REGULATIONS AND SYLLABUS

2021 - 2022

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES

SCHOOL OF LIFE SCIENCES

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

ASSAM DON BOSCO UNIVERSITY

Tapesia Gardens,
Sonapur – 782402
Assam

Azara,
Guwahati – 781017
Assam

Kharguli Campus,
Guwahati – 781004
Assam

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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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CONTENTS

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES

Detailed Syllabus

SCHOOL OF LIFE SCIENCES

Detailed Syllabus

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

Detailed Syllabus

REGULATIONS

ASSAM DON BOSCO UNIVERSITY REGULATIONS

GRADUATE DEGREE PROGRAMMES

The following are the regulations of the Assam Don Bosco University concerning the Graduate Programmes leading to the award of the Bachelor's Degree in various disciplines 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 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 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 Graduate Programme shall be as per the table given below:

Programme	Number of Semesters	Number of Years
Bachelor of Technology (BTECH)	8	4
Bachelor of Computer Applications (BCA)	6	3
Bachelor of Business Administration (BBA)	6	3
Bachelor of Commerce (BCOM) Honours	6	3
Bachelor of Arts (BA) Honours	6	3
Bachelor of Science (BSc) Honours	6	3

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 University follows Outcome Based Education with Choice Based Credit System (CBCS) for all the Graduate Degree Programmes. One credit is equivalent to 15 hours of lecture/tutorial or 30 hours of practical. The courses offered for the 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 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.

3.2.3 For UGC programmes, core courses include Discipline Specific Core Courses, Ability Enhancement Compulsory Courses and Skill Enhancement Courses. For AICTE programmes, 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.

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 For UGC programmes, elective courses include Discipline Specific Elective Courses and Generic Elective Courses. For AICTE programmes, elective courses include Professional Elective Courses and Open Elective Courses.

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

3.4 The schema of categorization of courses is given below:

Core Courses	
Discipline Specific Core (DC) or Professional Core (PC)	Core courses which are offered by the department conducting the programme
Elective Courses	
Discipline Specific Elective (DE) or Professional Elective (PE)	Elective courses which are specific to the programme of study
Generic Elective (GE) or Open Elective (OE)	Elective courses which are offered by departments of the University from departments other than the parent department

3.5 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.

3.6 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.

3.7 **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 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.

3.8 The medium of instruction shall be English and examinations and project reports shall be in English.

3.9 The course structure and syllabi of the Graduate Degree Programmes shall be approved by the Academic Council of the University. Departmental Boards of Studies (DBS) 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 (SBS). The SBS shall consider the proposals from the departments and make recommendations to the Academic Council for consideration and approval.

3.10 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 by respective departments, even during semester breaks as approved by the School Board of Studies.

3.11 In addition, students may also opt for additional elective courses in consultation with their mentors (Cf. 3.12). Elective 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.

3.12 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 groups of students. Generally the faculty advisor/mentor shall be assigned by the concerned department, in consultation with the Director of the School concerned. (For the first year students of the BTECH programme, the Director of the School of Technology may assign the faculty advisor/ mentor from departments belonging to other Schools teaching at the SOT). 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 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 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 securing grades/marks as specified in the table below.

4.2.2 A candidate must also obtain qualifying marks required by the University in entrance tests/personal interview as the case may be. These marks shall be valid only for the academic year for which the test is held.

4.2.3 Admission will be on the basis of performance of the candidate at the qualifying examination, entrance test and/or personal interview.

Programme	Grade /Marks requirement from qualifying examinations	Entrance Examinations / Personal Interview
BTECH	Passed the qualifying examination with Physics/ Mathematics /Chemistry/ Computer Science/Electronics/Information Technology/ Biology/Informatics Practices/ Biotechnology/Technical Vocational subject/ Agriculture/ Engineering Graphics/ Business Studies/Entrepreneurship with 45% in the aggregate of all subjects and 45% in the aggregate of any of the three	National Entrance Test such as JEE / State level entrance examination such as CEE or the ADBU Entrance Examination for Engineers
BBA, BCA, BCOM, BA Honours	Passed the qualifying examination in any stream with aggregate marks specified by appropriate academic body	Satisfactory performance in the Personal Interview
BSc Honours	Passed the qualifying examination in the science stream with aggregate of Physics, Chemistry and Mathematics specified by appropriate 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 BTECH Lateral Entry into Programmes

4.6.1 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 BTECH Programme against vacancies and/or seats in addition to the sanctioned intake in the first year.

4.6.2 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.

4.6.3 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.

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

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 BTECH Honours

A student of BTech 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).

4.10 BTECH Minor Engineering

A student of BTech 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).

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 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.

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 10.5 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 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.

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	E	Excellent	9
70 ≤ x < 80	A+	Very Good	8
60 ≤ x < 70	A	Good	7
50 ≤ x < 60	B	Average	6
40 ≤ x < 50	C	Below Average	5
x < 40	F	Failed	0

In addition, a student may be assigned the grades 'P' 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', 'NP' 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', 'NP', 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 Service Learning, Constitution of India, Essence of Indian Traditional Knowledge etc. 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 at the beginning of each semester.

8.3 Lab Courses: Lab courses (Laboratory, Drawing, Workshop, etc.) 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

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 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

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 Industry Training/Internship Programme

8.5.1 Departments may require students to undergo industry training/internship programmes.

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

8.5.3 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.

8.5.4 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.

8.6 The Major Project

8.6.1 Students of the BTECH programme and BCA programme shall undertake a Major Project during the course of their graduate studies. The BTECH 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. The BCA major project work is conducted during the sixth semester of the programme, and is to be done individually or in groups within the campus.

8.6.2 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.

8.6.3 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.

In the case of the BTECH 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.

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

8.6.5 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.

8.6.6 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.

8.6.7 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.

8.6.8 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.

8.6.9 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.

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

8.6.11 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

8.6.12 Independent projects as envisaged in clause 8.6.1 shall be evaluated in the same manner as Phase II of the major project.

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

8.7 Minor and Mini Projects

8.7.1 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.

8.7.1.1 BCOM students shall undertake a Project (phase 1 & 2) spread across 5th and 6th semesters.

8.7.2 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.

8.7.3 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.

8.8 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.

8.9 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.

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

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

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

8.10.2 He/she has satisfactory attendance during the semester according to the norms laid out in section 6 of these regulations.

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

8.11 Registration for end-semester Examinations

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

8.11.2 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 8.10.

8.11.3 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.

8.11.4 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.

8.11.5 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.

8.11.6 When a student re-registers for the end semester examination of a course, in accordance with clause 8.11.4 above, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

8.12 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.

8.13 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.

8.14 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.

8.15 Re-examining of answer scripts

8.15.1 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.

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

8.15.3 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.

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

8.15.5 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.

8.15.6 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.

8.15.7 Without prejudice to any of the clauses of section 8.15, 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.

8.16 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.

8.17 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 below for improvement examinations.

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

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 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).

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 Change of Branch (only for BTECH)

9.1 Normally a student admitted to a particular branch of the BTECH 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.

9.2 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.

9.3 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.

9.4 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.

9.5 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.

9.6 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.

9.7 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.

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

9.9 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.

9.10 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.

10.0 Enrolment (for semesters other than the first)

10.1 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.

10.2 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.

10.3 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.

10.4 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.

10.5 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.

11.0 Eligibility for the Award of the Graduate Degree

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

11.1.1 completed all the credit requirements for the degree with grade 'C' or higher grade in each of the mandatory graded courses and grade 'P' in all mandatory non-graded courses;

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

11.1.3 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;

11.1.4 owes no dues to the University, School, Department, Hostels; and

11.1.5 has no disciplinary action pending against him/her.

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

12.0 Termination from the Programme

12.1 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.

12.2 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

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 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 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 Computer Applications (MCA)	~~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 th programme
School Core (SC)	Core courses which are offered by a department other than the departme conducting the programme, from within the same School

Institutional Core (IC)	Core courses which are offered by departments of the University fro Schools other than the parent School
Elective Courses	
Departmental Elective (DE)	Elective courses which are offered by the department conducting th programme
School Elective (SE)	Elective courses which are offered by a department other than th department conducting the programme, from within the same School
Institutional Elective (IE)	Elective courses which are offered by departments of the University fro 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)
***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.

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	E	Excellent	9
70 ≤ x < 80	A+	Very Good	8
60 ≤ x < 70	A	Good	7
50 ≤ x < 60	B	Average	6
40 ≤ x < 50	C	Below Average	5
x < 40	F	Failed	0

In addition, a student may be assigned the grades 'P' 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', 'NP' 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', 'NP', 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 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**
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 'P' 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 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)

***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 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 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.

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	E	Excellent	9
70 ≤ x < 80	A+	Very Good	8
60 ≤ x < 70	A	Good	7
50 ≤ x < 60	B	Average	6
40 ≤ x < 50	C	Below Average	5
x < 40	F	Failed	0

In addition, a student may be assigned the grades 'P' and 'NP' 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', 'NP' or 'X' in any course implies a 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', 'NP', 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.

14.5 The 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.

14.12 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 ASSESSMENT

GRADUATE DEGREE PROGRAMMES

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 6 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, DRAWING AND WORKSHOP

All Laboratory courses 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

In-Semester Evaluation of Minor and Mini 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	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 BTECH Major Project Phase I and Phase II

The in-semester evaluation of Major Project Phase I and Phase II shall have 60% weightage. The modality and conduct of the in-semester evaluation of the Major Project Phase I, and their weightages shall be declared by the DPEC of each department at the beginning of the semester. The following aspects are to be assessed, among others:
Synopsis presentation Progress seminars Progress reports Weekly activity reports

In-Semester BCOM Project Evaluation

The scheme of in-semester evaluation and the modalities along with the weightages will be specified by the department at the beginning of the semester.

SCHEME OF IN-SEMESTER EVALUATION

POST GRADUATE DEGREE PROGRAMMES

MCA, MSW, MSC (Psychology), MA English, MA Education, 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.

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.

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES

DEPARTMENT OF CHEMISTRY

BACHELOR OF SCIENCE - HONOURS IN CHEMISTRY

**** Wherever there is a practical there will be no tutorial and Vice versa***

SEMESTER I				
Type of Course	**Course Code**	**Course Name**	***Credits L-T-P**	**Page**
Core Course 1 (Theory)	CHAB0101	Inorganic Chemistry-I: Atomic Structure & Chemical Bonding	4-0-0	118
Core Course 2 (Theory)	CHSI0102	Physical Chemistry-I: States of Matter & Ionic Equilibrium	4-0-0	119
Core Course 1 (Lab)	CHAB6101	Inorganic Chemistry-I: Atomic Structure & Chemical Bonding Lab	0-0-2	165
Core Course 2 (Lab)	CHIS6102	Physical Chemistry-I: States of Matter & Ionic Equilibrium Lab	0-0-2	166
Ability Enhancement compulsory Course 1	EGEC0107	English Communication	2-0-0	1011
Generic Elective Course 1 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 1 (Lab)			0-0-2	
Mandatory Course	USIP001	Student Induction Programme	NC	
Value added course	CHPC6137	Petroleum Chemistry	NC	185
Total Credits			**20**	
SEMESTER II				
Core Course 3 (Theory)	CHBH0103	Organic Chemistry-I: Basics & Hydrocarbons	4-0-0	121
Core Course 4 (Theory)	CHCT0104	Physical Chemistry-II: Chemical Thermodynamics & its Applications	4-0-0	122
Core Course 3 (Lab)	CHBH6103	Organic Chemistry-I Basics & Hydrocarbons Lab	0-0-2	166
Core Course 4 (Lab)	CHCT6104	Physical Chemistry-II: Chemical Thermodynamics & its Applications Lab	0-0-2	167
Ability Enhancement compulsory Course 2	CHES0002	Environmental Studies	2-0-0	92
Generic Elective Course 2 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 2 (Lab)			0-0-2	
Service Learning	CHSL0100	Elements of Service Learning in Chemistry	2	117
Value added course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	186
Total Credits			**20**	
SEMESTER III				
Core Course 5 (Theory)	CHSP0133	Inorganic Chemistry II: s - and p-block elements	4-0-0	146
Core Course 6 (Theory)	CHOG0134	Organic Chemistry II: Oxygen Containing Functional Groups	4-0-0	147
Core Course 7 (Theory)	CHPC0135	Physical Chemistry III: Phase Equilibria and Chemical Kinetics	4-0-0	148
Core Course 5 (Lab)	CHSP6126	Inorganic Chemistry II: s- and p-block elements Lab	0-0-2	179

Core Course 6 (Lab)	CHOG6127	Organic Chemistry II: Oxygen Containing Functional Groups Lab	0-0-2	180
Core Course 7 (Lab)	CHPC6128	Physical Chemistry III: Phase Equilibria and Chemical Kinetics Lab	0-0-2	181
Skill Enhancement Course 1 (Elective)	CHBA0113	Basic Analytical Chemistry	1-0-1	126
	CHCI0114	Chemoinformatics	1-0-1	127
	CHCP0115	Chemistry of Cosmetics and Perfumes	1-0-1	128
	CHIC0136	IT Skills for Chemists	1-0-1	149
	CHCS0137	Chemical Technology & Society	2-0-0	150
	CHBS0138	Business Skills for Chemists	2-0-0	151
Generic Elective Course 3 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 3 (Lab)			0-0-2	
Value added course	CHPC6137	Petroleum Chemistry	NC	185
Total Credits			**26**	
SEMESTER IV				
Core Course 8 (Theory)	CHCC0139	Inorganic Chemistry III: Coordination chemistry	3-1-0	151
Core Course 9 (Theory)	CHHC0140	Organic Chemistry III: Heterocyclic Chemistry	3-1-0	152
Core Course 10 (Theory)	CHEL0141	Physical Chemistry IV: Electrochemistry	3-1-0	153
Core Course 8 (Lab)	CHCC6129	Inorganic Chemistry III: Coordination chemistry Lab	0-0-2	182
Core Course 9 (Lab)	CHHC6130	Organic Chemistry III: Heterocyclic Chemistry Lab	0-0-2	182
Core Course 10 (Lab)	CHEL6131	Physical Chemistry IV: Electrochemistry Lab	0-0-2	183
Skill Enhancement Course 2 (Elective)	CHPY0116	Pesticide Chemistry	1-0-1	128
	CHFC0117	Fuel Chemistry	1-0-1	129
	CHIP0118	Intellectual Property Rights	2-0-0	129
	CHAB0142	Analytical Clinical Biochemistry	1-0-1	154
	CHGM0143	Green Methods in Chemistry	2-0-0	155
	CHPC0144	Pharmaceutical Chemistry	1-0-1	156
Generic Elective Course 4 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 4 (Lab)			0-0-2	
Value added course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	186
Total Credits			**26**	
SEMESTER V				
Core Course 11 (Theory)	CHBM0121	Organic Chemistry IV: Biomolecules	4-0-0	133
Core Course 12 (Theory)	CHQS0122	Physical Chemistry V: Quantum Chemistry and Spectroscopy	4-0-0	134
Core Course 11 (Lab)	CHBM6115	Organic Chemistry IV: Biomolecules Lab	0-0-2	171
Core Course 12 (Lab)	CHQS6116	Physical Chemistry V: Quantum Chemistry and Spectroscopy Lab	0-0-2	172
	CHAC0123	Application of Computers in Chemistry	4-0-0	135

Discipline Specific Elective 1 (Theory)	CHAM0124	Analytical Methods in Chemistry	4-0-0	136
Discipline Specific Elective 2 (Theory)	CHNS0125	Novel Inorganic Solids	4-0-0	137
	CHPC0126	Polymer Chemistry	4-0-0	138
	CHMD0145	Molecular Modelling & Drug Design	4-0-0	156
Discipline Specific Elective 1 (Lab)	CHAC6117	Applications of computers in Chemistry Lab	0-0-2	172
	CHAM6118	Analytical Methods in Chemistry Lab	0-0-2	173
Discipline Specific Elective 2 (Lab)	CHNS6119	Novel Inorganic Solids Lab	0-0-2	174
	CHPC6120	Polymer Chemistry Lab	0-0-2	174
	CHMD6132	Molecular Modelling & Drug Design Lab	0-0-2	183
Value added course	CHPC6137	Petroleum chemistry	NC	185
		Total Credits	**24**	
SEMESTER VI				
Core Course 13 (Theory)	CHOC0127	Inorganic Chemistry IV: Organometallic Chemistry	4-0-0	139
Core Course 14 (Theory)	CHSP0128	Organic Chemistry V: Spectroscopy	4-0-0	140
Core Course 13 (Lab)	CHOC6121	Inorganic Chemistry IV: Organometallic Chemistry Lab	0-0-2	176
Core Course 14 (Lab)	CHSP6122	Organic Chemistry V: Spectroscopy Lab	0-0-2	176
Discipline Specific Elective 3 (Theory)	CHII0130	Inorganic materials and Industrial Importance	4-0-0	142
	CHGC0129	Green Chemistry	4-0-0	141
Discipline Specific Elective 4 (Theory)	CHEC0131	Industrial Chemicals and Environment	4-0-0	143
	CHRM0132	Research Methodology for Chemistry	5-1-0	145
	CHIM0146	Instrumental Methods of Chemical Analysis	4-0-0	157
Discipline Specific Elective 3 (Lab)	CHII6124	Inorganic materials and Industrial Importance Lab	0-0-2	178
	CHGC6123	Green Chemistry Lab	0-0-2	177
Discipline Specific Elective 4 (Lab)	CHCE6125	Industrial Chemicals and Environment Lab	0-0-2	179
	CHIM6133	Instrumental Methods of Chemical Analysis Lab	0-0-2	184
Value added course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	186
Audit Course	EDCI0200	Constitution of India	NC	
		Total Credits	**24**	
		Total Programme Credits	**140**	

MASTER OF SCIENCE IN 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	93
Theory/DC	CHOC0004	Fundamentals of Organic Chemistry	4-0-0	94
Theory/DC	CHPC0005	Fundamentals of Physical Chemistry	4-0-0	95
Theory/DC	CHQT0029	Introduction to Quantum Chemistry and Group Theory	4-0-0	115

Lab/DC	CHIQ6002	Inorganic Qualitative and Quantitative Analyses and Preparations - Lab	0-0-3	163
Audit Course	CHSL0200	Elements of Service Learning	NC	187
Value Added Course	CHPC6137	Petroleum Chemistry	NC	185
Total Credits			**19**	
SEMESTER II				
Theory/DC	CHIR0007	Advanced Inorganic Chemistry I	4-0-0	96
Theory/DC	CHOG0008	Advanced Organic Chemistry I	4-0-0	97
Theory/DC	CHAP0009	Advanced Physical Chemistry I	4-0-0	98
Theory/DC	CHFY0030	Fundamentals of Spectroscopy	4-0-0	116
Theory/DC	CHGC0011	Introduction to Green and Environmental Chemistry	3-0-0	99
Lab/DC	CHEQ6003	Experimental Physical Chemistry - Lab	0-0-3	163
Value Added Course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	186
Total Credits			**22**	
SEMESTER III				
Theory/DC	CHAI0012	Advanced Inorganic Chemistry II	4-0-0	100
Theory/DC	CHAO0013	Advanced Organic Chemistry II	4-0-0	101
Theory/DC	CHAP0014	Advanced Physical Chemistry II	4-0-0	102
Theory/DC	CHSP0015	Special Topics in Biochemistry	3-0-0	103
Theory/DC	CHAP0031	Applied Spectroscopy	3-0-0	117
Theory/DC	CHRM0017	Research Methodology for Chemistry	3-0-0	104
Lab/DC	CHQA6004	Organic Qualitative Analysis and Synthesis Lab	3-0-0	164
Value Added Course	CHPC6137	Petroleum Chemistry	NC	185
Total Credits			**24**	
SEMESTER IV				
Theory/ DE	CHMC0018	Materials Chemistry	3-0-0	105
Theory/ DE	CHCC0019	Computational Chemistry	3-0-0	106
Theory/ DE	CHFC0020	Food Chemistry	3-0-0	107
Theory/ DE	CHIC0021	Industrial Chemistry	3-0-0	108
Theory/ DE	CHMD0022	Medicinal Chemistry	3-0-0	109
Specialization I: Inorganic Chemistry				
Theory/ DE	CHOC0027	Organometallic Chemistry	3-0-0	113
Theory/ DE	CHIP0028	Inorganic Rings, Clusters and Polymers	3-0-0	114
Specialization II: Physical Chemistry				
Theory/ DE	CHRC0023	Recent Advances in Catalysis	3-0-0	110
Theory/ DE	CHBC0024	Biophysical Chemistry	3-0-0	111
Specialization III: Organic Chemistry				
Theory/ DE	CHHC0025	Heterocyclic Chemistry	3-0-0	111
Theory/ DE	CHNP0026	Natural Products Chemistry	3-0-0	112
Project/DC	CHRP6005	Research Project	12	165
Value Added Course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	186
Audit Course	EDCI0200	Constitution of India	NC	
Total Credits			**21**	
Total Programme Credits			**86**	

