personality and Motivation: Attitude- Concept, Factors in Attitude formation, Attitude and Behaviour; Personality: Concept, Theories and determinants, Personality and Behaviour; Motivation: Concept, Theories, Motivation and Behaviour, Motivational system and Incentives, Quality Work Life (QWL), Job Design and Motivation.

Module III (10 hours)
Stress Management and Organizational Change: Power and Politics - Concept, Significance, Concentration and Types of power, Reasons and Management of Organizational Politics.

Module IV (10 hours)
Stress Management: Concept, Causes and Effects of Stress, Coping Strategies; Organizational Change: Nature, Factors and Resistance to Change.

Suggested Readings
1. Kumar, Niraj. Organizational Behavior: A New Look Concept, Theory and Cases. New Delhi: Himalaya 2012.
2. Parikh, Margie and Rajen Gupta. Organisational Behaviour. McGraw Hill Education (India) Pvt Ltd, 2010.
3. Robbins Stephen P. Organizational Behavior 15 Paperback, New Delhi: Pearson 2013.
4. Prasad, L.M. Organizational Behavior. New Delhi: Sultan Chand and Sons, 2019.
5. Pershing, Sandra Parkes and Eric K. Austin. Organization Theory and Governance for the 21st Century. New Delhi: Sage, 2015.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	H
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PABF0013: BUDGET AND FINANCIAL ADMINISTRATION IN INDIA

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES
At the end of this course students are able to:
1. Understand the concept and significance of Budget (Remembering & Understanding)
2. Understand the Budget Policy orientation in India (Understanding)
3. Analyze the Budgetary Process in India (Analyzing)
4. Evaluate Central-State Financial Relations (Applying)

Module – I (10 hours)
Meaning, nature and scope of Financial Administration; Concept of Budget; Definitions of Budget; Significance of Budget; Types of Budget

Module – II (10 hours)
Budget Policy Orientation in India; Major actors in Budgetary Process in India

Module-III (10 hours)
Budget system in India; Budgetary Process in India; Financial Management in India;

Module –IV (15 hours)
Budget system reforms in India; Financial System reforms in India; Finance Commission; Central-State Financial Relations.

Suggested Readings
1. Lall. G.S. - Public Finance & Financial Administration in India
2. Mokherjee, S.S. - Financial Administration in India
3. Chand, Prem - Performance Budgeting
4. Handa, K.L. - Financial Administration
5. Sury, M. M. Government Budgeting in India
6. Geol, S.L. - Public Financial Adminstration
7. Thavaraj, M.J.K. - Financial Administration of India

8. Tyagi, B.P. - Public Finance
9. S.K. Mahajan and A.P. Mahajan: Financial Administration in India

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PASW0014: SOCIAL WELFARE ADMINISTRATION

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Understand the concept and significance of social welfare administration in India (Remembering & Understanding)
2. Understand the Social Welfare Administration in New Economic Order (Understanding)
3. Analyze the role of various agencies in social welfare administration (Analyzing)
4. Evaluate the role of International Agencies for Social Welfare (Applying)

Module – I (10 hours)

Social Welfare Administration: Meaning, Scope & Significance, Approaches/Models; Meaning, Social Welfare State- meaning; Social Change and Social Justice; Social Welfare Administration in New Economic Order; Social Welfare in Democratic and Authoritarian States.

Module – II (10 hours)

Social Welfare Administration at Union Level: Composition and Functions of Ministry of Social Justice and Empowerment; Ministry of Tribal Affairs; Ministry of Women and Child Development, Ministry of Minority Affairs; CSWB & SSWAB; Social welfare administration at the state level.

Module-III (15 hours)

Social Welfare Policies and Programmes for SC/ST, OBCs, Women, Child, Disabled and Aged at Central & State level; Composition and Functions of National Commission: for SC/ST, Women, Other Backward Classes and Minorities; Sub Plan strategies for Welfare of Weaker Section.

Module –IV (10 hours)

International Agencies for Social Welfare: Composition and Functions of UNESCO, UNICEF, ILO, WHO (with special reference to India).

Suggested Readings

1. Mukherjee, Radhakamal - Social Welfare Administration
2. Chaudhary, D.P. - A. Hand Book of Social Welfare
3. Sachdeva, D.R. - Social Welfare Administration
4. Prasad, R. - Encyclopedia of Social Welfare Administration
5. Shukla, K.S. - Social Welfare Administration in India
6. Chandra, Sushil - Social Work in Uttar Pradesh
7. Annual Reports of Ministry of Social Justice & Empowerment, Government of India.
8. Goel, S.L. - Social Welfare Administration.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	H	L	L	L
CO 3	L	H	L	H
CO 4	L	L	L	H

PAEG0015: ENVIRONMENTAL GOVERNANCE

Credits: -3 (45 lectures) (45 hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Understand the concept of Global Environmental Governance (Remembering & Understanding)
2. Understand the Development and Environmental issues in India (Understanding)
3. Analyze the Impact of urbanization on Environment (Analyzing)
4. Evaluate the Urban Environmental Governance in India (Applying)

Module – I (10 hours)

Development – Environment Discourse; Global Environmental Governance

Module – II (15 hours)

Development and Environmental issues in India; Environmental Policy in India; Role of Judiciary in Environmental governance in India; Civil Society and Environmental protection in India

Module-III (10 hours)

Urban Environmental governance and politics in India; Impact of urbanization on Environment and Public Health.

Module –IV (10 hours)

Urban Environmental Governance: Major initiatives; Environmental politics in Urban India; Environmental Protection and Peoples right.

Suggested Readings

1. Ajith Sankar- Environmental Management
2. Bruckmeier, Karl - Global Environmental Governance: Social-Ecological Perspectives
3. Arild Vatn- Environmental Governance: Institutions, Policies and Actions
4. J.P. Evans - Environmental Governance
5. Jean-Frederic Morin, Amandine Orsini- Essential Concepts of Global Environmental Governance
6. Frank Biermann, Philipp H. Pattberg - Global Environmental Governance Reconsidered
7. Prakash Chand Kandpal- Environmental Governance in India: Issues and Challenges
8. Albert Breton- Environmental Governance and Decentralisation

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PACA0016: CITIZENS AND ADMINISTRATION

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Understand the Interaction between Citizens and Administration (Remembering & Understanding)
2. Understand the Preconditions for Citizens-centric Administration (Understanding)
3. Analyze the Mechanism for Redressal of Public Grievances (Analyzing)
4. Evaluate the Changing role of Citizens (Applying)

Module – I (10 hours)

Interaction between Citizens and Administration; Citizens' Perception about Administration

Module – II (10 hours)

Preconditions for Citizens-centric Administration; Peoples participation in India

Module-III (10 hours)

Administrative Accountability; Mechanism for Redressal of Public Grievances

Module –IV (15 hours)
Grievance Redressal Mechanism in India; Governance Discourse and the Changing Role of Citizens.

Suggested Readings
1. S. N. Sadasivan - Citizen and Administration
2. Nita Sanghvi - Administration and the Citizen
3. Citizen, Customer, Partner, Engaging the Public in Public Management, by John Clayton Thomas · 2014
4. Citizens and the New Governance: Beyond New Public Management, by Luc Rouban
5. Avasthi A & Maheshwari, S.R., Public Administration; Lakshmi Narain ' Agarwal: Agra.
6. Barnabas, A.P., Citizens' Grievances and Administration; IIPA, New Delhi.
7. Bhattacharya, Mohit, 1987. Public Administration-Structure, Process and Behaviour
8. Chaturvedi T.N. & Sadasivan S.N. (Eds), 1984. Citizen and Administration; IIPA: New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PADL0017: DECENTRALIZATION AND LOCAL GOVERNANCE

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES
At the end of this course students are able to:
1. Understand various approaches of decentralization (Remembering & Understanding)
2. Understand the concept of democratic decentralization (Understanding)
3. Analyze the implication of the 73rd and 74th Amendment Acts (Analyzing)
4. Evaluate the role of Peoples participation in Rural and Urban Development (Applying)

Module – I (10 hours)
Decentralization: The concept; the significance of decentralization; Approaches to Decentralization

Module – II (10 hours)
Types of Decentralization; Democratic decentralization and local governance in India

Module-III (10 hours)
Rural local government; Urban local government; Implication of 73rd and 74th Amendment Acts; Critical appraisal

Module –IV (15 hours)
Peoples participation in Rural and Urban development; Major Rural and Urban development programmes.

Suggested Readings
1. Pranab Bardhan, Dilip Mookherjee - Decentralization and Local Governance in Developing Countries – A Comparative Perspective
2. T. R. Raghunandan - Decentralisation and Local Governments: The Indian Experience
3. Rémi de Bercegol - Small Towns and Decentralisation in India: Urban Local Bodies in the Making
4. D. Rajasekhar, M Devendra Babu, R Manjula - Decentralisation in Contemporary India: Status, Issues and the Way Forward
5. Chandan Sengupta, Stuart Corbridge - Democracy, Development and Decentralisation in India: Continuing Debates

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PAEG0018: E-GOVERNANCE

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Understand Electronic Service Delivery mechanism (Remembering & Understanding)
2. Understand the Models of E-Governance (Understanding)
3. Analyze the Evolution in E-Governance (Analyzing)
4. Evaluate the significance of Technological Infrastructural Preparedness (Applying)

Module – I (10 hours)

Introduction to E-Government and E-Governance: Difference between E-Government and E-Governance; E-Government as Information System; Benefits of E-Government; E-Government Life Cycle; Online Service Delivery and Electronic Service Delivery; Evolution, Scope and Content of E-Governance; Present Global Trends of Growth in E-Governance

Module – II (15 hours)

Models of E-Governance: Introduction; Model of Digital Governance: Broadcasting / Wider Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive – Service Model / Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Towards Good Governance through E-Governance Models

Module-III (10 hours)

E-Government Infrastructure Development: Network Infrastructure; Computing Infrastructure; Data centres; E-Government Architecture; Interoperability Framework; Cloud Governance; E-readiness; Data System Infrastructure; Legal Infrastructural Preparedness; Institutional Infrastructural Preparedness; Human Infrastructural Preparedness; Technological Infrastructural Preparedness

Module –IV (10 hours)

Case Studies: E-Government Initiatives in USA, UK and India.

Suggested Readings

1. R.P. Sinha- E-governance in India: Initiatives and Issues
2. Prabhu- E-Governance: Concepts and Case Studies
3. Sri Ram Khanna- Digital Drive, E-governance and Internet Services in India: Quality Dimensions
4. Suri, P.K., Sushil - Strategic Planning and Implementation of E-Governance
5. Basandra, S.K - Computers Today Galgotia Publishers Pvt. Ltd
6. Bhatnagar S.S. - E-government: From Vision to Implementation
7. Bhatacharya, J. - E-gov2.0: policies, progress and technologies
8. Brien, J and Marakas G.M - Management Information System: India(TMH)
9. B. Srinivas - E-Governance Technique

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PADP6001: DISSERTATION – Phase I

Credits: -6 (90 Hours)

Every student shall undertake a research project work which has bearing on his/her area under the supervision and guidance of a faculty member. The preliminary work may begin in the third semester. The students are expected to complete the Literature Survey and Synopsis before going for data collection. The thesis is to be submitted to the department before the date notified. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the 3rdsemester. There shall be a viva voce examination on the research project. 6 Credits of this course will be allotted in the 4th semester.

PADP6005: DISSERTATION – Phase II
Credits: -6 (90 Hours)

Every student shall undertake a research project work which has bearing on his/her area under the supervision and guidance of a faculty member. The preliminary work may begin in the third semester. The students are expected to complete the Literature Survey and Synopsis before going for data collection. The thesis is to be submitted to the department before the date notified. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the 3rdsemester. There shall be a viva voce examination on the research project. 6 Credits of this course will be allotted in the 4th semester.

VALUE ADDED COURSES

PAEP0021: ENVIRONMENTAL POLICY AND ADMINISTRATION

Credits: -3 (45 lectures) (45 hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Understand the Development and Environmental issues in India (Understanding)
2. Understanding the Environmental Policies in India and recent developments (Remembering and understanding)
3. Analyze the Impact of urbanization on Environment (Analyzing)
4. Evaluate the Urban Environmental administration in India (Applying)

Module – I (10 hours)

Development and Environmental issues in India; Environmental Policy in India; Role of Judiciary in Environmental administration in India; Civil Society and Environmental protection in India

Module – II (15 hours)

Development – Environment Discourse; Global Environmental Governance

Module-III (10 hours)

Urban Environmental administration and politics in India; Impact of urbanization on Environment and Public Health.

Module –IV (10 hours)

Urban Environmental administration: Major initiatives; Environmental politics in Urban India; Environmental Protection and People's right and duties; Steps taken by the government for environmental protection in the recent years.

Suggested Readings

1. Ajith Sankar- Environmental Management
2. Bruckmeier, Karl - Global Environmental Governance: Social-Ecological Perspectives
3. Arild Vatn- Environmental Governance: Institutions, Policies and Actions
4. J.P. Evans - Environmental Governance
5. Jean-Frederic Morin, Amandine Orsini- Essential Concepts of Global Environmental Governance
6. Frank Biermann, Philipp H. Pattberg - Global Environmental Governance Reconsidered
7. Prakash Chand Kandpal- Environmental Governance in India: Issues and Challenges
8. Albert Breton- Environmental Governance and Decentralisation

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PAIG0023: INNOVATION IN GOVERNANCE

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Understand the Institutional Framework for Promoting Innovations (Remembering & Understanding)
2. Understand the Methodological Approach for studying best Practices (Understanding)
3. Analyze the Innovations in Public Services (Analyzing)
4. Evaluate the role of citizen's participation in governmental innovations (Applying)

Module – I (10 hours)

Innovations in Governance: Meaning of innovation in governance; Perspectives and Challenges; Characteristics and Patterns of Innovations; Institutional Framework for Promoting Innovations; Public Governance and Innovations: Administrative Reform to Innovation Discourse

Module – II (10 hours)
Understanding Innovations: Innovation for Achieving a Quality of Life, Methodological Approach for studying best Practices, Capacities for Innovation and Best Practices

Module – III (10 hours)
Innovations in Public Services: Recent trends; Innovation Capacity in Organizations; Leadership and Innovation; Innovations in different sectors: General Administration, Urban Administration, Health Administration, Private Sector, Agriculture, etc

Module – IV (10 hours)
Transferability of Best Practices and Innovations: The Ombudsman against Corruption, Technology and Changing Nature of Organizations, Best Practices of Knowledge Management Framework, Diffusion of Innovation in a Development Context

Module – V (05 hours)
Issue Areas: Originality and Replication of Innovations; Innovation with or Without Improvement; Citizen Participation in Government Innovations; Research in Innovative Governance

Suggested Readings

1. Anttiroiko et.al. (Eds.) (2011), Innovations in Public Governance, IOS Press.
2. Bevir, Mark, ed. (2010) The Sage Handbook of Governance. Thousand Oaks, CA: Sage Publications.
3. Borins, S. (2001), The Challenge of Innovating in Government (PricewaterhouseCoopers Endowment for the Business of Government,) Governance Innovators Network, http://www.innovations.harvard.edu/
4. Innovations in Governance and Public Administration: Replicating what works, (2006) Department of Economic and Social Affairs, United Nations, New York
5. Jean Hartley (January 2005), Innovation in Governance and Public Services: Past and Present, Public Money & Management, pp.27-36.
6. Newman, J., Raine, J. and Skelcher, C. (2000), Innovation in Local Government: A Good Practice Guide (DETR, London).
7. Peters, B. Guy (1996) The Future of Governance: Four Emerging Models, pp. 1-20.
8. Pollitt, C. and Bouckaert, G. (2000), Public Management Reform: A Comparative Analysis (Oxford University Press, Oxford).
9. Sandford Borins, ed., (2008), Innovations in Government Research, Recognition, and Replication, Brookings Institution Press.
10. Stephen P. Osborne, Ed.,(2001), The New Public Governance? Emerging Perspectives on the Theory and Practice of Public Governance. London: Routledge
11. Walker, R., Jeanes, E. and Rowlands, R. (2002), Measuring innovation: Applying the literature based innovation output indicator to public services. Public Administration, 80, pp. 201–214.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PASL0200: SERVICE LEARNING

Course Code: Credits: 2 (30 lectures) (60 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

1. Learn the concept of service learning and community engagement. (Remembering)
2. Understand the importance of service learning and community engagement for developing the skills of addressing real life issues in one's own community. (Understanding)
3. Develop an understanding of the importance of communication skills in interacting with community members. (Understanding)
4. Be exposed to and empathize with people who are less fortunate than they are, politically, economically, socially, academically etc. (Applying)

5. Organize awareness programmes, rallies, campaigns, social service etc. (Analysing)
6. Develop the skills of problem solving and reflective thinking. (Analysing)
7. Realize one's potentiality to make a difference in the life of their community members. (Evaluating)
8. Understand and experience various political and administrative issues that exist in the Society. (Evaluating)

Module I: Introduction to Service learning (10 hours)
Nature, Objectives, Historical Overview, Models, Qualities, Role of Higher Education Institutions (HEIs), Benefits, Challenges and Opportunities of Service Learning.

Module II: Social Responsibilities of HEIs (10 hours)
Understanding Social Responsibilities of HEIs, Community-University Engagement, Engaged Teaching, Research and Service, Principles for Community Engagement, Forms of Community Engagement, Community Based Participatory Research.

Module III: Understanding Rural Society (20 hours)
Rural Life Style, Rural Society, Rural Economy and Livelihood, Rural Institutions (Traditional Rural Organisations, Self-Help Groups, Panchayati Raj Institutions), Rural Development Programmes (Sarva Siksha Abhiyan, Beti Bachao Beti Padhao, Swatchh Bharat, Ayushman Bharat, MNREGA etc.).

Module IV: Practices for Service learning and Community (10 hours)
Internship, Community Mobilization, Awareness/Advocacy campaign, community meetings, rural reporting, case studies.

Suggested Readings

1. Berryman, S., and Bailey, T. (1992): The Double &elix of Education and the Economy. New York: The Institute on Education and thd Economy, Teachers College, Columbia University.
2. Blum, R. E. (May 10, 1995): Learning and Teaching: Our Work Together. Draft Concept Paper. Portland, OR: Northwest Regional Educational Laboratory.
3. Carnevale, A.; Gainer, L.; and A. Meltzer. (1990): Workplace Basics: The Essential Skills Employers Want. San Francisco: Jossey-Bass Publishers.
4. Collins, A., Brown, J.S. and S. Newman. "Cognitive Apprenticeship: Teaching the Craft of Reading, Writing and Mathematics", in L.B. Renick (ed.) Knowing Learning and Instruction: Essays in honour of Robert Glaser. Hillsdale, Erlbaum. Druian, G., Owens, J. and S. Owen. "Experiential Education: Search for Common
5. Roots". in R. Kraft and Y. Kielomeier (eds.) Experiential Learning in Schools and Higher EducationJ'. Dubuque, IAI KendalVHunt Publishing Co. (1995), pp. 17-25.
6. Dukehart, L. (1994). Community as Classroom: A Report Based on Presentations at the Work Now and in the Future 11 Conference". 7th Portland, OR Northwest Regional Educational Laboratory.
7. Hamilton, S.F. (1990). Apprenticeship for Adulthoad: Preparing Youth for the Future. New York: Free Press.
8. Zelldin, S. (1995). School to Work and Youth Development: Identifying Common Ground. Boston, M;A. High.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	H	L	L
CO 2	L	H	L	L
CO 3	L	L	L	H
CO 4	L	L	H	H
CO 5	L	L	H	H
CO 6	L	L	L	H
CO 7	L	L	L	H
CO 8	H	H	H	H

DE -1: Elective Group I - Choose any one

PAHR0024: INTRODUCTION TO HUMAN RIGHTS (HR)

Credits: 3 (45 Hours)

Course Outcomes:

At the end of this course, students would be able to:

CO 1: Recall the meaning, kinds and nature of human rights, and their evolution and development at domestic and

international levels (Remembering)
CO 2: Explain the nature and importance of UDHR, its universality and worldwide influence(Understanding)
CO 3: Identify the codification, nature and types of rights provided by the ICCPR (applying)
CO 4: Examine the state's obligations for implementing ICESCR (Analysing)

Module - I (15 hours) Understanding Human Rights:
Meaning of Human Rights; Kinds and Nature of Human Rights; Evolution of Rights - Developments at Domestic Level; Important Declarations of Rights; International Efforts to Develop Human Rights Norms.

Module – II (15 hours) Universal Declaration of Human Rights:
Objectives, Nature, and importance of UDHR; Critique of Human Rights; Universality of Human Rights; Worldwide Influence of UDHR; NGOs on Human Rights.

Module -III (15 hours) International Covenant on Civil and Political Rights:
Codification of Rights; Nature of International Covenant on Civil and Political Rights (ICCPR); types of Rights provided by the ICCPR; Limitations on the Exercise of Rights; Mechanism for monitoring the implementation of Rights; The procedure to file complaints.

Module - IV (15 hours) International Covenant on Economic, Social and Cultural Rights:
International Covenant on Economic, Social and Cultural Rights (ICESCR); Implementation Mechanism; The Nature of Obligations under ICESCR; Economic, Social and Cultural Rights under the Indian Constitution.

Suggested ReadingS

1. Baehr, Peter. *Human rights: Universality in practice*. Springer, 2016.
2. O'Byrne, Darren. *Human rights: An introduction*. Routledge, 2014.
3. Assembly, UN General. "Universal declaration of human rights." *UN General Assembly* 302.2 (1948): 14-25.
4. Nickel, James W. *Making sense of human rights: Philosophical reflections on the universal declaration of human rights*. Univ of California Press, 1987.
5. Joseph, Sarah, and Melissa Castan. *The international covenant on civil and political rights: cases, materials, and commentary*. Oxford University Press, 2013.
6. Schabas, William A. *UN International Covenant on Civil and Political Rights: Nowak's CCPR Commentary*. NP Engel Verlag, 2019.
7. Saul, Ben, David Kinley, and Jaqueline Mowbray. *The international covenant on economic, social and cultural rights: commentary, cases, and materials*. OUP Oxford, 2014.
8. Sepúlveda, M. Magdalena, and María Magdalena Sepúlveda Carmona. *The nature of the obligations under the International Covenant on Economic, Social and Cultural Rights*. Vol. 18. Intersentia nv, 2003.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PAIR0025: INTRODUCTION TO INTERNATIONAL RELATIONS (IR)

Credits: 3 (45 Hours)

Course Outcomes:
At the end of this course, students would be able to:
CO 1: Explain the Basic concepts of IR, its development as a discipline, Actors and Processes, Power and Balance of Power, International Economics (Understanding)
CO 2: Identify the theories of International Relations (Applying)
CO 3: Examine the various Issues in Contemporary IR (analyzing)

MODULE I [15 hours]: Introduction and Basic concepts of IR:
a. Introduction: Why study IR – Development of IR as discipline – International System/International Society- Impact of

Globalisation - Global South and IR

b. Actors and processes in IR: States and Non-State Actors (IGO's, NGO's, MNC's and terrorist groups).
c. Power: Definition and Exercising Power – Elements of National Power, Soft Power and Its relevance in the contemporary IR study.
d. Balance of Power – Bi-Polar/Unipolar/Multi-Polar and Non-Polarity- Soft balancing.
e. International Economics

Module II [15 hours]: Theories of International Relations:
Realist, Liberal, Marxist and Critical Theories of IR [Newly added]

MODULE-III [15 hours]: Issues in Contemporary IR:
International Terrorism, Nuclear Proliferation, Human Security, Climate Change and Environmental Security, Energy Security, Natural resource scarcity, Pandemic and Disaster Management, IR in In Covid and Post Covid

Suggested Readings

1. Andrew F. Hart & Bruce D. Jones (2010-2011), How Do Rising Powers Rise**?,** Survival, vol. 52 no.
2. 6, December –January, pp. 63–88.
3. Baylis, John and Steve Smith (2011): *The Globalisation of World Politics,* New York: Oxford University Press .
4. Derek Mcdougal (2012): Responses to 'Rising China' in the East Asian Region: soft balancing with accommodation, Journal of Contemporary China, 21(73), January, 1–17.
5. Joseph Y. S. Cheng (2011): The Shanghai Co-operation Organization: China's Initiative in Regional Institutional Building, Journal of Contemporary Asia, 41:4, 632-656.
6. Mary Martin and Taylor Owen (2010): The Second Generation of Human Security: lessons from the
7. UN and EU Experience, *International Affairs* 86: 1, 211-224.
8. Michael Sheehan (2010): International Security: An Analytical Survey, Viva Books: New Delhi.
9. Oxford University Press: New Delhi.
10. Paul R. Viotti and Mark V. Kauppi (2007): International relations and World Politics: Security,
11. Economy, Identity, Pearson: Delhi.
12. Paul, T.V. (2009): *The Tradition of Non-use of Nuclear Weapons,* Stanford: Stanford University Press.
13. Seethi K.M.(2009): Perils of Nuclear Renaissance, Indian Journal of Politics and International Relations, vol. 1, July-December
14. Tanja A. Börzel and Thomas Risse (2010): Governance without a state: Can it work? *Regulation & Governance,* 4, 113–134.
15. Thomas Wilkins (2010): The new 'Pacific Century' and the rise of China: an international relations perspective, Australian Journal of International Affairs, 64:4, 381-405
16. Vinodan.C. (2010): Energy, Environment and Security in South Asia, *International Journal of South Asian Studies*, vol.3, no.1, pp 1-12

PAIC0026: ISSUES IN CONTEMPORARY INTERNATIONAL RELATIONS (HR/IR)

Course Outcomes:
At the end of this course, students would be able to:
CO 1: Explain the Basic concepts of Globalisation and Challenges to Developing countries (Understanding)
CO 2: Identify Various Environmental Issues addressed at International levels (Applying)
CO 3: Examine the various Regional and Global Security Issues (analyzing)

Module I [Hours 15] : Globalisation and Challenges to Developing Countries
Globalization and (under)development- population explosion- human rights issues- international migration and refugee crisis

Module II [Hours 15] : International Relations of Environmental Issues
Sustainable development- the notion of collective goods- natural resource exploitation and scarcity- global warming and international climate regimes- disputes over resources- nuclear proliferation and international treaties

Module III [Hours 15] : Regional and Global Security Issues
Political instability in third world countries- energy security- cyber security- arms proliferation-Non State actors- terrorism and counter terrorism

Suggested Reading

1. Baylis, John & Smith S (Eds) (2014).*The Globalization of World Politics: An Introduction to International Relations*. OUP.
2. Betts, Alexander & Loescher G (Eds) (2011). *Refugees in International Relations*. Oxford University Press.
3. Brown C & Ainley K (2009). *Understanding International Relations* (4th ed). Palgrave Bull, Hedley (1977). *The Anarchical Society: A Study of Order in World Politics*. Macmillan.
4. Buzan B. & Lawson G. (2015). *The Global Transformation: History, Modernity and the Making of International Relations: CUP*.
5. Castles, Stephen & Davidson A. (2005). *Citizenship and Migration: Globalization and Politics of Belonging*. Routledge
6. Castles, Stephen & Miller M. J. (2003). *The Age of Migration: International Population Movements in the Modern World* (Third Edition). MacMillan.
7. Christian, Reus -Smith & Snidal D (eds.) (2008). *Oxford Handbook of International Relations*.
8. Clark I. (1997). *Globalization and Fragmentation: International Relations in the Twentieth Century*. Oxford University Press.
9. Dinar, Shilom. (2009). Scarcity and Cooperation along International Rivers. *Global Environmental Politics*, *9*(1), 109.
10. Fiddian-Qasmiyeh E. et al. (Eds) (2014). *The Oxford Handbook of Refugee and Forced Migration Studies*. Oxford University Press.
11. Higgins, R. & Flory, M. (2003). *Terrorism and International Law*. Routledge.
12. Robert Art & Robert Jervis (eds) (2012). *International Politics: Enduring Concepts and Contemporary Issues* (11th ed). Pearson.
13. Samson, T. (2000). *Issues in International Relations*. Routledge.
14. Teryima B, Ashaver (2013, Sep. -Oct.). Poverty, Inequality and Underdevelopment in Third World Countries: Bad State Policies or Bad Global Rules?. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, *15*(6), 33-38.
15. Vincent, R. J. (1995). *Human Rights and International Relations*. CUP.
16. Zolberg A. R. Et al (1989). *Escape from Violence: Conflict and the Refugee Crisis in the Developing World*. Oxford University Press.