DEPARTMENT OF MATHEMATICS

BACHELOR OF SCIENCE - HONOURS IN MATHEMATICS

**** Wherever there is a practical there will be no tutorial and Vice versa***

SEMESTER I				
Type	**Course Code**	**Course Name**	***Credits L-T-P**	**Page**
Core Course 1 (Theory)	MACS0101	Calculus	4-0-0	226
Core Course 1 (Lab)	MACS6101	Calculus Lab		261
Core Course 2 (Theory)	MAAG0102	Algebra	5-1-0	227
Ability Enhancement compulsory Course -1/IC	EGEC0107	English Communication/MIL	2-0-0	1011
Generic Elective Course 1 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 1 (Lab)			0-0-2	
Value Added Course	MAFG0154	Fractal geometry and Applications	2-0-0	256
Total Credits			20	
SEMESTER II				
Core Course 3 (Theory)	MAER0103	Real Analysis	5-1-0	227
Core Course 4 (Theory)	MADQ0104	Differential Equations	4-0-0	228
Core Course 4 (Lab)	MADQ6102	Differential Equations Lab	0-0-2	261
Ability Enhancement compulsory Course -1/IC	CHES0002	Environmental Studies	2-0-0	
Generic Elective Course 2 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 2 (Lab)			0-0-2	
Value Added Course	MAML0152	Essential Mathematics for Machine Learning	NC	258
Mandatory Course	MASL0100	Mathematics and Service Learning (Theory & Practice)	NC	225
Total Credits			20	
SEMESTER III				
Core Course 5 (Theory)	MARF0109	Theory of Real Functions	5-1-0	230
Core Course 6 (Theory)	MAGT0110	Group Theory I	5-1-0	231
Core Course 7 (Theory)	MANM0115	Numerical Methods	4-0-0	235
Core Course 7 (Lab)	MANM6103	Numerical Methods Lab	0-0-2	262
Skill Enhancement Course	MAPC0112	Programming in C	2-0-0	233
1/IE	MALS0113	Logic and sets	2-0-0	233
Generic Elective Course 3 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 3 (Lab)			0-0-2	
Value Added Course	MAFG0154	Fractal geometry and Applications	2-0-0	256
Total Credits			26	
SEMESTER IV				
Core Course 8 (Theory)	MAPE0114	PDE and Systems of ODE	4-0-0	234
Core Course 8 (Lab)	MAPE6104	PDE and Systems of ODE Lab	0-0-2	263
Core Course 9 (Theory)	MAMC0111	Multivariate Calculus	5-1-0	232

Core Course 10 (Theory)	MAGT0129	Group Theory II	5-1-0	239
Skill Enhancement Course 2/IE	MACG0117	Computer Graphics	2-0-0	236
	MAGY0118	Graph Theory	2-0-0	236
Generic Elective Course 4 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 4 (Lab)			0-0-2	
Value Added Course	MAML0152	Essential Mathematics for Machine Learning	NC	258
Total Credits			26	
SEMESTER V				
Core Course 11 (Theory)	MAMC0126	Metric Space and Complex Analysis	5-1-0	237
Core Course 12 (Theory)	MART0127	Ring Theory and Linear Algebra I	5-1-0	238
Discipline Specific Elective I/DE	MAPS0137	Probability and Statistics	5-1-0	245
	MALP0130	Linear Programming		240
	MAAG0140	Analytical Geometry		247
	MAMM0141	Mathematical Modelling		248
Discipline Specific Elective II/DC	MANT0128	Number Theory	5-1-0	238
	MAPO0142	Portfolio Optimization		248
	MAIM0133	Industrial Mathematics		242
	MAHM0143	Hydromechanics		249
Mandatory Course	EDCI0200	Constitution of India	2-0-0	
Value Added Course	MAFG0154	Fractal geometry and Applications	NC	256
Value Added Course	MAML0152	Essential Mathematics for Machine Learning	NC	258
Total Credits			24	
SEMESTER VI				
Core Course 13 (Theory)	MARI0131	Riemann Integration and Series of Functions	5-1-0	241
Core Course 14 (Theory)	MART0132	Ring Theory and Linear Algebra II	5-1-0	241
Discipline Specific Elective III/DE	MATE0144	Theory of Equations	5-1-0	250
	MAMC0116	Mechanics		235
	MAMF0134	Mathematical Finance		243
Discipline Specific Elective IV/DE	MAMB0135	Bio-Mathematics	5-1-0	243
	MADG0136	Differential Geometry		244
	MAIT0145	Integral Transforms		250
Value Added Course	MAML0152	Essential Mathematics for Machine Learning	NC	258
Optional Dissertation or Project Work in place of one Discipline Elective (DSE) Course				
Project Work		Project Work	6	
Total Credits			24	
Total Programme Credits			140	

MASTER OF SCIENCE IN MATHEMATICS

SEMESTER I				
Type of course/ Category	**Course Code**	**Course Name**	**Credits L-T-P**	**Page**
DC	MARA0014	Real Analysis	4-0-0	195
DC	MALA0015	Linear Algebra	4-0-0	196
DC	MAAB0016	Abstract Algebra	4-0-0	196
DC	MADE0017	Differential Equations	4-0-0	197
DC	MAMT0018	Mathematical Methods I	4-0-0	198
Mandatory Course	MASL0200	Community Engagement and Service Learning	NC	259
Value Added Course	MAFG0154	Fractal Geometry and Applications	NC	256
		Total Credits	20	
SEMESTER II				
DC	MATF0019	Topology and Functional Analysis	4-0-0	199
DC	MACA0020	Complex Analysis	4-0-0	199
DC	MAMP0021	Measure Theory and Probability Theory	4-0-0	200
DC	MAMD0022	Mathematical Methods II	4-0-0	201
DC	MACL0023	Classical Mechanics	4-0-0	202
Mandatory	EDCI0200	Constitution of India	NC	
Value Added Course	MAML0152	Essential Mathematics for Machine Learning	NC	258
		Total Credits	20	
SEMESTER III				
DC	MADS0030	Discrete Mathematics	4-0-0	202
DC	MACP0031	Computer Programming in C	2-0-0	203
DC	MACP6002	Computer Programming in C Lab	0-0-1	260
DC	MARM0032	Research Methodology for Mathematical Sciences	3-0-0	204
DC	MARS6001	Research Seminar	2-0-0	260
	Specialization I: Theoretical			
DE	MAFA0033	Field theory & commutative Algebra	4-0-0	205
DE	MANT0034	Number Theory		205
DE	MAML0035	Mathematical Logic		206
DE	MAFS0036	Fuzzy sets and Applications		207
	Specialization II: Applicable			
DE	MAFD0037	Fluid Dynamics I	4-0-0	207
DE	MARC0038	Riemannian Geometry & Tensor Calculus		208
DE	MADS0059	Dynamical Systems and Chaos		220
DE	MACO0060	Convex Optimization		221
DE	MANS0039	Numerical solution of PDE	4-0-0	209
	Specialization III: Computational			

DE	MACN0040	Computational Number Theory	4-0-0	210
DE	MASC0041	Scientific Computing		210
DE	MASF0042	Special Functions		211
DE	MAGT0061	Introduction to Game Theory		222
Total Credits			20	
SEMESTER IV				
Specialization I: Theoretical				
DE	MAAS0046	Advanced Analysis	4-0-0	213
DE	MAGY0047	Graph Theory	4-0-0	213
DE	MACA0048	Multivariable calculus	4-0-0	214
DE	MAAY0049	Algebraic Number Theory	4-0-0	215
	MAAN0062	Algebraic Geometry		223
Specialization II: Applicable				
DE	MAFL0050	Fluid Dynamics II	4-0-0	215
DE	MACM0051	Continuum Mechanics	4-0-0	216
DE	MATR0052	Theory of Relativity	4-0-0	217
DE	MANO0063	Numerical Optimization	4-0-0	223
Specialization III: Computational				
DE	MADN0054	Design and Algorithms Analysis	4-0-0	218
DE	MAML0064	Machine Learning	4-0-0	224
DE	MAFE0053	Finite Elements Methods	4-0-0	218
DE	MAIC0055	Introduction to Cryptography	4-0-0	219
Project DC	MARP6003	Research Project	8	261
Value Added Course	MAMR0153	Statistical Methods & Software in Research	3-0-0	257
Total Credits			20	
Total Programme Credits			80	

DEPARTMENT OF PHYSICS

BACHELOR OF SCIENCE - HONOURS IN PHYSICS

**** Wherever there is a practical there will be no tutorial and Vice versa***

SEMESTER I				
Type of Course	**Course Code**	**Course Name**	***Credits L-T-P**	**Page**
Core Course 1 (Theory)	PSMY0101	Mathematical Physics-I	4-0-0	291
Core Course 2 (Theory)	PSMC0102	Mechanics	4-0-0	292
Core Course 1 (Lab)	PSMY6101	Mathematical Physics-I Laboratory	0-0-2	327
Core Course 2 (Lab)	PSMA6102	Mechanics Laboratory	0-0-2	328
Ability Enhancement	EGEC0107	English Communication	2-0-0	1011

compulsory Course 1				
Generic Elective Course 1 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 1 (Lab)			0-0-2	
Mandatory Course	USIP001	Student Induction Programme	NC	
Value Added Course	PSCP6120	Computational Physics using PYTHON	2-0-0	344
Total Credits			**20**	
SEMESTER II				
Core Course 3 (Theory)	PSEM0103	Electricity and Magnetism	4-0-0	293
Core Course 4 (Theory)	PSWO0104	Waves and Optics	4-0-0	294
Core Course 3 (Lab)	PSEM6103	Electricity and Magnetism Laboratory	0-0-2	329
Core Course 4 (Lab)	PSWO6104	Waves and Optics Laboratory	0-0-2	330
Ability Enhancement compulsory Course 2	CHES0002	Environmental Studies	2-0-0	92
Generic Elective Course 2 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 2 (Lab)			0-0-2	
Service Learning	PSSL0100	Elements of Service Learning in Physics	NC	320
Total Credits			**20**	
SEMESTER III				
Core Course 5 (Theory)	PSMS0105	Mathematical Physics–II	4-0-0	295
Core Course 6 (Theory)	PSPT0106	Thermal Physics	4-0-0	296
Core Course 7 (Theory)	PSDA0107	Digital Systems and Applications	4-0-0	297
Core Course 5 (Lab)	PSMS6105	Mathematical Physics–II Laboratory	0-0-2	330
Core Course 6 (Lab)	PSPT6106	Thermal Physics Laboratory	0-0-2	330
Core Course 7 (Lab)	PSDA6107	Digital Systems and Applications Laboratory	0-0-2	333
Skill Enhancement Course 1 (Elective)	PSCP0111	Computational Physics Skills	2-0-0	301
	PSEN0112	Electrical circuits and Network Skills		302
Generic Elective Course 3 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 3 (Lab)			0-0-2	
Value Added Course	PSCP6120	Computational Physics using PYTHON	NC	344
Total Credits			26	
SEMESTER IV				
Core Course 8 (Theory)	PSMP0108	Mathematical Physics III	4-0-0	298
Core Course 9 (Theory)	PSEP0109	Elements of Modern Physics	4-0-0	299
Core Course 10 (Theory)	PSAS0110	Analog Systems and Applications	4-0-0	300
Core Course 8 (Lab)	PSMP6108	Mathematical Physics III Laboratory	0-0-2	333
Core Course 9 (Lab)	PSEP6109	Elements of Modern Physics Laboratory	0-0-2	333
Core Course 10 (Lab)	PSAS6110	Analog Systems and Applications Laboratory	0-0-2	335
Skill Enhancement Course 2 (Elective)	PSBI0113	Basic Instrumentation Skills	2-0-0	303
	PSRS0114	Radiation Safety		304
Generic Elective Course 4 (Theory/ Theory-Tutorial)			4-0-0/5-1-0	
Generic Elective Course 4 (Lab)			0-0-2	

Audit Course	EDCI0200	Constitution of India		
Total Credits			**26**	
SEMESTER V				
Core Course 11 (Theory)	PSQM0115	Quantum Mechanics and Applications	4-0-0	307
Core Course 12 (Theory)	PSSS0116	Solid State Physics	4-0-0	308
Core Course 11 (Lab)	PSQM6111	Quantum Mechanics and Applications Laboratory	0-0-2	337
Core Course 12 (Lab)	PSSS6112	Solid State Physics Laboratory	0-0-2	338
Discipline Specific Elective 1	**Option 1**			
	PSES0117	Embedded systems- Introduction to Microcontroller	4-0-0	309
	PSES6113	Embedded systems- Introduction to Microcontroller Laboratory	0-0-2	339
	Option 2			
	PSDI0118	Physics of Devices and Instruments	4-0-0	310
Discipline Specific Elective 2	PSDI6114	Physics of Devices and Instruments Laboratory	0-0-2	339
	Option 1			
	PSCD0119	Classical Dynamics	5-1-0	311
	Option 2			
	PSCE0120	Communication Electronics	4-0-0	312
	PSCE6115	Communication Electronics Laboratory	0-0-2	340
Total Credits			24	
SEMESTER VI				
Core Course 13 (Theory)	PSET0121	Electromagnetic Theory	4-0-0	313
Core Course 14 (Theory)	PSSM0122	Statistical Mechanics	4-0-0	314
Core Course13 (Lab)	PSET6116	Electromagnetic Theory Laboratory	0-0-2	341
Core Course14 (Lab)	PSET6117	Statistical Mechanics Laboratory	0-0-2	341
Discipline Specific Elective 3	**Option 1**			
	PSNP0123	Nuclear and Particle Physics	5-1-0	315
	Option 2			
	PSNA0124	Nano Materials and Applications	4-0-0	316
	PSNA6118	Nano Materials and Applications Laboratory	0-0-2	342
Discipline Specific Elective 4	**Option 1**			
	PSDP0125	Digital Signal Processing	4-0-0	317
	PSDP6119	Digital Signal Processing Laboratory	0-0-2	343
	Option 2			
	PSAA0126	Astronomy and Astrophysics	5-1-0	319
Total Credits			**24**	
Total Programme Credits			**140**	

MASTER OF SCIENCE PHYSICS

Semester I				
Type of Course/ Category	**Course Code**	**Course Name**	**Credits**	**Page**
Theory/DC	PSCM0020	Classical Mechanics	4	271
Theory/DC	PSQM0021	Quantum Mechanics I	4	271
Theory/DC	PSMP0022	Mathematical Physics	4	272
Theory/DC	PSEL0049	Electronics I	4	286
Theory/DC	PSPL6009	Physics Laboratory I	4	322
Mandatory	PSPS0200	Physics and Service Learning		320
Value Added Course	PSCP6120	Computational Physics using PYTHON	2-0-0	344
		Total Credits	**20**	
Semester II				
Theory/DC	PSQM0024	Quantum Mechanics II	4	273
Theory/DC	PSCP0025	Condensed Matter Physics	4	274
Theory/DC	PSED0026	Electrodynamics	4	275
Theory/DC	PSNP0050	Nanophysics I	4	286
Theory/DC	PSPL6003	Physics Laboratory II	4	321
Mandatory	PSPS0200	Physics and Service Learning	0	320
		Total Credits	**20**	
Semester III				
Theory/DC	PSAM0028	Atomic and Molecular Physics	4	276
Theory/DC	PSNP0054	Nuclear Physics	4	290
Theory/DC	PSRM0051	Research Methodology	2	287
Theory/DC	PSCN0030	Computer Oriented Numerical Methods	2	277
Theory/DC	PSCN6010	Computer Oriented Numerical Methods Laboratory	4	323
Theory/DC	PSPP6011	Project Phase I	4	324
	Specialisation: High Energy Physics			
Theory/DE	PSHP0052	High Energy Physics I	4	288
	Specialisation: Astrophysics			
Theory/DE	PSPL0036	Plasma Physics I	4	278
	Specialisation: Plasma Physics			
Theory/DE	PSPL0036	Plasma Physics I	4	278
	Specialisation: Electronics			
Theory/DE	PSEC0037	Electronics II	4	279
	Specialisation: Nanophysics			
Theory/DE	PSNS0041	Nanophysics II	4	280
Value Added Course	PSCP6120	Computational Physics using PYTHON	2-0-0	344
Mandatory	EDCI0200	Constitution of India		
		Total Credits	**22**	
Semester IV				
Theory/DC	PSSM0034	Statistical Mechanics	4	278
Theory/DC	PSPR6012	Project Phase II	6	325
Theory/DC	PSST6016	Study Tour	P/NP	327
	Specialisation: High Energy Physics			
Theory/DE	PSEP0053	High Energy Physics II	4	289
Theory/DE	PSGR0044	General Theory of Relativity and Cosmology	4	281
	Specialisation: Astrophysics			
Theory/DE	PSAR0045	Astrophysics	4	282
Theory/DE	PSGR0044	General Theory of Relativity and Cosmology	4	281
	Specialisation: Plasma Physics			
Theory/DE	PSPM0046	Plasma Physics II	4	283

Theory/DE	PSPM6013	Plasma Physics Laboratory	4	325
	Specialisation: Electronics			
Theory/DE	PSER0047	Electronics III	4	284
Theory/DE	PSEL6014	Electronics Laboratory	4	325
	Specialisation: Nanophysics			
Theory/DE	PSNY0048	Nanophysics III	4	285
Theory/DE	PSNY6015	Nanophysics Laboratory	4	326
Total Credits			18	
Total Programme Credits			80	

GENERIC ELECTIVES

DEPARTMENT OF CHEMISTRY				
Type of course/ Category	**Course Code**	**Course Name**	**Credits L-T-P**	**Page**
General Elective – I/III/SE	CHAH0105	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	4-0-0	123
	CHCK0120	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics	4-0-0	132
	CHSC0147	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II	4-0-0	159
	CHCS0148	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy	4-0-0	160
	CHAH6105	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab	0-0-2	168
	CHCK6114	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics Lab	0-0-2	170
General Elective – II/IV/SE	CHCF0106	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I	4-0-0	124
	CHOS0119	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy	4-0-0	130
	CHML0149	Molecules of life	4-0-0	161
	CHCF6106	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I Lab	0-0-2	169
	CHOS6113	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy Lab	0-0-2	169
	CHML6136	Molecules of life Lab	0-0-2	

DEPARTMENT OF MATHEMATICS				
General Elective – I//IE/ SE/DE	MACD0105	Calculus and Differential Equations	5-1-0	229
	MANA0138	Numerical Analysis	5-1-0	246
General Elective – II//IE/ SE/DE	MALG0106	Algebra	5-1-0	230
	MAVC0139	Vector Calculus and Co-ordinate Geometry	5-1-0	246
General Elective – III//IE/ SE/DE	MAER0103	Real Analysis	5-1-0	227
	MAEN0146	Econometrics	5-1-0	251
	MAFE0147	Finite Element Methods	5-1-0	252
	MADS0148	Descriptive Statistics	5-1-0	253

General Elective – IV/IE/ SE/DE	MACA0150	Complex Analysis	5-1-0	254
	MACM0151	Combinatorial Mathematics	5-1-0	255
	MAMF0134	Mathematical Finance	5-1-0	243
	MAIP0149	Introduction to Probability Theory	5-1-0	254

DEPARTMENT OF PHYSICS				
Generic Elective- III (Physics)/SE	PSGP0115	General Thermal Physics	4-0-0	305
	PSDA0107	Digital System and Applications		297
	PSGP6111	General Thermal Physics Lab	0-0-2	336
	PSDA6107	Digital System and Applications Lab		333
Generic Elective – III (Botany)/SE	PSGM0116	General Elements of Modern Physics	4-0-0	306
	PSAS0110	Analog system and its applications		300
	PSGM6112	General Elements of Modern Physics Lab	0-0-2	337
	PSAS6110	Analog system and its applications Lab		335

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	369
Core Course (Theory)	MBCG0011	Cell Biology and Genetics	4-0-0	387
Core Course (Theory)	BCFB0013	Fundamentals of Biochemistry	4-0-0	350
Core Course (Theory)	BCAT0014	Analytical Techniques	4-0-0	351
Core Course (Lab)	BCFB6009	Fundamentals of Biochemistry Lab	0-0-1	361
Core Course (Lab)	BTTE6009	Thermodynamics and Enzymology Lab	0-0-1	380
Core Course (Lab)	BCAT6010	Analytical Techniques Lab	0-0-1	362
Core Course (Lab)	MBCB6011	Cell Biology and Genetics Lab	0-0-1	393
	BTIV6011	Industrial/Laboratory visit	0-0-1	
	BCRT6012	**Remedial Teaching & NET Coaching course**	**NC**	
	MBNT6013	NPTEL Course	NC	
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	358
Total Credits			20	
SEMESTER II				
Core Course (Theory)	BTGE0005	Genetic Engineering	3-0-0	367
Core Course (Theory)	BTCA0010	Computer Applications and Bioinformatics	3-0-0	370
Core Course (Theory)	MBBM0014	Basic Microbiology	2-0-0	389
Core Course (Theory)	BCMB0015	Molecular Biology	4-0-0	352
Core Course (Theory)	BCFI0016	Fundamentals of Immunology	4-0-0	353
Core Course (Lab)	BTGE6004	Genetic Engineering Lab	0-0-1	378
Core Course (Lab)	BTCA6010	Computer Applications and Bioinformatics Lab	0-0-2	380
Core Course (Lab)	MBBM6012	Basic Microbiology Lab	0-0-1	394
Core Course (Lab)	BCMB6013	Molecular Biology Lab	0-0-1	363
Core Course (Lab)	BCFI6014	Fundamentals of Immunology Lab	0-0-1	363
Elective Skill Enhancement Courses				
Skill Enhancement Course 1	MBWM0012	Waste Management	1-0-0	388
Skill Enhancement Course 2	BTFF0013	Fermentation and Food Microbiology	1-0-0	373
Skill Enhancement Course 3	MBMC0013	Mushroom cultivation	1-0-0	389
Skill Enhancement Course 4	BCHD0017	Herbal Drug Technology	1-0-0	354
	MBIT6014	Internships/Summer Training	NC	
	BCRT6015	Remedial Teaching & NET Coaching	NC	
	BCSL0200	Service Learning in Biosciences	NC	358
Total Credits			23	
SEMESTER III				
Core Course (Theory)	BTRM0003	Research Methodology &Biostatistics	4-0-0	366
Core Course (Theory)	BCBM0010	Medical Biochemistry	3-0-0	347
Core Course (Theory)	BCPY0011	Physiology	3-0-0	348
Core Course (Lab)	BCIM6004	Medical Biochemistry Lab	0-0-1	359
Core Course (Lab)	BCPY6005	Physiology Lab	0-0-1	359
Core Course (Theory)	BCNM0019	Nutritional Biochemistry & Metabolism	3-0-0	355
Core Course (Theory)	BCBE0018	Bioenergetics	3-0-0	355
Core Course (Lab)	BCNM6013	Nutritional Biochemistry & Metabolism Lab	0-0-1	362
Core Course (Lab)	BCBM6006	Bioenergetics Lab	0-0-1	360
	BCDI6007	Dissertation Phase I	0-0-2	360
	BCRT6015	Remedial Teaching & NET Coaching	NC	
Core Course (Theory)	BTIE0014	IPR & Entrepreneurship	1-0-0	374

Core Course (Lab)	BCJS6016	Journal Club and scientific communications	0-0-1	364
Service Learning	BCSL0200	Service Learning in Biosciences	NC	358
Value Added Course	BTCL6014	Clinical Laboratory Techniques	NC	382
Total Credits			24	
SEMESTER IV				
Core Course (Theory)	BCOB0020	Omics Biology and its Tools	4-0-0	356
Elective courses				
Elective Course 1 (Theory)	BTAT0017	Agriculture Technology	2-0-0	376
Elective Course 2 (Theory)	MBNB0016	Nanobiology	2-0-0	391
Elective Course 3 (Theory)	BCBM0021	Bioresource Management	2-0-0	357
	BCDI6008	Dissertation Phase II	0-0-16	361
Service Learning	BCSL0200	Service Learning in Biosciences	NC	358
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	369
Core Course (Theory)	MBCG0011	Cell Biology and Genetics	4-0-0	387
Core Course (Theory)	BCFB0013	Fundamentals of Biochemistry	4-0-0	350
Core Course (Theory)	BCAT0014	Analytical Techniques	4-0-0	351
Core Course (Lab)	BCFB6009	Fundamentals of Biochemistry Lab	0-0-1	361
Core Course (Lab)	BTTE6009	Thermodynamics and Enzymology Lab	0-0-1	380
Core Course (Lab)	BCAT6010	Analytical Techniques Lab	0-0-1	362
Core Course (Lab)	MBCB6011	Cell Biology and Genetics Lab	0-0-1	393
	BTIV6011	Industrial/Laboratory visit	0-0-1	
	BCRT6012	Remedial Teaching & NET Coaching course	NC	
	MBNT6013	NPTEL Course	NC	
Service Learning	BCSL0200	Service Learning in Biosciences	NC	358
Total Credits			20	
SEMESTER II				
Core Course (Theory)	BTGE0005	Genetic Engineering	3-0-0	367
Core Course (Theory)	BTCA0010	Computer Applications and Bioinformatics	3-0-0	370
Core Course (Theory)	MBBM0014	Basic Microbiology	2-0-0	389
Core Course (Theory)	BCMB0015	Molecular Biology	4-0-0	352
Core Course (Theory)	BCFI0016	Fundamentals of Immunology	4-0-0	353
Core Course (Lab)	BTGE6004	Genetic Engineering Lab	0-0-1	378
Core Course (Lab)	BTCA6010	Computer Applications and Bioinformatics Lab	0-0-2	380
Core Course (Lab)	MBBM6012	Basic Microbiology Lab	0-0-1	394
Core Course (Lab)	BCMB6013	Molecular Biology Lab	0-0-1	363
Core Course (Lab)	BCFI6014	Fundamentals of Immunology Lab	0-0-1	363
Elective Skill Enhancement Courses				
Skill Enhancement Course 1	MBWM0012	Waste Management	1-0-0	388
Skill Enhancement Course 2	BTFF0013	Fermentation and Food Microbiology	1-0-0	373
Skill Enhancement Course 3	MBMC0013	Mushroom cultivation	1-0-0	389
Skill Enhancement Course 4	BCHD0017	Herbal Drug Technology	1-0-0	354
	MBIT6014	Internships/Summer Training	NC	
	BCRT6015	Remedial Teaching & NET Coaching	NC	
Service Learning	BCSL0200	Service Learning in Biosciences	NC	358
Total Credits			23	
SEMESTER III				
Core Course (Theory)	BTRM0003	Research Methodology &Biostatistics	4-0-0	366

Core Course (Theory)	BTBE0007	Bioprocess Engineering	3-0-0	368
Core Course (Theory)	BTPB0011	Plant Biotechnology	3-0-0	371
Core Course (Theory)	BTAB0012	Animal Biotechnology	3-0-0	372
Core Course (Theory)	BTPE0015	Pharmaceutical & Environmental Biotechnology	3-0-0	374
Core Course (Lab)	BTAP6003	Animal Biotechnology Lab	0-0-1	377
Core Course (Lab)	BTBE6006	Bioprocess Engineering Lab	0-0-1	378
Core Course (Lab)	BTBP6011	Plant Biotechnology Lab	0-0-1	381
Core Course (Lab)	BTPE6012	Pharmaceutical & Environmental Biotechnology Lab	0-0-1	381
	BTDI6007	Dissertation Phase I	0-0-2	379
	BCRT6015	Remedial Teaching &NET Coaching	NC	
Core Course (Theory)	BTIE0014	IPR and Entrepreneurship	1-0-0	374
Core Course (Lab)	MBJS6016	Journal Club and scientific communications	0-0-1	
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	
Value Added Course	BTCL6014	Clinical Laboratory Techniques	NC	382
Total Credits			24	
SEMESTER IV				
Core Course (Theory)	BTTB0016	Trends in Biotechnology	4-0-0	375
Elective courses				
Elective Course 1 (Theory)	BTAT0017	Agriculture Technology	2-0-0	376
Elective Course 2 (Theory)	MBNB0016	Nanobiology	2-0-0	391
Elective Course 3 (Theory)	BCBM0021	Bioresource Management	2-0-0	357
	BTDI6008	Dissertation Phase II	0-0-16	379
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	385
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	369
Core Course (Theory)	MBCG0011	Cell Biology and Genetics	4-0-0	387
Core Course (Theory)	BCFB0013	Fundamentals of Biochemistry	4-0-0	350
Core Course (Theory)	BCAT0014	Analytical Techniques	4-0-0	351
Core Course (Lab)	BCFB6009	Fundamentals of Biochemistry Lab	0-0-1	361
Core Course (Lab)	BTTE6009	Thermodynamics and Enzymology Lab	0-0-1	380
Core Course (Lab)	BCAT6010	Analytical Techniques Lab	0-0-1	362
Core Course (Lab)	MBCB6011	Cell Biology and Genetics Lab	0-0-1	393
	BTIV6011	Industrial/Laboratory visit	0-0-1	
	BCRT6012	Remedial Teaching & NET Coaching course	NC	
	MBNT6013	NPTEL Course	NC	
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	358
Total Credits			20	
SEMESTER II				
Core Course (Theory)	BTGE0005	Genetic Engineering	3-0-0	367
Core Course (Theory)	BTCA0010	Computer Applications and Bioinformatics	3-0-0	370
Core Course (Theory)	MBBM0014	Basic Microbiology	2-0-0	389
Core Course (Theory)	BCMB0015	Molecular Biology	4-0-0	352
Core Course (Theory)	BCFI0016	Fundamentals of Immunology	4-0-0	353
Core Course (Lab)	BTGE6004	Genetic Engineering Lab	0-0-1	378
Core Course (Lab)	BTCA6010	Computer Applications and Bioinformatics Lab	0-0-2	380
Core Course (Lab)	MBBM6012	Basic Microbiology Lab	0-0-1	394

Core Course (Lab)	BCMB6013	Molecular Biology Lab	0-0-1	363
Core Course (Lab)	BCFI6014	Fundamentals of Immunology Lab	0-0-1	363
Elective Skill Enhancement Courses				
Skill Enhancement Course 1	MBWM0012	Waste Management	1-0-0	388
Skill Enhancement Course 2	BTFF0013	Fermentation and Food Microbiology	1-0-0	373
Skill Enhancement Course 3	MBMC0013	Mushroom cultivation	1-0-0	389
Skill Enhancement Course 4	BCHD0017	Herbal Drug Technology	1-0-0	354
	MBIT6014	Internships/Summer Training	NC	
	BCRT6015	Remedial Teaching & NET Coaching	NC	
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	358
Total Credits			23	
SEMESTER III				
Core Course (Theory)	BTRM0003	Research Methodology &Biostatistics	4-0-0	366
Core Course (Theory)	MBVM0003	Virology and Mycology	3-0-0	384
Core Course (Theory)	MBEM0009	Environment Microbiology	3-0-0	385
Core Course (Theory)	MBMM0010	Medical Microbiology	3-0-0	386
Core Course (Theory)	MBIM0015	Infection and Molecular Diagnostics	3-0-0	390
Core Course (Lab)	MBVM6008	Virology and Mycology Lab	0-0-1	394
Core Course (Lab)	MBEM6009	Environment Microbiology Lab	0-0-1	395
Core Course (Lab)	MBMM6010	Medical Microbiology Lab	0-0-1	395
Core Course (Lab)	MBIM6015	Infection and Molecular Diagnostics Lab	0-0-1	396
	MBDI6006	Dissertation Phase I	0-0-2	397
	BCRT6015	Remedial Teaching &NET Coaching	NC	
Core Course (Theory)	BTIE0014	IPR & Entrepreneurship	1-0-0	374
Core Course (Lab)	BTJS6013	Journal Club and scientific communications	0-0-1	
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	358
Value Added Course	BTCL6014	Clinical Laboratory Techniques	NC	382
Total Credits			24	
SEMESTER IV				
Core Course (Theory)	MBIF0018	Industrial and Food Microbiology	4-0-0	392
Elective courses				
Elective Course 1 (Theory)	BTAT0017	Agriculture Technology	2-0-0	376
Elective Course 2 (Theory)	MBNB0016	Nanobiology	2-0-0	391
Elective Course 3 (Theory)	BCBM0021	Bioresource Management	2-0-0	357
	MBDI6007	Dissertation Phase II	0-0-16	397
Service Learning	BCSL0200	Service Learning in Bio Sciences	NC	358
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 ZOOLOGY

BACHELOR OF SCIENCE - HONOURS IN ZOOLOGY

**** Wherever there is a practical there will be no tutorial and Vice versa***

SEMESTER I				
Types of Course/Category	**Course Code**	**Course Name**	***Credits**	**Page**
Core course I (Theory)/DC	ZGPP0101	Non-chordates I: Protista to Pseudocoelomates	4-0-0	431
Core course 2 (Theory)/DC	ZGPE0102	Perspectives in Ecology	4-0-0	432
Core course I (Lab)/DC	ZGPP6101	Non-chordates I: Protista to Pseudocoelomates Lab	0-0-2	468
Core course 2 (Lab)/DC	ZGPE6102	Perspectives in Ecology Lab	0-0-2	468
Ability Enhancement Compulsory Course I /IC	EGEC0107	English Communication	2-0-0	1011
Generic Elective Course 1 (Theory)			4-0-0/5-0-0	
Generic Elective Course 1 (Lab/ Tutorial)			0-0-2/0-1-0	
Total Credits			**20**	
SEMESTER II				
Core course 3 (Theory)/DC	ZGCL0103	Non-chordates II: Coelomates	4-0-0	433
Core course 4 (Theory)/DC	ZGCB0104	Cell Biology	4-0-0	434
Core course 3 (Lab)/DC	ZGCL6103	Non-chordates II: Coelomates Lab	0-0-2	469
Core course 4 (Lab)/DC	ZGCB6104	Cell Biology Lab	0-0-2	470
Ability Enhancement Compulsory Course 2 /IC	CHES0002	Environmental Studies	2-0-0	92
Generic Elective Course 2 (Theory)			4-0-0/5-0-0	
Generic Elective Course 2 (Lab/ Tutorial)			0-0-2/0-1-0	
Total Credits			**20**	
SEMESTER III				
Core course 5 (Theory)/DC	ZGDC0107	Diversity of Chordates	4-0-0	437
Core course 6 (Theory)/DC	ZGAP0108	Animal Physiology: Controlling and Coordinating systems	4-0-0	438
Core course 7 (Theory)/DC	ZGFB0109	Fundamentals of Biochemistry	4-0-0	438
Core course 5 (Lab)/DC	ZGDC6107	Diversity of Chordates Lab	0-0-2	471
Core course 6 (Lab)/DC	ZGAP6108	Animal Physiology: Controlling and Coordinating systems Lab	0-0-2	472
Core course 7 (Lab)/DC	ZGFB6109	Fundamentals of Biochemistry Lab	0-0-2	472
Skill Enhancement Course 2	ZGRM0110	Research Methodology	2-0-0	439
Generic Elective Course 3 (Theory)			4-0-0/5-0-0	
Generic Elective Course 3 (Lab/ Tutorial)			0-0-2/0-1-0	
Total Credits			**26**	
SEMESTER IV				
Core course 8 (Theory)/DC	ZGCA0111	Comparative Anatomy of Vertebrates	4-0-0	440
Core course 9 (Theory)/DC	ZGAS0112	Animal Physiology: Life Sustaining Systems	4-0-0	441
Core course 10 (Theory)/DC	ZGBM0113	Biochemistry of Metabolic Processes	4-0-0	441
Core course 8 (Lab)/DC	ZGCA6110	Comparative Anatomy of Vertebrates Lab	0-0-2	472
Core course 9 (Lab)/DC	ZGAS6111	Animal Physiology: Life Sustaining Systems Lab	0-0-2	473
Core course 10 (Lab)/DC	ZGBM6112	Biochemistry of Metabolic Processes Lab	0-0-2	473
Skill Enhancement Cours-2	ZGSE0114/	Sericulture / Aquarium Fish Keeping	2-0-0	442/443

	ZGAF0115			
Generic Elective Course 4 (Theory)			4-0-0/5-0-0	
Generic Elective Course 4 (Lab/ Tutorial)			0-0-2/0-1-0	
Total Credits			**26**	
SEMESTER V				
Core course 11 (Theory)/DC	ZGMB0116	Molecular Biology	4-0-0	444
Core course 12 (Theory)/DC	ZGPG0117	Principles of Genetics	4-0-0	445
Core course 11 (Lab)/DC	ZGMB6113	Molecular Biology Lab	0-0-2	474
Core course 12 (Lab)/DC	ZGPG6114	Principles of Genetics Lab	0-0-2	474
Discipline Specific Elective-1/DE	ZGWM0118	Wildlife Conservation and Management	4-0-0	446
	ZGWM6115	Wildlife Conservation and Management Lab	0-0-2	475
	ZGAC0119	Animal Behaviour and Chronobiology	4-0-0	447
	ZGAC6116	Animal Behaviour and Chronobiology Lab	0-0-2	475
Discipline Specific Elective-2/DE	ZGCB0120	Computational Biology	4-0-0	448
	ZGCB6117	Computational Biology Lab	0-0-2	476
	ZGAB0121	Animal Biotechnology	4-0-0	449
	ZGAB6118	Animal Biotechnology Lab	0-0-2	476
Total Credits			**24**	
SEMESTER VI				
Core course 13 (Theory)/DC	ZGDB0122	Developmental Biology	4-0-0	450
Core course 14 (Theory)/DC	ZGEB0123	Evolutionary Biology	4-0-0	450
Core course 13 (Lab)/DC	ZGDB6119	Developmental Biology Lab	0-0-2	477
Core course 14 (Lab)/DC	ZGDB6120	Evolutionary Biology Lab	0-0-2	477
Discipline Specific Elective-3/DE	ZGIM0124	Immunology	4-0-0	452
	ZGIM6121	Immunology Lab	0-0-2	478
	ZGPA0125	Parasitology	4-0-0	453
	ZGPA6122	Parasitology Lab	0-0-2	478
Discipline Specific Elective-4/DE	ZGFF0126	Fish and Fisheries	4-0-0	453
	ZGFF6123	Fish and Fisheries Lab	0-0-2	479
	ZGBI0127	Biology of Insecta	4-0-0	454
	ZGBI6124	Biology of Insecta Lab	0-0-2	479
Total Credits			**24**	

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	422
Core Course (Theory)	ZGCI0028	Cell Biology and Immunology–Theory and Applications	4-0-0	423
Core Course (Theory)	ZGBG0029	Molecular Biology and Genetics	4-0-0	424
Core Course (Theory)	ZGAP0030	Animal Physiology	4-0-0	425
Core Course (Theory)	ZGEE0031	Ecology and Environmental Biology	4-0-0	426
Core Course (Lab)	ZGBE6019	Biosystematics and Environmental Biology Lab	0-0-2	465
Core Course (Lab)	ZGCI6020	Cell Biology, Genetics and Basic Bioinformatics Lab	0-0-2	466
Total Credits			**24**	
SEMESTER II				
Core Course (Theory)	ZGDB0005	Developmental Biology	4-0-0	404
Core Course (Theory)	ZGEB0032	Endocrinology and Biochemistry	4-0-0	428

Core Course (Theory)	ZGAZ0033	Applied Zoology	4-0-0	429
Core Course (Theory)	ZGEP0034	Ethology and Population Genetics	4-0-0	430
Core Course (Lab)	ZGDB6021	Developmental Biology and Biochemistry Lab	0-0-2	466
Core Course (Lab)	ZGEP6022	Ethology and Population Genetics Lab	0-0-2	467
Value Added Course	ZGPR6004	Project Management, Reporting and Documentation	NC	456
Service Learning Course	ZGSL0200	Service Learning in Zoology	NC	
Total Credits			**20**	
SEMESTER III				
Core Course (Theory)	BTRM0003	Research Methodology and Biostatistics	4-0-0	366/403
Discipline Specific Elective	**Specialization 1: Entomology**			
	ZGIF0008	Insects- Structure & Function	4-0-0	405
	ZGIP0009	Insect Physiology	4-0-0	406
	ZGEE6011	Specialization Lab I- Entomology and Environmental Biology	0-0-2	461
	Specialization 2: Cell and Molecular Biology			
	ZGCB0010	Cell and Molecular Biology –I	4-0-0	407
	ZGIY0011	Immunology I	4-0-0	408
	ZGCM6012	Specialization Lab I- Cell and Molecular Biology	0-0-2	461
	Specialization 3: Fishery Science			
	ZGTF0012	Taxonomy and Functional Anatomy	4-0-0	409
	ZGAF0013	Aquaculture and Fish Genetics	4-0-0	410
	ZGFS6013	Specialization Lab I - Fishery Science	0-0-2	462
	Specialization 4: Animal Ecology and Wildlife Biology			
	ZGEB0014	Animal Ecology and Biogeography	4-0-0	412
	ZGWM0015	Wildlife Conservation and Management	4-0-0	413
	ZGAW6014	Specialization Lab I- Animal Ecology and Wildlife Biology	0-0-2	462
	ZGDI6006	Dissertation (Phase I)	0-0-4	458
Value Added Course	ZGJP6007	Introduction to Journalism and Photography	NC	458
Total Credits			**18**	
SEMESTER IV				
Discipline Specific Elective		**Specialization 1: Entomology**		
	ZGIG0017	Insect Ecology	4-0-0	414
	ZGPM0018	Principles of Pest Management	4-0-0	415
	ZGEE6015	Specialization Lab II- Entomology and Environmental Biology	0-0-2	463
		Specialization 2: Cell and Molecular Biology		
	ZBMB0019	Cell and Molecular Biology –II	4-0-0	416
	ZGIM0020	Immunology II	4-0-0	417
	ZGCM6016	Specialization Lab II- Cell and Molecular Biology	0-0-2	464
		Specialization 3: Fishery Science		
	ZGCP0021	Capture fishery and Post-harvest Technology	4-0-0	417
	ZGLF0022	Limnology, Fishery economics, Ornamental Fishery and Fish pathology	4-0-0	419
	ZGFS6017	Specialization Lab II - Fishery Science	0-0-2	464
		Specialization 4: Animal Ecology and Wildlife Biology		
	ZGRE0025	Wildlife Resource management, Laws and Techniques in population study	4-0-0	420
	ZGWC0026	Techniques in Wildlife study, Wildlife Health, Forensics and Conflict	4-0-0	421
	ZGAW6018	Specialization Lab II- Animal Ecology and Wildlife Biology	0-0-2	465
Core Course (Dissertation)	ZGDS6009	Dissertation (Phase II)	0-0-8	460
Value Added Course	ZGTM6010	Teaching Methodology and Class room Management	NC	460
Total Credits			**18**	
Total Programme Credits			**80**	

DEPARTMENT OF BOTANY

BACHELOR OF SCIENCE - HONOURS IN BOTANY

**** Wherever there is a practical there will be no tutorial and Vice versa***

SEMESTER I				
Type of Course/Category	**Course Code**	**Course Name**	***Credits**	**Page**
Core course 1 (Theory)/DC	BOAM0101	Algae and Microbiology	4-0-0	506
Core course 2 (Theory)/DC	BOBC0102	Biomolecules and Cell Biology	4-0-0	507
Core course 1 (Lab)/DC	BOAM6101	Algae and Microbiology Lab	0-0-2	534
Core course 2 (Lab)/DC	BOBC6102	Biomolecules and Cell Biology Lab	0-0-2	535
Ability Enhancement compulsory Course -1/IC	EGEC0107	English Communication	2-0-0	1011
Generic Elective Course 1 (Theory)			4-0-0/5-0-0	
Generic Elective Course 1 (Lab/ Tutorial)			0-0-2/0-1-0	
Service Learning Course		Plant utilization and Economic Importance	1	
Service Learning Practical lab		Plant utilization and Economic Importance Lab	1	
Total Credits			22	
SEMESTER II				
Core course 3 (Theory)/DC	BOMP0103	Mycology and Phytopathology	4-0-0	508
Core course 4 (Theory)/DC	BOAR0104	Archegoniate	4-0-0	509
Core course 3 (Lab)/DC	BOMP6103	Mycology and Phytopathology Lab	4-0-0	535
Core course 4 (Lab)/DC	BOAR6104	Archegoniate Lab	0-0-2	536
Ability Enhancement compulsory Course –2/IC	CHES0002	Environmental Studies	0-0-2	
Generic Elective Course 2 (Theory)			4-0-0/5-0-0	
Generic Elective Course 2 (Lab/ Tutorial)			0-0-2/0-1-0	
Total Credits			**20**	
SEMESTER III				
Core course 5 (Theory)	BOMA0105	Morphology and Anatomy	4-0-0	510
Core course 6 (Theory)	BOEB0106	Economic Botany	4-0-0	511
Core course 7 (Theory)	BOGE0107	Genetics	4-0-0	512
Core course 5 (Lab)	BOMA6105	Morphology and Anatomy Lab	0-0-2	537
Core course 6 (Lab)	BOEB6106	Economic Botany Lab	0-0-2	538
Core course 7 (Lab)	BOGE6107	Genetics Lab	0-0-2	538
Skill Enhancement Course 1(Elective)	BOET0108	Ethnobotany	2-0-0	513
	BOIP0109	Intellectual Property Rights	2-0-0	514
Generic Elective Course 3 (Theory)			4-0-0/5-0-0	
Generic Elective Course 3 (Lab/ Tutorial)			0-0-2/0-1-0	
Total Credits			**26**	
SEMESTER IV				
Core course 8 (Theory)	BOMB0110	Molecular Biology	3-1-0	515
Core course 9 (Theory)	BOPE0111	Plant Ecology and Phytogeography	3-1-0	516
Core course 10 (Theory)	BOPS0112	Plant Systematics	3-1-0	516
Core course 8 (Lab)	BOMB6108	Molecular Biology Lab	0-0-2	539
Core course 9 (Lab)	BOPE6109	Plant Ecology and Phytogeography Lab	0-0-2	540
Core course 10 (Lab)	BOPS6110	Plant Systematics Lab	0-0-2	540