PAPF0027: POLICY FORMULATION- STRUCTURES AND PROCESSES (PP)

Credits: 3 (45 Hours)

Course Outcomes:

At the end of this course, students would be able to:

CO1- Recall the basic concepts and types of public policy (Understanding).
CO2- Identify the role of different institution in policy formulation (Applying)
CO3- Examine the agencies involved in policy formulation process(Analysing)

Module I (15 Hours) Introduction to Public Policy

Meaning, Nature and Scope of Public Policy; Significance of Public Policy; Types of Policy; Public Policy and Public Administration; Policy Cycle.

Module II (15 hours)Policy Formulation Structures

Inter-Governmental Relations; Role of Legislature; Role of Executive; Role of Judiciary; Role of Bureaucracy; Challenges in Policy Formulation.

Module III (15 Hours) Policy Formulation Processes

Techniques of Policy Formulation; Approaches/ Models of Policy Formulation; Agencies involved in Policy Formulation; Informal Channels of Policy Formulation; Role of International Organizations.

References:

1. R.K Sapru, Public Policy: A Contemporary Perspective, Sage Publications India Pvt Ltd, 2017.
2. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
3. Maniram sharma, Public Policy in India, Mahaveer Publications, 2023.
4. Haridwar Shukla,Public Policy and Administration in India, Mahaveer Publications, 2021
5. Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015
6. Ramesh Kumar Tiwari and Aasha Kapur Mehta, Public Policy and Administration, Gyan Publishing House 2012.
7. Christoph Knill and Jale Tosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.

DE 3 : Elective Group II - Choose anyone

PALM0028: LABOUR MIGRATION, CITIZENSHIP AND GOVERNANCE (HR/IR)

Credits: 3 (45 Hours)

Course Outcomes:
At the end of this course, students would be able to:
CO 1: Recall the meaning, nature, reasons, and impact of labour migration. (Remembering/ Understanding)
CO 2: Identify the issue of human rights violations of migrant labourers. (Applying)
CO 3: Explain the Contribution of Labour Migration in India's Development (Understanding)
CO 4: Examine the issues of Labour migration and citizenship rights. (Analysis)

Module - I (15 hours) Understanding Labour Migration
Labour migration-meaning; nature and determinants; reasons and impact; Migrant Labours and human rights; International labour standards on labour migration; the role of ILO.

Module – II (15 hours) Labour Migration in India:
Overview of Labour Migration in India; Contribution of Labour Migration in India's Development; Labour Rights and Labour Standards for Migrant Labour in India.

Module -III (15 hours) Citizenship:
Significance; Nature of Citizenship; Labour migration and citizenship rights.

Module - IV (15 hours) Case studies:
Case Study on Inter-State Labour migration in India; Case Study on International Labour migration; Active citizenship case studies.

Suggested Reading:
1. Amrith, Megha, and Nina Sahraoui, eds. *Gender, work and migration: agency in gendered labour settings*. Routledge, 2018.
2. Panneerselvan, A. S. "Uncertain journeys: labour migration from South Asia".
3. Rajan, S. Irudaya, ed. *India migration report 2010: Governance and labour migration*. Taylor & Francis, 2020.
4. Acharya, Ashok. *Citizenship in a globalizing world*. Pearson Education India, 2011.
5. Mahanta, Nani G. *Citizenship Debate over NRC and CAA: Assam and the Politics of History*. SAGE Publishing India, 2021.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2	H	M		
CO 3		H		
CO 4			H	M

PASE0029: INDIA IN SOUTH EAST ASIAN POLITICS (HR /IR)
(3 CREDITS)

Course Outcomes:
At the end of this course students are able to:
CO 1: relate important aspects of the history of India and South East Asia (Remembering).
CO 2: explain the policies of India in relation to South East Asian Countries. (Understanding)
CO 3: Identify various Important International institutions and agencies in South East Asia (Applying)
CO 4: Examine the challenges faced by India by South East Asian Politics. (Analysing)

Module I Historical Developments:
Historical, cultural, political, Trade and Social history of India with South East Asia, Indian Influence on South east Asia,

Module II India and its Neighborhood:
Look East Policy, Act East Policy, Kaladan Multi-modal Transit Transport Project,

Module III International Institutions:
ASEAN, RECP, ADB, JICA, World Bank, SCO, BRICS, BIMSTEC

Module IV Indian Challenges:
Golden Triangle, South China Sea and Chinese Claims, String of Pearls, CPEC, OBORI, Malaccan Dilemma, Border Disputes, and Insurgency.

Suggested Readings:
1. Devotta, Neil (2015) An Introduction to South Asian politics. Routledge Publishing: New Delhi.
2. Ahmad, Ahrar (2013) Government and Politics in South Asia. West View Press: Colorado,US.
3. Pandit, Dhulipudi, Santishree and Basu, Rimli (2012) Cultural Diplomacy in South-East-Asia: India's Look East Policy, Buddhism as an instrument of Foreign Policy. LAP Lambart Academic Publishing: London, UK.
4. Ludden, David (2015) India and South Asia: A Short History (Short Histories). Pan Macmillan India: New Delhi.
5. Tat,Urni (2022) India's Development Diplomacy: Understanding Development Cooperation As a Tool For Strategic Engagement In South Asia. KW Publishers: New Delhi.
6. Bhattacharyya, Daipayan (2016) Government as Practice: Democratic Left in a Transforming India (South Asia in the Social Sciences) Cambridge University Press: New Delhi.

PAPP0030: PUBLIC POLICY IN INDIA (PP)

Credits: 3 (45 Hours)

Course Outcomes:
At the end of this course students are able to:
CO 1: Recall the various stages and determinants of public policy(Remembering).
CO 2: Explain the various determinants of Public Policy (Understanding)
CO 3: Identify India's developmental policies(Applying).
CO 4: Examine the policies for weaker and marginalized sections (Analysing).

Module I (15 Hours): Introduction to Public Policy in India
Historical perspectives and developments of Public Policy (Five Year Plans); Socio-economic and political determinants of Public Policy; Technology and Public Policy; Ethics in Public Policy

Module II (15 Hours) India's Developmental Policies
Education Policy; Health Policy; Environmental Policy; IT Policy; Economic Policy.

Module III (15 Hours) Policies for Weaker and Marginalized Sections
Tribal Development; Children Welfare; Women Empowerment; Policies for Senior Citizens; Transgender Inclusion;

References:
1. Rajesh Chakrabarti and Kaushiki Sanyal, Public Policy in India, Oxford University Press, 2016.
2. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
3. Maniram sharma, Public Policy in India, Mahaveer Publications, 2023.
4. Haridwar Shukla,Public Policy and Administration in India, Mahaveer Publications, 2021
5. Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015
6. Veerendra Mishra, Transgenders in India: An Introduction, Taylor and Francis Group, Routledge Publications, 2023.
7. John Baldock et. al., Social Policy, London: Oxford University Press, 2011.

PADV0031: DATA MANAGEMENT AND VISUALISATION

Credits: 2 (L.T.P 1-0-1) 15+30 hours

Course Outcomes:
At the end of this course, students would be able to:
CO 1: Exhibit a basic understanding of data management and visualization (Understanding)
CO 2: Apply knowledge of data management and visualization to solve a business problem. (Applying)

Module – I Data Management & Visualisation:
Meaning and significance of data management; Data Management Platforms and software.
Meaning and significance of data visualization; Data Visualization tools and software.

Module -II Data Management & Visualisation – Practical:
SAS - Statistical Analysis System
Visualization software (Tableau, Excel, Power BI)

Suggested Reading:
1. Strengholt, Piethein. Data Management at Scale. N.p., O'Reilly Media, 2020.
2. International, Dama. DAMA-DMBOK: Data Management Body of Knowledge. United States, Technics Publications, 2017.
3. Data Visualization: Trends and Challenges Toward Multidisciplinary Perception. Germany, Springer Nature Singapore, 2020.
4. Grant, Robert. Data Visualization: Charts, Maps, and Interactive Graphics. United States, CRC Press, 2018.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H	H		
CO 2			H	H

PAIO0032: INTERNATIONAL ORGANISATIONS AND NATIONAL INTEREST (HR/IR)

Credit 3 (Hours 45)

Course Outcomes:
At the end of this course students are able to:
CO 1: Recall key concepts and importance of IOs and national interests (Remembering)
CO 2: Identifying theoretical perspectives of IOs and national interests (Applying)
CO 3: Examine the functioning of the United Nations Organization and other International Organisations (Analysing)

Module 1 (Hours 10): International Organisations (IOs) and National Interest:
Key concepts, necessities of IOs, IOs and national interests, the demand for international regime

Module 2 (Hours 15): Theoretical approaches to international organizations and national interests:
Theories and approaches to IOs and national interest

Module 3 (Hours 20): Functioning of the United Nations Organization and other IOs:
Evolution and Development, role and achievement of the UNO and other IOs, issues and challenges; nation-states' response to the UNO (case study of the permanent member states; non-permanent member states like India)

Suggested Readings:
1. Lenz, T., Hooghe, L., Marks, G. (2019). A Theory of International Organization. United Kingdom: OUP Oxford.
2. Pease, K. S. (2018). International Organizations: Perspectives on Global Governance. United Kingdom: Taylor & Francis.
3. Krasner, S. D. (2020). Defending the National Interest: Raw Materials Investments and U.S. Foreign Policy. United States: Princeton University Press.
4. Burchill, S. (2005). The National Interest in International Relations Theory. United Kingdom: Palgrave Macmillan UK.
5. Weiss, T. G. (2019). The United Nations and Changing World Politics. United States: Taylor & Francis.
6. Coicaud, J. (2007). Beyond the national interest: the future of UN peacekeeping and multilateralism in an era of U.S. primacy. Washington: United States Institute of Peace Press.
7. Roach, S. C., Griffiths, M., O'Callaghan, T. (2014). International Relations: The Key Concepts. United Kingdom: Taylor & Francis.

PAPI0033: POLICY IMPLEMENTATION (PP)

Credits: 3 (45 Hours)

Course Outcome:
At the end of this course students are able to:
CO 1: Explain the policy implementation system, models and approaches (Understanding).
CO 2: Identify policy implementation techniques and challenges(Applying).
CO 3: Examine the impact of public policy through case studies(Analysing).

Module I (15 Hours) Policy Implementation System

Policy Implementation as a Concept; Systems and Issues of Policy Implementation; Approaches/ Models in Policy Implementation;

Module II (15 Hours) Implementation Techniques
Conditions for Successful Implementation of Public Policy;Agencies in Policy Implementation; Challenges in Policy Implementation**.**

Module III (15 Hours) Case Studies in Policy Implementation
Suggested areas- Education, Health, Tribal Development, Weaker Sections. Evaluation and Feedback: Monitoring and Social Audit.

Suggested Readings
1. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
2. Christoph Knill and Jale Tosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.
3. Paul Cairney,. Understanding Public Policy: Theories and Issues, Red Globe Press, London, 2020
4. Jaideep Singh, Case Studies in Public Administration, Indian Institute of Public Administration, 1983.
5. Maniram sharma, Public Policy in India, Mahaveer Publications, 2023.
6. Haridwar Shukla,Public Policy and Administration in India, Mahaveer Publications, 2021.
7. Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015

PACG0034: CHINA AND THE GLOBAL SYSTEM (HR/IR)

Credit 3 (Hours 45)
Course Outcome:
At the end of this course students are able to:
CO 1: Explain the policy implementation system, models and approaches (Understanding).
CO 2: Identify policy implementation techniques and challenges (Applying).
CO 3: Examine the impact of public policy through case studies (Analysing).

Module 1 (Hours 15): Rise of China and the debate on Asian Century
1.1 Theoretical Explanations: China as a major power
1.2 China's Foreign policy and World view- Peaceful Rise and State power
1.3 Chinas perspectives on Asian Century
1.4 China and the UNO

Module 2 (Hours 15): China and Global powers
2.1 US- China relations
2.2 Russia- China relations
2.3 EU-China relations
2.4 India- China Relations
2.5 Japan – China

Module 3 (Hours 15): Chinas engagement with the regions
3.1 OBOR (One Belt, One Road)
3.2 Neighbourhood policy – South Asia- East Asia and South East Asia
3.3 Territorial disputes: Maritime disputes: South China Sea Boundary dispute

Suggested Readings:
1. Dahlman, C. (2011). The World Under Pressure: How China and India Are Influencing the Global Economy and Environment. United States: Stanford University Press.
2. Cao, C., Han, X., Parker, R., Appelbaum, R. P., Simon, D. (2018). Innovation in China: Challenging the Global Science and Technology System. United Kingdom: Polity Press.
3. He, A. (2016). The Dragon's Footprints: China in the Global Economic Governance System Under the G20 Framework. Canada: McGill-Queen's University Press.
4. Liu, W. (2014). China in the United Nations. United States: World Century Publishing Corporation.
5. Oertel, J. (2015). China and the United Nations. Germany: Bloomsbury Publishing.
6. Mifune, E., Kondapalli, S. (2010). China and Its Neighbours. India: Pentagon Press.
7. Tai, M. (2019). China and Her Neighbours: Asian Diplomacy from Ancient History to the Present. United Kingdom: Zed Books.

PAPO0035: POLICY ANALYSIS (PP)

Credits: 3 (45 Hours)

Course Outcome:

At the end of this course students are able to:

CO 1: Explain the basic concept and framework of policy analysis (Understanding)
CO 2: Identify methods and techniques of Policy Analysis (Applying).
CO 3: Examine the various issues involved in policy analysis (Analyzing).

Module I (15 Hours) Introduction to Policy Analysis

Meaning of Policy Analysis; Stages in Policy Analysis; Types of Policy Analysis; A Framework of Public Policy Analysis in Indian Context.

Module II(15 Hours)

Policy Analysis Scenario: Policy Sciences: Nature, Scope and Utility; Methods and Techniques of Policy Analysis; Civil Societies and democratization of Policy Analysis;

Module III (15 Hours)

Issues in Policy Analysis: Ethics in Policy Analysis, Key elements of Policy Analysis (Stuart S. Nagel); The major Dimensions of policy analysis; Policy Analysis and Emerging Crisis

References:

1. Jean Dreze, Social Policy, New Delhi: Orient Blackswan Private Limited, 2016.
2. V. K. Agnihotri, Public Policy: Analysis and Design, Concept Publishing Company, 1995.
3. Rachel Meltzer and Alex Schwartz, Policy Analysis as Problem Solving: A Flexible and Evidence-Based Framework, Routledge, 2018.
4. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
5. Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015
6. Ramesh Kumar Tiwari and Aasha Kapur Mehta, Public Policy and Administration, Gyan Publishing House 2012.
7. Rajesh Chakrabarti and Kaushiki Sanyal, Public Policy in India, Oxford University Press, 2012.

DEPARTMENT OF SOCIAL WORK
MASTER OF SOCIAL WORK- MSW

VISION

To be a centre of excellence in Social Work teaching, learning, research and practice which promotes commitment to social justice, fosters social consciousness and sensitivity, and upholds the dignity and worth of all.

MISSION

The Social Work Department of Assam Don Bosco University seeks to:

- Promote rights based approaches to development based on the International declaration of human rights
- Achieve excellence in teaching, learning, research, practice, outreach programmes and extension services
- Promote critical thinking and innovative intervention in response to societal and environmental problems
- Mould professionally competent individuals who are sensitive and committed to the values, principles and ethics of social work
- Create and foster an environment of justice and respect for all by promoting social consciousness, courage of conviction, appreciation for diversity and caring for creation.

PROGRAM OUTCOMES – MSW PROGRAMME

PO 1: **Critical Thinking and Professional Judgment:** Apply theoretical knowledge to make a critical analysis, intervene using innovative frameworks and evaluate and follow up.

PO 2: **Effective Communication**: Engage in inter-personnel, behavioral change communication and be proficient in Information Communication Technology.

PO 3: **Gender Sensitization, Social Commitment and Social Interaction**: Work in teams and partnerships at local, national and transnational projects and settings with focus on gender equity and cultural sensitivity

PO 4: **Effective Citizenship**: Engage in service learning and community engagement programmes for contributing towards achieving of local, regional and national goals.

PO 5: **Ethics**: To engage in social work practice as per National Association of Social Worker's ethical framework.

PO 6: **Environment and Sustainability**: Participate and promote World sustainable development goals 2030.

PO 7: **Self-directed and Life-long Learning**: Engage in continuous learning for professional growth and development.

PO 8: **Scientific Temper: -** Gaining aptitude for research for contribution to knowledge enterprise and documentation of social work theory and practice.

PROGRAM SPECIFIC OUTCOMES

PSO 1: **PSO 1: Conceptual clarity:** Students get familiarized and attain conceptual clarity in social work theories, perspectives, models, methods and processes of social work practice.

PSO 2: **PSO2: Attaining procedural skills:** Students attain knowledge of different steps of doing a work/intervention as per local, national and international protocols- norms, legal bindings and regulations.

PSO 3: **PSO3: Strategic intervention skills**: Learn what should be done when, and how it should be done when it comes to social work interventions in the fields of children, women, families, community development, health and mental health, development projects, and other welfare activities.

PSO 4: **PSO4: Attitudinal change:** Working with the personal self for meaningful and enriching social work professional career.

LIST OF COURSES

Sl.NO	Course
1.1	History, Ideologies and fields of Social Work
1.2	Human Growth and Development
1.3	Introduction to Indian Society, Polity and Economics
1.4	Social Work with Communities and Social Action
1.5	Environment and Disaster Management
1.6	Gender Studies
1.7	Concurrent Field Work and Rural Practicum
1.8	Service learning/Rural practicum
2.1	Social Casework Practice with Individuals and families

2.2	Social Work Practice with Groups
2.3	Social Work Research and Statistics
2.4	Social Welfare Administration
2.5	Introduction to Disability Studies
2.6	Concurrent Field Work II
3.1	Social Justice, Human Rights & Para-legal Education
3.2	Emerging Social Work Perspectives and Integrated Approach
3.3	Computer Applications for Social Sciences (Lab)
3.4	Community Development: Rural, Tribal and Urban
3.5	Governance and Community Development
3.6	Family Centered Social Work Practice
3.7	Social Work Practice with Children
3.8	Medical Social Work
3.9	Mental Health and Social Work
3.10	Organisational Structure, Behaviour and Development
3.11	Policies For Development Organisations – Urban, Rural and Tribal Communities
3.12	Introduction to Child Psychology and Development
3.13	Rights of the Child – Legal Framework, National and International Instruments
3.14	Continuous Field Work I
4.1	Social Development and Social Policy
4.2	Project cycle Management and Resource Mobilisation
4.3	Dissertation (Research Phase I and Research Phase II)
4.4	Community Health and Population Management
4.5	Community Development Practice with Disempowered Communities
4.6	Development Concerns and Women Empowerment
4.7	Families With Special Needs
4.8	Psychiatric Social Work
4.9	Community Health and Services
4.1	Human Resource Management: Social Work Perspective
4.11	Corporate Social Responsibilities – Concepts & Ideologies
4.12	Children with Special Needs
4.13	Child Centered Social Work Practice
4.14	Continuous Fieldwork II
4.15	Internship
VALUE ADDED COURSES	
4.16	Results Based Management of Projects and Programmes
4.17	Academic Writing, Research Proposal Development and Dissertation Writing Course
4.18	Working with Diversity

Mapping of Pos and PSOs.

Sl.No	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
1.1	History, Ideologies and fields of Social Work	H			L	H				H			M
1.2	Human Growth and Development	H	M							H	M		
1.3	Introduction to Indian Society, Polity and Economics	H	M		L		L			H			
1.4	Social Work with Communities and Social Action			H		M	M		M	H	M	M	M
1.5	Environment and Disaster Management	H		H			H		M	H		M	M
1.6	Gender Studies	H		H		M		M	M	H	M		H
1.7	Concurrent Field Work and Rural Practicum	M	M	L	L		M			H	L	L	L

1.8	Service learning/Rural practicum	H	H	H	M	L	M	H	L	M	H	M	L
2.1	Social Casework Practice with Individuals and families	H	M			H			H	H	H	H	H
2.2	Social Work Practice with Groups	H	H			M				H	H	M	H
2.3	Social Work Research and Statistics	H		L		M		M	M	M	L		
2.4	Social Welfare Administration	H	M		M	M				H	M	H	
2.5	Introduction to Disability Studies	H				M				H	M		
2.6	Concurrent Field Work II	H	H	M	M	M		M		H	M	M	M
3.1	Social Justice, Human Rights & Para-legal Education	H		M	H	M				H	M		M
3.2	Emerging Social Work Perspectives and Integrated Approach	H		H		M		M	L	H	H	M	
3.3	Computer Applications for Social Sciences (Lab)	M	H		L			H					M
3.4	Community Development: Rural, Tribal and Urban	H		H	M	M	H		M	H	H	H	H
3.5	Governance and Community Development	M			M		L	H		H		H	H
3.6	Family Centered Social Work Practice	H		H		M				H	H	H	M
3.7	Social Work Practice with Children	H	H	M	M	H				H	H	M	H
3.8	Medical Social Work	H	H			H			M	H	H	H	H
3.9	Mental Health and Social Work	H	H						M	H	H	H	H
3.1	Organisational Structure, Behaviour and Development	H	M			L		M		H		M	
3.11	Policies For Development Organisations - Urban, Rural and Tribal Communities	H		M			M			H	H	H	H
3.12	Introduction to Child Psychology and Development	H				H		M		H	H	H	H
3.13	Rights of the Child – Legal Framework, National and International Instruments	H		H	H	H				H	H	H	
3.14	Continuous Field Work I	H	H	H	H	H	H	H	H	H	H	H	H
4.1	Social Development and Social Policy	H		H	M					H	M	M	
4.2	Project cycle Management and Resource Mobilisation	H				L		H		H	M	H	
4.3	Dissertation ((Research Phase I and Research Phase II))	H	H			M		H	H	H			M
4.4	Community Health and Population Management	H		H	M	M			M	H	H	H	H
4.5	Community Development Practice with Disempowered Communities	H		L	M			M		H	H	H	H
4.6	Development Concerns and Women Empowerment	H	M	H	M	M			M	H	H	M	M
4.7	Families With Special Needs	H	H	H		M				H	H	H	H
4.8	Psychiatric Social Work	H	H			M		M	H	H	H	H	H
4.9	Community Health and	H		H		M			M	H	H	H	H

	Services												
4.1	Human Resource Management: Social Work Perspective	H				M		H		M		H	
4.11	Corporate Social Responsibilities - Concepts & Ideologies	H				M			M	H		M	
4.12	Children with Special Needs	H	M	H		M			M	H	H	H	H
4.13	Child Centered Social Work Practice	H	M	H		M			M	H	H	H	H
4.14	Continuous Fieldwork II	H	H	H	H	H	H	H	H	H	H	H	H
4.15	Internship	H	H	H	H	H	H	H	H	H	H	M	H
4.16	Results Based Management of Projects and Programmes	H	M	H	M	M	H	H	H	M	H	M	H
4.17	Academic Writing, Research Proposal Development and Dissertation Writing Course	M	M	H	M	M	H	H	H	M	M	M	H
4.18	Working with Diversity	M	H	M	H	M	H	M	H	M	M	H	M

DETAILED SYLLABUS

SWHI0035: HISTORY, IDEOLOGIES AND FIELDS OF SOCIAL WORK

(3-0-0) (3 Credits - 45 hours)

Course Outcomes:

- Introduce the basic concepts of social work to the students. (Understanding)
- Introduce to the students the history and philosophy of social work, its methods and fields (Remembering)
- Introduce social work as a profession (Applying)
- Motivate the students to appreciate social work as a profession and to recognize the need and importance of social work education, training and practice. (Creating)

Module I: Introduction to Social Work (11 hours)

Concepts and Definitions: – Social Work, Social Service, Social Welfare, Social Reform, Social Defense, Social Policy, Social Action, Social Legislation and Social Advocacy ; Principles, Objectives, Scope and Goals ; Process of Social Work; Professional values and Code of ethics; Skills of social worker

Module II: History and Ideologies of Social Work (11 hours)

Historical development of Social Work in UK, USA and India: The Elizabethan poor law (1601); Charity Organization Society (1869);The Settlement House Movement, (USA); The Poor Law Commission of 1905; The Beveridge Report (1941); Social Reforms and Social Movements; Gandhian Philosophical Foundation to Social Work in India.

Module III: Social Work Profession (11 hours)

Social Work Theories; Professional organizations; Indian Association of Professional Social Workers; National Association of Social Workers; International/Indian Council of Social Workers; International Association of Schools of Social Work

Module IV: Fields of Social Work Practice (12 hours)

Family, Child and Youth Welfare; Social Work Practice in Industries/ Industrial Social Work; Social Work for weaker sections: Aged, Persons with Disability, Women Welfare; Environment/Ecology; Healthcare: Medical and Psychiatric; School Social Work; Correctional Administration

Suggested Readings

1. Gore. M.S, Social Work and Social Work Education, Asia, Publication house, Mumbai, 1965
2. Jainendra Kumar Jha, Practice of Social work, Anmol Publications, New Delhi, 2002,
3. Joshi.S.C, The Handbook of Social work, Akansha Publishing House, New Delhi, 2004.
4. Paul Chowdhury, Introduction to Social Work, ATMA RAM and SONS, Delhi, 2000.
5. Sanjay Bhattacharya, Social work – An Integrated Approach, Deep and Deep Publications Pvt Ltd, New Delhi, 2003
6. Walsh Joseph, Theories of Direct Social work practice, Thomson Brooks, Cole, 2006
7. Allan, June, Bob Pease and Linda Briskman (ed.). Critical Social Work – An Introduction to Theories and Practices, Rawat Publications, Jaipur, 2003.
8. Bhattacharya, Sanjay, Social Work Interventions and Management, Deep and Deep, New Delhi, 2008
9. Bogo, Marion, Social Work Practice – Concepts, Processes and Interviewing, Rawat Publications, Jaipur, 2007
10. Cox, David and Manohar Pawar, International Social Work – Issues, Strategies and Programs, Vistar Publications, New Delhi, 2006
11. Desai, Murli, Ideologies and Social Work, Rawat Publications, Jaipur, 2002
12. Dominelli, Lena, Social Work: Theory and Practice for a Changing Profession, Polity Press, London, 2004
13. Skidmore AR and Milton G Thackeray, Introduction to Social Work, Prentice Hall, New Jersey
14. Lukose P J, Social analysis: A guide for the Social Workers, Media House Publications, New Delhi-2015.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2		H	M	
CO 3	M	H	H	H
CO 4			H	H

SWGD0036: HUMAN GROWTH AND DEVELOPMENT

(2-0-0) (2 Credits - 30 hours)

Course Outcomes

- Introduce the basic concepts of human growth and development. (Remembering)
- Introduce the Personality theories (Understanding & Applying)
- Introduce the Concept of Mental Health and discuss the role of social worker in promoting it. (Understanding and Creating))
- Introduce the concept of health, causes, symptoms, treatment and prevention of communicable and non-communicable diseases (Understanding, Applying, Analyzing and Evaluating)

Module I: Meaning of Growth and Development (8 hours)

a. Meaning of growth, development and maturity, Principles of human development
b. Approaches to the study of human development: biological, maturational, psychoanalytic, behavioural, cognitive-developmental, ecological, Social
c. Influence of socialization and development - family, social groups, institution, community and culture.