Skill Enhancement Course 2 (Elective)	BOBF0113	Biofertilizers	2-0-0	517
	BOMB0114	Medicinal Botany		518
Generic Elective Course 4 (Theory)			4-0-0/5-0-0	
Generic Elective Course 4 (Lab/ Tutorial)			0-0-2/0-1-0	
Total Credits			26	
SEMESTER V				
Core course 11 (Theory)	BORA0119	Reproductive Biology of Angiosperms	4-0-0	522
Core course 12 (Theory)	BOPP0120	Plant Physiology	4-0-0	523
Core course 11 (Lab)	BORA6115	Reproductive Biology of Angiosperms Lab	0-0-2	543
Core course 12 (Lab)	BOPP6116	Plant Physiology Lab	0-0-2	544
Discipline Specific Elective I	BOAP0121	Analytical Techniques in Plant Sciences	4-0-0	524
		Plant Breeding		
	BOAP6117	Analytical Techniques in Plant Sciences Lab	0-0-2	545
		Plant Breeding Lab	0-0-2	
Discipline Specific Elective II		Natural Resource Management	4-0-0	
	BOBS0122	Biostatistics	4-0-0	525
		Natural Resource Management Lab	0-0-2	
	BOBS6118	Biostatistics Lab	0-0-2	545
Total Credits			24	
SEMESTER VI				
Core course 13 (Theory)	BOPM0123	Plant Metabolism	4-0-0	526
Core course 14 (Theory)	BOPB0124	Plant Biotechnology	4-0-0	527
Core course 13 (Lab)	BOPM6119	Plant Metabolism Lab	0-0-2	546
Core course 14 (Lab)	BOPB6120	Plant Biotechnology Lab	0-0-2	546
Discipline Specific Elective III		Horticultural Practices and Post-Harvest Technology	4-0-0	
	BORM0125	Research Methodology for Botany	4-0-0	528
		Horticultural Practices and Post-Harvest Technology Lab	0-0-2	
	BORM6121	Research Methodology for Botany Lab	0-0-2	547
Discipline Specific Elective IV	BOIE0126	Industrial and Environmental Microbiology	4-0-0	529
		Bioinformatics	4-0-0	
	BOIE6122	Industrial and Environmental Microbiology Lab	0-0-2	547
		Bioinformatics Lab	0-0-2	
Total Credits			24	
Total Programme Credits			142	

MASTER OF SCIENCE IN BOTANY

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	485
Core Course (Theory)	BOBP0022	Bryophytes, Pteridophytes and Gymnosperms	4-0-0	486
	BOAN0023	Angiosperms	4-0-0	487
Core Course (Lab)	BOMP6026	Mycology and Phycology Lab	0-0-3	530
Core Course (Lab)	BOBA6027	Bryophytes, Pteridophytes and Gymnosperms and Angiosperms Lab	0-0-3	530
Value added course		Fundamentals of Horticulture and Floriculture	NC	
Value added course		Bio-Fertilizer Technology	NC	
Service Learning	BOSL0100	Service Learning on Ethno Botanical Practices	NC	
Total Credits			18	
SEMESTER II				

Core Course (Theory)	BOCM0024	Cell and Molecular Biology	4-0-0	488
Core Course (Theory)	BOPB0025	Plant Physiology and Biochemistry	4-0-0	489
Core Course (Theory)	BOPP0026	Plant Microbiology and Plant Pathology	4-0-0	490
Core Course (Lab)	BOCB6028	Cell and Molecular Biology and Plant Physiology and Biochemistry Lab	0-0-3	531
Core Course (Lab)	BOPP6029	Plant Microbiology and Plant Pathology Lab	0-0-3	532
		MOOCS/NPTEL Course		
Service Learning	BOSL0100	Service Learning on Ethno botanical Practices	NC	
Total Credits			**18**	
SEMESTER III				
Core Course (Theory)	BOCP0027	Cytogenetics and Plant Breeding	4-0-0	491
Core Course (Theory)	BOPE0028	Plant Ecology and Phytogeography	4-0-0	492
Core Course (Theory)	BOBB0029	Biochemical, Molecular Techniques and Bioinformatics	4-0-0	493
Core Course (Theory)	BOTC0030	Plant Cell and Tissue Culture	4-0-0	
Core Course (Lab)	BOPE6030	Plant Ecology Lab	0-0-3	532
Core Course (Lab)	BOCT6031	Cytogenetics, Molecular Techniques and Tissue Culture Lab	0-0-3	533
Value added course		Herbal Medicine	NC	
Value added course		Forest Inventory and Mensuration	NC	
Core Course (Lab)	BODI6032	Dissertation Phase I	0-0-4	534
Total Credits			**26**	
SEMESTER IV				
Core Course (Theory)	BOER0031	Environmental Management, Research Methodology and Biostatistics	4-0-0	494
Core Course (Lab)	BOER6033	Environmental Management, Research Methodology and Biostatistics Lab	0-0-2	534
		Plant Biotechnology		
Discipline Specific Elective	BOFP0032	Fundamentals of Plant Biotechnology	4-0-0	495
Discipline Specific Elective	BOAB0033	Advances in Plant Biotechnology	4-0-0	496
		Plant Genetics		
Discipline Specific Elective	BOGT0034	Genetics, Plant Breeding and Transformation	4-0-0	497
Discipline Specific Elective	BOMB0035	Molecular Genetics and Bioinformatics	4-0-0	498
		Plant Microbiology		
Discipline Specific Elective	BOMG0036	Microbial Physiology and Genetics	4-0-0	499
Discipline Specific Elective	BOAM0037	Applied Microbiology	4-0-0	500
		Angiosperm Taxonomy		
Discipline Specific Elective	BOTS0038	Taxonomy of Angiosperms and Biosystematics	4-0-0	501
Discipline Specific Elective	BOBE0039	Economic Botany and Ethnobotany	4-0-0	502
		Plant Ecology		
Discipline Specific Elective	BOEG0040	Ecology, Environment and Global concerns	4-0-0	504
Discipline Specific Elective	BORE0041	Restoration Ecology	4-0-0	505
Service Learning	BOSL0100	Service Learning on Ethno Botanical Practices	4-0-0	
Core Course (Dissertation)	BODI6034	Dissertation Phase II	0-0-12	534
Total Credits			**26**	
Total Programme Credits			**88**	

GENERIC ELECTIVES

ZOOLOGY				
General Elective – I /SE Theory	ZGAD0105	Animal Diversity	4-0-0	435
	ZGEP0106	Environment and Public Health	4-0-0	436
General Elective – I/SE Lab	ZGAD6105	Animal Diversity Lab	0-0-2	470
	ZGEP6106	Environment and Public Health Lab	0-0-2	471
General Elective – II /SE Theory	ZGAD0105	Animal Diversity	4-0-0	435
	ZGEP0106	Environment and Public Health	4-0-0	436
General Elective – II/SE Lab	ZGAD6105	Animal Diversity Lab	0-0-2	470
	ZGEP6106	Environment and Public Health Lab	0-0-2	471

BOTANY				
Generic Elective - IV	BOBB0118	Economic Botany and Plant Biotechnology	4-0-0	521
Generic Elective - IV Lab	BOBB6114	Economic Botany and Plant Biotechnology Lab	0-0-2	543
Generic Elective - III	BOEB0117	Environmental Biotechnology	4-0-0	520
Generic Elective - III Lab	BOEB6113	Environmental Biotechnology Lab	0-0-2	542

CHEMISTRY				
General Elective – III	CHAH0105	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	4-0-0	123
	CHCK0120	Chemistry of S- and P- Block Elements, States of Matter and Chemical Kinetics	4-0-0	132
General Elective – III Lab	CHAH6105	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab	0-0-2	168
	CHCK6114	Chemistry of S- And P- Block Elements, States of Matter and Chemical Kinetics Lab	0-0-2	170
General Elective – IV	CHCF0106	Chemical Energetics, Equilibria & Functional Organic Chemistry	4-0-0	124
	CHOS0119	Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy	4-0-0	130
General Elective –IV (Chemistry) - Lab	CHCF6106	Chemical Energetics, Equilibria & Functional Organic Chemistry- Lab	0-0-2	169
	CHOS6113	Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy - Lab	0-0-2	169

DEPARTMENT OF ECONOMICS

BACHELOR OF ARTS - HONOURS IN ECONOMICS

Course Structure of BA Programme

SEMESTER I						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Core Course	ENME0028	Introductory Microeconomics	5-1-0	6	549
Theory	Core Course	ENMT0029	Mathematical Methods for Economics-I	5-1-0	6	550
Theory	Ability Enhancement Compulsory Course (AECC)	EGEC0107	English Communication	2-0-0	2	1011
Theory	Generic Elective Course (GEC) I					
				Total Credits	**20**	
SEMESTER II						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Core Course	ENME0030	Introductory Macroeconomics	5-1-0	6	552
Theory	Core Course	ENMS0031	Mathematical Methods for Economics-II	5-1-0	6	553
Theory	Ability Enhancement Compulsory Course (AECC)	CHES0002	Environmental Studies	2-0-0	2	
Theory	Generic Elective Course (GEC) II					
Theory	Service Learning		Service Learning	2-0-0	2	
				Total Credits	**20**	
SEMESTER III						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Core Course	ENIM0032	Intermediate Microeconomics-I	5-1-0	6	555
Theory	Core Course	ENIC0033	Intermediate Macroeconomics-I	5-1-0	6	556
Theory	Core Course	ENSM0034	Statistical Methods for Economics	5-1-0	6	557
Theory & Practical	Skill Enhancement Course (SEC)	ENDP0035	Data Collection and Presentation	2-0-0	2	558
Theory	Generic Elective Course (GEC) III					
				Total Credits	**26**	
SEMESTER IV						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Core Course	ENMI0039	Intermediate Microeconomics-II	5-1-0	6	562
Theory	Core Course	ENMA0040	Intermediate Macroeconomics-II	5-1-0	6	563
Theory	Core Course	ENIS0041	Introductory Econometrics	5-1-0	6	564
Theory & Practical	Skill Enhancement Course (SEC)	ENSD0042	Statistical Data Analysis	2-0-0	2	565
Theory	Generic Elective Course (GEC) IV					
				Total Credits	**26**	
SEMESTER V						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**

Theory	Core Course	ENIE0021	Indian Economy-I	5-1-0	6	570
Theory	Core Course	ENDE0046	Development Economics-I	5-1-0	6	571
Theory	Discipline Specific Elective Course (DSE) *(Any two from the list)*	ENHE0047	Economics of Health and Education	5-1-0	6x2=12	572
Theory & Practical		ENAE0048	Applied Econometrics			573
Theory		ENHI0044	Economic History of India (1857-1947)			574
Theory		ENTM0049	Topics in Microeconomics-I			575
Theory		ENPO0050	Political Economy-I			576
Theory		ENFM0051	Money and Financial Markets			577
Theory		ENPF0020	Public Economics			578
				Total Credits	**24**	
SEMESTER VI						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Core Course	ENIY0025	Indian Economy-II	5-1-0	6	579
Theory	Core Course	ENDE0052	Development Economics-II	5-1-0	6	580
Theory	Discipline Specific Elective Course (DSE) 3 & 4 *(Any two from the list)*	ENPC0053	Political Economy-II	5-1-0	6 x 2=12	581
Theory		ENCC0054	Comparative Economic Development (1850-1950)			583
Theory		ENFI0055	Financial Economics			584
Theory		ENTM0056	Topics in Microeconomics-II			585
Theory		ENEE0026	Environmental Economics			586
Theory		ENIE0024	International Economics			587
Dissertation		ENDI6001	Dissertation/Project			588
				Total Credits	**24**	
				Total Programme Credits in BA Economics	**140**	

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	590
Theory	Core Course	ENMY0047	Macroeconomic Analysis	4-0-0	4	591
Theory	Core Course	ENMM0048	Mathematical Methods in Economics	4-0-0	4	593
Theory	Core Course	ENEO0049	Economics of Development	4-0-0	4	594
Theory	Department Elective (DE)	ENMB0050	Money and Banking	3-0-0	3	595
Theory	School Elective (SE)	ENIP0051	Indian Economic Development	3-0-0	3	596
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	597
Theory	Core Course	ENEM0053	Econometric Methods	4-0-0	4	598
Theory	Core Course	ENPS0054	Public Economics	4-0-0	4	599
Theory	Core Course	ENDV0055	Indian Economic Development and Policy	4-0-0	4	600
Theory	School Elective (SE)	ENPB0056	Public Finance	3-0-0	3	601

				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	602
Theory	Core Course	ENES0058	Environmental Economics and Sustainability	4-0-0	4	603
Theory	Core Course	ENDI6003	Dissertation Phase I	2-0-0	2	605
Theory	Discipline Specific Elective (DSE) (Any one)	ENEG0059	Agriculture Economics - Issues and Management	4-0-0	4	606
Theory		ENED0060	Economics of Education			607
Theory	Discipline Specific Elective (DSE) (Any one)	EVHE0061	Health Economics	4-0-0	4	608
Theory		ENEI0062	Economics of Industry			609
				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	610
Theory	Core Course	ENPE0064	Population Economics	4-0-0	4	611
Theory	Core Course	ENDI6004	Dissertation Phase II	4-0-0	4	612
Theory	Discipline Specific Elective (DSE) (Any one)	ENOR0065	Operations Research	4-0-0	4	613
Theory		ENGE0066	Gender Economics			614
Theory		ENFE0067	Financial Economics			615
Theory	Discipline Specific Elective (DSE) (Any one)	ENRE0068	Rural Economy and Development	4-0-0	4	616
Theory		ENLE0069	Labour Economics			618
Theory		ENBE0070	Behavioural Economics			619
				Total Credits	**20**	
				Total Programme Credits in BA Economics	**83**	

BA Economics - LIST of VALUE ADDED COURSES

TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE
Theory cum Practical	Value added	ENOS6002	Operations of Stock Markets	1-0-1	2	

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
BACHELOR OF ARTS - HONOURS IN EDUCATION

SEMESTER I						
Type of Course	Category	Course Code	Course Title	L-T-P	Credits	Page No.
Theory	Core Course 1	EDFE0124	Foundations of Education	6(5-1-0)	6	623
	Core Course 2	EDTE0125	Theories and Principles of Education	6(5-1-0)	6	624
Theory	Ability Enhancement Course (AEC) - 1	EGEC0107	English Communication/MIL	2(2-0-0)	2	1011
	Generic Elective Course (GEC) I					
Orientation	Service Learning	EDSL0200				
				Total Credits	20	
SEMESTER II						
Theory	Core Course 3	EDPF0126	Philosophical Foundations of Education	6(5-1-0)	6	627
Theory	Core Course 4	EDES0127	Education and Society	6(5-1-0)	6	629

Theory	Ability Enhancement Course (AEC) - 2	CHES0002	Environmental Studies	2(2-0-0)	2	
	Generic Elective Course (GEC) II					
Theory	Service Learning	EDSL0200				
Total Credits					20	
SEMESTER III						
Theory	Core Course 5	EDPB0130	Psychological Bases of Education	6(5-1-0)	6	632
Theory	Core Course 6	EDDE0131	Distance Education	6(5-1-0)	6	633
Theory	Core Course 7	EDDI0132	Development of Education in India	6(5-1-0)	6	635
Practicum	Skill Enhancement Course (SEC) – I	EDSE0133	Life Skills Education	2(2-0-0)	2	636
	Generic Elective Course (GEC) III					
Practicum (Community Engagement)	Service Learning	EDSL0200				
Total Credits					26	
SEMESTER IV						
Theory	Core Course 8	EDET0135	Educational Thinkers	6(5-1-0)	6	639
Theory	Core Course 9	EDTC0136	Educational Technology	6(5-1-0)	6	640
Theory	Core Course 10	EDFC0137	Foundations of Curriculum Development	6(5-1-0)	6	641
Practicum	Skill Enhancement Course (SEC) – II	EDTS0138	Teaching Skills and Teaching Practice	2(1-0-1)	2	642
Theory	Generic Elective Course (GEC) IV					
Practicum (Community Engagement)	Service Learning	EDSL0200				
Total Credits					26	
SEMESTER V						
Theory	Core Course 11	EDME0140	Measurement and Evaluation in Education	6(5-1-0)	6	645
Theory	Core Course 12	EDIE0141	Inclusive Education	6(5-1-0)	6	646
Theory	Discipline Specific Elective (DSE)-I (Course I and Course II) (Choose any two)	EDHR0142	Human Rights Education	6(5-1-0) X 2	6+6	648
		EDES0143	Elementary Statistics in Education			649
		EDAE0144	Adult Education			650
		EDSP0145	Special Education			651
		EDEE0146	Economics of Education			652
		EDHG0147	Human Growth and Development			655
Practicum (Community Engagement)	Service Learning	EDSL0200				
Total Credits					24	
SEMESTER VI						
Theory	Core Course 13	EDTL0148	Teaching Learning Method on Pedagogy	6(5-1-0)	6	656
Theory	Core Course 14	EDEM0149	Educational Management and Administration	6(5-1-0)	6	658

Theory	Discipline Specific Elective (DSE) (Course III and Course IV) (Choose any two)	EDTE0150	Teacher Education	6(5-1-0) X 2	6+6	659
		EDEE0151	Environmental Education			660
		EDPN0152	Physical Education			662
		EDPE0153	Peace Education			664
		EDIT0154	Instructional technology			666
		EDER0155	Elements of Research			667
Practicum (Community Engagement)	Service Learning	EDSL0200				
Total Credits					24	
				TOTAL PROGRAMME CREDITS	**140**	

MASTER OF ARTS IN EDUCATION

SEMESTER I					
Type of Course	Category	Course Code	Course Title	Credits	Page No.
Theory	DC	EDFE0011	Philosophical Foundations of Education	4(4-0-0)	689
	DC	EDEP0012	Fundamentals of Educational Psychology	4(4-0-0)	691
	DC	EDTE0013	Emerging Trends in Education	3(3-0-0)	694
	DC	EDDE0014	History and Development of Education in India	3(3-0-0)	696
	Elective Group I				
	DE	EDET0015	Educational Technology	3(3-0-0)	698
	Elective Group II				
	DE	EDLR0007	Leadership and Social Responsibility	3(3-0-0)	688
Practicum	DC	EDJG6002	Journaling – A Technique for Personal and Academic Growth	3(3-0-0)	732
Total Credits				23	
SEMESTER II					
Theory	DC	EDSF0017	Sociological Foundations of Education	4(4-0-0)	702
	DC	EDRM0034	Research Methodology in Education	4(4-0-0)	731
	DC	EDTK0018	Knowledge and Curriculum	3(3-0-0)	704
	Specialisation Courses: One area of Concentration to be opted (Educational Leadership/Educational Psychology)				
	DC	EDEL0019	Developing Educational Leadership	3(3-0-0)	706
	DC	EDDL0020	Human Development and Learning	3(3-0-0)	708
	Elective Group I				
	Elective Group II				
	DE	EDPC0016	Peace Education and Conflict Management	3(3-0-0)	700
Practicum	DC	EDES6003	Educational Seminar I	2	734
	SE	SWCA6010	Computer Applications for Social Sciences (Lab)	2	

	DC	EDSV6004	School Visits	2	734
	Total Credits			26	
SEMESTER III					
Theory	DC	EDCI0021	Curriculum Development and Instruction	3	710
	DC	EDTP0022	Principles and Techniques of Teaching and Pedagogy	3	712
	DC	EDTE0023	Teacher Education	3	713
	DC	EDME0024	Measurement and Evaluation in Education	3	668
	SPECIALIZATION COURSES				
	Educational Leadership				
	DC	EDPL0025	Educational Law and Government Policy	3	717
	DC	EDFM0026	Financial Management and Accounting	3	718
	Educational Psychology				
	DC	EDLE0027	Life Span Development and Education	3	720
	DC	EDLI0028	Learning and Individual Differences	3	721
Practicum	DC	EDDI6005	Dissertation Phase I	2	735
	DC	EDES6009	Educational Seminar II	2	739
	DC	EDTP6010	Teaching Practice	2	740
		Total Credits		24	
SEMESTER IV					
Theory	DC	EDOC0029	Organisational Communication	3	723
	SPECIALIZATION COURSES				
	Educational Leadership				
	DC	EDEA0030	Educational Administration	3	725
	DC	EDSR0031	Ethics and Social Responsibility in Education	3	727
	Educational Psychology				
	DC	EDSP0032	Counselling Skills for Educational Psychologists	3	728
	DC	EDCA0033	Child and Adolescent Mental Health	3	729
Practicum	DC	EDDI6007	Dissertation Phase II	4	736
	DC	EDIN6008	Internship	3	738
	Total Credits			16	
	TOTAL PROGRAMME CREDITS			89	

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	745
		EDTT6012	Teacher and Teaching Skills	1-0-1	2	746

DEPARTMENT OF MASS COMMUNICATION

BACHELOR OF ARTS - HONOURS IN MASS COMMUNICATION

SEMESTER I						
Type of Course	Category	Course Code	Course Name	L-T-P	Credits	Page No.
Theory	Core Course 1	MCMC0131	Introduction to Media and Communication	5-1-0	6	811
Theory	Core Course 2	MCIJ00132	Introduction to Journalism	5-1-0	6	812
Theory	Ability Enhancement Course (AEC) - 1	EGEC0107	English Communication/MIL	0-0-2	2	1011
Theory	Generic Elective Course (GEC) – I (Anyone)	LSWC0105	Academic Writing and Composition	5-1-0	6	
Theory		PCGP0126	General Psychology			
Theory		EDGC0128	Guidance and Counselling			
Theory		ENIE0028	Introductory Microeconomics			
Total Credits					22	
SEMESTER II						
Theory	Core Course 3	MCHM0133	History of Media	5-1-0	6	813
Theory	Core Course 4	MCVC0134	Visual Communication	4-0-0	4	814
Practicum		MCGD6103	Graphic Design	0-0-2	2	820
Theory	Ability Enhancement Course (AEC) - 2	CHES0002	Environmental Studies	2-0-0	2	
Theory	Generic Elective Course (GEC) – II (Anyone)	EGCE0113	Contemporary India: Women and Empowerment	5-1-0	6	
Theory		EDGE0129	Gender Education			
Theory		ENIS0029	Introductory Macroeconomics			
Theory		PCHW0127	Psychology for Health and Well being			
Theory	Service Learning	MCLS0100	Community Media	2-0-0	2	810
Total Credits					20	
SEMESTER III						
Theory	Core Course 5	MCIB 0141	Introduction to Broadcast Media	4-0-0	4	821
Practicum		MCTP0142	Television Production	0-0-2	2	822
Theory	Core Course 6	MCNM0143	Introduction to New Media	5-1-0	6	823
Theory	Core Course 7	MCSC0144	Media Culture and Society	5-1-0	6	824
Practicum	Skill Enhancement Course (SEC) – I (Anyone)	MCRP6104	Radio Production	0-0-2	2	825
		MCIC0145	Introduction to Computer Applications	0-0-2	2	825
Theory	Generic Elective Course (GEC) - III (Anyone)		Language and Linguistics	5-1-0	6	
Theory			Population Education			
Theory			Indian Economy -I			
Theory			Psychology and Media			
Total Credits					26	
SEMESTER IV						
Theory	Core Course 8	MCPR0146	Advertising and Public Relations	5-1-0	6	828
Theory	Core Course 9	MCDC0147	Development Communication	5-1-0	6	829
Theory	Core Course 10	MCLE0148	Media Laws and Ethics	5-1-0	6	830
Practicum	Skill Enhancement Course (SEC) – II (Any one)	MCNA6105	News Reading and Anchoring	0-0-2	2	831
Practicum		MCFM0149	Folk Media	0-0-2	2	832
Theory	Generic Elective Course (GEC) - IV		Language, Literature and Culture			

Theory	(Any one)		Early Childhood Care & Education			
Theory			Indian Economy -II	5-1-0	6	
Theory			Psychology at Work			
Total Credits					26	
SEMESTER V						
Theory	Core Course 10	MCIR0150	Introduction to Research	5-1-0	6	833
Theory	Core Course 12	MCAB0151	Advance Broadcast Media	5-1-0	6	834
Theory	Group - I Discipline Specific Elective (DSE) (Any One)	MCME0152	Media Management and Entrepreneurship	5-1-0	6	835
Theory		MCPH0153	Art and Practice of Digital Photography	4-0-0	4	836
Practicum		MCPH6106	Photography	0-0-2	2	837
Theory	Group - II Discipline Specific Elective (DSE) (Any one)	MCDM0154	Communication and Disaster Management	5-1-0	6	837
Theory		MCVF0155	Introduction to Animation and VFX	4-0-0	4	838
Practicum		MCVF6107	Animation and VFX	0-0-0	2	839
Internship	Compulsory (Non-Credited Course)	MCIN6108	Internship			839
Total Credits					24	
SEMESTER VI						
Theory	Core Course 13	NCGM0156	Global Media and Politics	5-1-0	6	839
Theory	Core Course 14	MCIF0157	Introduction to Film Studies	4-0-0	4	840
Practicum		MCDP6109	Documentary Production	0-0-2	2	842
Theory	Group-III Discipline Specific Elective (DSE) (Any one)	MCNE0158	Media in North East India	5-1-0	6	843
		MCHR0159	Human Rights and Conflict Reporting	5-1-0	6	843
Project	Group-IV Discipline Specific Elective (DSE) (Any one)	MCMP6110	Media Project	0-0-6	6	844
Practicum		MCDI6111	Dissertation	0-0-6	6	845
Total Credits					24	
TOTAL PROGRAMME CREDITS					140	

MASTER OF ARTS IN MASS COMMUNICATION

SEMESTER - I					
Type	Category	Course Code	Name	Credits	Page No.
Theory	DC	MCHD0028	History and Development of Communication Media	3	802
	DC	MCPC0029	Philosophy of Communication	3	803
	DC	MCTC0030	Theoretical Perspectives of Communication	4	804
	DC	MCPJ0031	Principles and Practices of Journalism	4	805
	Elective 1: One Course to Be Opted				
Theory	SE	PCEC0013	Eastern Approaches to Psychology and Counselling	3	
	SE	EDET0015	Education Technology	3	
	SE	SWEM0038	Environment and Disaster Management	3	
	Elective 2: One Course to Be Opted				
Theory	DE	MCML0027	Media Literacy	3	801
	SE	EDLR0007	Leadership and Social Responsibility	3	
	SE	SWGS0039	Gender Studies	3	
	SE	LSET0019	English Language Teaching	3	

Practicum	DC	MCTP6015	Techniques of Photography and Image Editing	2	818
Practicum	DC	MCJG6016	Journaling	1	819
Theory	Service Learning	MCLS0100	Community Media	2	801
Total Credits				26	
SEMESTER - II					
Theory	DC	MCID0032	Investigative and Data Driven Journalism	3	806
Theory	DC	MCTS0033	Theories of Development Communication and Social Change	4	807
Theory	DC	MCRM0034	Media and Communication Research Methodology	4	808
Theory	DC	MCDM0035	Digital Media	3	809
	Elective 1: One Course to Be Opted				
Theory	SE	SWDS0044	Introduction to Disability Studies	3	
Theory	SE	PCPD0007	Personality Development		
Theory	DE	MCRC0026	Rural Communication		800
	Elective 2: One Course to Be Opted				
Theory	SE	PCSP0006	Introduction to Social Psychology	3	
Theory	SE	EDPC0016	Peace Education and Conflict Management		
Theory	SE	SWEM0038	Environment and Disaster Management		
Theory	SE	LSNE0020	North-East Indian Literature in English		
Practicum	DC	MCDI6017	Dissertation Phase - I	2	819
Practicum	DC	MCAV6018	Audio-Video Production	2	820
Total Credits				21	
SEMESTER- III					
Theory	DC	MCML0037	Media Laws, Ethics and Social Responsibility	3	845
Theory	DC	MCAM0038	Advertising, Marketing and Public Relations	3	846
Practicum	DC	MCDP6019	Dissertation Phase - II	2	847
	Specialization: Electronic Media				
Theory	DC	MCAV0039	Audio-Video Editing	3	848
Theory	DC	MCTV0040	Television and Video Production	4	849
Theory	DC	MCSM0041	Sound for Media	4	850
	Specialization: Print Media				
Theory	DC	MCPC0042	Political Communication	3	851
Theory	DC	MCNR043	News Reporting and Editing	4	852
Theory	DC	MCHE0044	Health and Environmental Communication	4	853
	Specialization: Communication for Development				
Theory	DC	MCPM0045	Programme Management	3	854
Theory	DC	MCSA0046	Situation Analysis for Communication Strategy	4	855
Theory	DC	MCCA0047	Planning Models and Communication Approaches	4	855
Total Credits				19	
SEMESTER - IV					
Theory	DC	MCMC0048	Media and Cultural Studies	3	856
Practicum	DC	MCIP6020	Internship	5	857
	Specialization: Electronic Media				
Theory	DC	MCFA0049	Film Appreciation	3	858
Project	DC	MCFP6021	Final Project	5	859
	Specialization: Print Media				

Theory	DC	MCBJ0050	Business Journalism	3	859
Project	DC	MCFP6021	Final Project	5	860
	Specialization: Communication for Development				
Theory	DC	MCPM0051	Project Monitoring and Evaluation	3	861
Project	DC	MCFP6021	Final Project	5	862
Total Credits				16	
TOTAL PROGRAMME CREDITS				82	

LIST OF VALUE-ADDED COURSES

Course Type	Category	Course Code	Name of Paper	T-L-P	Credits	Page No.
Theory & Practicum	Value Added	MCCS6122	Communication Skills	1-0-1	2	862
Theory & Practicum		MCCW6123	Creative Writing	1-0-1	2	863
Theory & Practicum		MCEM6124	Event Management	1-0-1	2	864

DEPARTMENT OF PSYCHOLOGY

BACHELOR OF ARTS – HONOURS IN PSYCHOLOGY

**** Wherever there is a practical there will be no tutorial and Vice versa***

SEMESTER I						
Type of Course	Category	Course Code	Course Title	L-T-P	Credits	Page No.
Theory	Core Course 1	PPCIP0122	Introduction to Psychology	4(4-0-0)	4	873
	Core Course 2	PCBP0123	Biopsychology	5-1-0	6	875
Theory	Ability Enhancement Course - 1	EGEC0107	English Communication/MIL	2-0-0	2	1011
	Generic Elective Course (GEC) I					
Practicum	Practicum	PCIP6104	Introduction to Psychology - Practicum	2(0-0-2)	2	
Theory	Service Learning (Orientation)	PCSL0200				
Total Credits					20	
SEMESTER II						
Theory	Core Course 3	PCPI0124	Psychology of Individual Differences	4(4-0-0)	4	878
Theory	Core Course 4	PCSR0125	Statistical Methods for Psychological Research - I	5-1-0	6	880
Theory	Ability Enhancement Course - 2	CHES0002	Environmental Studies	2(0-0-2)	2	
	Generic Elective Course (GEC) II					
Practicum	Practicum	PCIP6105	Psychology of Individual Differences - Practicum	2(0-0-2)	2	879
Theory	Service Learning	PCSL0200				
Total Credits					20	
SEMESTER III						
Theory	Core Course 5	PCPR0128	Psychological Research	4(4-0-0)	4	883
Theory	Core Course 6	PCDT0129	Development of Psychological Thought	5-1-0	6	884
Theory	Core Course 7	PCSY0130	Social Psychology	5-1-0	6	885

Theory	Skill Enhancement Course – I	PCSM0131	Stress Management	2-0-0	2	886
	Generic Elective Course (GEC) III					
Practicum	Practicum		Photography Practicum	2(0-0-2)	2	
Practicum	Practicum	PCPR6106	Psychological Research-Practicum	2(0-0-2)	2	888
Practicum	Service Learning	PCSL0200				
Total Credits					26	
SEMESTER IV						
Theory	Core Course 8	PCSM0133	Statistical Methods for Psychological Research - II	5-1-0	6	889
Theory	Core Course 9	PCDP0134	Developmental Psychology	5-1-0	6	890
Theory	Core Course 10	PCPA0135	Applied Social Psychology	4(4-0-0)	4	891
Practicum	Skill Enhancement Course – II	PCEM0136	Emotional Intelligence	2-0-0	2	892
	Generic Elective Course (GEC) IV					
Practicum	Practicum	PCAP6107	Applied Social Psychology-Practicum	2(0-0-2)	2	894
Practicum	Service Learning	PCSL0200				
Total Credits					26	
SEMESTER V						
Theory	Core Course 11	PCUD0138	Understanding Psychological Disorders	5-1-0	6	
Theory	Core Course 12	PCOB0139	Organizational Behaviour	4(0-0-0)	4	
Theory	Discipline Specific Elective)-I (Course I and Course II) (Choose any two)	PCPP0140	Positive Psychology	4(4-0-0)	4	
		PCHP0141	Health Psychology	4(4-0-0)	4	
		PCHR0142	Human Resource Management	4(4-0-0)	4	
Practicum	Discipline Specific Elective (DSE)-I (Course I and Course II) (Choose any two)	PCPP6108	Positive Psychology-Practicum	2-0-0	2	
		PCHP6109	Health Psychology-Practicum	2-0-0	2	
		PCHR6110	Human Resource Management-Practicum	2-0-0	2	
Practicum	Practicum	PCOB6111	Organizational Behaviour-Practicum	2-0-0	2	
Practicum	Service Learning	PCSL0200				
Total Credits					24	
SEMESTER VI						
Theory	Core Course 13	PCPD0143	Understanding and dealing with Psychological Disorders	5-1-0	6	
Theory	Core Course 14	PCCP0144	Counselling Psychology	4(0-0-0)	4	
Theory	Discipline Specific Elective (DSE) (Course III and Course IV) (Choose any two)	PCCY0145	Community Psychology	4(4-0-0)	4	
		PCIP0146	Cultural and Indigenous Psychology	4(4-0-0)	4	
Practicum		PCDI6112	Project/ Dissertation	6	6	
Practicum	Discipline Specific Elective (DSE) (Course III and Course IV) (Choose any two)	PCCY6113	Community Psychology-Practicum	2-0-0	2	
		PCIP6114	Cultural and Indigenous Psychology-Practicum	2-0-0	2	
Practicum	Practicum	PCCP6115	Counselling Psychology-Practicum	2-0-0	2	
Practicum	Service Learning	PCSL0200				
Total Credits					24	
TOTAL PROGRAMME CREDITS					140	

MASTER OF SCIENCE PSYCHOLOGY (Clinical/Counselling Psychology)

SEMESTER I					
Type of Course	Category	Course Code	Course Title	Credits	Page No.
Theory	Core Course	PCTP0020	Theories of Personality	4	908
		PCMH0021	Concepts of Mental Health and Illness-I	4	909
		PCRM0022	Research Method and Statistics in Social Sciences	4	910
		PCCP0023	Cognitive Psychology	3	911
	Elective 1: One Course to Be Opted				
	SE	PCEC0013	Eastern Approaches to Psychology and Counselling	3	913
	SE	EDET0015	Education Technology	3	
	SE	SWEM0038	Environment and Disaster Management	3	
	Elective 2: One Course to Be Opted				
	DE	MCML0027	Media Literacy	3	
	SE	EDLR0007	Leadership and Social Responsibility	3	
	SE	SWGS0039	Gender Studies	3	
	SE	LSET0019	English Language Teaching	3	
	SE	PCGP0024	General Psychology	3	914
Practicum	DC	****	Practicum (NO TITLE)	2	
	DC	PCPG6018	Personal Growth	P/NP	916
		Total Credits		23	
SEMESTER II					
Theory	DC	PCCM0025	Concepts of Mental Health and Illness-II	4	917
	DC	PCBP0026	Bio- psychology	3	918
	DC	PCPT0027	Psychological Testing	4	919
	Elective 1: One Course to Be Opted				
	SE	PCHT0028	Health Psychology	3	920
	SE	SWDS0044	Introduction to Disability Studies		921
	DE	MCRC0026	Rural Communication		
	Elective 2: One Course to Be Opted				
	SE	PCSP0006	Introduction to Social Psychology	3	
	SE	EDPC0016	Peace Education and Conflict Management		
	SE	SWEM0038	Environment and Disaster Management		
	SE	LSNE0020	North-East Indian Literature in English		
Practicum		******	Practicum (NO TITLE)	2	
		******	Field Work (NO TITLE)	2	
	DC	PCFA6019	Psychological First Aid	P/NP	924
		Total Credits		21	
SEMESTER III (COUNSELLING PSYCHOLOGY SPECIALIZATION)					
Theory	DC	PCFP0029	Foundations of Counseling Psychology	4	925
	DC	PCCY0030	Child and Youth Counseling	3	926
	DC	PCDR0031	Disability and Rehabilitation Psychology	4	927
Practicum	DC	PCRP6020	Research Project Phase-I	4	933
	DC	****	Practicum-III (NO TITLE)	2	

	DC	PCSI6021	Supervised Internship Phase-I	4	933
	DC	PCIP6022	Summer Internship	P/NP	934
	DC	PCST6023	Study Tour	P/NP	935
		Total Credits		21	
SEMESTER IV (COUNSELLING PSYCHOLOGY SPECIALIZATION)					
Theory	DC	PCAT0032	Addiction and Trauma Counselling	3	636
	DC	PCMF0033	Marriage and Family Counselling	4	637
Practicum	DC	*****	Practicum-IV (NO TITLE)	2	
	DC	PCSI6024	Supervised Internship Phase-II	8	942
	DC	PCRP6025	Research Project Phase-II	6	941
		Total Credits		23	
SEMESTER III (CLINICAL PSYCHOLOGY SPECIALIZATION)					
Theory	Core Course	PCFC0034	Foundations of Clinical Psychology	4	929
		PCPG0035	Psychodiagnostics	4	930
		PCRP0036	Forensic Psychology	3	931
	Practicum	PCRP6020	Research Project Phase-I	4	933
		****	Practicum-III (NO TITLE)	2	
		PCSI6021	Supervised Internship Phase-I	4	933
Practicum		PCIP6022	Summer Internship	P/NP	934
		PCST6023	Study Tour	P/NP	935
		Total Credits		21	
SEMESTER IV (CLINICAL PSYCHOLOGY SPECIALIZATION)					
Theory	Core Course	PCPC0037	Psychotherapy	4	938
		PCNP0038	Neuropsychology	3	939
Practicum	Practicum	******	Practicum-IV (NO TITLE)	2	
		PCSI6024	Supervised Internship Phase-II	8	942
		PCRP6025	Research Project Phase-II	6	941
		Total Credits		23	
		TOTAL PROGRAMME CREDITS		88	

LIST OF VALUE-ADDED COURSES – BA Psychology

Course Type	Category	Course Code	Name of Paper	L-T-P	Page No
Theory & Practicum	Value Added	PDWK6116	Working for Diversity	2-0-0	
Theory & Practicum	Value Added	PDSP6117	School Psychology	2-0-0	
Theory & Practicum	Value Added	PDCM6118	Community Mental Health	2-0-0	
Theory & Practicum	Value Added	PCLS6119	Life Skills Education	2-0-0	

LIST OF VALUE-ADDED COURSES – MSc Psychology

Course Type	Category	Course Code	Name of Paper	L-T-P	Page No
Theory & Practicum	Value Added	PCWO6026	Working for Diversity	2-0-0	
Theory & Practicum	Value Added	PCSO6027	School Psychology	2-0-0	
Theory & Practicum	Value Added	PCCO6027	Community Mental Health	2-0-0	

Theory & Practicum	Value Added	PCLS6028	Life Skills Education	2-0-0	

DEPARTMENT OF SOCIAL WORK

MASTER OF SOCIAL WORK

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	951
Theory	Departmental core	SWGD0036	Human Growth and Development	2-0-0	2	952
Theory	Departmental core	SWIS0037	Introduction to Indian Society, Polity and Economics	2-0-0	2	953
Theory	Departmental core	SWCS0070	Social Work with Communities and Social Action	3-0-0	3	955
Theory	School Elective	SWEM0038	Environment and Disaster Management	3-0-0	3	956
Theory	Departmental Elective	SWGS0039	Gender Studies	3-0-0	3	958
Practicum	Departmental Core	SWFR6008	Concurrent Field Work	0-0-16	6	1000
Practicum	Departmental Core	SWSL0200	Participatory Service Learning –Rural Practicum	30-0-50 in 10 days	2	1003
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	959
Theory	Departmental core	SWPG0041	Social Work Practice with Groups	3-0-0	3	960
Theory	Departmental core	SWRS0042	Social Work Research and Statistics	3-0-0	3	961
Theory	Departmental core	SWWA0043	Social Welfare Administration	3-0-0	3	963
Theory	Departmental Elective	SWDS0044	Introduction to Disability Studies	3-0-0	3	964
Theory	Departmental Elective	SWEM0038	Environment and Disaster Management	3-0-0	3	956
Practicum	Departmental Core	SWFW6009	Concurrent Field Work II	0-0-16	6	1000
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	965
Theory	Departmental core	SWES0046	Emerging Social Work Perspectives and Integrated Approach	3-0-0	3	967
Theory	Departmental core	SWCA0047	Computer Applications for Social Sciences (Lab)	0-0-2	2	1001
Theory	Departmental Elective	SWRT0048	Community Development: Rural, Tribal and Urban	3-0-0	3	968
Theory	Departmental Elective	SWGC0049	Governance and Community Development	3-0-0	3	970
Theory	Departmental Elective	SWCS0050	Family Centered Social Work Practice	3-0-0	3	971
Theory	Departmental Elective	SWPC0051	Social Work Practice with Children	3-0-0	3	972
Theory	Departmental Elective	SWMS0052	Medical Social Work	3-0-0	3	974
Theory	Departmental Elective	SWHS0053	Mental Health and Social Work	3-0-0	3	975
Theory	Departmental Elective	SWOD0054	Organisational Structure, Behaviour and Development	3-0-0	3	976
Theory	Departmental Elective	SWDO0055	Policies for Development Organisations -	3-0-0	3	977

			Urban, Rural and Tribal Communities			
Theory	Departmental Elective	SWCP0056	Introduction to Child Psychology and Development	3-0-0	3	978
Theory	Departmental Elective	SWRC0057	Rights of the Child – Legal Framework, National And International Instruments	3-0-0	3	980
Internship	Departmental Core	SWFW6010	Continuous Field Work I	0-0-200 In one month	6	1001
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	981
Theory	Departmental core	SWPM0059	Project cycle Management and Resource Mobilisation	3-0-0	3	983
Dissertation	Departmental core	SWDI6011	Dissertation	2-2-2	6	1002
Theory	Departmental Elective	SWHP0060	Community Health and Population Management	3-0-0	3	984
Theory	Departmental Elective	SWDC0061	Community Development Practice with Disempowered Communities	3-0-0	3	985
Theory	Departmental Elective	SWWE0062	Development Concerns and Women Empowerment	3-0-0	3	986
Theory	Departmental Elective	SWSN0063	Families With Special Needs	3-0-0	3	987
Theory	Departmental Elective	SWPW0064	Psychiatric Social Work	3-0-0	3	989
Theory	Departmental Elective	SWCH0065	Community Health and Services	3-0-0	3	990
Theory	Departmental Elective	SWHR0066	Human Resource Management: Social Work Perspective	3-0-0	3	991
Theory	Departmental Elective	SWCI0067	Corporate Social Responsibilities - Concepts & Ideologies	3-0-0	3	993
Theory	Departmental Elective	SWSP0068	Children with Special Needs	3-0-0	3	994
Theory	Departmental Elective	SWSW0069	Child Centered Social Work Practice	3-0-0	3	995
Internship	Departmental Core	SWCF6012	Continuous Fieldwork II	0-0-200 In one month	6	1002
Internship	Departmental Core	SWIN6013	Internship	0-0-200 In one month	P/NP	1003
VALUE ADDED COURSES						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory & Practicum	Value Added	SWRB6014	Results Based Management of Projects and programmes	15-0-15	2	997
Theory & Practicum	Value Added	SWAW6015	Academic Writing, Research Proposal Development and Dissertation Writing Course	15-0-15	2	997
Theory & Practicum	Value Added	SWWD6016	Working with Diversity	15-0-15	2	999