Module II: Developmental Stages and Personality Theories (10 hours

a. Physical, Emotional, Cognitive and Social aspects of the following developmental stages with special reference to Indian conditions – Infancy, Babyhood, childhood, adolescence, adulthood, old age.
b. Personality theories – Freud, Jung, Adler, Erikson, Rogers, Maslow

Module III: Mental health (5 hours)

a. Concept of Normalcy and abnormality - Symptoms, Causes and treatment of neuroses and psychoses, personality disorder and mental retardation.
b. Role of Social Workers in Promoting Mental Health

Module IV: Physical Health (7 hours)

a. Concept of health, hygiene, WHO definition of health; nutrition, malnutrition and its impact on growth
b. Communicable and non-communicable diseases - Symptoms, causes, treatment, prevention and control of some common diseases – communicable: T.B., Leprosy, STD, HIV, Typhoid, Chickenpox, Malaria, Hepatitis; non-communicable: Hypertension, Diabetes, Cancer, Malnutrition and deficiency diseases.
c. Institutions and agencies intervening in human growth and development- family, education, Health care systems

Suggested Readings

1. Berk, Laura E. Development through the Lifespan, 5th edition. Allyn and Bacon. London: 2009
2. Ahuja, Niraj. A Short textbook of Psychiatry, Himalaya Publishing House. New Delhi: 2005
3. Bhattacharya, Sanjay Dr. 2008. Social Work: Psycho-Social and Health Aspects. New Delhi: Deep and Deep Publication, 1992.
4. Clifford T. Morgan, Richard A. King, John R. Weisz, John Schopler, Introduction to Psychology, Tata Mc.Graw Hill Edition.
5. Coleman James. C, Abnormal Psychology and Modern Life, D.B. Taneporevela. Mumbai: 1975
6. Dandapani S., General Psychology, Neelkamal Publications Pvt. Ltd. Hyderabad: 2007
7. Diagnostic and Statistical Manual of Mental Disorders – 4th Edition. DSM – IV-TR. American Psychiatric Association. Washington DC: 2000
8. Hurlock, Elizabeth, Developmental Psychology, Tata Mc Graw Hill. New York: 2001
9. Kaplan Saddock, Synopsis of Psychiatry. 7th Ed. BI Waverly Pvt. Ltd. New Delhi: 1994
10. Park. J.E and Park. K, TextBook of Preventive and Social Medicine, Bansaridas Bhanot. Jabalpur: 2003
11. Robert A. Baron, Psychology, 5th Edition. Pearson. Prentice Hall: 2001
12. Steinberg, Laurence, Adolescence, McGraw Hill Inc. New York: 1993
13. WHO, The ICD – 10 Classification of Mental and Behavioural Disorders, Diagnostic Criteria for Research, AITBS Publishers and Distributors (Regd.). Delhi: 2004
14. Archambeault, John. (2009). Social Work and Mental Health, UK: Learning Matters Pvt Ltd.
15. Paula Nicolson, Rowan Bayne and Jenny Owen. (2006). Applied Psychology for Social Workers, UK: Palgrave Macmillan Ltd. (3rd Edition).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	M	H	H	
CO 3		M	H	
CO 4	M			H

SWIS0037: INTRODUCTION TO INDIAN SOCIETY, ECONOMICS AND POLITY

(2-0-0) (2 Credits- 30 hours)

Course Outcomes

- Understand the concept of society& culture, major social institutions, structure, stratification, different approaches to the study of society and to develop an understanding onsocial change and social mobility; (Remembering and Understanding)
- Understand and define basic concepts of economic and political theories ;(Remembering and Understanding)
- Explain how the economic and political institutions are organized, and how they have a bearing on human society ;(Applying)
- Identify and evaluate the political institutions, processes and experiences of India, with special reference to North East India (Evaluating and Creating)

Module I: Basic Sociological Concepts (10 hours)

a. The concept of society – Meaning, definition and characteristics of society;
b. The concept of culture - Meaning, definition, elements & characteristics;
c. Social structure and stratification- Caste, Class, Tribes, Gender & Religion;
d. Approaches to the study of society- Structural Functionalism approach; Conflict/ Dialectical approach; Symbolic Interactionism;
e. Social institutions- Marriage, Family, Education& Religion;
f. Social change and social mobility; Social Work and society

Module II: Basic Concepts in Economics (10 hours)

a. Concept and definition: economy, micro and macroeconomics; market, demand and supply, national income, national income indicators; per-capita income,standard of living, poverty and its measurement in India
b. Economic systems: capitalism, socialism, communism, mixed economy, neoliberalism
c. Global economic institutions: World Bank, IMF, WTO, Asian Development Bank
d. Globalisation and Indian economy: Special Economic Zones and MNCs
e. Growth, development and social justice
f. Social work and economics

Module II: Basic Concepts in Politics (10 hours)

a. The concept of state – Meaning and definition, and elements;Nationalism and Nation State;
b. Perspectives of the state – Liberal, Marxist, Feminist, Gandhi, and Ambedkar
c. Key concepts-Liberty, Equality,Justice, Power, Legitimacy, Authority, Sovereignty;
d. The Constitution of India, and the Federal characteristic of Indian state;
e. Citizenship: rights and duties;
f. North East India: Decentralised governance &political movements

Suggested Readings

1. Abbas, H. Indian government and politics. New Delhi: Dorling Kindersley. (2010).
2. Ananth, V.K. India since independence: making sense of Indian politics. New Delhi: Dorling Kindersley. (2010).
3. Anthony, G. Sociology. Cambridge: Cambridge Polity Press. (2001).
4. Behera, M.C. (Ed.). Globalization and development dilemma: reflection from North East India. New Delhi: Mittal Publications. (2004).
5. Boyes, W., & Michael, M. Textbook of economics: Indian adaptation (6th ed.). New Delhi: Houghton Mifflin Co. (2005).
6. Desai, S. B. et al. Human Development in India: challenges for a society in transition. Hyderabad: OUP. (2010).
7. Dreze, J., &Sen, A. Uncertain glory: India and its contradictions. New Delhi: OUP. (2013).
8. Gupta, D. (Ed.). Social Stratification. New Delhi: Oxford University Press. (1997).
9. Guru, G., &Sarukkai, S. The Cracked Mirror: An Indian Debate on Experience and Theory. New Delhi: OUP (2017).
10. Hayami, Y., &Godo, Y. Development economics: from poverty to the wealth of nations, (3rd ed.). New Delhi: OUP. (2010).
11. Johari, J.C. Contemporary political theory: new dimensions, basic concepts and major trends. New Delhi: Sterling Publishers. (2006).
12. Mankiw, N. G. Principles of economics. Manson OH South West: Cengage Learning. (2008).
13. Menon, N Gender and Politics in India. New Delhi: Oxford University Press. . (1999).
14. Schrems, J. Understanding principles of politics and the state. Maryland: University Press of America. (2007).
15. Sen, A. Development as. New York: OUP. (1999).
16. Sesagiri, N. (Ed.). Survey of rural India: a comprehensive study of gram panchayat and community development block, (Vol. 26). New Delhi: GyanPrakashan. (2013).
17. Xaxa, V. State Society and Tribes. New Delhi: Pearson Education. (2014).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2	M	H	H	
CO 3		M	H	
CO 4	M			H
CO 5	H		M	H

SWCS0070: SOCIAL WORK WITH COMMUNITIES AND SOCIAL ACTION

(3-0-0) (3 Credits– 45 hours)

COURSE OUTCOMES

- Define and spell community organisation and social action as methods in social work education and practice.(Remembering)
- Explain the concepts related to community organisation and social action as methods of social work education and practice.(Understanding)
- Apply the understanding of the concepts of community organisation and social action in the fields of practice.(Applying)
- Analyze various field situations and apply there levant methods to address social concerns. (Analyzing)
- Assess and choose community organisation or social action strategies to address social issues. (Evaluating)
- Combine effectiveness of community organisation or social action models and strategies and make modification if required for effective intervention in communities. (Creating)

Module I: Concepts of Community (11 hour)

Understanding Community: Definition, Concept, Types(Urban, Rural, Tribal and Open Communities), Structure and Functioning; Community Power Structure and Leadership; Community Dynamics.

Module II: Community Organization (11 hours)

Community Organization: Definition, Scope, Philosophy, Principles; Community Organization and Community Development; Approaches to Community Organization; Role and Skills of Social Worker in the Community; Techniques and Strategies of Community Organization.

Module III: Phases of Community Organization (11 hours)

Process of Community Organization - Study and Survey, Analysis, Assessment, Discussion, Organization, Action, Reflection, Modification and Continuation.

Module IV: Models of Community Organization, Community Development and Social Action (12Hours)

Models of Community Organization; Social Action – Principles and Process of Social Action and its Scope in India; Approaches to Social Action: Radical and Right based; Models of Community Development: Locality Development, Social Planning Model, Social Action Model, Saul Alinsky Model.

Suggested Readings

1. Bhattacharya, Sanjay, Social Work an Integrated Approach, Deep and Deep, New Delhi, 2006
2. Christopher, A.J.,and Thomas William, Community Organization and Social Action, Himalaya Publications, New Delhi, 2006
3. Freire, Paulo, Education for the Oppressed, Seaburg Press, New York, 1970
4. Freire, Paulo, Cultural Action for Freedom, Penguin, Harmonds Worth, 1972
5. Kumar,Somesh,MethodsforCommunityParticipation–aCompleteGuideforPractitioners, Vistaar Publications, New Delhi, 2002
6. Prasad, Ankit, Social Welfare and Social Action.New Delhi: Mittal Publications
7. Ross.M.G.,CommunityOrganisation.Theories,Principles,andPractices,HarperandRow,NewYork, 1955
8. Siddqui, H.Y.., Working with Communities, Hira Publication,New Delhi, 1997
9. Skidmore, A. Rex and Milton. G. Thackeray, Introduction to Social Work, Prentice Hall, New Jersey,1976
10. Shrivasta, S. K (1988) Social Movements for development, Allahabad: Chugh Publications
11. Siddique, H.Y. (1984) Social Work and Social Action,New Delhi: Harnam Publications
12. ZastrowH.Charles–ThePracticeofSocialWork–AComprehensiveWorktext,BROOKS/COLE– Cengage Learning Publications,9th Edition
13. Alinsky Saul (1971) Rules for Radicals: A Practice Primer for Realistic Radicals, Vintage
14. RM Mac Iver and Charles H Page, Society – An Introductory Analysis, Surjeet Publications

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	M	M	H
CO 2	H	H	M	M
CO 3			H	
CO 4				H
CO 5		M		M
CO 6	M		H	

SWEM0038: ENVIRONMENT STUDIES AND DISASTER MANAGEMENT(3-0-0)

(3 Credit- 45 hours)

Course Outcome:

- Understand the interrelatedness of human life and environment (Understanding)
- Develop an understanding of problems arising out of environmental degradation and globalization (Analysing)
- Understand the roles of State in disaster management (Evaluating)
- Study the role of social work practice in tracking environmental issues and disaster management (Creating)

Module I: Environment and Sustainable Development (11 hours)

Concepts: Environment and Ecology; the Interrelatedness of living organisms and natural Resources; Global Environmental Crisis and its linkages to the development process. Global warming, Environmental politics and resource development regimes; Sustainable development: Management and Conservation changes

Module II: The State and the Environment (11 hours)

State of India's Environment: Waste Management; Pollution – Air, Water, Soil, Noise; Laws Related to environment; Social Work and Environment: Environment Education, Environment Ethics, Promotion Environment Movements, Environment Management – EIA.

Module III: Concept of Disaster and Models of Disaster Management (11 hours)

Disaster: Definition, Natural and Human made disasters; multiple causes and effects; Stages of disaster; Development and Disaster; Preventive Measures; Models of Disaster: Crunch Model and Release Model

Module IV: Roles of Organizations in Disaster Management (12 hours)

Disaster Management and Phases. Pre-disaster: Prevention, Preparation, Education, Vulnerability and Preparedness. Actual Disaster: Contingency, Short Term and Long Term Plans, Search, Relief, Rescue, Recovery and Restoration. Post Disaster: Rehabilitation and Commemorations; Role of Social Workers and Voluntary Agencies: Role of Social Work Professionals at different levels

Suggested Readings

1. Abbasi S.A., Wetlands of India: Ecology and Threats Vol. 1-3, 1997.
2. Dorr Donal, Social Justice Agenda: Justice, Ecology, Power and the Church, 1990.
3. Goel P.K., Environmental Guidelines and Standards in India, 1996.
4. Madhav Godgil; Ramachandra Guha, Ecology and Equity: The use and abuse of nature in contemporary India, 1995.
5. Neugeboren Bernard, Environmental Practice in the Human Services: Integration of Micro and Macro Roles, Skills and Contexts, 1996
6. Shukla S.K., Srivastava P.R., Human Environment: An analysis, 1992.
7. Shukla S.K., Srivastava P.R., Environmental Pollution and Chronic Diseases.
8. Auf Der Heide. Disaster Response: Principles of Preparation and Coordination. St. Louis: Mosbe, 1989.
9. 9. Canton, Lucien G. Emergency Management: Concepts and Strategies for Effective Programs. Hoboken NJ: Wiley Inter-Science, 2007.
10. Cutter, Susan L. (Ed.). American Hazardscapes: The Regionalization of Hazards & Disasters. Wash DC: Joseph Henry Press, 2001.
11. Godschalk, David R., Timothy Beatley, Philip Berke, David Brower, and Edward Kaiser. Natural Hazard Mitigation: Recasting Disaster Policy & Planning. Island Press. 1999.
12. Haddow, George D. and Jane A. Bullock. Introduction to Emergency Management (2nd Ed.).Burlington, MA: Elsevier Butterworth-Heinemann, 2006.
13. May, Peter J, et al. Environmental Management and Governance: Intergovernmental Approaches to Hazards and Sustainability. London & NY: Routledge, 1996.
14. National Research Council. Facing Hazards and Disasters: Understanding Human Dimensions. Washington, DC: National Academies Press, 2006.

15. Noji, Eric K. (Ed.). The Public Health Consequences of Disasters. New York and Oxford: Oxford University Press, 1997.
16. Platt, Rutherford H. Disasters and Democracy: The Politics of Extreme Natural Events. Washington, DC: Island Press, 1999.
17. Quarantelli, E.L. (ed.) What is a Disaster – Perspectives on the Question. London and New York: Routledge, 1998
18. Tobin, Graham A. and Burrell E. Montz. Natural Hazards: Explanation and Integration. New York and London: The Guilford Press, 1997.
19. Waugh, William L. Living With Hazards/Dealing With Disasters-An Introduction To Emergency Management. Armonk, NY: M.E. Sharpe, Inc., 2000.
20. Wisner, Ben, Piers Blaikie, Terry Cannon, and Ian Davis. At Risk: Natural Hazards, People's Vulnerability and Disasters (2nd Ed.). London and New York: Routledge, 2004.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H		
CO 2	H		H	
CO 3		H		M
CO 4		M	H	

SWGS0039: GENDER STUDIES (3-0-0)

(3 Credit- 45 hours)

Course Outcomes

- Understand the concept of gender, patriarchy, gender roles and relationships. (Remembering and Understanding)
- Study the feminist theories, women's movements, and women's development(Remembering and Understanding)
- Critically study the intersectionality i.e. how race/ethnicity, sexuality, class, age, citizenship, and other identities crosscut and shape gender identities and roles (Applying and Analysing)
- Critically understand concerns of gender issues, and aim to analyze everyday gendered experiences from Social Work perspectives. (Evaluating and Creating)

Module I: Understanding gender, gender and society, gender studies (11 hours)

Introduction – Gender, Sex, Sexuality, Gender Perspectives of Body, Social Construction of Femininity, Social Construction of Masculinity, Patriarchy, LGBTQ, Gender roles, Gender Lens: Political and Legal Systems, Gender and Education, Inter-sectionality, Social Dynamics of Gender, Women's Studies and Gender Studies

Module II: History, Theory and Women's Movement (11 hours)

Historical Overview of Feminist Movements, Feminist Movement in Europe and the US, Women's Movement in India, Changing profile of women in India- pre and post independent India, History of women's education; Theory- Feminism and types of feminism, Gender Schema theory, Queer theory; Approaches to understanding women and development

Module III: Gender Concerns (11 hours)

Violence against women, conflict, poverty, displacement, migration, disaster –impact on women, women working in organized and unorganized sector, reproductive health, social, cultural and political determinants of health

Module IV: Constitutional Rights of Women, Policies and Programmes (12 hours)

CEDAW, Dowry Prohibition Act 1961, Equal Remuneration Act 1976, Maternity Benefit Act 1961, Plantation Labour Act 1951, Medical Termination of Pregnancy Act 1971, Pre-natal Diagnostic Techniques (Regulation and Prevention of Misuse Act 2002, Protection of Women from Domestics Violence Act 2005, The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act 2013, Functions of National Commission for Women and State Commission for Women

Suggested Readings

1. Bhasin, K. Understanding Gender. Kali for Women Publication. (2000).
2. Bhasin, K. What is Patriarchy? Kali for Women Publication. (2000).
3. Ckhakravati, U. Gendering Caste: Through a Feminist Lens (Theorizing Feminism). Stree; UK ed. edition (January) (2003).
4. Cook, R. Human Rights of Women: National and International Perspectives. Philadelphia, University of Pennsylvania Press (1994).
5. Harding, Sandra G(ed.). The Feminist Standpoint Theory Reader. New York: Routledge. (2004).
6. Gordon, L. P. Violence against Women. New York: Nova Publishers. (2002).
7. Kumar, Girish (ed.). Health Sector Reforms in India. New Delhi: Manohar (2009).
8. Lalkima, C. Lalneihzovi. Changing Status of women in north-eastern states. New Delhi: Mittal Publications. (2009).
9. Pandya, Rameshwari. Patel, Sarika. Women in the Unorganised Sector of India. New Delhi: New Century Publications. (2010).
10. Joshir, T.S. Women and Development. New Delhi, Mittal Publications. (1999).

11. Mies, M.,Shiva, V. Eco-feminism. London: Zed Books.. (1993).
12. Agnes, Flavia. Law and Gender Inequality: The Politics of Women's Rights in India. Delhi: Oxford University Press. (2004).
13. Arya, Sadhna. Roy, Anupama. Poverty, Gender and Migration. New Delhi: Sage Publications. (2006).
14. Ramazanouglu, Caroline. Holland, Jannet. (ed). Feminist Methodology: Challenges and Choices. London: Sage Publications Inc. (2002).
15. Ganesamurthy, V,S. Empowerment of Women in India: Social, Economic and Political. New Delhi: New Century Publications. (2008).
16. Datar, Chaya. Integrating activism and academics. In Jain, Devika and Rajput, Pam (Eds.), Narratives from the Women's Studies Family: Recreating Knowledge (pp. 136-149). New Delhi: Sage Publication. (2003).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	
CO 2	M	H	H	
CO 3		M	H	
CO 4	M		M	H

SWPF0040: SOCIAL WORK PRACTICE WITH INDIVIDUALS AND FAMILIES(3-0-0)

(3 Credits – 45 hours)

Course Outcomes:

- Introduce the concept of social casework as a method of social work practice and the tools used in Casework. (Remembering, Understanding & Applying)
- Introduce the approaches to Case work. (Remembering, Understanding & Applying)
- Introduce Casework process and the techniques used. (Understanding, Applying, Analyzing & Evaluating)
- Discuss the application of social casework in different settings. (Understanding, Analyzing, Evaluating & Creating)

Module I: Introduction to Nature and Development of Social Casework (11 hours)

Social Casework: Meaning, Nature, Assumptions, Principles, Ethics and Process of Social Casework; Tools – Observation, Listening, Relationship, Interview, Home Visit, Collateral Visit, Family group conferencing; Casework and Counseling, Casework and Psychotherapy

Module II: Approaches to Casework Practice (11 hours)

Diagnostic and Functional approach; Psycho-social approach; Problem solving approach; Task centered approach; Client centered approach; Pearlman approach

Module III: Process and technique of social casework (11 hours)

Phases of casework intervention: Intake, Problem identification, Diagnosis of the problem, Treatment, Assessment, Monitoring and Evaluation, Termination/ Follow up; Techniques of Casework Intervention -Supportive Techniques, Enhancing Resources Techniques; Casework recording: Types and Principles of recording

Module IV: Social Casework Practice (12 hours)

Application of Social Case Work in different settings and Clientele groups- Casework with Children, Correctional Settings, Clinical Settings, Geriatric Care, the Terminally Ill people, and Crisis Situations; Discussion of Case Records in different Agency Settings, Relations of Casework with other methods of social work.

Suggested Readings

1. Biestek Felix, The Casework Relationship, Unwin University Books, London, 1968
2. Government of India, Encyclopedia in Social Work, Publication Division (Social Welfare Ministry), New Delhi, 1987
3. Hamilton, Gordon, The New York School of Social Work: Theory and Practice of Social Case Work, Columbia University Press, New York and London, 1970
4. Holis, Florence and Woods, Mary E., Casework – A Psychosoical Therapy, Fantom House, New York, 1981
5. Kadushin, Alfred, The Social Work Interview, Colulmbia University Press, New York, 1990
6. Keats, Daphne, Interviewing – A Practical Guide for Students and Professionals, Viva Books Pvt. Ltd., New Delhi, 2002.
7. Mathew Grace, An Introduction to Social Case Work, Tata Institute of Social Sciences, Bombay, 1992
8. Nelson Jones, Richard, Practical Counseling and Helping Skills, Harper and Row, London, 1984
9. Nursten, Jean, Process of Case Work, Pitman Publishing Corporation, 1974
10. O'Hagan, Kieran, Kingsley, Jessica, Competence in Social Work Practice – A Practical Guide for Professionals, London, 2003
11. Perlman, Helen Harris, Social Case Work – A Problem Solving Process, University of Chicago Press, London, 1964
12. Rameshwari Devi, Ravi Prakash, Social Work Methods, Practices and Perspectives (Models of Casework Practice), Vol. II, Ch.3, Mangal Deep Publication, Jaipur, 2004

13. Richmond, Mary, Social Diagnosis, Free Press, New York, 1970
14. Thompson, Neil, People Skills, 2nd Ed., Palgrave Macmillan, New York, 2006
15. Aptekar Herbert, The Dynamics of Casework and Counseling, Houghton Mifflin Co., New York, 1955.
16. Babara, J. G., Beyond Case Work, London, 1991
17. Fisher Joe, Effective Case Work Practice – An Elective Approach, McGraw Hill, New York, 1978
18. Garrett, Annett, Interviewing – Its Principles and Methods, Family Service Association of America, New York, 1972
19. Lishman, Joyce, Communication in Social Work, Palgrave MacMillan, New York, 1994
20. Sena, Fine and Glass, Paul H., The First Helping Interview Engaging the Client and Building Trust, Sage Publications, New York, 1966
21. Sheafor, Bradford, Horejsi, Charles, Horejsi, Gloria, Techniques and Guidelines for Social Work Practice, Allyn and Bacon, London, 1997
22. Timms, Noel, Social Case Work, Routledge and Kegan Paul, London, 1966

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	M
CO 2		H		H
CO 3			H	H
CO 4		H		H

SWPG0041: SOCIAL WORK PRACTICE WITH GROUPS (3-0-0)

(3 Credits- 45 hours)

Course Outcomes

- Understand the concept of groups and its importance and influence on individuals (Remembering and Understanding)
- Understand social group work as a method of social work (Remembering and Understanding)
- Develop skills to apply group work methods in various settings (Creating and Evaluating)
- Identify and acquire the skills needed to work with groups effectively (Applying and Analysing)

Module I: The Concepts (11 hours)

Concept of group: definition, characteristics, Classification of different social Groups, Functions of Groups and Group as a medium of Social change.

Module II: Methods of Social Group Work (11 hours)

Social group work as a method of social work: definition, values, principles, assumptions, ethics, and functions of social group work; Techniques and skills used in Social Group work practice, Roles of Social group workers.

Module III: Process and Phases of Social Group Work (11 hours)

Group work process; Identification of the needs and interest; Program Planning and Program Development; Criteria of effective process and programme in SGW; Phases of Group Work: Pre-group, initial, treatment, and critical phase, evaluation and termination; Stages of Group Development (Forming, Norming, Storming, Performing and Adjourning) and Group Dynamics

Module IV: Social Group Work Practice in Agency Settings (12 hours)

Social Group Work in Different Settings: Self Help Groups, Groups in community setting, Groups in institutional settings (Hospitals, Rehabilitation Centers, Children's Home, Old Age Homes and Educational Settings); Discussion of Group records.

Suggested Readings

1. Cooper, Cary L, Theories of Group Processes, London: John Wiley and Sons, 1976
2. Douglas, Tom, Group Work Practice, London: Tavistock Publications, 1976
3. Douglas, Tom, Basic Group Work, London: Tavistock Publications, 1978
4. Ely, P.J. and M.K.McCullough, Social Work with Groups, London: Routtedge and Kegan Paul, 1975
5. Kanopka G, Social Group Work – A Helping Process, Engelwood Cliff: Prentice Hall (later version), 1963
6. Siddiqui, H.Y, Group Work: theories and practice; India, Pakistan, Bangladesh and Sri Lanka, Jaipur: Rawat Publications, 2007
7. Toseland, W. and Rivas, R.S. An Introduction to Groups Work Practice, Boston: Allyn and Bacon, 2000
8. Trecker, H.B., Social Group, New York: Association Press, 1975.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	H		M
CO 2	H	M	H	
CO 3	H	M	H	
CO 4	M			H

SWRS0042: SOCIAL WORK RESEARCH AND STATISTICS(3-0-0)

(3 Credits- 45 hours)

COURSE OUTCOMES

- Define and show social science research and social work research and the application of statistics in social work practice. (Remembering)
- Explain and discuss social work research as a method of social work and it application in addressing social issues. (Understanding)
- Apply the knowledge, skills for interpretation, documentation and presentation of results of social work research and statistics in carrying out applied research in addressing social issues. (Applying)
- Analyze various social issues and use research methods, strategies and data to suggest solutions.(Analyzing)
- Assess relevant research methods and techniques in carrying out social work research. (Evaluating)
- Create critical methods to carry out research in social work practice and suggest solutions to social issues. (Creating)

Module I: Introduction to Social Work Research (7 hours)

a. Research and Social Work Practice- Philosophical Foundations of Research.
b. Natural and social science research - characteristics and scientific attitude.
c. Social work research as a social research - relevance, ethics and values. Scope of social work research - basic and applied research.

Module II: Research designs, approaches and types (7 hours)

a. Research designs: Descriptive, Exploratory and Experimental: meaning, scope, characteristics, application in social work setting.
b. Research Approaches: Qualitative and Quantitative Research: meanings, scope, methods, steps, sampling, data collection, analysis, interpretation and reporting. Strengths and weaknesses.
c. Evaluative research: Programme and projects evaluation: concept, types, steps, reports.
d. Participatory research and action research: concepts, scope, application and steps.

Module III: Steps in Research Process (12 hours)

a. Problem Formulation: Identifying research issue, formulating research topic and problem, review of literature (library work), theoretical framework, formulating objectives, clarifying concepts, variables - conceptual and operational, formulating hypothesis.
b. Population and Sampling: Inclusion and exclusion criteria of population, the logic of sampling size and techniques: probability and non-probability sampling.
c. Tools for data collection: Levels, Types of measurements, reliability and validity of tools. Constructing tools for data collection: questionnaire, interview schedule, scales. Quantification of qualitative data.
d. Sources, Collection and Analysis of Data: Secondary and primary sources. Data collection data editing, coding, master sheet, analysis, report writing. Using a computer for data analysis: coding, analysis- graphs and results.

Module IV: Introduction to Statistics (12 hours)

a. Statistics: Definitions, Uses and Limitations. Classification and tabulation of data, univariate and bivariate, diagrammatic and graphical presentations. Measures of central tendency, Mean, Median and Mode and their uses; Measures of variability - range, variance and standard deviation.
b. Correlation: Meaning and computation of coefficient of correlation as product moment, Spearman's Rank Correlations, interpretation of correlations.
c. Test of Hypotheses: Basics, Probability distribution, normal distribution. t-test, Chi-Square Test

Module V: Application of Statistics and Reporting Research (7 hours)

a. Application of Statistics in Social Work Research.
b. Ethical guidelines in social work research.
c. Professional writing.
d. Introduction to software packages for statistical analysis.

Suggested Readings

1. Ahuja, Ram, Research Methods, Rawat, Jaipur, 2001
2. Alston, M. Bocoles, W., Research in Social Workers- An Introduction to the Methods, Rawat, Jaipur, Indian Edition 2003
3. Baker, T.L., Doing Social Research, McGraw Hill, Singapore, 1994
4. Dooley, D., Social Research Methods, Prentice Hall of India Pvt. Ltd., New Delhi, 1997
5. Goode, W.J. and Hatt, P.K., Methods in Social Research, McGraw Hill Singapore, 1981
6. Grinell, R. M., (Jr.), Social Work Research and Evaluation, F.E. Peacock Pub. Inc., Illinois, 1988
7. Gupta, C.B., Introduction to Statistical Methods, Vikas Publishing House, 1995
8. Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House, Delhi, 1997
9. Gupta, S.P., Statistical Methods, Sultan Chand and Sons, New Delhi 1997
10. Jacob, K.K., Methods and Fields of Social Work in India, Asia Publishing, Bombay, 1996
11. Kothari, C.R., Research Methodology: Methods and Techniques, 2nd edition reprint, New Age International New Delhi, 2004
12. Krishnaswamy, O.R., Methodology for Research in Social Science, Himalaya, Bombay, 1993
13. Laldas, D.K., Practice of Social Research, Rawat, Jaipur, 2000
14. Mikkelsen, B., Methods for Development Work and Research-A New Guide for practitioners, Sage, New Delhi, 2005
15. Ramchandran, P., Social Work Research and Statistics, Allied Publishers, Bombay, 1968
16. Rubin, A. and Babbie, E., Research Methods for Social Work, 4th edition, Wadsworth, West, Brooks/Cole and Schirmer, 2001
17. Sarantakos, S., Social Research, Palgrave Macmillan, New York, 2005
18. Sharma, B.A.V., Prasad, R.D. and Satyanarayana, C., Research Methods in Social Sciences, Sterling, New Delhi, 2002
19. Sharma, K.R., Research Methodology, National Publishing House, Jaipur, 2002
20. Wilkinson, T.S. and Bhandarkar, P.L., Methodology and Techniques of Social Research, Himalaya, Bombay, 1984
21. Young, p., Scientific Social Surveys and Research, Asian Students edition, Asia Publishing House, Japan, 1960

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				M
CO 2	M				H
CO 3			H	H	
CO 4		H	M	M	H
CO 5		H		M	
CO 6	M				H

SWWA0043: SOCIAL WELFARE ADMINISTRATION (3-0-0)

(3 Credits- 45 hours)

Course Outcome:

- Develop an understanding of social welfare administration as a method of social work (Remembering)
- Understand the various components of social welfare administration (Understanding)
- Understand the concept and theories of Development (Analysing)
- Familiarize the students with the concepts of Management of Organisations and its principles (Evaluating)

Module I: Social Welfare Administration (11 hours)

Social Welfare Administration: Definition, Characteristics, Principles and Functions of Social Welfare Administration; Types of Social Welfare Administration: Social Welfare Administration and Public Administration; Establishment, Objectives and Importance of Central Social Welfare Board, State Social Welfare Board and International Organizations

Module II: Management of an Organization (11 hours)

Management: Principle and Significance of Management for Social Work; Components of Programme Management, Finance Management, Human Resource Management and Office Management

Module III: Strategies and Mechanisms of Administration (11 hours)

Processes related to Registration of Societies, Trust and Non-Profit Organization: Societies Registration Act 1860, Trusts and Non-Profit Organizations under Indian Companies Act: Foreign Contribution Regulation Act 1976 and Income Tax Rules applicable to Development / Charitable Organisations under Income Tax Act 1961; Role of Social Workers in Decision Making Process, Communication and Networking, and Sustainability of Programme

Module IV: Social Welfare Programmes (12 hours)

Social Welfare Programmes and Policies: Children, Youth, Women, Widows, Elderly and Differently- able and marginalized

Groups; Recent trends and Changes in Social Welfare Administration

Suggested Readings

1. Chowdry, Paul, Social Welfare Administration, Atma RRam and Sons, Delhi, 1992
2. Sankaran and Rodrigues, Handbook for the Management of Voluntary Organisations, Alpha Publications Chennai, 1983
3. Kulkarni, P.D., Social Policy and Social Development in India Association of schools of social work in India
4. Fred, Luthans, Organization Behaviour, III and IV edition
5. Rao, Subba, GCV. Family Law in Law, S. Gogia and Company, Hyderabad, 1999
6. Sulivan, Michael, Sociology and Social Welfare, Allen and Unwin, Winchester, USA, 1987
7. Reider, Dale, Evaluating Development Programmes and Projects, Second edition, Sage Publications, 2004
8. Gupta, N.S. Organization Theory and Behaviour. Delhi, 2009
9. Chaturvedi, A.N, Rights of the Accused under Indian Constitution.: Deep and Deep Delhi. 1984
10. Donnisson, D &Chapman, Social Policy and Administration. London. 1989
11. P.J. Lukose, Inclusive Development : A Human Rights Approach, Media House, New Delhi, 2014

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	H	H		
CO 3				
CO 4		M	H	

SWDS0044: INTRODUCTION TO DISABILITY STUDIES(3-0-0)

(3 Credits- 45 hours)

Course Outcomes:

- Introduce the concept and different types of disabilities.(Remembering, Understanding & Applying)
- Introduce the Legislations for Persons with disabilities. (Remembering, Understanding & Applying)
- Introduce the concept of Inclusive Education in India. (Understanding, Applying, Analyzing, Evaluating and Creating)
- Discuss the Preventive Measures and government programs for Persons with Disabilities. (Understanding, Applying, Analyzing, Evaluating & Creating).

Module I: Understanding Disability (11 hours)

Disability: Definition, Causes, Types of Disabilities; Magnitude of various disabilities and their impact on persons with disability and their families; Needs and problems of persons with disability and their families across the life span; Social attitudes towards persons with disability.

Module II: Legislation, Programme and Schemes for PWD (11 hours)

Legal instruments related to PWDs: Persons with Disability Act-1995; Rehabilitation Council of India Act – 1992; National Trust Act-1999; Mental health Act; Rights of the Person with Disability Act 2016,

Module III: Inclusive Education (11 hours)

Concept and Meaning, Needs and importance; issues and challenges in implementing Inclusive education in India; Planning and managing an inclusive curriculum in schools; Measures for implementing Inclusive Education.

Module IV: Management of Disability and Policies (12 hours)

Prevention and Management of Disabilities at Primary, Secondary and Tertiary levels; Models -Social, Medical, Educational and Institutional ; National Policy on Persons with Disabilities, UN Conventions and Declarations on Persons with Disabilities; Different Government Schemes and programmes for Persons with Disabilities.

Suggested Readings

1. Albrecht G.L, Katherine D Seelman. & Michael Bury. Handbook of Disability (2001).
2. Bacquer, A. and Sharma, A. Disability: Challenges vs Responses, Delhi: CAN Publications (2007).
3. Hans, A. and Patri, A. Women and Disability, Delhi: Sage. (2003).
4. Hegarty Seamus & Mithu Alur. Education and Children with special needs, London: Sage. (2002).
5. Karanth, Pratibha & Joe Rozario. Learning disability in India, London: Sage (2003).
6. Grant. Learning disability: A lifecycle approach to valuing people, London: Open University Press (2005).
7. Moore. Researching disability issues, London: Open University Press. (2005).
8. Rothman, J.C. Social Work Practice Across Disability. Boston: Allyn & Bacon. (2003).
9. Oliver, M. & Sapey, B. (ed.) Social Work with Disabled People. London: Palgrave Macmillan. (1998).

10. Banerjee, G. Legal Rights of a Person with Disability. New Delhi: Gyan Publishing House. (2001).
11. WHO. Community-based rehabilitation: CBR guidelines. Geneva: WHO Press. (2010).
12. Karna, G.N. Disability Studies in India: Retrospect and Prospects, New Delhi: Gyan Publishing House. (2001).
13. NCF National Curriculum Framework. New Delhi: NCERT. (2005).
14. B huimali, A Rights of disabled Women and Children In India. New Delhi: Serials Publications (2010).
15. Burke, Peter Disability and Impairment: Working with children and families. Jessica Kingsley Publications. (2008).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		M
CO 2	M	H		
CO 3		M	H	
CO 4	M	M		H

SWSJ0045: SOCIAL JUSTICE, HUMAN RIGHTS AND PARALEGAL EDUCATION(3-0-0)

(3 Credits–45 hours)

Course Outcomes

- Provide an understanding on social legislation and social action with relevance to social work practice (Remembering and Understanding)
- Develop an understanding about various social welfare legislationswith specific reference to different groups of people; 9 Evaluating and Creating)
- Understand the provisions of the legal system and the mechanisms available in the country for addressing issues of social change. (Understanding, Applying and Analysing)

Module I: Social Justice and Human Rights (7 hours)

a. Meaning of Justice, Forms of Justice, Theories of Justice,
b. Law and Social Justice, Human Rights and Social Justice, Issues in Social Justice.

Module II: Social Legislation and Social Work (7 hours)

a. Understanding concepts of law, social justice and social legislation, Legislation as an instrument of social justice and control.
b. The Constitution of India: preamble and fundamental rights; Directive Principles of State Policy
c. Classification of law: civil and criminal law. Relevance of law and legal systems to social work practice, partnership and interface between social workers and legal systems.

Module III: Reformatory Law and Laws related to Protection of Human Rights (7 hours)

a. Major provisions of the law for the protection of human rights, Structure, functions and powers of National and State Human Rights Commissions.
b. Major provisions in Indian Penal Code (IPC) related to family violence, murder, suicide, rape.
c. Meaning of cognizable and non-cognizable offences and conditions and procedures for bail; Importance and Procedures for filing a First Information Report (FIR)

Module IV: Social legislations: Major Provisions (20 hours)

a. Laws Related to Children: Juvenile Justice Act, Laws relating to Adoption and Guardianship, Child Marriage Restraint Act, Prohibition and Regulation of Child Labour Act. Protection of Children from Sexual Offences (POCSO) Act Laws Related to Family: Personal laws and the Civil law related to Marriage, Divorce, Maintenance and Succession; Law against Domestic Violence; Law of Family Court. Laws Related to Women: Immoral Trafficking Prevention Act (ITPA), The Sexual harassment of Women at Workplace (Prevention, Prohibition, Redressal) Act, 2013. Medical termination of pregnancy, Prohibition against Prenatal diagnostic tests (for sex determination). Laws Related to Scheduled Castes and Scheduled Tribes: Protection of Civil Rights; Law against Atrocities. Laws Related to Disabled: Mental Health Act, Persons with Disabilities Act, National Trusts Act. Laws Related to Workers: Minimum wages, Workmen's compensation. Laws Related to Consumers and Citizens: Consumer protection, Food adulteration, Right to information, Project affected persons.
b. Protection of Children from Sexual Offences Act (POCSO) and Sexual harassment of women in workplace act.

Module V: Justice System and Legal Aid provisions (4 hours)

a. Agencies of the justice system: police, judiciary, correctional systems, their structure and functions
b. Structure and jurisdiction of courts: district and sessions courts, high court, Supreme Court. Distinction between civil and criminal courts; Consumer courts Special courts/tribunals– accident, corruption
c. Concept of legal aid, Lok Adalat; Public Interest Litigation (PIL)

Suggested Readings

1. Samaddar Ranabir (Ed), State of justice in India-issues of social justice, sage publication, 2009.
2. Acharya, Basu Durga Das: Introduction to the Constitution of India, New Delhi: Prentice Hall of India Pvt.Ltd. (7th. Edition)
3. Ahuja, Ram: Criminology, Jaipur: Rawat Publications
4. Biju, M. R, Human Rights in a Developing Society, New Delhi: Mittal Prakashan, 2005
5. Diwan, Paras and Diwan, Peeyush, Child and Legal Protection, New Delhi : Deep and Deep Publications, 1994
6. Flavia, Give us this Day, Our Daily Bread, Procedures and Case Law on Maintenance, 1997
7. Gaikwad, P. E, Law Basic Concepts, Pune: YASHADA, 2004
8. Galanter, Marc, Law and Society in Modern India, Delhi: Oxford University Press, 1992
9. Gangrade, K.D, Social Legislation in India (Vol-1 and Vol.2), Delhi: Concept Publishing Company.
10. Gaur K. D, A Textbook on the Indian Penal Code, Delhi: Universal Law Publication Co. Ltd., 2004
11. Kant, Anjani, Women and the Law, New Delhi: APH Publication Corporation. 1997
12. Matthew, P. D, Constitution of India Simplified, New Delhi: Indian Social Institute, 1993
13. Pradhan, V. P, The Indian Constitution, New Delhi: Ombudsman Publishing House, (1st Edition).
14. Prakash, Ravi, Constitution of Fundamental Rights and Judicial Activism in India, Jaipur: Mangal Deep Publications
15. Purohit, B. R. and Joshi, Sandeep (Ed)) Social Justice in India, Jaipur: Rawat Publication, 2003
16. Qureshi, M. A, Muslim Laws of Marriage, Divorce and Maintenance, New Delhi: Deep and Deep Publications, 1992
17. Sastry, T. S. N, India and Human Rights, Delhi: Concept Publishing Company, 2005
18. Saxena, D. R, Law Justice and Social Change, New Delhi: Deep and Deep Publications, 1996
19. Shah, Ghanshyam,Social Justice- A Dialogue, Jaipur: Rawat Publication, 1998
20. Sharma, S. S, Legal Aid to the Poor, New Delhi: Deep and Deep Publications, 1993
21. Siddiqi, Fatima E. and Ranganathan Sarala: Handbook on Women and Human Rights – A Guide for Social Activists (Part 1 and Part 2), New Delhi: Kanishka Publication.
22. Singh, Alka, Women in Muslim Personal Law, New Delhi: Rawat Publications, 1992
23. Singh, Shiv Sahai, Unification of Divorce Laws in India.1992
24. South Asia Human Rights Documentation Centre. Handbook of Human Rights and Criminal Justice in India, New Delhi: Oxford University Press, 2006
25. P J. Lukose, Inclusive Development: A Human Rights Approach, New Delhi: Media Publications, 2014

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		M
CO 2	M	H		
CO 3		M	H	

SWES0046: EMERGING TRENDS AND PERSPECTIVES IN INTEGRATED SOCIAL WORK PRACTICE (3-0-0)

(3 credits- 45 hours)

Course Outcomes

- Define, identify and explain the meaning and concept of a social work perspectives (Remembering and Understanding)
- List, define and classify the perspectives that have prominently informed social work practice ;(Applying and Analysing)
- Locate and critically evaluate the relevance of perspectives in social work fields of practice ;(Evaluating and Creating)
- Apply social work perspectives in practice settings (Applying)

Module I: Perspectives on Social Problems (11 hours)

Meaning and concept of Social Work Perspective: its importance and implications for practice; Social problems, human systems and social work response- structural-functionalist perspective, Conflict perspective, symbolic interactionist perspective

Module II: International Social Work Perspectives (11 hours)

Integrated Social Work Practice Model; Systems Theory and Ecosystems Perspective- Conceptual Systems in Social Work Practice; Strengths Perspective- Philosophy, Concept and Principles, Preparation for Strengths Approach to Practice; Assessing Clients' Strengths; Human Rights Perspective: Human Rights Based Approach

Module III Radical Social Work Perspectives (11 hours)

Marxist approaches- Critical and Structural Social Work; Freirian and Liberation theological perspectives-Conscientization and adult education; Feminist approach; Anti-discriminatory and anti- oppressive perspectives

Module IV Indian Social Work Perspectives (12 hours)

Gandhian Social Work Principles; Ambedkarite Social Work practice: Anti-caste intervention framework in India; Tribal/Indigenous Social Work Perspective; Social Work Practice in North East India

Suggested Readings:

1. Freire, P. Cultural Action for Freedom New York: Penguin Books. (1972)
2. Goldstein, H. Social work practice: a unitary approach. Columbia: University of South Carolina Press. (1973)
3. Gray, M., Coates, J., & Bird, M.Y. Indigenous social work around the world: towards culturally relevant education and practice. Burlington: Ashgate. (2008)
4. Mapp, Susan C.. Human rights and social justice in a global perspective: an introduction to international social work. New York: OUP. (2008)
5. Mooney, L. A., Knox, D., & Schacht, C. Understanding Social Problem, (2nd Edition). USA: Wadsworth/Thomson Learning. (2000).
6. Miley, K. K., O'melia, M., & Dubois, B. L. Generalist Social Work Practice: An Empowering Approach. Boston: Allyn and Bacon. (1995).
7. Mullaly, R. Structural social work: ideology, theory and practice. Toronto: McClelland & Stewart Inc. The Canadian Publishers. (1993).
8. Nash, M., Munford, R., & O'Donoghue, K. (Eds). Social Work Theories in Action. London: Jessica Kingsley. (2005).
9. Pardeck, J.T. Social work practice: an ecological approach. Westport, CT: Greenwood Publishing Group. (1996)
10. Payne, M... Modern Social Work Theory, (2nd Ed). Chicago: Lyceum Books. (1997)
11. Pincus, A., & Minahan, A. . Social work practice: model and method. Illinois: F.E. Peacock Publishers. (1993)
12. Powell, F. The politics of social work. New Delhi: Sage. (2001).
13. Saleeby, D. (Ed.). The strengths perspective in social work practice, (3rd Ed). Boston: Allyn and Bacon. (2002)
14. Saulnier, C. F. Feminist theories and social work: approaches and applications. NY: Haworth Press. (1996).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		M
CO 2	M	H		
CO 3		M	H	
CO4	H			M

SWRT0048: COMMUNITY DEVELOPMENT: RURAL, TRIBAL AND URBAN(3-0-0)

(3 credits- 45hours)

Course Outcomes

- Define the concepts, approaches, policies and strategies of community development (rural, tribal and urban) (Remembering)
- Discuss and explain the development issues of communities – tribal, rural and urban (Comprehension)
- Apply the knowledge and skills acquired in social work education to address issues of marginilisation, exclusion and oppression. (Application)
- Able to analyse various developmental issues and address them by applying relevant empowerment and development models and approaches in social work practice (Analyse)
- Able to assess development concerns, and adopt and apply models and approaches of development for alleviation and reduction of community inequities (Evaluating)
- Able to design development practice for effective community development experiences (Creating).

Module I: Community and Community Development (11 hours)

Understanding Communities – Urban, Rural and Tribal; Concept, Definition and Objectives of Community Development; Aspects of Community Development – Social, Cultural, Economic, Political and Environment; Approaches of Rural, Tribal and Urban Development.

Module II: Rural and Tribal Community Development (11 hours)

Rural Demography, Sociology and Economy; Tribal Identity and Ethnicity; Rural and Tribal Development Policies; Rights and Positive Discrimination; Governance Structures and Functions of Rural and Tribal Communities; Rural Reconstruction Experiments – Pioneering Period Sriniketan, Marthandam, Gurgaon; Probation period: Firka, Nilokheri and Etawh Projects.

Module III: Urban Community Development (11 hours)

Urban, Urbanization, Urbanism, Industrialization and Development; Urban Development Authority; Urban Governance; Urban Ecology and Growth of Cities; Concepts of Metropolis, Megapolis, Satellite Towns, Commuter Town / Bedroom Community, Suburbs, Metropolitan; Leisure Time Theories and Leisure Time in Cities.

Module IV: Issues of Rural, Tribal and Urban Development and Social Work Intervention (12 hours)

Rural and Tribal Development Concerns – Poverty, Migration, Education, Unemployment, Development Induced Displacement,

Health and Livelihoods; Urban Development Concerns – Poverty, Migration, Slums, Homelessness, Eviction, Traffic Congestion and Accidents, Health, Human Trafficking and Crimes; Role of Social Worker in Rural, Tribal and Urban Development.

Suggested Readings

1. Desai, A. R., Rural Sociology in India, Bombay: Popular Prakashan, 1961
2. Narang, A., Indian Rural Problems, Murari Lal and Sons, New Delhi, 2006
3. Shah, Dilip., Rural Sociology, ABD Publisher, India, 2005
4. Butter W Edgar, Urban Sociology- A Systematic Approach, Harper and Row Publishers, New York, 1976
5. Loornis and Beegle, Rural Sociology (The Strategies of change), Englewook, Cliffs, New Jersey : Prentice Hall, Inc, 1957
6. Sharma, K Rajendra, Rural Sociology, Atlantic Publishers and Distributors, New Delhi, 2004
7. Sharma Ramnath, Indian Rural Sociology, Munshiram Manoharlal Publishers Pvt. Ltd. New Delhi, 1979
8. Doshi S L, Rural Sociology, Rawat Publications, Jaipur, 2002
9. Singh S, Rural Sociology, Prakashan Kendra, Lucknow, 1980
10. Bhanti, Raj, Social Development (Analysis of some social work and field), Himanshu Publication, New Delhi, 2001
11. Dasgupta, Bilap, Village Society and Labour Use, Oxford University Press, New Delhi
12. Doshi, S.L. and Jain, P.C., Social Anthropology, Rawat Publications, New Delhi 2001
13. Dubey, S.C., Indian Society, National Book Trust in India, New Delhi.
14. Jain, Netra Pal, Rural Reconstruction in India and China (A comparative study), Writers and Publishers Corporation, 1970
15. Khadria, B., The Migration of Knowledge workers, New Delhi, London: Sage Publications, 1999
16. Khan, Mumtaz Ali, Scheduled Caste and their status in India, Uppal, Publishing House, New Delhi, 1980
17. Mishra, Anil Kant, Rural Tension in India, Discovery Publishing House, New Delhi, 1998
18. Mishra, Omprakash (Ed.), Forced Migration, Manak Publication, Delhi, 2004

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M			H
CO 3			M	M
CO 4		H	M	M
CO 5	M	H		
CO 6				H

SWGC0049: GOVERNANCE AND COMMUNITY DEVELOPMENT (3-0-0)

(3 Credits- 45 hours)

Course Outcomes

- Understand the context, meaning and relevance of decentralised governance for urban, rural and tribal areas. (Remembering and Understanding)
- Develop knowledge about the structure and functioning of governing bodies at various levels. (Creating and Evaluating)
- Develop an understanding to the various constitutional amendments for better governance and development (Creating and Evaluating)
- Understand contemporary issues and challenges in accessing governance bodies for people's development. (Applying and Analysing)

Module I: Rural Governance (11 hours)

Democratic Decentralization: Meaning, objectives and Importance, Governance: Meaning and Structures; Concept and Evolution of Panchayati Raj: Historical Development of the Concept, National level Committees in the evolution of Panchayati Raj (Balwantrai Mehta, Ashok Mehta, Singhvi committees)

Module II: The Functions of Panchayati Raj Institutions/Traditional Institutions (11 hours)

Panchayati Raj/Traditional Institutions: Structure, Functions and Powers at each level; Revenue Sources at each level; its role and Importance, Community Participation in Governance.

Module III: Urban Governance: Urban Local Self-Government in India (11hours)

Types of Urban Local Self-Government in India, Municipal Corporation, Municipalities, Municipal Council/Nagar Palika; Structures, Functions and Powers at each level; Sources of Revenue at each level; System of Elections to Urban Local Self-Government; Relation of Urban Local Self-Government with bodies of Governance at the State level issues; Challenges in Developing Partnerships between Elected Bodies, Bureaucracy and Civil Society.

Module IV: Constitutional Amendments (12 hours)
The 73rd Constitutional Amendment; PESA (Panchayat Extension in Scheduled Areas): Context of its Emergence and its Significance; Issues and Challenges in its implementation; 74th Constitutional Amendment

Suggested Readings

1. Chahar, S.S. (Ed.), Governance of Grassroots Level in India, Kanishka Publishers, New Delhi, 2005
2. Devas, N. et. al., Urban Governance, Voice and Poverty in Developing World, Earthscan, London, 2006
3. Hooja, Prakash and Hooja, Meenakshi, Democratic Decentralization and Planning, Rawat Publications, Jaipur, 2007
4. Mishra, S.N., Mishra Sweta and Pal, C., Decentralized Planning and Panchayati Raj Institutions, Mittal Publications, New Delhi, 2000
5. Singh, Amita (Ed.), Administrative Reforms (towards sustainable practice), Sage Publications, New Delhi, 2005
6. Baluchamy, S. Panchayat Raj Institutions, Mittal Publication, New Delhi, 2004
7. Bevir, Mark (Ed.), Encyclopedia of Governance in United Kingdom, Sage Publication, 2007
8. Bevir, M., Governance: A Short Introduction. United Kingdom, Oxford University Press, 2011
9. Chhotray, Vasudha and Stoker, G., Governance Theory and Practices: A Cross-Disciplinary Approach, UK: Palgrave Macmillan, 2009
10. Goel, S.L., Good Governance: An Integral Approach. New Delhi: Deep & Deep Publication Ltd., 2007
11. Grindle, Merilee S., Going Local: Decentralization, Democratization, and the Promise of Good Governance, New Jersey: Princeton University Press, 2007
12. Anwar Shah (ed.), Local Governing in Developing Countries (Public Sector Governance and Accountability Series). Washington: World Bank
13. Sivaramakrishnan, K C., Revisiting the 74th Constitutional Amendment for better Metropolitan Governance, Economic and Political Weekly Vol. 48 (13), 2013
14. Srivastava, OM Prie., Municipal Government and Administration in India, Allahabad: Chuch Publications, Contribution to Indian Sociology 45 (2), Pp. 157- 187, 1980
15. Stoker, Gerry., Governance as Theory: Five Preposition, International Social Science Journal Vol 50 (155), Pp 17-28, 2008

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		M	M
CO 4		H	M	M

SWCS0050: FAMILY CENTERED SOCIAL WORK PRACTICE (3-0-0)

(3 credits- 45 hours)

Course Outcomes:

- Define family and marriage, and theories associated with these concepts in the context of prevalent customary, legal instruments and social processes and explain how the differential structure of families affect its dynamics and processes (Remembering and Understanding)
- Assess and present the gender relations in society in the context of patriarchal social structure (Evaluating and Creating)
- Apply social work theoretical models for conceptualizing intervention plans that are best-suited for addressing problems located in different family structures (Applying and Analysing)
- Identify and evaluate the different plans and schemes of the government of India pertaining to family development and welfare (Evaluating)

Module I: Concept and Forms of Family and Marriage (11 hours)
Concept of family- Origin, Traditional Forms Family; Concept of marriage- Types of Marriage; Alternative Forms of Family and Marriage Patterns and Structures- Dual earner/Career Families; Single Parent families, Reconstituted/Step families; Childless Families; Same-sex Families, Adoptive family & Foster Family.