DEPARTMENT OF ENGLISH

BACHELOR OF ARTS - HONOURS IN ENGLISH

Course Structure of BA Programme

SEMESTER I						
TYPE	CATEGORY	COURSECODE	COURSE TITLE	L-T-P	CREDITS	PAGE
Theory	Core Course 1	EGBP0101	British Poetry and Drama: 14th to 17th Centuries	6(5-1-0)	6	1007
Theory	Core Course 2	EGPD0103	British Poetry and Drama: 17th and 18th Centuries	6(5-1-0)	6	1009
Theory	AECC 1	EGEC0107	English Communication/MIL	2(2-0-0)	2	1011
	Generic Elective Course (GEC) I					
Orientation	Service Learning	EGSL0200	Language Communication			
SEMESTER II						
Theory	Core Course 3	EGBL0102	British Literature: 18th Centuries	6(5-1-0)	6	1008
Theory	Core Course 4	EGBR0114	British Romantic Literature	6(5-1-0)	6	1013
Theory	AECC 2	CHES0002	Environmental Studies	2(2-0-0)	2	92
	Generic Elective Course (GEC) 2					
Theory	Service Learning	EGSL0200	Language Communication	2	2	1064
SEMESTER III						
Theory	Core Course 5	EGLE0104	British Literature- 19th Century		6	1009
Theory	Core Course 6	EGEC0115	British Literature: The Early 20th century		6	1014
Theory	Core Course 7	EGCL0116	European Classical Literature		6	1015
Theory	SEC 1	EGCW0117	Creative Writing	2(2-0-0)	2	1015
Theory		EGSS0118	Soft Skills			1016
	Generic Elective Course (GEC) 3					
Practicum	Service Learning	EGSL0200	Language Communication			1064
SEMESTER IV						
Theory	Core Course 8	EGIC0120	Indian Classical Literature	6(5-1-0)	6	1018
Theory	Core Course 9	EGAM0121	American Literature	6(5-1-0)	6	1019
Theory	Core Course10	EGME0122	Modern European Drama	6(5-1-0)	6	1019
Theory	SEC 2	EGLT0123	English Language Teaching	2(2-0-0)	2	1020
Theory		EGTS0124	Translation Studies			1021
	Generic Elective Course (GEC) 4					
Practicum	Service Learning	EGSL0200	Language Communication			1064
SEMESTER V						
Theory	Core Course11	EGPL0126	Post-Colonial Literature	6(5-1-0)	6	1022
Theory	Core Course 12	EGIE0127	Indian Writing in English	6(5-1-0)	6	1024
Theory		EGLM0128	Literary Criticism	6(5-1-0)	6	1025
Theory	DSE 1	EGPW130	British Literature: Post World War II			1027
Theory		EGLD0129	Literature of Indian Diaspora	6(5-1-0)	6	1026
Theory	DSE 2	EGSD0131	Science Fiction and Detective Literature			1028
Practicum	Service Learning	EGSL0200	Language Communication			1064
SEMESTER VI						
Theory	Core Course13	EGPL0132	Popular Literature	6(5-1-0)	6	1029
Theory	Core Course 14	EGWW0133	Women's writings	6(5-1-0)	6	1029
Theory	DSE 3	EGLY0134	Literary Theory	6(5-1-0)	6	1030
Theory		EGTW0136	Travel Writing			1032
Theory	DSE 4	EGPL0135	Partition Literature	6(5-1-0)	6	1031
Theory		EGAU0137	Autobiography			1033

Practicum	Service Learning	EGSL0200	Language Communication			1064

MASTER OF ARTS IN ENGLISH

SEMESTER I					
TYPE	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CREDITS**	**PAGE**
Theory	EGEP0001	Chaucer to Elizabethan Period – Poetry, Drama and Romance	DC	4	1037
	EGLS0002	Literary and Social History of England - Chaucer to Elizabethan Period	DC	3	1038
	EGSD0003	Shakespearean Drama I – Comedy and History Plays	DC	4	1039
	EGRP0004	Rhetoric and Prosody		2	1039
	Elective I One course to be chosen				
	EGTS0005	T.S. Eliot	DE	3	1040
	EGTH0006	Thomas Hardy	DE		1041
	Elective II One course to be chosen				
	MCML0027	Media Literacy	SE	3	
	EDLR0007	Leadership and Social Responsibility	DE		
	SWGS0039	Gender studies	SE		
	EGET0007	English Language Teaching	SE		1042
Seminar	EGSM6001	Seminar and Presentation I	DC	1	1060
Orientation	EGSL0200	Service Learning-Language Communication			1064
Total Credits				20	
SEMESTER II					
Theory	EGRR0008	Restoration to Romantic Period – Poetry and Drama	DC	4	1043
	EGLC0028	Literary Criticism – Plato to F.R. Leavis and Select Twentieth Century Perspectives	DC	4	1059
	EGSH0010	Shakespearean Drama II – Tragedy and Tragi-Comedy	DC	4	1044
	EGAL0011	Approaches to Language and Literary Research	DC	3	1044
	Elective I One course to be chosen				
	EGTR0012	Classics in Translation	DE	3	1045
	EGIW0013	Indian Women Writers	DE		1046
	Elective II One course to be chosen				
	SWEM0038	Environment and Disaster Management	SE		
	EDPC0016	Peace Education and Conflict Management	SE		
	PCSP0006	Introduction to Social Psychology	SE		
	EGNE0014	North-East Indian Literature in English	DE		1047
Seminar	EGSP6002	Seminar and Presentation II	DC	1	1061
Theory	EGSL0200	Service Learning-Language Communication			1064
SEMESTER III					
Theory	EGVP0015	Victorian to Post-Modern Period – Poetry, Drama & Fiction	DC	4	1048
	EGPL0016	Post-Colonial Literature – Poetry, Drama & Fiction	DC	3	1049
	EGAL0017	American literature – Poetry, Drama & Fiction	DC	3	1050
	EGLT0018	Literary and Critical Theory	DC	4	1051
	EGGN0019	Gender and Literature	DC	2	1052
	Specialisation Course: Language and Linguistics				
	EGLS0020	Linguistics and Stylistics I	DC	3	1053
	Specialization Paper: European Literature				
	EGIM0021	Introduction to Modern European Literature I	DC	3	1053
	Specialization Paper: African Literature				
	EGAL0022	Colonial and Post- Colonial African Literature I	DC	3	1054
Project	EGPP6003	Project Phase I	DC	3	1063
Practical (Community Engagement)	EGSL0200	Service Learning-Language Communication			1064
Total Credits				21	

COURSE STRUCTURE

SEMESTER IV					
Theory	EGIW0023	Indian Writing in English – Poetry, Drama & Fiction	DC	4	1055
	EGSA0024	South-Asian Literature	DC	4	1056
	Specialization Paper: Language and Linguistics				
	EGLS0025	Linguistics and Stylistics II	DC	3	1057
	Specialization Paper: European Literature				
	EGEL0026	Introduction to Modern European Literature II	DC	3	1058
	Specialization Paper: African Literature				
	EGPC0027	Colonial and Post- Colonial African Literature II	DC	3	1059
Project	EGPP6004	Project Phase II- Dissertation	DC	8	1063
Practical (Community Engagement)	EGSL0200	Service Learning-Language Communication			1064
Total Credits				19	
Total Programme Credits				80	

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	1065
		EGML0028	Myths in Literature	2-0-0	2	1066

GENERIC ELECTIVE COURSES

BA ECONOMICS						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Generic Elective Course (GEC)I	ENIE0028	Introductory Microeconomics	5-1-0	6	551
Theory	Generic Elective Course (GEC) II	ENIS0029	Introductory Macroeconomics	5-1-0	6	552
Theory	Generic Elective Course (GEC) III *(Any One)*	ENIE0036	Indian Economy-I	5-1-0	6	559
Theory		ENMB0037	Money and Banking			560
Theory		ENEE0038	Environmental Economics			61
Theory	Generic Elective Course (GEC) IV *(Any One)*	ENIE0043	Indian Economy-II	5-1-0	6	566
Theory		ENHI0044	Economic History of India 1857-1947			567
Theory		ENPF0045	Public Finance			568
MA ECONOMICS						
SEMESTER I						
TYPE	**CATEGORY**	**COURSE CODE**	**COURSE TITLE**	**L-T-P**	**CREDITS**	**PAGE**
Theory	Department Elective (DE)	ENMB0050	Money and Banking	3-0-0	3	595
Theory	School Elective (SE)	ENDV0055	Indian Economic Development	3-0-0	3	600
SEMESTER II						
Theory	School Elective (SE)	ENPB0056	Public Finance	3-0-0	3	601

BA EDUCATION						
Course Type	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page No.**
Theory	Generic Elective Course (GEC) – I	EDGC0128	Guidance and Counselling	5-1-0	6	626
Theory	Generic Elective Course (GEC) – II	EDGE0129	Gender Education	5-1-0	6	630
Theory	Generic Elective Course (GEC) - III	EDPE0134	Population Education	5-1-0	6	637
Theory	Generic Elective Course (GEC) – IV	EDCC0139	Early Childhood Care and Education	5-1-0	6	644
MA EDUCATION						
Theory	DE	EDET0015	Educational Technology	3-0-0	3	670
Theory	DE	EDLR0007	Leadership and Social Responsibility	3-0-0	3	688
Theory	DE	EDPC0016	Peace Education and Conflict Management	3-0-0	3	700

BA MASS COMMUNICATION						
Course Type	**Category**	**Course Code**	**Name of Paper**	**T-L-P**	**Credits**	**Page No.**
Theory	Generic Elective Course (GEC) – I	MCPC0135	Professional Communication	5-1-0	6	815
Theory	Generic Elective Course (GEC) – II	MCBJ0136	Basics of Communication and Journalism	5-1-0	6	817
Theory	Generic Elective Course (GEC) - III	MCBP0139	Basics of Photography	4-0-0	4	826
Practicum		MCPY0140	Photography	0-0-2	2	827
Theory	Generic Elective Course (GEC) – IV	MCMC0131	Mobile Communication	5-1-0	6	811
MA MASS COMMUNICATION						
Theory	DE	MCML0027	Media Literacy	3-0-0	3	801
Theory	DE	MCRC0026	Rural Communication	3-0-0	3	

COURSE STRUCTURE

BA PSYCHOLOGY					
Course Type	Category	Course Code	Name of Paper	L-T-P	Page No
Theory	Generic Elective Course (GEC) – I	PCGP0126	General Psychology	5-1-0	876
Theory	Generic Elective Course (GEC) – II	PCHW0127	Psychology for Health and Well being	5-1-0	881
Theory	Generic Elective Course (GEC) - III	PCPM0132	Psychology and Media	5-1-0	887
Theory	Generic Elective Course (GEC) – IV	PCPW0137	Psychology at work	5-1-0	893
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	913
Theory	Elective – II (Semester II)	PCSP0006	Introduction to Social Psychology	3-0-0	

BA ENGLISH					
Course Type	Category	Course Code	Name of Paper	L-T-P	Page No
Theory	Generic Elective Course (GEC) – I	EGWC0105	Academic Writing and Composition	5-1-0	1010
Theory	Generic Elective Course (GEC) – II	EGWE0113	Contemporary India: Women and Empowerment	5-1-0	1012
Theory	Generic Elective Course (GEC) - III	EGLL0119	Language and Linguistics	5-1-0	1017
Theory	Generic Elective Course (GEC) – IV	EGLA0125	Language, Literature and Culture	5-1-0	1022

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 of chemistry
- to help them generate their ideas and provide them the knowhow to convert them into reality

Program Outcomes – BSC 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 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.

Program Specific Outcomes- BSc Chemistry (Honours)

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.

Courses offered in BSc Chemistry (Honours)

Sl. No.	Course Name
1.1	Inorganic Chemistry-I:Atomic Structure &Chemical Bonding
1.2	Physical Chemistry-I: States of Matter & Ionic Equilibrium
1.3	Inorganic Chemistry-I: Atomic Structure & Chemical Bonding - Lab
1.4	Physical Chemistry-I: States of Matter & Ionic Equilibrium – Lab
1.5	English Communication
1.6	Generic Elective I
1.7	Value Added Course
2.1	Organic Chemistry-I: Basics & Hydrocarbons
2.2	Physical Chemistry-II: Chemical Thermodynamics & its Applications
2.3	Organic Chemistry-I Basics & Hydrocarbons Lab
2.4	Physical Chemistry-II: Chemical Thermodynamics & its Applications Lab
2.5	Environmental Studies
2.6	Generic elective II
2.7	Elements of Service Learning in Chemistry
2.8	Value Added course
3.1	Inorganic Chemistry II: Metallurgy and s- and p-block elements
3.2	Organic Chemistry II: Halogenated Hydrocarbons and Oxygen and Sulphur Containing Functional Groups
3.3	Physical Chemistry III: Phase Equilibria, Electrochemical Cells and Surface Chemistry
3.4	Inorganic Chemistry II: Metallurgy and s- and p-block elements Lab
3.5	Organic Chemistry II: Halogenated Hydrocarbons and Oxygen and Sulphur Containing Functional Groups Lab
3.6	Physical Chemistry III: Phase Equilibria, Electrochemical Cells and Surface Chemistry Lab
3.7.1	Basic Analytical Chemistry
3.7.2	Chemoinformatics
3.7.3	Chemistry of Cosmetics and Perfumes
3.8	Generic Elective III
3.9	Value Added course
4.1	Inorganic Chemistry III: Chemistry of d- and f-block elements
4.2	Organic Chemistry III: Chemistry of Amines, Amides, Nitriles and Heterocycles
4.3	Physical Chemistry IV: Conductance, Chemical Kinetics and Photochemistry
4.4	Inorganic Chemistry III: Chemistry of d- and f-block elements Lab
4.5	Organic Chemistry III: Chemistry of Amines, Amides, Nitriles and Heterocycles Lab

4.6	Physical Chemistry IV: Conductance, Chemical Kinetics and Photochemistry Lab
4.7.1	Pesticide Chemistry
4.7.2	Fuel Chemistry
4.7.3	Intellectual Property Rights
4.8	Generic Elective IV
4.9	Value Added Course
5.1	Organic Chemistry IV: Biomolecules
5.2	Physical Chemistry V: Quantum Chemistry and Spectroscopy
5.3	Organic Chemistry IV: Biomolecules Lab
5.4	Physical Chemistry V: Quantum Chemistry and Spectroscopy Lab
5.5.1	Application of Computers in Chemistry
5.5.2	Analytical Methods in Chemistry
5.5.3	Applications of computers in Chemistry Lab
5.5.4	Analytical Methods in Chemistry Lab
5.6.1	Novel Inorganic Solids
5.6.2	Polymer Chemistry
5.6.3	Novel Inorganic Solids Lab
5.6.4	Polymer Chemistry Lab
5.7	Value Added Course
6.1	Inorganic Chemistry IV: Organometallic Chemistry
6.2	Organic Chemistry V: Spectroscopy
6.3	Inorganic Chemistry IV: Organometallic Chemistry Lab
6.4	Organic Chemistry V: Spectroscopy Lab
6.5.1	Inorganic materials and Industrial Importance
6.5.2	Green Chemistry
6.5.3	Inorganic materials and Industrial Importance Lab
6.5.4	Green Chemistry Lab
6.6.1	Industrial Chemicals and Environment
6.6.2	Research Methodology for Chemistry
6.6.3	Industrial Chemicals and Environment Lab
6.7	Value Added Course

BSc Chemistry (Honours) Mapping of COs to PO/PSO

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					H	M		H	L		
1.3	H	H	H	M				M	M	L	H	M		
1.4	H	H	H	M				M	M	L	H	M		
1.5	M	M								L		M		M
1.6	H	H	H	M				L	M		H	L		
1.7	M	M					M			H	M	M	H	

2.1	H	H	H					H	M		H	L		
2.2	H	H	H					H	M		H	L		
2.3	H	H	H	M				M	M	L	H	M		
2.4	H	H	H	M				M	M	L	H	M		
2.5				L	M	M	H					M		
2.6	H	H	H					L	M		H			
2.7	M		H	M		H		L			M	M		
2.8	M	M					M			H	M			
3.1	H	H	H					H	M		H			
3.2	H	H	H					H	M		H			
3.3	H	H	H					H	M		H			
3.4	H	H	H	M				M	M	L	H	M		
3.5	H	H	H	M				M	M	L	H	M		
3.6	H	H	H	M				M	M	L	H	M		
3.7.1	H	H	H	H	M		M	M	M	M	H	H	H	
3.7.2	H	H	H	H	M			M	H	M	H	M	H	
3.7.3	H	H	H	H	M			M	M	M	H	H	H	
3.8	H	H	H					L	M		H			
3.9	M	M					M			H	M	M	M	
4.1	H	H	H					H	M		H			
4.2	H	H	H					H	M		H			M
4.3	H	H	H					H	M		H			L
4.4	H	H	H	M				M	M	L	H	M		
4.5	H	H	H	M				M	M	L	H	M		M
4.6	H	H	H	M				M	M	L	H	M		
4.7.1	H	H	H	H	M		H	M	M	M	H	H	H	H
4.7.2	H	H	H	H	M		H	M	M	M	H	H	H	
4.7.3	H	H	H	H	M			M	M	M	H		H	
4.8	H	H	H					L	M		H			
4.9	M	M					M			H	M	M	M	
5.1	H	H	H					H	M		H			H
5.2	H	H	H					H	H		H			
5.3	H	H	H	M				M	M	L	H	M		H
5.4	H	H	H	M				M	H	L	H	H		
5.5.1	H	H	H		L			M	H	M	H		M	
5.5.2	H	H	H		L			M	M	M	H		M	
5.5.3	H	H	H	M	L			M	H	M	H	L	H	
5.5.4	H	H	H	M	L			M	M	M	H	H	H	
5.6.1	H	H	H		L			M	M	L	H		M	
5.6.2	H	H	H		L			M	M	L	H		M	
5.6.3	H	H	H	M	L			M	M	M	H	M	H	

5.6.4	H	H	H	M	L			M	M	M	H	M	H	
5.7	M	M					M			H	M			
6.1	H	H	H					H	M		H			
6.2	H	H	H					H	M	M	H			
6.3	H	H	H	M				M	M	L	H	M		
6.4	H	H	H	M				M	M	L	H	H		
6.5.1	H	H	H		L			M	M	M	H		M	
6.5.2	H	H	H	M	L	L	M	M	M	M	H		M	
6.5.3	H	H	H	M	L			M	M	M	H	M	H	
6.5.4	H	H	H	H	L	L	M	M	M	M	H	M	H	
6.6.1	H	H	H	M	L			M	M	L	H		M	
6.6.2	H	H	H	M	L			M	H	H	H	L		
6.6.3	H	H	H	H	L			M	M	M	H	M	H	
6.7	M	M					M			H	M			

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 Skill: 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 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 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 chemistry such as organic, nanoscience, analytical, physical etc.

PSO 4. Learning skills on life processes: Acquire advanced level of knowledge in natural products as well as biological 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	

DETAILED SYLLABUS

THEORY COURSES

CHES0002: Environmental Studies (2-0-0)

Course Outcomes

1. Recall the multidisciplinary nature of environmental studies. (Remembering)
2. Explain ecological processes of natural resources. (Understanding)
3. Categorize different types of natural resources. (Analysing)
4. Evaluate the global scale of environmental pollution. (Evaluating)

Module I: The Multidisciplinary Nature of Environmental Studies (3 lectures)

Definition, scope and importance, need for public awareness.

Module II: Natural Resources (3 lectures)

a. Different types of natural resources and associated problems - forest resources, water resources, mineral resources, food resources, energy resources, land resources.
b. Conservation of natural resources.

Module III: Ecosystems (4 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 (4 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 (6 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 (6 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 (4 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.

Mapping of COs to Syllabus

	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

CHIC0003: Fundamentals of Inorganic Chemistry (4-0-0)

Course Outcomes

1. Recall the fundamental concepts associated with hard and soft acids and bases. (Remembering)
2. Explain the general characteristics and applications of coordination compounds. (Understanding)
3. Make use of the electronic spectra to understand the electronic transition in coordination complexes. (Applying)
4. Analyse the Metal-ligand bonding in transition metal complexes. (Analysing)
5. Explain the Magnetic properties of transition metal complexes. (Evaluating)
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 University Press.
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

	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

1. Recall various concepts associated with the kinetics of organic reaction mechanisms. (Remembering)
2. Explain the generation and application of different reaction intermediates in organic synthesis. (Understanding)
3. Analyse Point group of organic molecules and their connection with optical activity. (Analysing)
4. Determine the absolute or relative configuration of chiral organic molecules and design asymmetric synthesis. (Evaluating)
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

	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

1. Explain the laws of thermodynamics. (Understanding)
2. Explain the methods to determine the properties of polymers. (Understanding)
3. Explain the various terms involved in data analysis. (Understanding)
4. Apply the laws of thermodynamics and kinetics of polymerization to solve problems. (Applying)
5. Distinguish between different types of systems, polymers and various statistical parameters. (Analysing).
6. Calculate the sizes of polymer molecules and analyses the results of different chemical experiments from the statistical 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

	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

1. Recall the concepts of organometallic chemistry. (Remembering)
2. Illustrate the photochemistry of different inorganic compounds. (Understanding)
3. Select the inorganic compounds for their suitable analytical and industrial use. (Applying)
4. Analyse the structure, bonding and synthesis of some inorganic compounds. (Analysing)
5. Explain the bonding in solid-state chemistry. (Evaluating)
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

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 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, Pearson Education.
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 University Press.
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

	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

1. Recall nucleophilic and electrophilic substitution reactions and the factors related to the rate of these reactions. (Remembering)
2. Explain the stereo chemical aspects and mechanism of elimination reactions. (Understanding)
3. Apply the practical utility of metal and metal-free oxidising agents in organic synthesis. (Applying)
4. Compare various kinds of reducing agents in chemo selective and stereo selective synthesis. (Analysing)
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

	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

1. Recall the kinetics of different types of chemical reactions. (Remembering)
2. Explain the interactions of ionic species with solvent molecules. (Understanding)
3. Apply the knowledge of chemical kinetics to some important types of reactions. (Applying)
4. Analyse the application of electrochemistry in different fields. (Analysing)
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

	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

1. Recall the basic concepts of green chemistry. (Remembering)
2. Explain the principles of green chemistry, green reaction conditions, renewable sources of energy etc. (Understanding)
3. Apply the concept of green chemistry in the applied research field. (Applying)
4. Analyse and solve the problems related to the environment. (Analysing)
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

	Module I	Module II	Module III	Module IV
CO 1			H	M
CO 2			H	H
CO 3			M	H
CO 4	H	H		
CO5	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

	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

1. Recall the principles of organic photochemistry, pericyclic reactions. (Remembering)
2. Explain the theories related to pericyclic reactions. (Understanding)
3. Apply the knowledge of different reactions in research and industrial field. (Applying)
4. Analyse the problems related to photochemistry and synthetic strategy. (Analysing)
5. Demonstrate different theories in pericyclic reaction and photochemistry to check the feasibility of chemical reactions. (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.

c. 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 Robinson annelation. 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

	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

1. Recall the basic structure and properties of solids. (Remembering)
2. Explain the electrical properties in terms of semiconductor, superconductor etc. (Understanding)
3. Interpret the results of problems related to adsorption processes and electro kinetic phenomena of surfaces. (Applying)
4. Analyse the process of surface adsorption and types of different catalysed reactions. (Analysing)
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.
   Reverse micelle and its application, solubilization, microemulsion.
b. 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

	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

1. Recall the characteristic, properties of carbohydrates. (Remembering)
2. Explain the synthesis and biosynthesis of different biomolecules. (Understanding)
3. Distinguish between the physical, chemical and biochemical properties of amino acids, proteins, peptides, enzymes etc. (Analysing)
4. Explain the chemistry of nucleic acids. (Understanding)
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.
   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

	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

1. Explain the different methods of scientific Research. (Understanding)
2. Explain how to use e-resources for research. (Understanding)
3. Explain the analysis and presentation of data. (Understanding)
4. Apply the knowledge of chemical safety and handle chemicals safely in the lab. (Applying)
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

	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

1. Recall the knowledge of the basic structure of materials. (Remembering).
2. Explain how molecular structure affects the properties of materials. (Understanding)
3. Explain the properties of different materials based on their structures. (Applying)
4. Analyse the application of different types of materials in a different fields. (Analysing).
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 types and 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-T_c 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

	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

1. Recall the programming and some numerical methods in Chemistry. (Remembering)
2. Explain the molecular mechanics methods. (Understanding)
3. Apply QM/MM methods in organic, inorganic and organometallic systems. (Applying)
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

	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

1. Recall the relationship between food, nutrition and health. (Remembering)
2. Explain the nutritional needs during the life cycle and nutritional deficiency and their prevention. (Understanding)
3. Apply the knowledge of food chemistry for entrepreneurial development. (Applying)
4. Explain the sources, functions of major nutritional constituents. (Analysing).
5. Outline the changes in nutrition during cooking, ripening, storage of different categories of food. (understanding)
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, Nutrition and cancer.

Module VI: Dietary goals & guidelines (10 lectures)

National Perspectives; nutritional perspectives of vegetarian diets; Social Health Issues – Smoking, Alcoholism, Drug Addiction, 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; Development of 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

	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

1. Recall the origin, importance of elastomers. (Remembering)
2. Recall the classification, limitations of synthetic fibers. (Remembering)
3. Illustrate the classification and utility of fertilizers and pesticides. (Understanding)
4. Compare and Analyse different chemical reactions and procedures adopted in different industries. (Analysing)
5. Evaluate the challenges existing in the tea and sugar industries and suggest ways to overcome them. (Evaluating)
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

	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

1. Recall the definition of drugs and pro drugs and history of drug development. (Remembering)
2. Explain the mechanisms and theoretical aspects of drug action. (Understanding)
3. Explain the properties and synthetic methods of antibiotics, antiviral, antimalarials etc. (Understanding)
4. Explain the classes of neurotransmitters, drugs affecting cholinergic and adrenergic pathways. (Understanding)
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

	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

1. Recall the kinetics of heterogeneous catalysis. (Remembering)
2. Explain the preparation and characterization of industrial catalysts. (Understanding)
3. Explain the synthesis and properties of Zeolite and clays. (Understanding).
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

	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

1. Recall the fundamentals of biological macromolecules. (Remembering)
2. Explain the molecular modelling and conformational analysis of biological macromolecules. (Understanding)
3. Explain different methods for analysis and separation of biomolecules. (Understanding)
4. Explain different techniques for the structural determination of biomolecules. (Understanding)
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 NMR spectroscopy.

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

	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

1. Recall the systematic nomenclature of heterocyclic compounds. (Remembering)
2. Explain the synthesis and properties of azoles and condensed five-membered rings. (Understanding)
3. Explain the synthesis and properties of three and four-membered heterocyclic compounds. (Understanding)
4. Explain the importance and chemistry of natural heterocyclic compounds. (Understanding)
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; Addition reactions; 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

	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

1. Recall the chemistry of medicinal compounds of natural origin. (Remembering)
2. Explain the role of co-enzyme during Bio-synthesis of natural products. (Understanding)
3. Illustrate the biosynthesis and total synthesis of terpenoids and alkaloids. (understanding)
4. Analyse the presence of isoprene units in the natural product. (Analysing)
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 its synthesis; 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

	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

1. Recall the fundamentals of organometallic compounds and their reactions. (Remembering)
2. Explain the physical techniques required for the characterization of Organometallic compounds. (Understanding)
3. Explain the synthesis and application of the main group organometallic compounds. (Understanding)
4. Analyse the function of transition metal-based organometallic compounds. (Analysing)
5. Evaluate potential applications of Organometallic chemistry in organic synthesis. (Evaluating)
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 Carbene complexes; 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

	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

1. Recall the knowledge of inorganic rings, clusters and inorganic polymers with respect to their structural diversity. (Remembering)
2. Illustrate different theories to predict the structure of metal clusters. (Understanding)
3. Make use of isolobal analogy in the understanding of structure and bonding of heteroboranes. (Applying)
4. Analyse the concept of electron deficiency and sufficiency of Polyhedral boranes. (Analysing)
5. Compare inorganic polymers with organic polymers. (Evaluating).
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's methods 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

	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

1. Recall the postulates and principles of quantum chemistry. (Remembering)
2. Explain the Schrodinger equation. (Understanding)
3. Solve the problems related to wave functions. (Applying)
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

	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

1. Recall the fundamental aspects of absorption and emission spectroscopy. (Remembering)
2. Explain the basic concepts of rotational and vibrational spectroscopy. (Understanding)
3. Illustrate basics and applications of electronic spectra. (Understanding)
4. Explain theories and applications of NMR, ESR and Mossbauer spectroscopy. (Understanding)
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 of laser 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, fragmentation processes 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

	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

1. Recall various principles involved in UV-Visible spectroscopy. (Remembering)
2. Explain the theories and applications of IR and mass Spectrometry. (Understanding)
3. Apply the NMR spectroscopy for structural elucidation of simple and complex molecules. (Applying)
4. Explain the role of various spectroscopic tools required for analysing the structure of unknown molecules. (Analysing)
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 structural assignment.
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

	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3			H
CO 4	L	H	H
CO 5		H	

CHSL0100: Elements of Service Learning in Chemistry (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 (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

	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3	M		H
CO 4			H

CHAB0101: Inorganic Chemistry-I: Atomic Structure & Chemical Bonding (4-0-0)

Course Outcomes

1. Recall the concepts of atomic structure. (Remembering)
2. Explain the concept of periodicity in elements. (Understanding)
3. Apply the concept of chemical bonding for the prediction of properties of the molecule. (Applying)
4. Analyse the concept of redox reactions and their role in predicting inorganic reactions. (Analysing)
5. Explain the concept of Hybridization, MOT, VSEPR theory for the determination of the shape or structure of simple molecules and problem-solving. (Evaluating)
6. Discuss systematic study of periodic properties of s, p, d and f block elements. (Creating)

Module I: Atomic Structure (14 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.

Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals. Contour boundary and probability diagrams.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

Module II Periodicity of Elements (16 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.

a. Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
b. Atomic radii (van der Waals).
c. Ionic and crystal radii.

d. Covalent radii (octahedral and tetrahedral).
e. Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.
f. Electron gain enthalpy; trends of electron gain enthalpy.
g. Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

Module III Chemical Bonding (26 lectures)

a. Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.
b. Covalent bond*:* Lewis's structure, Valence Bond theory (Heitler-London approach).
c. Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl, BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization.
d. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.
e. Metallic Bond*:* Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.
f. Weak Chemical Forces*:* van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions.
g. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment). Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

Module IV Oxidation-Reduction (4 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. Concise Inorganic Chemistry, J.D. Lee, ELBS.
2. Concepts & Models of Inorganic Chemistry, B.E. Douglas and D. H. Mc Daniel, Oxford.
3. Physical Chemistry, P.W. Atkins and J. Paula, Oxford Press.
4. Theoretical Inorganic Chemistry, M.C. Day and J. Selbin, ACS Publications.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H
CO 5			H	
CO 6		M		

CHSI0102: Physical Chemistry-I: States of Matter & Ionic Equilibrium (4-0-0)

Course Outcomes

1. Recall concepts associated with the properties of three states of matter. (Remembering)
2. Explain the principles of ionic equilibria. (Understanding)
3. Apply the principles to solve problems related to ionic equilibrium. (Applying)
4. Differentiate between properties of real and ideal gases. (Analysing)
5. Learn about different crystal structure of solids. (Evaluate)

Module I: Gaseous state (18 lectures)

a. Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure.

b. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, *Z*, and its variation with pressure for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dielectric); virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

Module II: Liquid state (6 lectures)

Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity.

Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases.

Qualitative discussion of structure of water.

Module III: Solid state (16 lectures)

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravis lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl.

Defects in crystals. Glasses and liquid crystals.

Module IV: Ionic equilibria (20 lectures)

a. 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; dissociation constants of mono-, di-and diprotic acids (exact treatment).

b. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body.

c. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.

Multistage equilibria in polyelectrolyte systems; hydrolysis and hydrolysis constants.

Suggested Readings

1. Atkin's Physical Chemistry, P. W. Atkins, J. Paula, Oxford University Press.
2. Physical Chemistry, D. W. Ball, Thomson Press, India.
3. Physical Chemistry, G. W. Castellan, Narosa.
4. Physical Chemistry Elsevier, R. G. Mortimer, NOIDA, UP.

Mapping of COs to Syllabus

	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	

CHBH0103: Organic Chemistry-I: Basics & Hydrocarbons (4-0-0)

Course Outcomes

1. Recall the basic properties of different hydrocarbons. (Remembering)
2. Explain the types and mechanisms of organic reactions. (Understanding)
3. Predict the possible mechanism of organic reactions. (Applying)
4. Differentiate enantiomer, diastereomers, meso compounds, racemic mixture etc. (Analysing)
5. Determine the absolute and relative configuration of organic compounds. (Evaluating)
6. Explain the extra stability of organic compounds or synthetic intermediate using the concept of the Huckel rule for aromaticity. (Creating)

Module I: 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.

Module II: Stereochemistry (18 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: Chemistry of Aliphatic Hydrocarbons (24 lectures)

a. **Carbon-Carbon sigma bonds:** Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.
b. **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.
c. **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.

Module IV: Aromatic Hydrocarbons (12 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.

Suggested Readings

1. Organic Chemistry, R. N. 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.
4. Stereochemistry of Organic Compounds, E. L. Eliel and S. H. Wilen, Wiley, London.
5. Stereochemistry Conformation and Mechanism, P. S. Kalsi, New Age International.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV

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

CHCT0104 Physical Chemistry-II: Chemical Thermodynamics & its applications (4-0-0)

Course Outcomes

1. Recall the laws of thermodynamics. (Remembering)
2. Explain how to derive and apply equations for different thermodynamic functions. (Understanding)
3. Calculate the change in the values of state functions accompanying a process. (Applying)
4. Derive an expression for different thermodynamic functions. (Analysing)
5. Compare and contrast ideal solutions from regular solutions. (Evaluating)
6. Apply their understanding of concepts to design and solve analytical problems. (Creating)

Module I: Chemical Thermodynamics (36 lectures)

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 (8 lectures)

Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions inmixing of ideal gases.

Module III: Chemical Equilibrium (8 lectures)

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 IV: Solutions and Colligative Properties (8 lectures)

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, A. Peter 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 Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H	H	M	
CO 3	H		H	
CO 4	M	H	H	
CO 5				H
CO 6	M		M	M

CHAH0105: Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons (4-0-0)

Course Outcomes

1. Learn the fundamentals of inorganic and organic chemistry. (Remembering)
2. Explain various concepts of atomic structure and chemical bonding. (Understanding)
3. Predict the structure and properties of molecules. (Applying)
4. Analyse the shape of inorganic molecules. (Analysing)
5. Evaluate the role of quantum mechanics in inorganic chemistry. (Evaluate)

Module I: Inorganic Chemistry (30 lectures)

a. Atomic Structure (14 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 ψ and ψ^2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. 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 (16 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, 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, trigonal bipyramidal and octahedral arrangements.

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, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of *s-p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+.

Module II: Organic Chemistry (30 lectures)

a. Fundamentals of Organic Chemistry (8 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. Stereochemistry (10 lectures)

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; *cis* – *trans* nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

c. 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

	Module I	Module II
CO 1	H	H
CO 2	H	L
CO 3	H	H
CO 4	H	
CO 5	H	

CHCF0106: Chemical Energetics, Equilibria and Functional Group Organic Chemistry (4-0-0)

Course Outcomes

1. Recall theories of chemical energetics; chemical equilibria. (Remembering)
2. Explain the thermodynamics of chemical reactions. (Understanding)
3. Calculate the change in free energy accompanying a chemical reaction. (Applying)
4. Explain the mechanism of nucleophilic substitution reaction. (Analysing)
5. Compare the mechanisms of different types of organic reactions. (Evaluating).
6. Learn the methods of preparation, reactions and mechanism of some organic compounds. (Creating)

Module I: Physical Chemistry (30 lectures)

a. Chemical Energetics (10 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 (8 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 (12 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 (30 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 (8 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 (8 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 $NaNH_2/NH_3$).

Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards Nucleophilic substitution reactions.

c. Alcohols, Phenols and Ethers (14 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.

Diols: oxidation of diols. Pinacol-Pinacolone rearrangement.

2. Phenols:

(Phenol case) *Preparation:* Cumene hydroperoxide method, from diazonium salts. *Reactions:* Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer- Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction. acidity and factors affecting.

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

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

CHBA0113: Basic Analytical Chemistry (1-0-1)

Course Outcomes

1. Recall concepts of data analysis and principles of chromatography. (Remembering)
2. Explain terms associated with analytical measurements. (Understanding)
3. Determining various parameters of soil and water samples. (Applying)
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.

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 Applications (Any one):

a. To study the use of phenolphthalein in trap cases.
b. To Analyse arson accelerants.
c. To carry out analysis of gasoline.

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. Quantitative Analysis, R. A. Day and A. L. Underwood, Prentice Hall of India.
7. Physical Biochemistry, D. W.H. Freifelder, Freeman and Co., N.Y.
8. The Tools of Biochemistry, T. G. Cooper, John Wiley and Sons, N.Y.
9. Vogel's Qualitative Inorganic Analysis, G. Svehla, Prentice Hall.
10. Vogel's Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, Prentice Hall.
11. Undergraduate Instrumental Analysis, J. W. Robinson, Marcel Dekker, Inc., New York.

Mapping of COs to Syllabus

	Module I
CO 1	M
CO 2	H
CO 3	H
CO 4	M

CHCI0114: Chemoinformatics (1-0-1)

Course Outcomes

1. Recall the principles of molecular modelling. (Remembering)
2. Explain principles of molecular modelling. (Understanding)
3. Predict properties of compounds, build models. (Applying)
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; Modeling 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

	Module I
CO 1	H
CO 2	M
CO 3	M
CO 4	M

CHCP0115: Chemistry of Cosmetics and Perfumes (1-0-1)

Course Outcomes

1. Provide introductory knowledge of cosmetics and perfumes. (Remembering)
2. Systematic study about the compositions of cosmetics and perfumes. (Understanding)
3. Application of the suitable method to prepare shampoos, enamels, face creams etc. (Applications)
4. Comparative study of natural vs synthetic sources for their preparation. (Analysing)
5. Evaluate the scope and limitations of the various methods of preparation of cosmetic or perfume. (Evaluate)
6. Design new cosmetics by modifying the proportion of basic ingredients. (Creating)

Module I:

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

Experiments

a. Preparation of talcum powder.
b. Preparation of shampoo.
c. Preparation of enamels.
d. Preparation of hair remover.
e. Preparation of face cream.
f. Preparation of nail polish and nail polish remover.

Suggested Readings

1. Industrial Chemistry, Vol -I, E. Stocchi, Ellis Horwood Ltd. UK.
2. Engineering Chemistry, P.C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.
3. Industrial Chemistry, B. K. Sharma, Goel Publishing House, Meerut.

Mapping of COs to Syllabus

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

CHPY0116: Pesticide Chemistry (1-0-1)

Course Outcomes

1. Recall the properties and synthesis of natural and synthetic pesticides. (Remembering)
2. Explain the properties of pesticides based on their structure. (Understanding)
3. Prepare pesticides such as organophosphates, phosphonates and thiophosphates. (Applying)
4. Analysing the chemical properties of pesticides. (Analysing)

Module I

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).

Experiments

a. To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.
b. Preparation of simple organophosphates, phosphonates and thiophosphates.

Suggested Reading

1. Pesticides, R. Cremlyn, John Wiley.

Mapping of COs to Syllabus

	Module I
CO 1	H
CO 2	H
CO 3	M
CO 4	M

CHFC0117: Fuel Chemistry (1-0-1)

Course Outcomes

1. Recall the basic concepts of energy sources. (Remembering)
2. Explain the chemistry behind the petroleum industry. (Understanding)
3. Learn methods to prepare fuel from waste, learn how to prepare clean fuels etc. (Applying)
4. Differentiate between renewable and non-renewable energy sources. (Analysing)
5. Evaluate the merits and demerits of renewable and non-renewable energy sources. (Evaluating)

Module I: Review of energy sources (renewable and non-renewable).

Classification of fuels and their calorific value.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses, fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (hydro gasification and catalytic gasification), coal liquefaction and solvent refining.

Module II: Petroleum and Petrochemical Industry

a. Composition of crude petroleum, Refining and different types of petroleum products and their applications.
b. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels.
c. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.
d. Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants, properties of lubricants (viscosity index, cloud point, pore point) and their determination.

Suggested Readings

1. Industrial Chemistry, Vol -I, E. Stocchi, Ellis Horwood Ltd. UK.
2. Engineering Chemistry, P.C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.
3. Industrial Chemistry, B.K. Sharma, Goel Publishing House, Meerut.

Mapping of COs to Syllabus

	Module I	Module II
CO 1	H	
CO 2	L	H
CO 3		H
CO 4	H	L
CO 5	H	L

CHIP0118: Intellectual Property Rights (2-0-0)

Course Outcomes

1. Recall the basic concepts of intellectual property. (Remembering)
2. Explain the need for protection of intellectual property. (Understanding)
3. Develop the knowledge of different types of intellectual property. (Applying)
4. Distinguish between different types of intellectual property. (Analysing)

5. Evaluate the overall laws and procedures involved in protecting intellectual property. (Evaluating)

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

Word 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

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	M	
CO 3	M			H
CO 4	M	M		
CO 5		M		M

CHOS0119: Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy (4-0-0)

Course Outcomes

1. Detail study of synthesis and properties of Organometallic compounds. (Remembering)
2. Explain the role of metal ions present in biological systems. (Understanding).
3. Application of 18 the electron rule for organometallic compounds. (Applying)
4. Comparison of the reactivity of polynuclear and heteronuclear aromatic molecules. (Analysing)
5. Employing of UV-Visible and IR-Spectroscopy for structural determination. (Creating)

Module I: Inorganic Chemistry (30 lectures)

a. Chemistry of 3d metals (6 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 (12 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)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

c. Bio-Inorganic Chemistry (12 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 (30 lectures)

a. Structure, preparation and properties of some aromatic molecules (12 lectures)

Structure elucidation of naphthalene, preparation and properties of naphthalene and anthracene. Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Furan, Pyrrole, Thiophene, and Pyridine.

b. Active methylene compounds (6 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 (12 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

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

CHCK0120: Chemistry of s- And p- Block Elements, States of Matter and Chemical Kinetics (4-0-0)

Course Outcomes

1. Explanation of the properties of s - and p- block elements. (Remembering)
2. Understand the concept of an ideal gas, real gas and properties of matter. (Understanding)
3. Application of Kinetic Theory of gases and Chemical kinetics to solve problems. (Applying)
4. Extraction of metal from its ore employing various techniques. (Analysing)
5. Utility of crystallographic principles for categorizing solids into crystal systems. (Evaluating)

Module I: Inorganic Chemistry (30 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 (26 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.

Diborane and concept of multicentre bonding, Structure, bonding and their important properties like oxidation/reduction, acidic/basic nature of the following compounds and their applications in industrial and environmental chemistry.