Module II: Theories and Dynamics of Family (11 hours)
Family theories – Developmental theory, Systems theory, Social Exchange theory, Structural Functionalist theory, Feminist theory, Ecological theory; Family Dynamics – Power, Myths, Role, Relationships; Gender and Patriarchy; Implications of Patriarchal Social Structure in Families-Global, National and Local.

Module III: Social Processes and Changes in Family Structure (11 hours)
Social Processes and Factors for Change- Industrialisation, Urbanisation, Modernisation, and Globalisation; Technology and Media; Migration; Displacement and Disaster (War, Conflict, riots and Natural Calamities)& Pandemics; Changes in the Family

Structure - Family Demography&Determinants of Change in Family Structure- Fertility change, Change in at marriage & age at first birth, Change in size and structure of the households, Change in Marital Unions, Marital Dissolution, Widowed, Remarriages, Non-Marital Unions & Sexual Behaviours, and Alternative family formation behaviours

Module IV: Social Work with Families- Interventions, Techniques and Skills (12 hours)
Family Social Work, Assumptions & Principle of Family Social Work; Practical Aspects of Family Social Work- Family Assessment- Qualitative-Genogram, Quantitative-Self-Anchored and Self-Monitoring Instruments; Problem Solving Approach; Developmental Approach- Family life-cycle & life enrichment programmes; Strengths& Resilience Perspective;Efforts of Government and Non-Government Agencies in strengthening families – Policy, Legislations and Programmes

Suggested Readings

1. Barnett, O.W., Miller-Perrin, C.L., & Perrin, R.D., Family violence across the lifespan: an introduction, New Delhi: Sage, 2011
2. Carter, B., &McGoldrick, M., The changing family life cycle: a framework for family therapy, (2nd Ed.), London: Pearson, 1989
3. Coontz, S., Marriage, a history: how love conquered marriage, New York: Penguin, 2005
4. Devine, E. T., The family and social work, New York: Andesite Press, 2017
5. Peoples, J., & Bailey, G., Humanity: an introduction to cultural anthropology, 7th ed., Belmont, CA: Thomson Wadsworth, 2006
6. Strong, B., DeVault, C., & Cohen, T.F., The marriage and family experience: intimate relationships in a changing society, Australia: Cengage, 2011
7. Yuen, F.K.O, Skibinski, G.J., &Pardeck, J.T., Family health social work practice: a knowledge and skills casebook, New York: Routledge, 2002
8. Collins, D., Jordan, C., & Coleman, H., An Introduction to Family Social Work, CA: Brooks/Cole, Cengage Learning, 2010
9. Hepworth, D., Rooney, R., Rooney, G., Strom-Gottfried, K., Direct Social Work Practice, 10th ed. Belmont, CA: Brooks/Cole, 2013 • Chapter 10: Assessing family functioning in diverse family and cultural contexts
10. White, J.M., Klein, D.M., Martin, T.F., Family Theories. An Introduction. New Delhi: Sage, 2015
11. Uberoi, P., Family, Kinship and Marriage in India, New Delhi: Oxford University Press, 1993
12. Parekh, S., Banerjee, G., &Kashyap, L., Family Life Education and Enrichment Programmes, The Indian Journal of Social Work, 70(2): 227-303, 2009
13. Chakravorty, S., Goli, S., & James, K.S., Family Demography in India: Emerging Patterns and Challenges, Sage Open: 1-18, 2021, https://doi.org/10.1177/21582440211008178

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		M	M
CO 4		H	M	M

SWPC0051: SOCIAL WORK PRACTICE WITH CHILDREN (3-0-0)

(3 Credits- 45 hours)

Course Outcomes:

- Understand the process of socialization of a child (Remembering and Understanding)
- Understand health and children's' health i.e. Both mental and physical well-being. (Remembering and Understanding)
- Analyze the difficult situations faced by children in the present context. (Analysing)
- Know the national and international efforts for child welfare and the child related laws. (Remembering and Understanding)
- Understand and acquire the skills for working with children. (Applying and Analysing)

Module I: Understanding Child and Childhood (11 hours)
Understanding Child- Childhood Development, Scope of Child Development, Meaning and Importance of different stages of Growth and Development - Heredity and Environment – Salient features of different stages in life - Factors influencing Growth and Development - Principles of Child Development;Child Rearing Practices, Socialization of Children with special needs- Special Schools/ Inclusive Schools; Theories: Cognitive Development Theory, Psycho-Social Theory, Personality Theory, Learning Theory

Module II: Concerns and Issues faced by Children (11 hours)
General Health of Children: Common Diseases, Malnutrition, Infant mortality and morbidity, health of Adolescent Girls; Concept of Mental Health, Child mental health and Psycho-Social Development. Mental health needs and mental health problems and

disorders in Children of various age groups, Learning Disabilities, Pervasive Developmental Disorder; Children in need of care and Protection- Street Child, Destitute, Abandoned, Orphaned, Child abuse, Child labour, Child trafficking, Natural calamity affected children, Children in Conflict situation, HIV-AIDS affected and infected children, Special problems of Girl child and Children in conflict with law.

Module III: Child Rights, Policies and Programmes (11 hours)
Working with Children – From charity to rights holders, Declaration of rights of the child 1924, UN Conventions and declarations - UNCRC, National Charter for Children, National Action Plan for Children, History of child development programs in India.; Constitutional Provisions, National Policy for Children, Commissions for Protection of Child Rights, Juvenile Justice (Care and Protection of Children) Act, 2015, Protection of children from sexual offences Act, 2012, Central Adoption Regulatory Agency (CARA guidelines), Child Labour (Prohibition and Regulation) Act 1986. Current initiatives- ICDS, ICPS, SSA and RTE, NRHM

Module IV: Fields of SWP and Skills for working with Children (12 hours)
Family, Child Welfare Organizations, School Settings, Children's Home, Adoption Agency; Communication Skill, Interpersonal Skills, Imagination and creativity- Art and Craft, and relationship building Skills, Counseling, and Discipline and Behavior Management; Good Practices by Organizations- CRY, Action Aid, Aide-Et-Action, UNICEF, RED CROSS and SOS Children's Village.

Suggested readings

1. Anandaraj, H., Children at Risk, Hyderabad: Neelkamal Publications, 2007
2. Banerjee, B. G., Child Development and Socialisation, New Delhi: Deep and Deep Publication, 1987
3. Baroocha, P. P., Handbook on Child, New Delhi: Concept Publishing Com, 1999
4. Berk, Laura E., Child Development (8th edition), New Delhi: Pearson Prentice Hall, 2009
5. Bhalla, M. M., Studies in Child Care, Delhi: Published by NIPCCD, 1985
6. Bossare, James H. S., The Sociology of Child Development, New York: Harper and Brothers, 1954
7. Chandra Kulshreshtha Jinesh, Child Labour in India, New Delhi: Ashish Publishing House, 1978
8. Chaturvedi, T. N., Administration for Child Welfare, New Delhi: Indian Institute of Pub., 1979
9. Choudhari, D. Paul., Child Welfare / Development, Delhi: Atma Ram and Sons, 1980
10. Ghathia, Joseph, Child Prostitution in India. New Delhi: Concept Publishing Company, 1999
11. Gokhale, Sharad D. and Sohoni, Neera K., Child in India, Mumbai: Somaiya Pub., 1979
12. Gopalakrishnan B., Rights of Child, Jaipur: Aavishkar Publishers, 2004
13. Hugh, Jolly, Diseases of Children, Oxford: The English Language book society and Blackwell Scientific Publications, 1981
14. Hurlock, Elizabeth B., Child Development, New Delhi : Tata McGraw Hill Pub; Com; Ltd., 1968
15. Kumar, Arvind, Fundamentals of Child Rights: Concepts, Issues and Challenges, Lucknow: Laxmi Shikshan Sansthan, 2002
16. Nanda, V. K., Nutrition and Health for child Development, New Delhi: Anmol Publication Pvt. Ltd., 1998
17. Pandya, K. C., Element of Child Development. New Delhi: Kalyani Pub., 1988
18. Pimpley, P. N., Singh K. P., A. Mahajan, Social Development Process and Consequences, Jaipur: Rawat Publication, 1989

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		M	M
CO 4		H	M	M
CO5	H	M		H

SWMS0052: MEDICAL SOCIAL WORK (3-0-0)

(3 credits-45 hours)

Course Outcome:

- Introduce the historical development of medical social work in western countries and in India. (Remembering)
- Students will develop an insight on the impact of disease on the individual and his/her social system.
- (Understanding)
- Students would learn to implement social work intervention strategies in medical and psychiatric settings. (Applying)
- Students will develop competencies in the roles and functions of medical social workers in various settings. (Applying)

Module I: Historical overview (11 hours)
Medical Social Work:- Historical development of Medical Social Work in Western Countries and in India; Social Workers in General Health Care System in India; Challenges in the field of Medical Social Work in India.

Module II: Disease, Illness and Sickness and Concept of Care (11 hours)

Illness as a social problem and its effect on the individual, family and community, the concept of Patient as a Person; Social and Emotional factors involved in disease; Social Work with terminally ill, Social Work with dying and bereaved, Palliative Care, Hospitalization and its implications on patient and the family members; Rights of Patients; Modern trends in treatment of illness; Care in different Medical Settings – Hospitals, Outpatient Departments, Emergency, Crisis care, Hospice, Special Clinics.

Module III: Skills (11 hours)
Skills and Qualities of Medical Social Worker; Teamwork and multidisciplinary approach in the treatment of illness; Role and functions of a Medical Social Worker, Organization and Administration of Medical Social Work Department in Hospitals; Assessment and Diagnosis- Interviews, Reporting and Record maintenance; Medical Social Worker and Public Relations.

Module IV: Medical Social Work in different Departments in Hospitals (12 hours)
Medical Social Work in different Departments in Hospitals: Oncology, Nephrology; Reproductive Health, Family Welfare and Family Planning; Sexual Health (STD, HIV/AIDS); Geriatrics, Diabetology, Cardiology, Accident, Disability and Burns Department.

Suggested Readings

1. Anderson R. and Bury M. (Eds.), Living with Chronic Illness – the Experience of Patients and their Families, Unwin Hymman: London, 1988
2. Bajpai P.K., Social Work Perspectives in health, Rawat Publications: New Delhi, 1997
3. Barlett H.M., Social Work Practice in the Health Field, New York: National Association of Social Workers, 1961
4. Dimatteo, M. Robin and Leslie R. Martin, Health Psychology, Dorling Kindersley (India) Pvt. Ltd.: New Delhi, 2007
5. Field M., Patients are People – A Medical – Social Approach to Prolonged Illness, Columbia University Press: New York, 1963
6. Narasimhan, M. C. and Mukherjee, A.K., Disability – A Continuing Challenge, Wiley Eastern Ltd. New Delhi, 1987
7. Pathak S. H., Medical Social Work in India, New Delhi: DSSW, 1961
8. Pokarno K.L., Social Beliefs, Cultural Practices in Health and Diseases, Rawat Publications, New Delhi, 1996
9. Park, J.E., Textbook of Social and Preventive Medicine, 17th edition, Jabalpur: Banarsidas Bhanot, 2006
10. World Health Organization, World Health Report, Geneva, 2001

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	
CO 2		H		M
CO 3	M	M	H	M
CO 4		M	M	H

SWHS0053: MENTAL HEALTH AND SOCIAL WORK (3-0-0)

(3 credits-45 hours)

Course Outcome:
- Introduce the concept of mental health, normal and abnormal behaviour, meaning of psychiatry and its history. (Remembering)
- Students will develop the skills of assessment of mental illness. (Applying)
- Students will learn about various mental illnesses affecting people. (Applying)
- Introduce the concept of Community Psychiatry and significance of community mental health. (Analyzing)

Module I: Understanding mental health and mental illness (10 hours)
Mental health: A Conceptual Framework: Historical background of the concept. Definitions of mental health components. Mental health in the changing society. Concept of normal and abnormal behaviour. Psychiatry – definition, history and growth of psychiatry. Traditional and modern attitude towards psychiatric illness. Symptomatology – Disorders of perception, thought, speech, memory, emotion.

Module II: Psychiatric assessment (10 hours)
Assessment in psychiatry. Psychiatric interviewing, case history recording and mental status examination (MSE). Classification in psychiatry- need, types - ICD and DSM.

Module III: Major Psychiatric disorders (15 hours)
Prevalence, etiology, clinical manifestation, course and outcome and different treatment modalities of the following disorders:
a. Neurotic and somatoform disorders – Phobia, anxiety disorders, Obsessive compulsive disorders, dissociative (conversion) disorders, somatoform disorders
b. Mood (affective) disorders
c. Organic mental disorders – dementia, (Alzheimers), Amnesic syndrome, delirium

d. Schizophrenia and Delusional disorders
e. Disorders of adult personality and behaviour _ paranoid, schizoid and histrionic personality disorders. Gender identity disorders, disorders of sexual preference
f. Disorders of psychological development – developmental disorders of speech and language and scholastic skills; learning disability, mental retardation, pervasive developmental disorders – autism, Rett's and Asperger's syndrome
g. Behavioural and emotional disorders in childhood and adolescence – Hyperkinetic and conduct disorders, anxiety, phobia and depression
h. Disorders due to substance use

Module IV: Community mental health (10 hours)

Community psychiatry – concept and meaning, evolution of community psychiatry; Community mental health in India, Social – cultural factors in psychiatric disorders with special reference to India, culture bound syndrome.

Suggested Readings

1. American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, 4th Edition. DSM –IV-TR, APA, Washington DC, 2000
2. Carlson R. Neil, Foundations of Physiological Psychology, 6th Ed, Pearson Education, India, 2007
3. Chaube S.P., Abnormal Psychology, Educational Publishers
4. Clifford T. Morgan, Richard A. King, John R. Weisz, John Schopler, Introduction to Psychology, Tata Mc. Graw Hill Edition
5. Colman. M. Andrew, Oxford Dictionary of Psychology, Oxford University Press, New York, 2009
6. Correy Gerald, Theory and Practice of Counseling and Psychotherapy, Student Manual, 8th Ed, Brooks Cole Cengage Learning, USA, 2005
7. Fernald/Fernald, Munn's Introduction to Psychology, 5th Edition, AITBS Publishers, India
8. James D. Page, Abnormal Psychology, Tata McGraw Hill Edition,
9. Kring M. Ann, Johnson L. Sheri, Davison C. Gerald, Neale M. John, Abnormal Psychology, 11th Ed, Wiley India Pvt. Ltd, New Delhi, 2010
10. Kumar Updesh, Mandal, Manas (Editors), Suicidal Behaviour, Assessment of People-at-Risk, Sage Publications India Pvt. Ltd, New Delhi, 2010
11. Maxmen S. Jerrold, Ward G. Nicholas, Essential Psychopathology and its Treatment, 2nd Ed. Revised for DSM IV, W.W. Norton and Company, New York, 1995
12. Mishra. A.K., Psychology of Aging, Sublime Publications, Jaipur, 2007
13. Patel Vikram, Thara R. (Editors), Meeting the Mental Health Needs of Developing Countries, NGO Innovations in India, Sage Publications, New Delhi, 2003
14. Ranjana, Cognitive Psychology, RBSA Publishers, Jaipur, 2010
15. Robert A. Baron, Psychiatry, 5th Edition, Pearson Education
16. Robert C. Carson, James N. Kutcher, Susan Minela, Jill M. Hooley, Abnormal Psychology, 13th edition, Pearson Education
17. Santrock W. John, Educational Psychology 2nd Ed, Tata McGraw- Hill Edition, New Delhi, 2006
18. Scileppi A. John, Teed L. Elizabeth and Torres D. Robin, Community Psychology: A common sense approach to mental health, Prentice Hall, USA, 2000
19. Shepherd, Michael et al., Childhood Behaviour and Mental Health, University Press. London, 1971
20. World Health Organization, the ICD 10 Classification of Mental and Behavioural Disorders, Clinical Description and Diagnostic Guidelines, Oxford University Press, Geneva, 1992

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	H	
CO 3		H	H	
CO 4	M			H

SWOD0054: ORGANISATIONAL STRUCTURE, BEHAVIOUR AND DEVELOPMENT (3-0-0)

(3 credit: 45 hours)

Course Outcome

- Understanding the structure and functioning of an organization (Remembering and Understanding)
- To develop the skills for Organisation Development Process (Evaluating and Creating)
- To establish and manage any development organisation. (Evaluating and Creating)
- To introduce the students to organisational structure and management (Remembering and Understanding)
- To familiarize the students with the skills and legal base for managing the workforce of an organisation. (Applying and Analysing)

Module I: Organizational Structure (10 hours)
Organizational Structure: Definition, Concept and Nature Formation of Organizational Structure; Types of organizational Structure

Module II: Basic concepts in Organisational Behaviour (10 hours)
Organizational Behaviour: concept and theories; Models of Organizational Behavior: Development and Types; Organisation Climate, Culture and Team building; Employee counseling, Work life balance, managing occupational stress

Module III: Basic skills for Organisational Development (10 hours)
Leadership - traits, typology and theories; Motivation: need, significance, theories, methods and practices; Communication - concept, significance, modes, channels, impact

Module IV: Legal Base for Practice (15 hours)
Legislations for industrial relations-Factories Act, 1948, Industrial Dispute Act,1947, Industrial Employment Standing Orders Act, 1946; Legislations related to Wages – Minimum Wages Act,1948, Payment of Wages Act, 1936, Equal Remuneration Act, 1976, The Payment of Bonus Act, 1965, Payment of Gratuity Act , 1972; Equal Opportunities, Protection of Rights & Full Participation) Act,1995; Provisions related to employees behaviour : discharge, misconduct, domestic enquiry and disciplinary action; sexual harassment at workplace; Legislations related to employment- Inter-state Migrant Worker's Act,1979, Contract Labour Act, 1970

Suggested Readings

1. Daft, R.L., Organization: Theory and Design, Mason: OH, South Western Publishing, 2004
2. Jacoby, S.M. (Ed.). The Workers of Nations: Industrial Relations in Globalized Economy, New York: Oxford University Press, 1994
3. Mallick, P.L., Industrial Law, Lucknow : Eastern Book Company, 2002
4. Mathis, R. L., & Jackson, J.H., Human Resource Management, U.K: Prentice Hall International, 1997
5. Pareek. U., & Rao, T.V., Designing and Managing HR Systems, New Delhi: Oxford & IBH Publishing, 1992
6. Ramnarayan, S., Rao, T.V., & Singh, K., Organization Development: Interventions and Strategies, New Delhi: Sage Publications, 1998
7. Robbins, S.P., Organizational Behaviour (10^{th}Ed.), New Delhi: Prentice Hall of India, 2002
8. Silvera, D.M., Human Resource Management: The Indian Experience, New Delhi: New India Publications, 1990
9. Sivananthiran, .A. & Venkatratnam, C.S., Best Practices in Social Dialogue, New Delhi: ILO, 2003
10. Veena, A.K., Kochan R.D., & Lansbury, R.D., Employment Relations in the Growing Asian Economics, London: Routledge, 1995
11. Ramnarayan, S., Rao, T.V., & Singh, K., Organization Development: Interventions and Strategies, New Delhi: Sage Publications, 1998
12. Robbins, S.P., Organizational Behaviour (10^{th}ed.), New Delhi: Prentice Hall of India, 2002

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2		H	H	
CO 3		H	H	
CO 4	M		M	H
CO5	H	M		H

SWDO0055: POLICIES FOR DEVELOPMENT ORGANISATIONS - URBAN, RURAL AND TRIBAL COMMUNITIES (3-0-0)

(3 credits- 45 hours)

Course Outcomes

- Develop an understanding about the social policies and decision making process of the government in planning for development in India. (Evaluating and Creating)
- Understand the Governmental efforts for development of Rural, Tribal and Urban communities (Remembering and Understanding)
- Understand and analyze Governance issues at local, regional, state and national levels (Applying and Analysing)

Module I: Introduction to Social Policies (8 hours)
Meaning and Definition of Policy and social policy; History and process of Social Policy development in India; Evolution of planning – Planning commission, NITIAayog.

Module II: Policies and Schemes in Urban Areas (8 hours)

Challenges for urban development; urban poverty management; urban governance systems; Government schemes and policies

Module III: Policies and Schemes in Rural Areas (8 hours)
Challenges for rural development; rural poverty management; rural governance systems - decentralization processes; Government schemes and policies

Module IV: Policies and Schemes in Tribal Areas (8 hours)
Challenges for tribal development; Poverty management; Governance systems; Government schemes and policies

Module V: Issues of Governance and Planning (13 hours)
Issues of Development and Displacement; Diversity and Citizenship Issues

Suggested Readings

1. Akhup, A., Identities and their struggles in Northeast India (TAS 2), Kolkata: Adivaani, 2015
2. Bodhi, S.R., Social Work in India: Tribal and Adivasi Studies- Perspectives from Within, Kolkata: Adivaani, 2016
3. Dreze, J., & Sen, A., An uncertain glory: India and its contradictions, London: Princeton University Press, 2013
4. Fernandes, W., Bharali, G., Uprooted for whose benefit? Development-induced displacement in Assam, Guwahati: NESRC Press, 2011
5. Jacob, K.K., Social Policy in India, Udaipur: Himalaya Publications, 1989
6. Shivaramkrishnan, K.C., Kundu, A. & Singh, B.N., Handbook of Urbanization in India, New Delhi: Oxford University Press, 2007
7. Mishra, R., Globalisation and the welfare state, London: Edward Elgae, 1999
8. Singh, K. (2009). Rural Development: Principles, Policies and Management, 3rd Ed. New Delhi: Sage.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	
CO 2		H	H	M
CO 3	M	H	H	

SWCP0056: INTRODUCTION TO CHILD PSYCHOLOGY AND DEVELOPMENT (3-0-0)

(3 Credits- 45 hours)

Course Outcomes

- Introduce and help students understand the psychological, legal and cultural definitions of child and childhood (Remembering and Understanding)
- Introduce students to the major personality theories of psychology thus enabling them to understand human behaviour. (Applying and Analysing)
- Help students discover the different factors that influence development and behavior of children (Evaluating and Creating)
- Understand the principles, values and code of ethics for working with children (Remembering and Understanding)

Module I: Introduction to Child and Childhood (11 hours)
Understanding Child and Childhood- Definitions and Notions of Childhood across varying Cultural, Political, Social, Historical, Biological and Philosophical Contexts; Legal and Constitutional Definitions: Different Age based definition in the Juvenile Justice (Care and Protection of Children) Act, 2000; Child Labour (Prohibition and Regulation) Act 1986; The Right of Children to Free and Compulsory Education Act, 2009; United Nations Convention on the Rights of the Child (UNCRC); Development Stages of Childhood- Human Life Cycle Approach: Development Stages, Socialization and Agents of Socialization, Child Rearing Practices; Common Illness and ailments

Module II: Theories on Child Development (11 hours)
Theories of Child Behavior; Emotional Theories; Learning Theories; Intellectual Theories; Psycho-Social Theories; Personality Theories; Moral Theories; Implications of Theories.

Module III: Situational Child Psychology (11 hours)
Factors Determining Well-Being and Development of Children – Adult Child Relationships- Age, Gender, Caste, Class, Education, Social and Cultural Practices, Ethnicity, Religion, Region, Language, Influence of Technology on Family Relationships; Family dynamics, Peer relationships, Sibling relationships and birth order; Effects of separation, divorce, bereavements; Power Dynamics- Protection, Care and Support; Punishments and Threats; General Adult Attitudes; Effect of Cultural Practices; Laws and Institutional Practices; Representation in Literature and Media; Factors enabling Healthy Adult Child Relationships

Module IV: Values and Principles of Working with Children (12 hours)
Code of ethics- Responsibility for Self, Responsibility to Children, Young People and their Families, Responsibility to Colleagues,

Responsibility to Employers, Responsibility to the Profession, Responsibility to Society; Principles and Values- Seven International Ethical Principles for People Working with Children and Young People; Psychiatric rehabilitation principles and values by Psychiatric Rehabilitation Association (PRA)

Suggested Readings:

1. Ahuja, N., A Short textbook of Psychiatry, Himalaya Publishing House, New Delhi, 2005
2. Banerjee, B. G., Child Development and Socialisation, New Delhi, Deep and Deep Publication, 1987
3. Archambeault, J., Social Work and Mental Health, UK: Learning Matters Pvt Ltd, 2009
4. Baroocha, P.P., Handbook on Child, New Delhi: Concept Publishing Com, 1999
5. Berk, Laura E., Child Development (8th edition), New Delhi: Pearson Prentice Hall, 2009
6. Bhalla, M. M., Studies in Child Care, Delhi: NIPCCD, 1985
7. Bossare, James H. S., The Sociology of Child Development, New York: Harper and Brothers, 1954
8. Berk, Laura E., Development through the Lifespan, 5th edition, Allyn and Bacon, London, 2009
9. Bhattacharya, S., Social Work: Psycho-Social and Health Aspects, New Delhi: Deep and Deep, 2008
10. Clifford T. Morgan, Richard A. King, John R. Weisz, John Schopler, Introduction to Psychology, Tata Mc.Graw Hill Edition.
11. Coleman James. C, Abnormal Psychology and Modern Life, D.B. Taneporevela, Mumbai, 1975
12. Feist Jess, Feist J. Gregory, Theories of Personality, 7th Edition, McGraw Hill, Primis, 2008
13. Fernald/Fernald, Munn's Introduction to Psychology, 5th Edition, AITBS Publishers, India
14. Feshback Seymour, Weiner Bernard, Bohart Arthur, Personality, 4th Edition, D.C. Health and Company, Lexington, 1996
15. Hurlock, Elizabeth, Developmental Psychology, Tata Mc Graw Hill, New York, 2001
16. Giddens, Anthony, Social Theory and Modern Sociology, Stanford University Press, 1987
17. Steinberg, Laurence, Adolescence, McGraw Hill Inc, New York, 1993
18. WHO, the ICD – 10 Classification of Mental and Behavioural Disorders, Diagnostic Criteria for Research, AITBS Publishers and Distributors (Regd.), Delhi, 2004
19. Theories of Personality, Hall and Goindzey

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	H		H	M
CO 4		H	M	M

SWRC0057: RIGHTS OF THE CHILD – LEGAL FRAMEWORK, NATIONAL AND INTERNATIONAL INSTRUMENTS(3-0-0)

(3 Credits- 45 hours)

Course Outcomes:

- Make the students well abreast of the International. National and other relevant instruments on Child Rights and get to know the legal sanctions and safeguards regarding children's rights(Remembering and Understanding)
- Get to know the provisions enshrined in the Indian constitution which safeguard the rights of children and ensures a life of dignity for them (Remembering and Understanding)
- Make the students understand the role, functions and powers of the UN agencies and their mandate in working towards the cause of children(Analysing)
- Familiarize the students with the working of the statutory bodies and their role in providing justice to children. (Evaluating and Creating)

Module I: Introduction to Human Rights and Children's Rights (11 hours)

Theoretical Foundation of Human Rights, Historical Evolution of Human Rights; Child Rights as Human Rights of Children; Evolution of Child Rights, Children as objects of Charity to rights holders; Specialized instruments on the Rights of the Child & Foundational Principles- Declaration of the Rights of the Child 1924, Declaration of the Rights of the child 1959, Beijing Rules, 1985; UN Convention on the Rights of the Child 1989 (Survival Rights, Development Rights, Protection Rights and Participation Rights), United Nations Convention on the Rights of Persons with Disabilities.

Module II: Legislations relating to Children in India (11 hours)

Introduction to the Indian Constitution, Fundamental Rights and Directive Principles of State Policy;; National Policy for Children, 1974 and 2013, Child Labour (Prohibition and Regulation Act, 1989), The Plantations Act, The Prohibition of Child Marriage Prevention Act, Immoral Trafficking (Prevention) Act, Pre-natal Diagnostic Techniques Act, 1994, Right to Education Act, POCSO Act;, Juvenile Justice (Care and Protection) Act 2016; Central Adoption Resource Agency, Rights of Children with Disabilities.

Module III: Child Protection (11 Hours)

The Legal Foundation of Child Protection, Defining Child Protection; Concept and definition of vulnerability, Settings or Habitats of Children and its Effect on Vulnerability: (Family, Streets or Public Places, Institutions); Magnitude of Abuse, Neglect, Violence and Exploitation Cases Child in need of care and protection or vulnerable groups- Child Labour, street Children, abused Children, Children With disability, Trafficked Children, Children in Institutions and Children in "Families At Risk". Child Poverty: Multi-dimensional Deprivation; Children and the Law- Children in Conflict with the Law, A System's Approach to Child Protection- Components of a Child Protection System, Identifying Problems in Child Protection System, Global and Local Action to Strengthen Child Protection Systems

Module IV: Child Rights, Protection and its Applications (12 hours)

Role of duty bearers in ensuring child rights and protection- Role in Protection, Prevention, Intervention and Rehabilitation by Family, Community, Civil Society, Media, and State; Structure, Functions and Role of UN and its specialized agencies for the protection of child rights, UNICEF, WHO, Red Cross; National and State Commissions for Protection of Child Rights - Their role and Functions; Government Schemes: Integrated Child Protection Scheme, Integrated Child Development Scheme; Programs and interventions for Child Protection- Family strengthening, Institutional Services and Non-Institutional services, Alternative Care

Suggested Readings

1. Acharya, B., & Das, D., Introduction to the Constitution of India, (7th. Edition), New Delhi: Prentice Hall of India Pvt.Ltd, 2008
2. Ahuja, R., Criminology, Jaipur, Rawat Publications
3. Biju, M. R., Human Rights in a Developing Society, New Delhi: Mittal Prakashan, 2005
4. Diwan, Paras and Diwan, Peeyush, Child and Legal Protection, New Delhi: Deep and Deep Publications, 1994
5. Nirmal C. J., Human Rights in India: Historical, Social and Political Perspectives (Oxford University Press, India)
6. Bajpai Asha, Child Rights in India: Law, Policy and Practice, Oxford University Press, USA, 2005
7. Leister Erich and Nanda Sujata, Human Rights of Children, Kalinga, New Delhi, 2009
8. KumariVed , The Juvenile Justice System in India: From welfare to Rights, Oxford University Press, New Delhi, 2004
9. Brien Damick, ed, Child Labour in India: Realities and Issue, London, OUP, 2010
10. Sinha Santa, Child Labour and Education Policy in India, Administrator Vol XII, July-September, 1996
11. Arun Kumar, Child as a Human Resource, Sarup& Sons, 2002
12. Myron Weiner, NeeraBurra, AshaBajpai, Born Unfree, OUP, 2006
13. JyotsnaTiwari, Child Abuse and Human Rights, Isha Books, 2011
14. Samaddar Ranabir (Ed), State of justice in India-issues of social justice, sage publication, 2009.
15. Sastry, T. S. N, India and Human Rights, Delhi, Concept Publishing Company, 2005

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	H		M	H
CO 4		H	M	M

SWSP0058: SOCIAL DEVELOPMENT AND SOCIAL POLICY (3-0-0)

(3 Credits- 45 hours)

Course Outcomes

- Understand the key concepts and issues related to Social Development (remembering and Understanding)
- Promote alternative paths of Social Development that promotes the wellbeing of Individuals, families and communities (Creating and Evaluating).
- Develop an understanding of social policy in the perspective of the national goals as stated in the constitution. (Creating and Evaluating)
- Develop the capacity to recognize the linkage between the developmental issues and social policy, plans and programmes related to social work practice. (Applying and Analysing)

Module I: Social Development (11 hours)

Definition, meaning and concepts; Approaches to Social Development; Developmental Indicators; Measurement of Development; Models of Development; Economic growth and Social Development; Human Development; Relationship between Social Development and Sustainable Development .

Module III: Theories of Social Development (11 hours)
Baran's Theory; World System Theory; Dependency Theory; Theory of Unequal Exchange; Theory of Economic Growth; Theory of Positivistic Development; Theory of Realistic Development.

Module III: Social Policy (11 hours)
Concept and Objectives; Values underlying Social Policy based on Constitutional provisions (i.e. Directive Principles of State Policy, Fundamental Rights and Fundamental Duties); Instruments of Social Policy; Approaches to Social Policy – Residual Welfare, Unified, Integrated, Sectoral; Models: Industrial achievement and Institutional Redistributive Model and their applicability to the Indian situation.

Module IV: Evolution of Social Policy (12 hours)
Process of Social Policy formulation; Methods of evaluation of Social Policy; Critical review of Policies concerning Education, Health, Youth, Welfare of Backward Classes, Tribal development and Poverty alleviation

Suggested Readings

1. Blakemore, Kenneth, Social Policy: An Introduction, Mc Graw- Giriggs, E, Hill Education, New York, 2007
2. Bogo Marion, Social worker Practice: concept, processes and interviewing, New Delhi, Rawat, 2007
3. Bose, A.B., Social Welfare Planning in India, New Delhi: ECAEF
4. Gilbert, N and Specht, H Planning for Social Welfare: Issues, Models and Tasks, Prentice Hall Inc. Englewood cliffs, New Jersey
5. Goel, S.L. and Jain, P.K., Social Welfare Administration, Vol. 1 and 2, New Delhi: Deep & Deep Publication, 1988
6. Huttman, E.D., Introduction to Social Policy, New YorkMcGraw Hill, 1981
7. Hills J., Making Social Policy Works, Rawat Publications, New Delhi, 2007
8. Hudson J., Understanding the Policy Process, Rawat Publications, ND, 2007
9. Jones, Kathleen and others, Issues in Social Policy, Routledge and Paul, Kopan London, 1983
10. Kulkarni, P.D., Social Policy in India, Tata Institute of Social Sciences, Bombay, 1965
11. Kulkarni, P.D., Social Policy and Social Development in India: Madras, Association of Schools of Social Work in India, 1979
12. Lavalette Michael, Alam, Social Policy-Theories, Concepts and Issues, Sage, New Delhi.
13. Livingstane, A., Social Policy in Developing Countries, London: Routledge and Kogan Paul, 1969
14. Modison, Bernice and George, Meaning of Social Policy: A Comparative Dimension in Social Welfare, London, 1980
15. Mishra, R., Society and Social Policy, Macmillian Ltd., London, Allen and Unwin, 1977
16. Mullard, M, Social Policy in Changing Society London: Routledge, Spicker, 1998.
17. Simpson, G., Social Policy for Social Welfare Professionals, 2011

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2		H	H	
CO 3		H	H	
CO 4	M			H

SWPM0059: PROJECT CYCLE MANAGEMENT AND RESOURCE MOBILISATION(3-0-0)

(3 Credits- 45 hours)

Course Outcomes

- Understand the importance and process of planning, methodology for planning and formulating projects using the Logical Framework Analysis (Remembering and Understanding)
- Develop an understanding of the problems and issues faced by the poor and the marginalized (Creating)
- Develop an insight into the different strategies and approaches commonly adopted by Development Organisations for Project Management (Applying and Analysing)
- Learn Skills to develop project proposals, implement, monitor and evaluate project, enhance process documentation and reporting skills (Evaluating and Creating)

Module I: Overview (7 hours)
Concept of Results Based Management; Planning and its importance for PCM; Overview of Project Cycle Management: Identification, Design, Implementation, Monitoring, Evaluation, Identification of the best practices.

Module II: Project Identification (8 hours)
Needs assessment: Situational analysis; Capacity assessment: Human, Social, Natural, Physical, Economic and Cultural; Stakeholders analysis, types: Primary and Secondary Stakeholders and mapping of Stakeholders; Importance of Stakeholder participation and different levels of participation

Module III: Project Design (10 hours)
Problem Tree analysis; Objective Tree analysis and formulation of objectives; Hierarchical results: Impact, outcome, Outputs, Inputs; Assumptions, Indicators, Means of Verification; Activities and scheduling; Budget preparation

Module IV: Monitoring and Evaluation (10 hours)
Concept and definition of monitoring and evaluation; Difference in Monitoring and Evaluation; Learning the lessons; documentation and reporting; PERT and Critical Path Method (CPM) of Monitoring

Module V: Resource Mobilization (10 hours)
Internal and External Resources; Fundraising – principles, sources, ethics, methods and their implications. International sources for Funding – Concept note; application, procedure and FCRA, record keeping, documentation and legal compliance

Suggested Readings
1. Lukose P J, A to Z in Projects Cycle Management: A Results Based Approach, Media House, Publications, New Delhi, 2015
2. Capezio, P., Powerful Planning Skills. Mumbai: Jaico Publishing House, 2000
3. Smith, S., Plan to Win. New Delhi: Kogan Page India, 2002
4. Dale, R., Evaluation Frameworks for Development Programmes and Projects. New Delhi: Sage Publications, 2001
5. Loehle, C., Thinking Strategically, New Delhi: Foundation Books, 2000
6. Padaki, V., Development Intervention and Programme Evaluation, New Delhi: Sage Publications, 1995
7. Dadrawala, N.H., The Art of Successful Fundraising, New Delhi: CAP

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		H	M
CO 2		H	H	
CO 3		H	H	
CO 4	M			H

SWHP0060: COMMUNITY HEALTH AND POPULATION MANAGEMENT (3-0-0)

(3 credit- 45 hours)

Course Outcomes
- Define health, disease, epidemiology, health policies, health education and related terms of community health and population studies (Remembering)
- Explain the concepts of health, health indicators and relevance of social work in health (Understanding)
- Apply and knowledge and understanding of the concepts of community health in social work practice for development (Application)
- Able to analyse various health issues in communities, and suggest and apply solutions to community health concerns (Analyse)
- Able to assess and choose health intervention plans and policies for community needs (Evaluate)
- Able to combine effectiveness of health interventions, approaches, policies and programmes for effective intervention for healthy communities (Creating).

Module I: Health, Disease and Epidemiology (11 hours)
Meaning and Scope of Health and Epidemiology; Concepts and Models of Health and Disease; Factors associated with health and diseases; Concepts of sickness, illness and diseases; Environmental Health, Nutritional Health, Occupational Health, Mental Health and Reproductive Health, Tribal Health.

Module II: Health Indicators, Health Statistics and Management System (11 hours)
Health Statistics and Health Indicators – Morbidity and Mortality: MMR, IMR, TFR; Communicable and Non-communicable diseases; HMIS – Computer systems, Data sources, Collection, Analysis and uses; Primary, Public and Community Health Care Services: Structure, Organization, and Community Participation; Physical and psychological aspects of Community Health; Preventive and Promotive Health care in Indian context. Community Health Concerns: Drugs and Alcoholism.

Module III: Health and Population Policies (11 hours)
Health and Population Policies: Health Policy; Alma Ata Declaration, National Health Policy; Mental Health Act; NRHM, Assam Public Health Act; Population Policy; Population Dynamics- National and the North East Context.

Module IV: Health Education and Role of Social Worker in Health Service (12 hours)
Health Education, Consumer Health and Health Products; Meaning, importance, principles and components of health education; IEC for health: mass media, audio-visual; Agencies for Health Education Programmes-Voluntary and Government; Analysis of Health Education in India. Formal and Informal health care provider; Modern and traditional practices, safe and risk

health behavior and practices. Quackery, Consumer Law on health, consumer agencies; Role of Social Work in Preventive, Promotive and Rehabilitative Programmes in Communicable and Non-Communicable Diseases.

Suggested Readings

1. Abelin, T., Brzenski Z.J., and Carstairs, V.D., Measurement in Health Promotion and Protection, WHO, Copenhagen, 1987
2. AIDS Prevention through Health promotion by WHO, end of pub.
3. Alderson, M., An Introduction to Epidemiology, 2nd edition, Mac-Millan, London, 1983
4. Anssi. Perakyla, AIDS Counseling – Institutional Interaction and Clinical Practice, Cambridge, University Press, 1995
5. Bhore, J., Report of the Health Survey and Development Committee. Vol. 2. Government of India., New Delhi, 1946
6. Dutta, I. and Bawari, S., Health and Healthcare in Assam: A Status Report, CHEAT and OKD, Mumbai, 2007
7. Francis, C.M., Promotion of Mental Health with community participation- The center for Health Care Research and Education, Kerala,1991.
8. Government of India (GOI). Operational Guidelines for Programme Managers and Service Providers for Strengthening STI/RTI Services, GOI, Ministry of Health and Family Welfare, New Delhi, 2011
9. Green L.W and Anderson, C.L., Community Health 5th edition, Times Mirror Mosby, St. Louis 1986
10. Park, K., Park's Textbook of Preventive and Social Medicine, 20th edition, Bhanot, 2009
11. Thomas, G., AIDS and Family Education – Gracious Thomas, Rawat, Jaipur, 1995
12. Thomas, G., Sinha, N.P. and Thomas, K.J. AIDS'S Social Work and Rawat, Jaipur, 1997

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	M	M
CO 2	M	M	M	M
CO 3	M			H
CO 4	M	H		
CO 5			H	M
CO 6				H

SWDC0061: COMMUNITY DEVELOPMENT PRACTICE WITH THE DISEMPOWERED COMMUNITIES (3-0-0)

(3 credits- 45 hours)

Course Outcomes:

- Understand the issues of marginalization, oppression and disempowerment of vulnerable communities such as the dalits, tribes and the indigenous peoples and women ;(Remembering and Understanding)
- Build capacity among the students for critical reflection and analysis of community development issues pertaining to the disempowered ;(Applying and Analysing)
- Build upon the existing understanding of community dynamics, structures and experiences ;(Evaluating and Creating)
- Strengthen skills and capacity of the students for intervention at different levels taking an "empowerment" and anti-oppressive stance. (Applying)

Module I: Power, Privilege and Oppression (11 hours)

Conceptual Frameworks and Theoretical Perspectives; Systems Theory; Critical Theories; Understanding oppression, privilege and oppression in Indian context.

Module II: Political Economy of the Dalit Development (11 hours)

Social stratification; Caste; Casteism; Colonialism and State; Ambedkar and the Annihilation of Caste

Module III: Political Sociology of the Tribes and Tribal Development (11 hours)

Perspectives on Tribes; History of Tribes/Adivasis in India; Evolution of Tribal Policy; Administration and Local Governance; Politics of Tribal Welfare and Development; Critical Social Work; Anti-oppressive Approach; Structural Social Work

Module IV: Specific Identity Constructs and Populations at Risk (12 hours)

Gender and Sexism; Gender, Culture, and Society; Race, Sexuality, and Culture (Intersections); Gendered Relations; Health, Sex, and Gender.

Suggested Readings

1. Chacko, P.M. (Ed.), Tribal Communities and Social Change
2. Freire, A. M. A., and Macedo, D. (Eds.), The Paulo Freire reader. New York: Continuum, 1995
3. Freire, P., Pedagogy of the oppressed, (M. B. Ramos, Trans.) New York: Continuum, 1990
4. Freire, P., Education for critical consciousness. New York: Continuum, 1969/1998
5. Freire, P., Pedagogy of freedom: Ethics, democracy, and civic courage. (P. Clarke, Trans.) Lanham, MD: Rowman and

Littlefield Publishers, Inc., 1998
6. Freire, P., and Macedo, D. P., A dialogue: Culture, language, and race. Harvard Educational Review, 65(3), 1995
7. Fultner, B. (ed.), JurgenHabermas: Key Concepts. Rawat Publications. Jaipur, 2012
8. Taylor, D. (ed.), Michael Foucault: Key Concepts. Rawat Publications. Jaipur, 2011
9. Elwin, V., The Philosophy of NEFA
10. Bartlett and Kennedy eds., Feminist Legal Theory , 1991
11. Wing ed., Critical Race Feminism: A Reader, 1997
12. Ortner, S., Is Female to Male as Nature is to Culture? ‖in M.Rosaldo and L. Lamphere (eds.), Women, Culture and Society, Stanford University Press, pp. 67-88., 1974
13. Moore, H.L., Feminism and Anthropology, Ch.2, Cambridge: Polity Press, pp. 12-41, 1988
14. Kimmel M., the Gendered Society. Introduction and Chapters 1, 2 and 4, 2000
15. Hollway, W., 'Gender difference and the production of subjectivity', in Helen Crowley and Susan Himmelweit (eds.) Knowing Women, p240 - 275, Oxford: Polity, 1984

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		M	M
CO 4		H	M	M

SWWE0062: DEVELOPMENT CONCERNS AND WOMEN EMPOWERMENT (3-0-0)

(3 Credits- 45 hours)

Course Outcomes:

- Develop an understanding of the feminist perspective of women empowerment (Remembering and Understanding)
- Understand the status of women in the present social, political and economic context (Remembering and Understanding)
- Develop an understanding of the women's problems and issues (Analyse)
- Know the national and international efforts for the welfare of women and gender parity(Evaluating and Creating)

Module I: Understanding Gender, Patriarchy, and Society (11 hours)

Gender, Sex and Patriarchy- Meaning; Social Construction of Femininity, Social Construction of Masculinity, Patriarchy, Intersectionality and Gender roles; Feminism – Meaning, Feminist Theories- Liberal, Radical, Marxist, Socialist and Eco-Feminism, Feminist Research Methodology; Feminist Economics and Introduction to Women's Studies

Module II: Women's Movement and Women's Development (11 hours)

Women's Movement in the USA, UK and India- Seneca Fall Declaration, the Suffragettes; Women in Indian Society - Women in early India, pre-colonial period and modern India, Women's Movement in India and its impact, The history of women's education; Theories of Development (Empowerment, Alternative Approaches: Women in Development, Women and Development and Gender and Development)

Module III: Concerns, Issues and Laws (11 hours)

Concerns relating to Women – Social, Economic and Political determinants of women's health; Women's right and Legal Advocacy; Violence against Women; Women in Conflict Areas; Migration, Displacement, Disaster – Impact on women; Women and Climate change; Working women in organized and Unorganized Sector; Sexual Harassment at Work place, Women and Globalization, PRIs and Women in India; Constitutional Rights of Women, Policies and programmes for empowerment of women, CEDAW, Dowry Prohibition Act 1961, Equal Remuneration Act 1976, Maternity Benefit Act 1961, , Medical Termination of Pregnancy Act 1971, Protection of Women from Domestics Violence Act 2005, The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act 2013, National Commission for Women and State Commission for Women.

Module IV: Social Work Practice with Women (12 hours)

Social Action- Saul Alinsky's Theory, Advocacy, Examples of Social Action by women's groups, Recent Trends; Good Practices by INGOs and NGOs- UN Women, SEWA, NEN, The Ant, ABWJF, MGSN, Meira Paibis, Assam Mahila Samitti, Naga Mothers Association, Mizo Hmichhe Insuihkhawm Pawl, Impulse, Achik Mothers Association.

Suggested Readings

1. Agnes, Flavia., Law and Gender Inequality: The Politics of Women's Rights in India. Delhi: Oxford University Press, 2004
2. Arya, Sadhna. Roy, Anupama, Poverty, Gender and Migration. New Delhi: Sage Publications, 2006
3. Addlakha, Renu., Deconstructing Mental Illness: An Ethnography of Psychiatry, Women, and the Family. New Delhi: Zubaan, 2008

4. Datar, Chaya., Integrating activism and academics. In Jain, Devika and Rajput, Pam (Eds.), Narratives from the Women's Studies Family: Recreating Knowledge (pp. 136-149). New Delhi: Sage Publication, 2003
5. Ferber, A, Marriane. Nelson, A, Juie., Feminist Economics Today: Beyond Economic Man. London: The United Chicago Press Inc., 2003
6. Ganesamurthy, V, S., Empowerment of Women in India: Social, Economic and Political. New Delhi: New Century Publications, 2008
7. Gordon, L. P., Violence against Women. New York: Nova Publishers, 2002
8. Harding, Sandra G (Ed.). the Feminist Standpoint Theory Reader. New York: Routledge, 2004
9. Iralu, E., A Terrible Matriarchy. Zubaan Publications. New Delhi, 2007
10. Lalkima, C. Lalneihzovi., Changing Status of women in north-eastern states. New Delhi: Mittal Publications, 2009
11. Kols, A., Women, Peace and Security in Northeast India. Zubam Publication, New Delhi, 2018
12. Kumar, Radha., The History of Doing. New Delhi: Zubaan, 1993
13. .Kumar, Girish (Ed.)., Health Sector Reforms in India. New Delhi: Manohar, 2009
14. Mies, M., Shiva, V., Ecofeminism. London: Zed Books, 1993
15. Pandya, Rameshwari. Patel, Sarika., Women in the Unorganised Sector of India. New Delhi: New Century Publications, 2010
16. Ramazanouglu, Caroline.Holland, Jannet. (ed)., Feminist Methodology: Challenges and Choices. London: Sage Publications Inc., 2002

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	H		M	M
CO 4		H	M	M

SWSN0063: FAMILIES WITH SPECIAL NEEDS (3-0-0)

(3 credits- 45 hours)

Course Outcomes:

- Understand the context, responses and practice framework for special-care-needs families (Remembering and Understanding)
- Imbibe and become familiar with practice principles, values and ethics while dealing with families with special needs (Remembering and Understanding)
- Develop skills required for meaningful intervention (Applying and Analysing)
- Promote care-planning for families with special needs (Evaluating and Creating)

Module I: Understanding the Context (11 hours)

Understanding Early Childhood Development: Disabilities, Diseases, Gender; Issues Of Care Planning For Children, Youths, Women, Men With Special Care Needs; Special Needs of families in Northeast India: Families in Conflict, Disasters, Displacement, Superstition, Homelessness and Poverty; Emerging Concerns Of Seniors and Elderly: Global, National And Regional Contexts.

Module II: Understanding the Responses (11 hours)

Understanding the theoretical foundations for Social Work Support, Counseling, Resource Coordination and Advocacy Services for Families With Special Care Needs; Overview of service systems for special need groups; Issues, challenges and practice approaches with children and parents in Adoptions and Foster care; Clients and care-providers in Institutional Care; Adoption System: pregnant women, Adoptive Parents And Adopted Children; Disability, Pregnancy, LGTBs, geriatric care, Long-term care needs of terminally ill; Social Work Practice Principles and values in these settings.

Module III: Advanced Practice Skills (11 hours)

Case/Care Management of families with special needs: Terminally ill person, Mental Health Care, Addictions, Long-Term Care, Aging, HIV/AIDS, Disabilities, Occupational services, Child Welfare, and Immigrant/Refugee Families; Assessment; Care planning, and Resource linkages: programmes, schemes and services; Family Therapy: Communication-pattern Approach; Family subsystem Approach; Cognitive Behavioral Approach: cognitive restructuring, contingency contracting, skills.

Module IV: Working with Parents in families with Special Needs (12 hours)

Child Development Knowledge and Care; Positive Interactions with Child, Responsiveness, Sensitivity; Nurturing, Emotional Communication, Disciplinary Communication, Discipline and Behavior Management; Promoting Children's Social Skills or Pro-social Behavior; Promoting Children's Cognitive or Academic Skills.**Suggested Readings**

1. Bhuimali, A., Rights of disabled women and children in India. New Delhi: Serials Publications, 2009
2. Bindra, A., HIV/AIDS health care and human rights. Delhi: Mangalam Publishers, 2010
3. Boyd-Franklin, N., Steiner, G.L., and Boland, M.G., Children, Families, and HIV/AIDS: Psychosocial and Therapeutic Issues. The Guilford Press, 1995
4. Burke, Peter, Disability and Impairment: Working with Children and Families. Jessica Kingsley Publishers, 2008
5. Cambridge, P., and Carnaby, S. eds., Person centered planning and care management with people with learning disabilities. Philadelphia: Jessica Kingsley Publishers, 2005
6. Cosis-Brown, H., and Cocker, C., Social Work with Lesbians and Gay Men. New Delhi: Sage, 2011
7. Dasgupta, S., and Lal, M. (eds.), The Indian family in transition: reading literary and cultural texts. New Delhi: Sage, 2007
8. Emmatty, L.A., An insight into dementia care in India. New Delhi: SAGE, 2009
9. Gorman, J.C., Working with challenging parents of students with special needs. New Delhi: Sage, 2004
10. Grobman, L.M., and Bourassa, D.B., Days in the Lives of Gerontological Social Workers: 44 Professionals Tell Stories from "Real-Life" Social Work Practice with Older Adults. White Hat Communications, 2007
11. Humphrey, G.M., and Zimpfer, D.G. (eds.), Counselling for grief and bereavement, 2nd Ed. New Delhi: Sage, 2012
12. Lobo, A., and Vasudevan, J., The penguin guide to adoption in India. Delhi: Penguin Books, 2002
13. McInnis-Dittrich, K., Social Work with Older Adults (3rd Edition). Pearson, 2008
14. McKenzie, R.B., Rethinking orphanages for the 21st century. New Delhi: Sage, 1998
15. Nayar, U.S. (Ed.). Child and adolescent mental health. New Delhi: Sage, 2012
16. Riddick-Grisham, S., and Deming, L., Pediatric life care planning and case management, second edition. Taylor and Francis Group, 2011
17. Satia, J., Misra, M., Arora, R., and Neogi, S., Innovations in maternal health: case studies from India. New Delhi: Sage, 2013

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	H	H		H
CO 3	M		M	H
CO 4		H	M	M

SWPW0064: PSYCHIATRIC SOCIAL WORK (3-0-0)

(3 credits- 45 hours)

Course Outcomes:

- Introduce the field of psychiatric social work and comprehend the roles and responsibilities of psychiatric social workers (Remembering and Understanding)
- Introduce the concept of rehabilitation and the application of different therapeutic interventions (Understanding and Applying)
- Introduce different non-pharmacological therapeutic approaches used in psychiatry (Understanding, Analyzing and Applying).
- Introduce National Policies and Programs related to Mental Health and discuss (Understanding, Analyzing, Evaluating & Creating)

Module I: Psychiatric Social Work and its Application in the Field (11 hours)

Psychiatric Social Work - Definition and Historical development in UK, USA and India; Present status and challenges in the field; Multi-disciplinary team approach in the treatment of Psychiatric Illness; Role and Functions of Psychiatric Social Worker in the team; Psychiatric social worker in the Field Of Community Mental Health; Skills and Techniques used in Psychiatric Social Work Practice.

Module II: Rehabilitation and Practice of Psychiatric Social Work in various Clinical settings (11 hours)

Psychiatric rehabilitation - definition, psychosocial rehabilitation, principles and strategies; The concept of social diagnosis and social work interventions in psychiatric settings.- psychiatric departments /hospitals/clinics, halfway homes, day care centers, child guidance clinics and de- addiction centers.

Module III: Therapeutic Approach to Mental Illness (11 hours)

Treatment and after care of mentally ill patients, application of social work methods in the treatment of mental disorders; Various therapeutic methods: Psychotherapy, Electroconvulsive Therapy, Occupational Therapy, Group Therapy, Client Centered Therapy, Gestalt Therapy, Reality Therapy, Behaviour Therapy, Play Therapy, Rational Emotive Therapy, Therapeutic Community, Motivational Enhancement Therapy, Psycho education and Family Therapy.

Module IV: Policies and Programmes in the Field of Mental Health (12 hours)

Mental health policies and legislation in India; National Mental Health Programmes; Designing and implementing programmes on mental health in communities, monitoring and evaluation of programmes; Research – qualitative and action research on mental health issues.

Suggested Readings:

1. Bhattacharya, Sanjay Dr., Social Work: Psycho-Social and Health Aspects. Deep and Deep New Delhi: 2008
2. Carson C. Robert, Kutcher N. James, Minela Susan, Hooley M. Jill, Abnormal Psychology. 13th Edition. Pearson Education. 2010
3. Francis, C. M., Promotion of Mental Health with Community Participation. The Center for Health Care Research and Education. Kerala: 1991
4. Hudson Barber, Social Work with Psychiatric Patients. Macmillan Publishers. New Delhi: 1960
5. Maxmen S. Jerrold, Ward G. Nicholas, Essential Psychopathology and its Treatment, 2nd Edition. W.W. Norton and Company. USA: 1994
6. Patel Chhaya, Social Work Practice – Religio – Philosophical Foundations. Essays in Honour of Professor Indira Patel. Rawat Publications. Jaipur: 2009
7. Patel Vikram, Thara R.., Meeting the Mental Health Needs of Developing Countries – NGO Innovations in India. SAGE Publications. New Delhi: 2003
8. Pritchard Colin, Mental Health Social Work, Routledge. USA: 2006
9. Rukadhikar A., Rukadhikar P., Mental disorders and You, Psychiatric Centre. Miraj: 2007
10. Scileppi A. John, Teed L. Elizabeth, Torres D. Robin, Community Psychology, A Common Sense Approach to Mental Health, Prentice Hall. New Jersey: 2000
11. Segal, E. A., Gerdes, K.E. and Steiner, S., Professional Social Work... Rawat Publications. New Delhi: 2010
12. Stroup H. Herbert, An Introduction to the Field. 2nd Edition, Surjeet Publications. New Delhi: 2008
13. Verma, Ratna, Psychiatric Social Work in India. Sage Publications. New Delhi: 1991

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2		H	M	
CO 3		M	H	
CO 4	M			H

SWCH0065: COMMUNITY HEALTH AND SERVICES (3-0-0)

(3 credits: 45 hours)

Course Outcomes

- Define the concept of health, community health and health care services. (Remembering)
- Explain the administration of basic health infrastructure and services in the country; and illustrate the important national health policy, health programmes, their implementation, advocacy and lobbying. (Understanding)
- Make use of the knowledge on health education and health promotion in the field of work. (Applying)
- Analyze the important strategies and approaches of social work in community health. (Analyzing)
- Assess the health problems and health services with specific focus on marginalized and vulnerable groups and determine the role and specific skills required for social work practice in community health. (Evaluating)
- Build the skills of communication, community mobilization, organization, counselling and referrals; and formulate approaches for prevention and promotion of health, curative and rehabilitative services in Indian context. (Creating)

Module I: Understanding the concept of Health and Community Health (11 Hours)

Understanding Health and epidemiology. Components of Health: Physical, psychological, Emotional, Social and Spiritual. Determinants of Health and Indicators of Health; Socio political, Economic and Cultural factors influencing health. Community Health: Aspects of community Health, Models of Intervention and the role of Professional Social Worker. Rural and Urban health in India: Health Status, Health Problems and Health Services with specific focus on marginalized and vulnerable groups.

Module II: Health education and health promotion (11 hours)

Meaning, importance, principles and components of health education. Agencies for Health education programme – voluntary and Governmental Organizations, Health Network, Educational and Religious Institutions. Approaches for prevention and promotion of health, curative and rehabilitative services in Indian context. Prevention levels and modes of intervention.

Module III: National Health Programmes (11 hours)

Health Policies and Committees – National Health policy, National Health Mission, Health programs; their implementation, advocacy and lobbying. Health administration and Planning: Structure and Functions at National and State and District levels-

Primary Health Centers - Corporation and Municipal health services. Hospital Administration and Management.

Module IV: Strategies and approaches of social work in Community health (12 hours)
Understanding health from the Human Rights perspective – Environment issues and health – Media and health. Health Movements and Campaigns. Role and Specific skills required for Social Work Practice. Health education and communication, counseling and referral, Community mobilization and organization, Health system restructuring and reform, Capacity building and training, Resource mobilization and application

Suggested Readings

1. Park, J. E., Textbook of Preventive and Social Medicine, 17th edition. Jabalpur: Banarsidas Bhanot, 2006
2. Ministry of Health and Family Welfare, National Health Policy, New Delhi, 1983
3. Department of Health Ministry of Health and Family Welfare, National Health Policy, New Delhi, 2002
4. Breslow, L., Encyclopedia of Public Health. New York: Macmillan Reference USA, 2002
5. Duggal R. and Gangolli L., Review of Healthcare in India. Mumbai: CEHAT, 2005
6. Gibson Robert, Counselling and Guidance, Merrill, 595,199 New Jersey, Fleet-2, 2003
7. Schneider, Mary- Jane, Introduction to Public Health. London: Jones and Bartlett, 2006
8. Abelin, T., Brzenski Z.J., and Carstairs, V.D., Measurement in Health promotion and protection, WHO, Copenhagen, 1887
9. Alderson, M., An introduction to Epidemiology, 2nd Edition, Mac-Millan, London, 1983
10. Green L.W and Anderson, C.L, Community Health 5th edition, Times Mirror Mosby, St. Louis, 1986
11. Government of India (GOI), Operational Guidelines for Programme Managers and Service Providers for Strengthening STI/RTI Services, GOI, Ministry of Health and Family Welfare, New Delhi, 201

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2	M		H	
CO 3			M	M
CO 4		M		H
CO 5	M			M
CO 6		M	M	H

SWHR0066: HUMAN RESOURCE MANAGEMENT: SOCIAL WORK PERSPECTIVE (3-0-0)

(3 Credits- 45 hours)

Course Outcomes

- Understand HRM as a profession. (Remembering and Understanding)
- Understand the role of HRM in business. (Remembering and Understanding)
- Equip learners with knowledge, skills, attitude, professional competencies and social sensitivities essential for a successful career in HRM. (Applying and Analyzing)
- Integrate the knowledge obtained from theory with the practice. (Evaluating and Creating)

Module I: Introduction to Human Resource Management (11 hours)
Concept, scope and applicability of Human Resource Management- HR as a profession (Strategic Role – Basics); Structure, functions, mechanisms of HRM; Functional area of Human Resource Management; Role, characteristics and skill essentials of Human Resource Managers; International HRM; HRM in a dynamic environment – Basic concepts and trends.

Module II: Basics of Human Resource Management Practice (11 hours)
Procurement of Personnel – Human Resource Planning, Recruitment, selection; Talent Management – Acquiring, nurturing and retaining talent in knowledge based economy- issues, challenges and approaches; Mobility of people – concept of promotion, transfer, separation – Management and issues; Wage determination and Administration – Payroll management, and deductions – issues and challenges. Fringe benefits, profit bonus, pay for performance and competency based pay; Social Compliance Audit and HR Audit; Competency Development and Management.

Module III: Contemporary Human Resource Management (11 hours)
Process, benefits and relevance of strategic HR; Human Resource - The Strategic Business Partner; Mergers and acquisitions – Concept, meaning, process and issues; Human Factors in mergers and acquisitions; Employee engagement and Climate /Engagement Surveys – Meaning, concept and best practices; Benchmarking – Meaning, concept and purpose.

Module 1V: Career Development (12 hours)
Career development and succession planning - Concept and changing aspects; Mentoring and employee development – Concept and issues; Performance Management System – Meaning, Methods, Merits and limitations; Quality Management

System and its significance – ISO Standards; Employee Counseling – Relevance and Practice.

Suggested Readings

1. K.B Akhilesh, Enabling execution excellence - Himalaya Pub House, 2006
2. Abraham, E, Alternative approaches and strategies of Human Resource Development, Jaipur: Rawat Publications, 1988
3. Agarwal, Naik Banerjee, Personnel Management & Industrial Relations, Meerat: Pragathi Publications, 2003
4. Aquinas, P.G., Personnel Management, Mangalore: Sita Publishing House, 2005
5. Aswathappa K, Human Resource & Personnel Management, Tokyo: Tata McGraw Hill, 2002
6. Alan Barkar, How to hold better meetings – Magan Page Ltd, 1997
7. Alan Barkar, Creativity for Managers Excel books. Magan Page Ltd, 2005
8. Armstrong Angela, Strategic HRM - Barn Jaico Pub house, 2007
9. Armstrong and Murlis, Reward Management – Kagan Page, 2007
10. K Ashwathappa, Human Resource and Personnel Management Tata – McGraw Publication 3rd Edition, 2002
11. Britt and Boyd, Marketing and Administrative Action 3rd Edition – Mac Glaw, 1999
12. Bhaskar Chatterjee, Human Resource Management Sterling Publishers, 2004
13. Bhargava P.P, Issues in Personnel Management, Print well Publishers, 1990
14. Beardwell Ian Len Holden, Human Resource Management, De Montfort University, 1995
15. Bhagoliwal T.N., Personnel Management & Industrial Relations, Agra: SahithyaBhavan Publications, 1996
16. BhaskarChattergi, Human Resource Management, New Delhi: Sterling Publications Pvt. Ltd, 2004
17. Cole, G.A. Personnel Management, Theory & Practice, London: D.P. Publications
18. Cushway& lodge, Organizational Behaviour and Design, New Delhi: Inst Publishing house, 2001
19. Cushway, Human Resource Management, New Delhi: Crest Publishing house, 2001
20. Cascio F Waynes, Managing Human Resources, New Delhi: Tata McGraw Hil, 2004
21. Chaudhri K.K, Personnel Management for Executives, New Delhi: Himalaya Publishing House, 1998
22. Cynthia D. Fisher, Human Resource Management, Chennai: All India Publishers and Distributors, 1998
23. Davis, Keith, Human Behaviour at work, New Delhi: Tata McGraw Hill, 1983
24. Rao, V.S.P, Human Resource Management Text and Cases, Excel Book, New Delhi, 2006
25. Sharma K.K. Organization Behaviour, New Delhi: Deep & Deep Publications
26. SubrotoBagchi, Go kiss the world. Penguin India, 2008
27. SubrotoBagchi, The Professional. Penguin India, 2009
28. SubrotoBagchi, The High Performance Entrepreneur. Penguin India, 2006

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		H
CO 2	M		H	
CO 3	H		M	M
CO 4		M		H

SWCI0067: CORPORATE SOCIAL RESPONSIBILITIES - CONCEPTS & IDEOLOGIES (3-0-0)

(3 Credits- 45 hours)

Course Outcome

- Introduce students into CSR concepts (Understanding)
- Develop competencies for effective field interventions, research and management of CSR interventions (Applying)
- Develop an insight into present CSR strategies and model business organization (analysing)
- Enable students with conceptual clarity on need, purpose and relevance of research applicability in CSR practice (Creating)

Module I: Concepts (11 hours)

CSR: Definition, Concept and scope; Evolution of CSR,; CSR and Social Legitimacy; The evolving role of stakeholders; Moral and Economic arguments for CSR; History of CSR in India; Dimensions & importance of CSR; Understanding CSR: Responsibility, Accountability & Sustainability.

Module II: CSR Policy and Governance (11 hours)

Stakeholder engagement; Environmental assessments; Theories & Models of CSR; CSR in emerging market; Limitation of CSR; Strategic Context of CSR.

Module III: Community Investment and Evaluation (11 hours)

CSR and Human Resource Management; Reporting and communication; Implementing CSR programmes; Monitoring and measuring the impact of CSR programs; Company Act: 2013; CSR: Global Perspective; Roles of institutions in CSR: Government,

NGOs, Education institutions & role of Media.

Module IV: - Introducing a Systems-Based Approach to Developing CSR (12 hours)
Assessing the current state of a company's CSR activities; Linking CSR to brands and reputation; Stakeholder engagement; Current and future Trends & Practices in CSR; Indian CSR: Selected Case Studies.

Suggested Readings

1. Bali. C. and Prasad. A., Corporate Social Responsibility, Concept & Cases: The Indian Experience, Excel Books, New Delhi, 2013
2. Modi. P. K., Corporate Social Capital Liability, Arise Publishers & Distributors, Delhi, 2009
3. Prasenjit M., Corporate Social Responsibility - Vol. – I & II, Sharda Publishing House, Jodhpur (India), 2010
4. Reddy S., Corporate Social Responsibility, The Environmental Aspects, The ICFAI University, ICFAI Books, Hyderabad, 2010
5. Raj S., Corporate Social Responsibility Cases, The ICFAI University, ICFAI Books, Hyderabad, 2012
6. Sharda M., Corporate Social Responsibilities. - Vol. – I & II, Publishing House, Jodhpur (India), 2010
7. Vara V., Case study on Corporate Social Responsibility. – Vol. – I [ICFAI Business School Case Development Centre.] ICFAI Books, Hyderabad, 2011
8. Werther. B.W. & Chandler D., Strategic Corporate Social Responsibility, Stake holders in a global Environment, Sage Publication, 2009

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2	H	M		M
CO 3		H	H	
CO 4	H		H	H

SWSP0068: CHILDREN WITH SPECIAL NEEDS (3-0-0)

(3 Credits – 45 hours)

Course Outcomes

- Understand the children with special needs and develop skills in social work intervention (Remembering and Understanding)
- Understand the context, responses and practice framework for inclusive programs and special-care-needs families (Remembering and Understanding)
- Imbibe and become familiar with practice principles, values and ethics while dealing with families with special needs (Applying and Analyzing)
- Apply a number of assessment procedures that identify internal and external risk protective and promotive factors that may affect children and adolescents. (Applying and Creating)

Module I: Understanding Children with Special Needs (11 hours)
Developmental Disabilities- Causes, Classifications and Labeling of children with special needs; Sensory Impairments- Vision, Hearing, And Speech; Physical disabilities and health problems; Learning, Behaviour and Emotional disorders; Understanding the Environment- Bronfenbrenner's ecosystem perspectives.

Module II: Best Practices in Inclusion (11 hours)
Definition and History of Inclusion; Benefits and challenges of Inclusion for Children with and without Disabilities; Elements of Good quality, inclusive programs for Infants, Toddlers, And Preschoolers; Six key aspects of best practices for Working with Children with Special Needs; Public Policy and Advocacy for inclusive practices; History and Impact of legislations affecting Children with Special Needs; Landmark court cases on Services for Children with Special Needs.

Module III: Documenting and Assessing to Support Families with Special Needs (11 hours)
Knowing about and using Observation, Documentation, and other appropriate Assessment Tools Understanding and practicing responsible Assessment, Knowing about Assessment Partnerships with Families and other Professionals; Documenting Case History; Family Assessment- Understanding the Goals, Benefits, and uses of Assessment; Problems-Strengths Identification.

Module IV: Partnerships with families and caregivers (11 hours)
Knowing about and understanding Family, Family in transition, and Community characteristics; Impact of Disabilities on Families- Understanding Families, Family Crises; Supporting and Empowering Families and Communities through Respectful, Reciprocal relationships; Involving Families and Communities in their Children's Development and Learning- Transitions and Adapting Materials and use of Adapting Technologies; Individualized Education Programs (IEPs); Individualized Transition Plans (ITPs) and; Individualized Family Service Plans (IFSPs); Community Resources and Cultural Sensitivity; Services by Government

and Non-government agencies in India.

Suggested Readings

1. K. Eileen Allen, Glynnis E. Cowdery, The exceptional child: inclusion in early childhood education, 6th edition. United States: Delmar Thompson Learning, 2009
2. Bhuimali, A., Rights of disabled women and children in India. New Delhi: Serials Publications, 2009
3. Boyd-Franklin, N., Steiner, G.L., and Boland, M.G., Children, Families, and HIV/AIDS: Psychosocial and Therapeutic Issues. The Guilford Press, 1995
4. Burke, Peter, Disability and Impairment: Working with Children and Families. Jessica Kingsley Publishers, 2008
5. Berk, Laura E. Development through the Lifespan, 5th edition. Allyn and Bacon. London: 2009
6. Cambridge, P., and Carnaby, S. eds., Person centered planning and care management with people with learning disabilities. Philadelphia: Jessica Kingsley Publishers, 2005
7. Dasgupta, S., and Lal, M. (eds.), The Indian family in transition: reading literary and cultural texts. New Delhi: Sage, 2007
8. Hurlock, Elizabeth, Developmental Psychology, Tata Mc Graw Hill. New York: 2001
9. Gorman, J.C., Working with challenging parents of students with special needs. New Delhi: Sage, 2004
10. Nayar, U.S. (Ed.)., Child and adolescent mental health. New Delhi: Sage, 2012
11. Riddick-Grisham, S., and Deming, L., Pediatric life care planning and case management, second edition. Taylor and Francis Group, 2012
12. Venkatesan, S., Children with developmental disabilities: a training guide for parents, teachers and caregivers. New Delhi: Sage, 2005
13. Webb, Nancy Boyd., Social work practice with children (2nd Ed.). New York: Guilford, 2003
14. Yuen, Francis K.O., Social Work Practice with Children and Families: A Family Health Approach (Haworth Health and Social Policy). Routledge, 2005
15. WHO, The ICD – 10 Classification of Mental and Behavioural Disorders, Diagnostic Criteria for Research, AITBS Publishers and Distributors (Regd.). Delhi: 2004

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	H		M	M
CO 4		H	M	H

SWRP0070: CHILD RIGHTS AND CHILD PROTECTION (3-0-0)

(3 Credits – 45 hours)

Course Outcomes

- Understand different social work perspectives on working with children. (Remembering and Understanding)
- Recognize the role of families and other stakeholders in child protection and demonstrate methods of strengthening families for child protection. (Applying and Analysing)
- Develop advanced intervention skills in working with children, adolescents and their families. (Evaluating and Creating)
- Help students practice effective communication, networking and collaboration skills with different stakeholders related to child protection. (Applying and Analyzing)

Module I: Social Work Perspectives on Working with Children (11 hours)

Ecological Model; Strengths based Perspectives; Child-centered Approach; Children's Perspective to Life; Family Centered Social Work, Problem Solving Approach; Developmental approach.

Module II: Governance and Child Rights (11 hours)

Understanding Governance, Child Rights Governance from Global Perspective; Governance in North East; Child Poverty and Good governance; Public finance and Child Budgeting, Child Rights Programming; Planning and Advocacy for Child Rights, Activism and Networking with Allied systems.

Module III: Working with Families and other Stakeholders (11 hours)

Working with Families- Families in the Indian Context (Diverse Functions, Structure and Size of Families) , Family Dynamics , Family Work and Parenting Skills, Strengthening Family's ability to Protect Children (Assessment, Identifying Needs and Life Stage of Each Member, Impact of Family Conditions on the Child, Linkages with Schemes for Family Strengthening); Working with Other Stakeholders (Child Protection Committees, Panchayats, Police, Government Departments, Schools, Residential Care Institutions, Community Groups, Self-Help Groups, Youth Groups), NGOs, Statutory Committee)

Module IV: Skills in Working with Children (12 hours)

Counseling and guidance - Counseling Techniques – Client-centered, Counselor Centered and Eclectic Counseling; Types of Counseling and Tools Required – Individual and Group counseling, Family Group Counseling, Individual Counseling Tools– Interview, Case study, Tests and Clinical; Assessment; Group Counseling–Informal Discussion; Group Reports, Lectures, Dramatics, Case conference; Communication Skills - Individual and Group, Use of Creative Activities like Storytelling, Play, Art, Music and Dance Movement; Skills in Behavior Modification techniques, Advocacy and Campaigning for Children, Relationship Building; Skills in working with different Vulnerable Groups; Facilitating Child Participation.

Suggested Readings

1. Barnes, V., Child-Centered Social Work: Theory and Practice. Red Globe Pres, Kingston University, 2018
2. Tait, A. & Wasu, H., Direct Work with Vulnerable Children: Playful Activities and Strategies for Communication, London: Jessica Kingsley Publishers, 2012
3. Nigudkar, M.; Kashyap, L., Skills of Communicating With Children, Mumbai: TISS. Brahmane, P. (2003) Making Best of Childhood, Pune: Personality School, 2009
4. Ruch, G., Post-qualifying Child Care Social Work - Developing Reflective Practice, London: Sage, 2009
5. Hanh, T. N., Planting Seeds: Practicing Mindfulness with Children, California: Parallaz Press, 2013
6. Nigudkar, M. &Kashyap, L., Skills of Communicating With Children, Mumbai: TISS, 2009
7. Alan, S. K.; Nancy, M.; Nadeen L.K.; Elizabeth, O. L., Essentials of Assessment Report Writing, New Jersey: John Wiley and Sons, Inc, 2004
9. Gangrade, K. D., working with Community at the Grassroot level: Strategies and Programmes, New Delhi: Radha Publications, 2001
10. Datar, S.; Baviskar, R. (et al), Skill Training for Social Workers: A Manual, London: Sage, 2010
11. D'Souza, B. & Sonawat, R., Handbook for Children in Difficult Situations: Activity Manual for Marginalised Adolescent (Vol. 1) Mumbai: Tej-Prasarni, 2003
12. Graves, D. H., Writing: Teachers and Children at Work. 20th Anniversary Edition, Portsmouth: NH Heinemann, 2003
13. Butler, I. & Roberts, G., Social Work with Children and Families: Getting into Practice (2nd Ed), London: Jessica Kingsley Publishers Ltd., 2004
14. Komanduri A. & Vennam U., Family-Centred Interventions in Indian Journal of Social Work (70) 2, 2009
15. Sanders, P., First Steps in Counselling: A Students' Companion for Basic Introductory Courses. PCCS Books, 2002
16. Jones. N. Richard., Theory and Practice of Counselling and Therapy. Sage Publication, 1995
17. Jones. N. Richard, Basic Counselling Skills: A helper's Manual. Sage Publication, 2003

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		H	H
CO 4		H	M	H

VALUE ADDED COURSES

SWAW6015: ACADEMIC WRITING, RESEARCH PROPOSAL DEVELOPMENT AND DISSERTATION WRITING COURSE (15-0-15)

(2 credits -30 hours)

Course Outcomes

- Remember the concepts and meaning related to academic and professional writing. (Remembering)
- Understand the different components, stages and steps of academic writing, research proposal development and dissertation writing. (Understanding)
- Able to apply the skill of professional and academic writing into practice. (Applying)
- Able to analyse different types of writing in professional life. (Analyzing)
- Able to review and evaluate writing styles in keeping with the framework of different professional and academic writing. (Evaluating)
- Able to write academic articles, develop research proposal, dissertations and professional reports. (Creating)

Module 1: Introduction to academic writing and publication (8 hours)

Academic writing – academic writing, citations, referencing – APA, MLA, Chicago etc., peer review process and types – single blind, double blind, open peer review; publishing in journals (Indexed and UGC CARE List), edited books and books; authorship and ethics of publication.

Module 2: Research Proposal Development, Presentation and Approval (14 hours)

Research proposal – Background of study, review or literature, statement of the problem/research concern, significance of the study, rationale of the study, research hypotheses, research questions, research objectives, definition of terms, research methodology – design, population, sampling, tools and techniques of data collection, sources of data, analysis, interpretation and representation of data, ethical concerns of research (Academic Integrity and Ethical Review Board), likely outcomes, limitation of the study and research timeline. Process of research proposal approval – presentation, feedback, revision, re-presentation and approval. The role of research guide in research process.

Module 3: Dissertation Writing, Presentation and Defense (8 hours)

Dissertation writing - scientific setting, sections of research dissertation, declarations and consent forms, chapterisation, annexures and reference. Drafts, mentoring by guide, printing, final submission, presentation, defense and viva voce examination.

Suggested Reading

1. American Psychological Association. (2020). Publication Manual of the American Psychological Association, Vol. 7. APA: Washington DC.
2. Ethical Principles of Psychologists and Code of Conduct. (2021), American Psychological Association. Source: https://www.apa.org/ethics/code
3. First Steps Toward Your Dissertation. (ND). Sage Publications, UK. Source: https://us.sagepub.com/sites/default/files/upm-assets/7155_book_item_7155.pdf.
4. UGC. (2019). Consortium for Academic Research and Ethics (CARE). UGC. New Delhi.
5. UGC. (2020). Guidance Document Good Academic Research Practices. UGC: New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	H	M
CO 2	M	H	M
CO 3	H	H	H
CO 4	M	M	M
CO 5	M	M	M
CO 6	M	M	H

SWRB6014: RESULTS BASED MANAGEMENT OF PROJECTS AND PROGRAMMES (15-0-15)

(2 Credits 30 hours)

Course Outcomes:

- Understand the importance and process of Result based management of projects and programmes and formulating projects using the Logical Framework Analysis
- Develop an understanding of the problems and issues faced by the poor and the marginalized

- Develop an insight into the different strategies and approaches commonly adopted by Development Organisations for Project Management
- Learn Skills to develop project proposals, implement, monitor and evaluate project, enhance process documentation and reporting skills

Module I: Overview (5 hours)
Overview of Results based Management and Project Cycle Management: Identification, Design, Implementation, Reviewing, Monitoring, Evaluation, Learning the lesions

Module 2: Project Identification (5 hours)
Project Identification :(Situational Analysis and Problem Tree Analysis)

Module 3: Project Design (10 Hours)
Capacity assessment: human, social, natural, physical, economic, cultural: Stakeholder analysis: user groups, interest groups, beneficiaries, decision makers; Primary and Secondary stakeholders: Identifying appropriate stakeholders for participation; levels of participation: Logical Framework Approach:

Module 4: Monitoring and Evaluation (4 Hours)
Methods and process of Monitoring and Evaluation

Module 5: Resource Mobilisation (6 Hours)
Internal and External Resources; Fundraising – principles, sources, ethics, methods and their implications. International sources for Funding – Concept note; application, procedure and FCRA, record keeping, documentation and legal compliance

Suggested Readings
1. Lukose P J, Results Based Management of Projects and Programmes and Fundamentals of Resource Mobilization: DVS Publications, Guwahati 2021
2. Capezio, P., Powerful Planning Skills. Mumbai: Jaico Publishing House, 2000
3. Smith, S., Plan to Win. New Delhi: Kogan Page India, 2002
4. Dale, R., Evaluation Frameworks for Development Programmes and Projects. New Delhi: Sage Publications, 2001

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	H	M
CO 2	M	H	M
CO 3	H	H	H
CO 4	H	M	H

SWWD6016: WORKING WITH DIVERSITY (15-0-15)

(2 Credits 30 hours)

Course Learning Objectives:
- Reflect on your own diversity (reflection), how it impacts on others (reflexivity) and how it informs to the development of critical cultural competence
- Understand the key theories related to the concept of diversity
- Critique the theoretical approaches of Equality, Human Rights and Diversity as they are applied in practice
- Apply the Diversity approach to current global issues including Covid-19
- Raise awareness of diversity through an application of theory to a co-created project promoting social change and human rights (Diversity Project and seminars)

Module – I (7 hours)
Defining Diversity and Difference; Theoretical and Conceptual understanding of Diversity; Models and Approaches; Levels of intervention in Diversity; Intersectionality and Structures of Diversity; Equality, Human Rights and Diversity.

Module – II (7 hours)
Perspectives of Diversity; Diversity, Difference and Disadvantage; Cultural Competence in Social Work and its Critiques; Current Strategies in Managing Diversity and its implications in Social Work;

Module III (7 hours)
Global Examples: Pandemic & Inequality; Black Lives Matter (Anti-Racism); Migration and Inclusion; Climate change and environmental issue; Resistance and solidarity in the context of indigenous (tribal/adivasi) development in India.

Module IV (9 hours)
Co-creation of Projects on Diversity and its management for social development in different global context.

Suggested Reading:

1. Thompson, N. (2011). Promoting Equality: Working with Difference and Diversity. Palgrave Macmillan. (Electronic book ordered for UEF students)
2. Thompson, N. (2016). Anti-discriminatory practice: Equality, diversity and social justice. Macmillan International Higher Education.
3. Hugman, R. (2012). Culture, values and ethics in social work: Embracing diversity. Routledge.Gast, L. E., & Patmore, A. (2012). Mastering approaches to diversity in social work. Jessica Kingsley Publishers. (Available online)
4. Marsiglia, F. F., Kulis, S. S., & Lechuga-Peña, S. (2021). Diversity, Oppression, & Change: Culturally Grounded Social Work. Oxford University Press, USA.
5. Online Journals:
   Journal of Ethnic and Cultural Diversity in Social Work
   Journal of Multicultural Social Work

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	H	M	H
CO 2	M	H	M	H
CO 3	H	H	H	M
CO 4	H	M	H	M
CO5	M	H	M	H

SWLS6017: Life Skills for competency development (15-0-15)

(2 Credits 30 hours)

Objectives:
The basic objective of the course is to introduce the students to the:

- Basic concepts and core life skills and its application
- Strategies for developing personality and competency
- Practice life skills for self-enrichment and well-being

Module 1: INTRODUCTION TO LIFE SKILLS [6 hours]

- Definition and importance of life skills
- Evolution and development of the concept of life skills:
  - Report of the Education Commissions of UNESCO: Faure Report and Delors' Report
  - UN Inter-Agency Report
  - Hamburg Declaration
  - Dakar Framework: Quality education and life skills

Module 2: CORE LIFE SKILLS: SOCIAL SKILLS, THINKING AND COPING SKILLS [12 hours]

- **Self-Awareness and Empathy**
  - Self-awareness: self-concept, self-image, self-esteem; techniques for self-exploration: Jo-Hari window, SWOT analysis
  - Empathy: sympathy, empathy & altruism; practising empathy
- **Effective Communication and Interpersonal Relationship**
- Effective communication: types and elements of communication; barriers of communication; presentation skills; questioning skills
- Interpersonal relationship: building, sustaining and ending relationships; factors affecting relationships; conflict resolution
- **High order thinking skills: Critical & Creative thinking**
  - Critical thinking: Process; strategies to enhance critical thinking
  - Creative thinking: Stages of creative thinking; strategies to enhance creative thinking
- **Problem Solving & Decision Making**
  - Problem solving: concept, stages in problem solving; models in problem-solving
  - Decision Making: process; models of decision making; decision making in a group
- **Coping Skills: Coping with Emotions and Stress**

- Coping with emotions: concept and types of emotions; coping with negative emotions and cultivating positive emotions
- Coping with Stress: concept and meaning; types and sources of stress, strategies to manage stress

Module 3: LIFE SKILLS FOR PERSONALITY DEVELOPMENT AND PRACTICUM [12 hours]

- **Life Skills for Personal Effectiveness**
  - Values: Punctuality, honesty, loyalty, dependability, reliability, integrity, respect, Constitutional values
  - Building self-confidence and self-motivation
  - Goal setting: types, steps, personal vision and goal
  - Time management
- **Topics prescribed for workshop/Skill lab**
  - Group discussion
  - Team building and team work
  - Facing interviews
  - Creativity
  - Leadership
  - Self-expression
  - Self-branding

Suggested Readings

1. Nair. A. Radhakrishnan & Gauri Hardikar, (2021), Mahatma Gandhi's Philosophy of Education and Life Skills Education: A Conceptual Study, IOSR *Journal of Research & Method in Education (IOSR-JRME)* e-ISSN: 2320–7388, p- ISSN: 2320-737x Volume 11, Issue 3 Ser. VII (May – June 2021), PP 01-11
2. Nair. A. Radhakrishnan & Gauri Hardikar, (2021), Swami Vivekananda's Philosophy of Life Skills Education, *IOSR Journal of Humanities and Social Science (IOSR-JHSS),* Volume 26, Issue 5, Series 10 (May. 2021) 01-07 e-ISSN: 2279-0837, p-ISSN: 2279-0845.
3. www.iosrjournals.org CYP (2003), *Adolescence and Life Skills*, Commonwealth Youth Programme Asia Centre, Tata Mc Graw- Hill
4. UNESCO (April 2000), *Dakar Framework for Action, Education for All: Meeting our Collective Commitments,* Dakar, Senegal.
5. Family Health International, NACO, USAID (2007), *Life Skills Education tool kit for Orphans and vulnerable children in India*
6. Hilgard, E, Atkinson R C & Atkinson R L (1976), *Introduction to Psychology (6th Ed), IBH Publishing Co. Pvt Ltd. New Delhi.*
7. Mangal S.K. (2008), *An Introduction to Psychology*, Sterling Publishers Pvt. Ltd., New Delhi.
8. Morgan and King (1993) *Introduction to Psychology*, Tata McGraw-Hill Publishing Company Ltd, New Delhi.
9. Rao P.L. (2008) Enriching Human Capital through Training and Development, Excel Books, Delhi.
10. RGNIYD. (2008). *Facilitators Manual on Enhancing Life Skills. Tamil Nadu*
11. Singh Madhu (2003), *Understanding Life Skills*, Background paper prepared for *Education for All: The Leap to Equality*
12. Stella, Cottrell (2008), *The Study Skills Handbook*, Palgrave Macmillan Ltd. (3rd Ed), New York
13. UNESCO and Indian National Commission for Co-operation with UNESCO (2001): *Life Skills in Non-formal Education: A Review*
14. Wallace R. Masters (2001) *Personal Development for Life and Work:* UK, South Western.
15. YUVA School Life Skills Programme: Handbook for Teachers, Vol. I – IV, (2008), Department of Education and State Council of Educational Research and Training, Delhi.

Web Sites:

- UNESCO – http://www.unesco.org/
- UNFPA - http://www.unfpa.org/
- UNICEF - http://www.unicef.org/
- United Nations - http://www.un.org/
- WHO - http://www.who.int/en/
- www.oecd.org

SWFT6018: FAMILY THERAPY (15-0-15)

(2 Credits 30 hours)

Module 1

Introduce the concept of Family and family therapy (7 Hours)

Family: Concept of family – Homeostasis, Family Rules, Content and Process of interaction, sequence of interaction, Specific dimensions – family context, Boundaries, Power, Decision making, Family affect, family goals, family myths and cognitive

pattern, family roles, family strengths, Pathology of – boundaries, alliances, triangles, hierarchies, Characteristics of family, family life cycle, Family Therapy – Brief History of Family Therapy, definition of Family Therapy, Challenges faced by a family therapist.

Module 2

Theoretical Perspectives of Family Therapy (8 Hours)

Key Concepts, Goals and Techniques used in **Structural Family Therapy and Systemic Family Therapy**

Module 3

Basic Concepts of Family Therapy (7 Hours)

Assessment –Family Assessment Performa – family structure, leadership patterns, Role structure and function, Communication, Reinforcement, Cohesiveness, Adaptive patterns, Exploring the presenting problem, assessing for attempted solutions, The process of family therapy- Pre-session, planning and task, Initial sessions, Middle Phase of Treatment, Termination

Module 4

Techniques Used (8 Hours)

Genogram- different symbols, Asking Questions – Lineal questions, Circular Questions, Strategic Questions, Reflexive Questions, Placating, Blaming, Super-reasonable, Irrelevant Behaviour, Family Reconstruction, Reframing, Boundaries, Unbalancing, channeling, specifying, tracking and linking, filtering, Normalizing, Providing support, Confronting, Pacing, Complementarity, Realties, Constructions, Strengths, Paradoxes

Tools- Family Sculpting, Family Genograms, Ecomap

Suggested Readings

1. Gladding, Samuel T. Family Therapy. 7th Edition, Pearson Education, Inc. NY : 2011
2. Patterson, JoEllen., Lee, Williams., Edwards, Todd, M., Chamow, Larry & Grauf-Grounds, Claudia. Essential Skills in family Therapy: From the first Interview to Termination. 3rd Edition, The Guildford Press, NY: 2018
3. Nicholas, Michael, P. & Davis, Sean, D. Family Therapy: Concepts and Methods, 11th Edition, Pearson Education, Inc. USA:2017
4. Rivett, M., Buchmuller, Joanne & Oliver, Karon. Family Therapy: Skills and Techniques in Action. Routlege, NY:2018
5. Antony, D., John., Psychotherapies in Counselling, Anugraha Publications. Tamil Nadu:2003

SWCD6019: INTRODUCTION TO COMMUNICATION FOR DEVELOPMENT (C4D) FOR SOCIAL WORK(15-0-15)

(2 Credits 30 Hours)

Course description

This course will introduce students to the field of communication for development (c4d). C4d is an evidence-based process that utilizes a mix of communication tools, channels and approaches to facilitate participation and engagement with children, families, communities, networks for positive social and behaviour change in both development and humanitarian contexts. It draws on learnings and concepts from the social, behavioural and communication sciences.

This course will bring together ideas of activists/professionals and academicians in the field to cover the theoretical and practical components of the subject. The students will learn the theory, history and practice of communication for development and its application for social and behaviour communication through puppet-making, or street-play or grassroots' comics. The students will be assessed while showcasing their skills in a community setting.

Learner objectives

- Understand, define and describe key theories around communication, development, culture, behaviour and social change
- Learn from organizations/practitioners/activists who effectively use different media techniques for disseminating development results, awareness-raising and public debate; and
- Showcase the skills of communication for development and social change in a community setting.

Participants

The course is open to everyone pursuing post-graduate study programme at assam don bosco university. A maximum of 30 students will be able to enroll in the course per batch.

Module 1: principles and concepts in communication for development (5 hours)

Introduction to c4d, planning, implementation and management of c4d projects

Module 2: behavior and social change theories in c4d (5 hours)

Behavior and social change theory in c4d, interpersonal-level change theories, community-level change theories, theory-led c4d research and planning

Module 3: c4d research, monitoring, and evaluation (5 hours)
Research, monitoring and evaluation concepts; participatory research; the c4d research, monitoring and evaluation framework

Module 4: presentation of a c4d project in a community setting (15 hours)
The learners will work in groups on a communication for development and social change project (using puppetry/street play/grassroot comics) and present it in a community setting.

Course outcomes

1. the learner is able to state the meaning and applications of communication for development in social work practice and research. (remembering)
2. The student is able to explain the uses of communication for development and its use in social work practice.(understanding)
3. the learner is able to apply the knowledge and skill of communication for developmentfor intervention projects aimed at social change. (applying)
4. the student is able to analyse and adopt appropriate media for carrying out communication for development applications in appropriate contexts. (analysing)
5. the learner is able to assess the appropriate use of communication for development to find participatory solutionsto different social and cultural issues affecting communities. (evaluating)
6. the learner is able to design and execute a communication for developmentproject for social and behaviour change communication. (creating)

Mapping of cos to syllabus

Course Outcomes	MODULE 1	MODULE 2	MODULE 3	MODULE 4
CO 1	H	H	H	H
CO 2	M	M	M	
CO 3	M	M		M
CO 4			M	M
CO 5		M		
CO 6	M			M

Suggested readings

1. Consortium for education communication (2014). *Development communication*. Youtube: https://www.youtube.com/watch?v=3zxoo0c0nmu
2. Kumar, s. (2002).*methods for community participation: a complete guide for practitioners.* Delhi: vistaar.
3. Steeves, h. L., & melkote, s.r. (2015). *Communication for development: theory and practice for empowerment and social justice.* New delhi: sage.
4. Unicef (2018).c*ommunication for development (c4d) - case study compendium 2013-17.* Delhi: unicef india. (available at: https://www.unicef.org/india/media/1421/file/c4d-compendium.pdf)
5. Wilkins, k.g.,tufte, t., & obregon, r. (2014).*the handbook of development communication and social change.* Delhi: wiley.

PRACTICUM

SWFR6008: CONCURRENT FIELDWORK I (6 credits):200 hours of Fieldwork in 15 weeks(0-0-16)

Expected Outcomes:

- Students are exposed to the community and community issues
- The students understand the dynamics and issues in the community and become aware of the sensitivities of people while working with them.
- Students get a close feel of the community and community settings
- They also get a firsthand experience of the programmes and projects implemented in the communities by NGOs and government agencies and the impact that these have on the community.
- Understand the tension between tradition and change that the communities in the region are likely to experience, and how it is handled.

Process

The field work practice in the first semester consists of orientation visits, lab sessions for skills training and placement.

- In the first semester, the focus of field work is the community.
- The students are placed in communities and in NGOs, Service Organizations and Government Agencies working with communities, and in those settings where they can be.
- They also interact with the agency personnel and the community members
- They, with the help of the agency and the field work supervisor, identify an issue and work on it following the principles of community organization. The students are expected to be creative and innovative in assisting the agency and community in whatever way possible.
- Normally a student spends fifteen hours over two days per week in field work. However, keeping in mind the peculiar situation of transport and communications in the region and the expenses involved, the field work practice may be arranged in other convenient ways as the department deems fit.
- After each session of field work the students write a report of their activities and submit to the concerned field work supervisor. The supervisor conducts individual and group field work conferences regularly.
- At the end of the semester the student submits a summary report for the semester and an external viva voce examination is conducted.

SWFW6009: CONCURRENT FIELD WORK II (0-0-16)

(6 credits- 200 hours of fieldwork in 15 weeks)

Expected Outcome:

Ensures that the student understands the way these institutions and agencies function and practice the skills of working with individuals and different groups.

Process

- The field work practice in the second semester will consist of lab sessions for skills training and placement. The focus will be on the practice of Social Case Work and Group works.
- The students shall be placed in NGOs, Government Departments, Service Organizations and Communities working with individuals and families, and in those settings where they can be exposed to issues related to individuals and groups. Normally a student spends fifteen hours over two days per week in field work.
- The student is expected to complete 5 cases in casework and follow up one group with at least 5 sessions.
- Besides this, the student shall be involved in the activities of the institution and fulfill the responsibilities that are asked of him/her by the agency/ field supervisor.
- After each session of field work the students shall write a report of their activities and submit to the concerned field work supervisor. The supervisor shall conduct individual and group field work conferences regularly.
- At the end of the semester the student shall submit a summary report for the semester and an external viva voce examination is conducted.

SWCA0047/SWCA6010: COMPUTER APPLICATIONS FOR SOCIAL SCIENCES (Lab)(0-0-2)

(2 Credits- 30 hours)

Course Outcome:

- Learn the basic computer applications; those are useful for a social worker. (Remembering)
- Learn and do data analysis for research using a Statistical Analysis Package. (Applying)

Module I (7 hours)
Word Processing: Meaning, Features, advantages; Structure of a Word Processor window; Creating document, saving opening and printing, find and replace. Creating table; Mail merge - main document, data source and merging

Module II (8 hours)
Spreadsheet Package: Cell, rows and columns; Range, structure of a spreadsheet window; Creating, saving opening and printing a spreadsheet, creating tables, charts; data analysis using formulae in a spreadsheet.

Module III (5 hours)
Presentation package: Creating presentations in a presentation package, text, tables, charts, Animation, running slide show, saving the slides, printing presentations; Internet and browsing, E-Mail, blogging, use of Internet in Research

Module IV (10 hours)
Data analysis using statistical software packages.

Suggested Reading:
1. Simon Slavin (Author), Richard Schoech. Human Services Technology: Understanding, Designing, and Implementing Computer and Internet Applications in the Social Services. NY: Haworth. (1999).
2. Connie Morrison, Dolores Wells. Computer Literacy Basics: A Comprehensive Guide to Ic3. www.Alibris.com

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	
CO 2	H	M		H

SWFW6010: CONTINUOUS FIELD WORK I (0-0-200)
(6 credits; 200 hours of Fieldwork in one month)

Expected Outcome:
- The students focus on their Area of Concentration / Specialization .
- Enable the students to become more proficient in the field and apply relevant skills and techniques in handling real situations.
- Opportunities to implement programmes

The process
1. The students shall be placed in the field for twenty five days of consecutive field work.
2. The field work settings shall be Communities, NGOs, Service Organizations, Hospitals, Clinics and Governmental Agencies.
3. The students will identify Organisations or Communities which will be approved by the Department.
4. The students are expected to apply all the methods of social work such as Social Casework, Group Work, Community Organization, Research and Administration, wherever applicable depending upon the organization and their services.
5. The students shall be involved in the activities of the Institution and fulfill the responsibilities as requested by the Agency Supervisor.
6. The students shall prepare a daily report of the field work activities implemented and share them through e-mail with the concerned Faculty Supervisor at the end of each day.
7. The Supervisor shall provide the necessary feedback and guidance to the students by also making personal visits if possible, to the field where they are placed.
8. At the end of the continuous field work placement, the students shall submit a consolidated or summary report highlighting the main activities implemented and the major learning from the field placement.
9. Every student shall also appear for an external viva voce examination at the end of the semester.

SWCF6012: CONTINUOUS FIELD WORK II (0-0-200)
(6 credits: 200 hours fieldwork in one month)

Expected Outcome:
- The students focus on their Area of Concentration / Specialization.
- Enable the students to become more proficient in the field and apply relevant skills and techniques in handling real situations.
- Opportunities to implement programmes

The process
- The students shall be placed in the field for twenty five days of consecutive field work.

- The field work settings shall be Communities, NGOs, Service Organizations, Hospitals, Clinics and Governmental Agencies.
- The students will identify Organisations or Communities which will be approved by the Department.
- The students are expected to apply all the methods of social work such as Social Casework, Group Work, Community Organization, Research and Administration, wherever applicable depending upon the organization and their services.
- The students shall be involved in the activities of the Institution and fulfill the responsibilities as requested by the Agency Supervisor.
- The students shall prepare a daily report of the field work activities implemented and share them through e-mail with the concerned Faculty Supervisor at the end of each day.
- The Supervisor shall provide the necessary feedback and guidance to the students by also making personal visits if possible, to the field where they are placed.
- At the end of the continuous field work placement, the students shall submit a consolidated or summary report highlighting the main activities implemented and the major learning from the field placement.
- Every student shall also appear for an external viva voce examination at the end of the semester.

SWIN6013: INTERNSHIP (0-0-200)

Pass/No Pass (200 hours fieldwork in one month)

Process

- After the Examinations at the end of the 4th Semester or as per the prevailing socio-political situations, the students shall be placed with an NGO or Agency for a period of not less than one month for practical experience and application of their skills.
- While Internship is not credited, it is mandatory for the completion of the MSW programme.
- The students shall contact an agency of his/her choice and get the choice of agency approved by the department.
- Students shall endeavor to choose an agency that is primarily in tune with their AOC and which has credentials in the concerned field.
- At the end of every week the student shall send a brief report to the supervisor and at the end of the internship a summary report shall be submitted.
- The summary report shall contain the short description of the agency, the social service skills applied in his/her work and the student's learning outcome.
- The report shall be submitted in the format prescribed by the department and shall be submitted together with the certificate from the agency confirming his/her internship in a prescribed format.

SWRP6020: RESEARCH PROJECT PHASE I

(3 credits)

Every student shall undertake a research project work which has bearing on his/her AoC under the supervision and guidance of a faculty member. The preliminary work may begin at the end of the second semester. The students are expected to complete the Literature Survey followed by a Synopsis presentation during the Phase I. The dates, the mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

SWRP6021: RESEARCH PROJECT PHASE II

(3 credits)

Every student shall undertake a research project work which has bearing on his/her AoC and present a written thesis on the research work under the supervision and guidance of a faculty member. The preliminary work may begin at the end of the second semester. The students are expected to complete the data collection before the fourth semester. The thesis is to be submitted to the department before the date notified. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester. There shall be a viva voce examination on the research project.

SWSL0200: PARTICIPATORY SERVICE LEARNING-RURAL PRACTICUM (30-0-50)

Credits: 2 (30 Hours)

Course Outcomes

- Understanding the meaning and objectives of service learning and participatory approach to social development (Remembering and Understanding)
- Learn and apply various methods, techniques and strategies for participatory rural/urban mapping, development and communication (Applying)
- Appraising the spatial, temporal and relational aspects of communities in the village/urban settings by application of

participatory learning, action and reflection (Evaluating)

- Being familiar with culture, tradition, customs and social change and transformation processes of a rural/urban locality(Creating);
- Engage in inter-cultural teamwork to study, understand and promote development in rural areas (Applying)

Module I: Introduction to Service Learning (5 Hours)
Concept of Service Learning— definition, principles, models of different Higher Education Institution Service Learning; Service Learning as a medium of Social change.

Module II: Introduction to participatory learning, action and reflection (5 Hours)
What is participation? Participatory approach to social development; Principles of community participation; Participatory Appraisal Methods.

Module III: Participatory community mapping (10 Hours)
Spatial maps- social map, transect, resource map, mobility map; Temporal maps- historical timeline, seasonal maps, daily activity maps, trends analysis; Relational maps- chapatti diagram, well-being ranking, pair-wise ranking, problem tree analysis. Community Dream Map.

Module IV: Participatory community development practice (10 Hours)
Rapport building, project identification, definition and planning, participatory implementation and monitoring, evaluation and Exit.

Suggested Readings

1. Chambers. R. (1983). Rural development: putting the last first. New Delhi: Routledge.
2. Jacoby, B. (2010). Service learning in higher education: concepts and practices. Michigan: Jossey-Bass Publishers.
3. Jacob, Islary. (2020). Pregnancy and Pregnancy care Practice: The lived Experience of the Bodos Mittal Publications, New Delhi.
4. Kelly, A., & Westoby, P. (2018). Participatory development practice: using traditional and contemporary frameworks. London: Practical Action Publishing.
5. Kumar, S. (2002). Methods for community participation: a complete guide for practitioners. New Delhi: Vistaar
6. Lukose P J, (2015) Social analysis: A guide for the Social Workers, Media House Publications, New Delhi
7. Lukose P J, (2015). A to Z in Projects Cycle Management: A Results Based Approach, Media House, Publications, New Delhi
8. Speck, B.W., & Hoppe, S.L. (2004). Service-learning: history, theory and issues. Connecticut: Greenwood Publishing Group.
9. https://www.washington.edu/carlson/students-3/browse-service-learning-positions/
10. https://ccel.umn.edu/

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	H
CO 2	M	H	H	
CO 3		M	H	
CO 4	M		M	H
CO5	M		H	

SWCP6022: Community Development Project I

SWCP6023: Community Development Project II

EDPC0201: INDIAN POLITY AND CONSTITUTION

Course Outcomes

At the end of this course students are able to:

1. Understand and analyse different governmental systems, the historical background and philosophy of the Indian Constitution
2. Understand and compare Indian Constitution with Constitution of other countries
3. Understand and analyse the Constitutional provisions for the Indian territory, citizenship, fundamental rights and duties and the procedure to amend the Indian Constitution
4. Understand and analyse the Indian federal structure, different levels of government and the Administration of special areas
5. Understand and analyse the Judicial system of India, rights and liabilities of the government and public servants, the functionalities of public service commissions and the electoral process in India
6. Understand and analyse the Constitutional provisions for the protection of SCs, STs and minorities and the contemporary issues of languages and cultures in India

Module - I

Governmental systems: Monarchy, Plutocracy, Theocracy, Democracy, Oligarchy, Authoritarianism, Totalitarianism, Parliamentary & Presidential, Unitary & Federal; The historical background and making of Indian Constitution; The philosophy and Features of the Indian Constitution; The Preamble; Comparison of Indian Constitution with Constitution of USA, UK, Australia and France

Module – II

Territory of the Indian Union; Citizenship; Fundamental Rights and Fundamental Duties; Directive Principles of the State Policy; Procedure of Amendment to the Constitution

Module – III

Polity: The Nature of the Federal system; Government of the Union; Government of the States; Administration of the Union Territories; Local Government; Administration of special areas (Scheduled areas and Tribal Areas)

Module – IV

The Judicature: The Supreme Court; The High Court; Subordinate Courts; Rights and liabilities of the government and public servants; Public Service Commissions; Elections; Constitutional provisions for the protection of Minorities; Scheduled Caste and Scheduled Tribes; The issues of Languages and culture.

Suggested Readings:

1. Austin, Granville. *Working A Democratic Constitution: The Indian Experience*. Oxford University Press, 2000.
2. Basu, Durga Das. *Introduction To The Constitution Of India*. Lexis Nexis Butterworths Wadhwa Nagpur, 2020.
3. Basu, Durga Das, and S. S Subbramani. *Commentary On The Constitution Of India: Articles 79 To 123*, 1950
4. Bhatia, Gautam. *The Transformative Constitution: A Radical Biography In Nine Acts*. 2019.
5. *Boyron, Sophie. The Constitution of France: A Contextual Analysis, Bloomsbury Publishing, 2012*
6. Chandrasekhar Rao, R. V. R, and V Sivalinga Prasad. *Indian Constitution And Polity*. Sterling Publishers, 1991.
7. Cheryl, Saunders. The Constitution of Australia: A Contextual Analysis (Constitutional Systems of the *World* Book 4). Hart Publishing; 1st edition, 2010
8. Choudhry, Sujit et al. *The Oxford Handbook Of The Indian Constitution*. 2016.
9. Courtney, Leonard Henry Courtney. *The Working Constitution Of The United Kingdom*. J.M. Dent, 1920.
10. Katju, Justice Markandey. *Whither Indian Judiciary*. 2018
11. Khosla, Madhav. *India'S Founding Moment: The Constitution Of A Most Surprising Democracy*. 2020.
12. Thiruvengadam, Arun K. *Constitution Of India - A Contextual Analysis*. 2017.
13. Wood, Gordon S. *The Creation Of The American Republic, 1776-1787*. The University Of North Carolina Press, 2011.

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