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 (30 lectures)

a. Kinetic Theory of Gases (7.5 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. Andrews isotherms of CO_2.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

b. 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).

c. Solids (7.5 lectures)

Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Glasses and liquid crystals.

d. Chemical Kinetics (10 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 Syllabus

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

CHBM0121: Organic Chemistry IV: Biomolecules (4-0-0)

Course Outcomes

1. Recall the structure and properties of the components of different biomolecules. (Remembering)
2. Explain the concept of energy in the biosystem. (Understanding)
3. Suggest the scheme for the synthesis of a peptide. (Applying)
4. Explain the roles of lipids, proteins, enzymes and nucleic acids in a living system. (Analysing)
5. Suggest mechanisms for creating a particular sequence of the protein or nucleic acid. (Creating)

Module I: Nucleic Acids (9 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 (18 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 (6 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 (8 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 (7 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 (12 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

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H	H	H	L	L
CO 2					H	
CO 3		H				
CO 4	H	H	H	H		
CO 5	H	H				H

CHQS0122: Physical Chemistry V: Quantum Chemistry and Spectroscopy (4-0-0)

Course Outcomes

1. Remembering the postulates of quantum mechanics. (Remembering)
2. Explaining the principles of spectroscopy. (Understanding)
3. Application of quantum mechanics to chemical bonding and spectroscopy. (Applying)

Module I: Quantum Chemistry (30 lectures)

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 II: Molecular Spectroscopy (30 lectures)

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 I	Module II
CO 1	H	L
CO 2	M	H
CO 3	H	H

CHAC0123: Application of Computers in Chemistry (4-0-0)

Course Outcomes

1. Recall the different components of computer hardware. (Remembering)
2. Recall the principles of the numerical methods. (Remembering)
3. Know how to write a program or how to use different software products. (Understanding)
4. Write programs to solve simple chemistry problems. (Applying)
5. Know which software to be employed for solving a chemistry problem. (Analysing)

Module I: Basic Computer system (in brief) (5 lectures)

Hardware and Software; Input devices, Storage devices, Output devices, Central Processing Unit (Control Unit and Arithmetic Logic Unit); Number system (Binary, Octal and Hexadecimal Operating System); Computer Codes (BCD and ASCII)**;** Numeric/String constants and variables. Operating Systems (DOS, WINDOWS, and Linux); Software languages: Low level and High Level languages (Machine language, Assembly language; QBASIC, FORTRAN and C++); Software Products (Office, chemsketch, sci lab, mat lab, hyper chem etc.), internet application.

Module II: Use of Programming Language for solving problems in Chemistry (40 lectures)

Computer Programming Language- QBASIC, (for solving some of the basic and in turn complicated chemistry problems). QB4 version of QBASIC can be used.

Programming Language – QBASIC; Commands: INPUT and PRINT Commands; GOTO, If, ELSEIF, THEN and END IF Commands; FOR and NEXT Commands; Library Functions (ABS, ASC, CHR$, EXP, INT, LOG, RND, SQR, TAB and trigonometric Functions), DIM, READ, DATA, REM, RESTORE, DEF FNR, GOSUB, RETURN, SCREEN, VIEW, WINDOW, LINE, CIRCLE. LOCATE, PSET Commands.

Simple programs using above mentioned commands.

QBASIC programs for Chemistry problems - Example: plotting van der Waal Isotherms (Simple Problem, available in general text books) and observe whether van der Waal gas equation is valid at temperatures lower than critical temperature where we require to solve a cubic equation and calculation of area under the curves (Complicated Problem, not available in general text books).

Solution of quadratic equation, polynomial equations (formula, iteration and Newton – Raphson methods, binary bisection and Regula Falsi); Numerical differential, Numerical integration (Trapezoidal rule), Simultaneous equations, Matrix addition and multiplication, Statistical analysis.

Module III: Use of Software Products (15 lectures)

Computer Software like Scilab, Excel, etc. to solve some of the plotting or calculation problems.

Basic idea of Molecular Modelling using software like chemsketch, arguslab and Accelerys J Draw etc. for geometry optimization and potential energy surface (local and global minima).

Suggested Readings

1. Mathematics for Physical Chemistry, D. A. McQuarrie, University Science Books.

2. Mathematics for Physical Chemistry, R. Mortimer, Elsevier.
3. The Chemical Maths Book, E. Steiner, Oxford University Press.
4. Chemical Calculations, P. Yates, CRC Press.
5. Quantitative Chemical Analysis, D. C. Harris, Freeman.
6. How to use Excel in analytical chemistry and in general scientific data analysis, R. de. Levie, Cambridge University Press
7. Programming in BASIC: Problem solving with structure and style, S. M. Venit, Jaico Publishing House, Delhi.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3	M	M	M
CO 4		M	
CO 5			H

CHAM0124: Analytical Methods in Chemistry (4-0-0)

Course Outcomes

1. Define principles of different methods of analysis. (Remembering)
2. Explain different optical methods of analysis. (Understanding)
3. Identify kinds of errors in chemical analysis. (Applying)
4. Analyse the techniques of thermogravimetry to estimate ions in a mixture. (Analysing)
5. Evaluate fundamentals of electrochemistry. (Evaluating).
6. Elaborate on different techniques for the separation of mixtures. (Creating)

Module I: Qualitative and quantitative aspects of analysis (5lectures)

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 (25 lectures)

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 lectures)

Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Module IV: Electroanalytical methods (10 lectures)

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 (15 lectures)

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

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	
CO 2		H			
CO 3	H				
CO 4			H		
CO 5				H	
CO 6					H

CHNS0125: Novel Inorganic Solids (4-0-0)

Course Outcomes

1. Explanation of various methods used for synthesizing inorganic solids. (Remembering)
2. Explanation about inorganic materials of technological importance. (Understanding)
3. Synthesis, application and future scope of nanomaterials in the different areas of science. (Applying)
4. Applicability of engineering materials and study of their composition variants. (Analysing)
5. Evaluate the role of matrix in composite materials and their practical importance. (Evaluating)

Module I: Synthesis and modification of inorganic solids (10 lectures)

Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods.

Module II: Inorganic solids of technological importance (10 lectures)

Solid electrolytes – Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments. One-dimensional metals, molecular magnets, inorganic liquid crystals.

Module III: Nanomaterials (10 lectures)

Overview of nanostructures and nanomaterials: classification.

Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nano architecture-one dimensional control. Carbon nanotubes and inorganic nanowires. Bio-inorganic nanomaterials, DNA and nanomaterials, natural nanomaterials, bio-nano composites.

Module IV: Introduction to engineering materials for mechanical construction (10 lectures)

Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminium and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.

Module V: Composite materials (10 lectures)

Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix.

Module VI: Speciality polymers (10 lectures)

Conducting polymers - Introduction, conduction mechanism, polyacetylene, polyparaphenylene and polypyrole, applications of conducting polymers, Ion-exchange resins and their applications. Ceramic & Refractory: Introduction, classification, properties, raw materials, manufacturing and applications.

Suggested Readings

1. Shriver & Atkins' Inorganic Chemistry, P. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Oxford University Press.
2. Inorganic Solids: An introduction to concepts in solid-state structural chemistry, D. M. Adam, John Wiley and Sons, London, New York, Sydney, Toronto.
3. Introduction to Nanotechnology , Jr. Poole, P. Charles, F. I. Owens, John Wiley and Sons.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				M
CO 3			H			
CO 4				H		H
CO 5					H	

CHPC0126: Polymer Chemistry (4-0-0)

Course Outcomes

1. Recall the basic concepts of Polymers. (Remembering)
2. Understand the different processes by which polymers are formed. (Understanding)
3. Apply the methods to measure the molecular weights of polymers. (Applying)
4. Analyse polymers based on their physical, thermal, flow and mechanical properties. (Analysing)
5. Based on the properties predict possible applications or uses of the polymer. (Evaluating)

Module I: Introduction and history of polymeric materials (4 lectures)

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 lectures)

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 lectures)

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 lectures)

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 lectures)

Structure Property relationships. Determination of molecular weight of polymers (M_n, M_w, 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 (T_g), determination of T_g, Polymer Solution and properties of Polymers (26 lectures)

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

	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	H
CO 5						H

CHOC0 127: Inorganic Chemistry IV: Organometallic Chemistry (4-0-0)

Course Outcomes

1. Recall principles involved in the analysis and separation of ions. (Remembering)
2. Explain the metal ion binding to biomolecules and their functions. (Understanding)
3. Apply the principles to separate a mixture of ions in the lab. (Applying)
4. List the procedures for the preparation of metal carbonyls and alkyls. (Analysing)
5. Use electron counting in assessing the reactivity and stability of organometallic compounds. (Evaluating)
6. Discuss the role of the organometallic compound in homogenous catalysed reactions. (Creating)

Module I: Theoretical Principles in Qualitative Analysis (H_2S Scheme) (12 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 and phosphate) and need to remove them after Group II.

Module II: Organometallic Compounds (26 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 III: Bioinorganic Chemistry (14 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 IV: Catalysis by Organometallic Compounds (8 lectures)

Study of the following industrial processes and their mechanism:

1. Alkene hydrogenation (Wilkinson's Catalyst).
2. Synthetic gasoline (Fischer Tropsch reaction).
3. Polymerisation of ethene using Ziegler-Natta catalyst.

Suggested Readings

1. Qualitative Inorganic Analysis, A. I. Vogel, Longman.
2. Vogel's Qualitative Inorganic Analysis, G. Svehla, Prentice Hall.
3. Principles of Bioinorganic Chemistry, S. J. Lippard and J.M. Berg, University Science Books.
4. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus, Wiley India.
5. Inorganic Chemistry, Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter, R. L. H. Keiter, Pearson.
6. Inorganic Chemistry, A. G. Sharpe, Indian Reprint (Pearson Education).
7. Concepts and Models in Inorganic Chemistry, B. E. Douglas, D. H. McDaniel and J. J. Alexander, John Wiley and Sons, NY.
8. Chemistry of the Elements, N. N. , Greenwood and A. Earnshaw, Elsevier.
9. Concise Inorganic Chemistry, J. D. Lee, John Wiley and sons.
10. Principles of Organometallic Chemistry, P. Powell, Chapman and Hall.
11. Inorganic Chemistry, D. D. Shriver, P. Atkins, and C. H. Langford, Oxford University Press.
12. Inorganic Chemistry, K. F. Purcell, and J. C. Kotz, W.B. Saunders Co.
13. Inorganic Chemistry, G. L. Miessler, D. A. Tarr, Pearson.
14. Principles and Applications of Organotransition Metal Chemistry, J. P. Collman, Mill Valley, CA: University Science Books.
15. The Organometallic Chemistry of the Transition Metals, R. H. Crabtree, John Wiley New York, NY.
16. Organometallic Chemistry, G. O. Spessard, G. L. Miessler, Upper Saddle River, NJ: Prentice-Hall.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2			H	
CO 3	H			
CO 4		M		
CO 5		H		
CO6				H

CHSP0128: Organic Chemistry V: Spectroscopy (4-0-0)

Course Outcomes

1. Recall the principles of UV, IR and NMR spectroscopy. (Remembering)
2. Explain absolute configuration of carbohydrates; mutarotation. (Understanding)
3. Apply different mechanisms to the polymerization reactions. (Applying)
4. Analyse the application of different types of dyes. (Analysing)
5. Analyse unknown organic compounds with the help of different spectroscopic techniques. (Evaluating)

Module I: Organic Spectroscopy (14 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 (16 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 (8 lectures)

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 (12 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 Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3				H
CO 4			H	
CO 5	H			

CHGC0129: Green Chemistry (4-0-0)

Course Outcomes

1. Recall the principles, goals and limitations of green chemistry. (Remembering)
2. Understand how the principles of green chemistry apply to chemical synthesis. (Understanding)
3. Check if a chemical reaction follows or violates the principles of green chemistry. (Applying)
4. Analyse the benefits of green reactions. (Analysing)
5. 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 (30 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– super critical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solvent less processes, immobilized solvents and how to compare greenness of 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 (wherever possible) in preference to stoichiometric reagents; catalysis and green chemistry, 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 —What you don't have cannot harm you‖, greener alternative to Bhopal Gas Tragedy (safer route to carbaryl) and Flixiborough accident (safer route to cyclohexanol) 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 (16 lectures)

a. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).
b. Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and decarboxylation reaction.
c. Ultrasound assisted reactions: sono chemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine).
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 (10 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

	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		M		
CO 3		M		
CO 4			H	
CO 5			M	H

CHII0130: Inorganic Materials of Industrial Importance (4-0-0)

Course Outcomes

1. Remember the composition of some industrially important materials. (Remembering)
2. Understand the processes involved in the preparation of silicates materials. (Understanding)

3. Know the principle involved in the preparation and applications of fuel cells, industrial application of catalysts. (Applying)
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, Water and Oil paints, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

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 (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) 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

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

CHEC0131: Industrial Chemicals and Environment (4-0-0)

Course Outcomes

1. Recall the hazard and handling of industrial gases and Inorganic chemicals. (Remembering)
2. Discussions of preparation of ultrapure metal in metallurgy having important applications. (Understanding)
3. Preventive measures to solve a specific problem related to environmental pollution. (Applying)

4. To provide knowledge about the different sources of energy. (Analysing)
5. Identify and solve pollution-related production of energy. (Evaluating)

Module I: Industrial Gases and Inorganic Chemicals (10 lectures)

a. Industrial Gases: Large scale production uses storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.
b. Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

Module II: Industrial Metallurgy (4 lectures)

Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.

Module III: Environment and its segments (30 lectures)

Ecosystems, biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere, chemical and photochemical reactions in atmosphere, air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry, environmental effects of ozone, major sources of air pollution.

Pollution by SO_2, CO_2, CO, NO_x, H_2S and other foul-smelling gases, methods of estimation of CO, NO_x, SO_x and control procedures.

Effects of air pollution on living organisms and vegetation, greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, sources and nature of water pollutants, techniques for measuring water pollution, impacts of water pollution on hydrological and ecosystems.

Water purification methods; Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal.

Industrial waste management, incineration of waste., water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

Module IV: Energy & Environment (10 lectures)

Sources of energy: Coal, petrol and natural gas, Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Module V: biocatalysts (6 Lectures)

Introduction to bio catalysis: Importance in “Green Chemistry” and Chemical Industry.

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. Handbook of Industrial Chemistry, J. A. K. Riegel, CBS Publishers, New Delhi.
4. A Textbook of Engineering Chemistry, S. S. Dara, S. Chand & Company Ltd. New Delhi.
5. Environmental Chemistry, K. De, New Age International Pvt., Ltd, New Delhi.
6. Environmental Pollution Analysis, S. M. Khopkar, Wiley Eastern Ltd, New Delhi.
7. Environmental Chemistry, S. E. Manahan, CRC Press.
8. Environmental Science, G. T. Miller, Brooks/ Cole.
9. Environmental Studies, A. Mishra, Selective and Scientific Books, New Delhi.

Mapping of COs to Syllabus

	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

CHRM0132: Research Methodology for Chemistry (4-0-0)

Course Outcomes

1. Recall resources for research literature, the purpose of a review article. (Remembering)
2. Explain methods of data analysis, explain how dc and ac circuits work. (Understanding).
3. Handle chemicals safely in the lab, dispose of chemicals the proper way. (Applying)
4. Differentiate between original research and review articles. (Analysing)
5. Select appropriate methods to analyses data. (Evaluating)
6. Develop a review paper based on original research articles. (Creating)

Module I: Literature Survey (20 Lectures)

Print: Sources of information: Primary, secondary, tertiary sources; Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.

Digital: Web resources, E-journals, Journal access, TOC alerts, Hot articles, Citation index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar, Chem Industry, Wiki- Databases, Chem Spider, Science Direct, Sci Finder, Scopus.

Information Technology and Library Resources: The Internet and World Wide Web, Internet resources for chemistry, Finding and citing published information.

Module II: Methods of Scientific Research and Writing Scientific Papers (20 Lectures)

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, publications of scientific work, writing ethics, avoiding plagiarism.

Module III: Chemical Safety and Ethical Handling of Chemicals (12 Lectures)

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.

Module IV: Data Analysis (13 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 V: Electronics (10 Lectures)

Basic fundamentals of electronic circuits and their components used in circuits of common instruments like spectrophotometers, typical circuits involving operational amplifiers for electrochemical instruments, elementary aspects of digital electronics.

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, J. Topping, Chapman Hall, London.
4. Quantitative chemical analysis, D. C. Harris, Freeman Chapters 3-5.
5. How to use Excel in analytical chemistry and in general scientific dataanalysis. R. de, Levie, Cambridge Univ. Press 487 pages.
6. Chemical safety matters – IUPAC – IPCS, Cambridge University Press, OSU safety manual 1.01.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2				H	H
CO 3			H		
CO 4	M	H			
CO 5				H	
CO 6		H			

CHSP0133: Inorganic Chemistry II: s - and p-block elements (4-0-0)

Course Outcomes

1. Recall the concepts of general principles of metallurgy, the chemistry of s and p block elements. (Remembering)
2. Explain the structure, bonding, properties and uses of some important inorganic compounds. (Understanding)
3. Apply the concepts to solve simple problems on periodic properties of s-block elements. (Applying)
4. Analyse the periodic properties p block elements. (Analysing)
5. Compare the usefulness and limitations of different metallurgical processes. (Evaluating)
6. Discuss the preparation, properties, structure and uses of some compounds of p-block elements. (Creating)

Module I: General Principles of Metallurgy (6 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 (22 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.
d. Complex formation tendency of s-block elements; structure of the following complexes: crown ethers and cryptates of Group I; basic beryllium acetate, beryllium nitrate, EDTA complexes of calcium and magnesium.
e. Solutions of alkali metals in liquid ammonia and their properties.

Module III: Chemistry of p-block elements (6 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 (13 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 (13 lectures)

a. Borazine.
b. Silicates, silicones.
c. Phosphonitrile halides $\{(PNCl_2)_n$ where n= 3 and 4$\}$.
d. Interhalogen and pseudohalogen compounds.
e. Clathrate compounds of noble gases, xenon fluorides (MO treatment of XeF_2).

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 Syllabus

	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		
CO 5	H				
CO6					H

CHOG0134: Organic Chemistry-II: Oxygen Containing Functional Groups (4-0-0)

Course Outcomes

1. Recall concepts of chemical reactivity of different organic compounds. (Remembering)
2. Explain the chemistry of halogenated hydrocarbons. (Understanding)
3. Solve problems of transformation of functional groups using different reactions conditions. (Applying)
4. Differentiate alcohols, phenol, ethers, epoxides. (Analysing)

Module I: Chemistry of Halogenated Hydrocarbons (16 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 (16 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 (16 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.

Module IV: Carboxylic Acids and their Derivatives (12 lectures)

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

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

CHPC0135: Physical Chemistry-III: Phase Equilibria and Chemical Kinetics (4-0-0)

Course outcomes

1. Recall basic concepts of chemical kinetics. (Remembering)
2. Explain concepts such as the Gibbs phase rule for non-reactive and reactive systems. (Understanding)
3. Apply the concepts of phase equilibria to systems with varying components. (Applying)
4. Analyse the kinetics of different types of chemical reactions. (Analysing)
5. Design and solve analytical problems. (Creating)

Module I: Phase Equilibria (28 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 (18 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 (8 lectures)

Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts, Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Module IV: Surface chemistry (6 lectures)

Physical adsorption, chemisorption, adsorption isotherms, nature of adsorbed state.

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

	Module I	Module II	Module III	Module IV
CO 1		H		
CO 2	H			
CO 3	H			
CO 4		H	M	
CO 5		H		M

CHIC0136: IT Skills for Chemists (1-0-1)

Course Outcomes

1. Recall the concepts of algebra, calculus, statistics etc. (Remembering)
2. Explain the various theorems and anecdotes related to algebra, calculus, statistics and, programming. (Understanding)
3. Apply the concepts to evaluate standard deviation, entropy change from heat capacity data etc. (Application)
4. Differentiating between analytic and numerical solutions. (Analysing)
5. Assessing the challenges and bottlenecks in programming, analytic and numerical approaches. (Evaluating)
6. Apply their understanding to write new BASIC programs. (Creating)

Module I: Mathematics

Fundamentals, mathematical functions, polynomial expressions, logarithms, the exponential function, units of a measurement, interconversion of units, constants and variables, equation of a straight line, plotting graphs.

Uncertainty in experimental techniques: Displaying uncertainties, measurements in chemistry, decimal places, significant figures, combining quantities.

Uncertainty in measurement: types of uncertainties, combining uncertainties, Statistical treatment. Mean, standard deviation, relative error. Data reduction and the propagation of errors, graphical and numerical data reduction. Numerical curve fitting: the method of least squares (regression).

Algebraic operations on real scalar variables (e.g., manipulation of van der Waals equation indifferent forms). Roots of quadratic equations analytically and iteratively (e.g. pH of a weak acid). Numerical methods of finding roots (Newton-Raphson, binary –bisection, e.g., pH of a weak acid not ignoring the ionization of water, volume of a van der Waals gas, equilibrium constant expressions).

Differential calculus: The tangent line and the derivative of a function, numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).

Numerical integration (Trapezoidal and Simpson's rule, e.g., entropy/enthalpy change from heat capacity data).

Module II: Computer programming

Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions, elements of the BASIC language, BASIC keywords and commands, Logical and relative operators, Strings and graphics, compiled versus interpreted languages, Debugging, simple programs using these concepts, matrix addition and multiplication, statistical analysis.

BASIC programs for curve fitting, numerical differentiation and integration (Trapezoidal rule, Simpson's rule), finding roots (quadratic formula, iterative, Newton-Raphson method).

HANDS ON

Module III: Introductory writing activities

Introduction to word processor and structure drawing (Chem Sketch) software. Incorporating chemical structures, chemical equations, expressions from chemistry (e.g. Maxwell-Boltzmann distribution law, Bragg's law, van der Waals equation, etc.) into word processing documents.

Module IV: Handling numeric data

Spreadsheet software (Excel), creating a spreadsheet, entering and formatting information, basic functions and formulae, creating charts, tables and graphs. Incorporating tables and graphs into word processing documents. Simple calculations, plotting graphs using a spreadsheet (Planck's distribution law, radial distribution curves for hydrogenic orbitals, gas kinetic theory- Maxwell-Boltzmann distribution curves as function of temperature and molecular weight), spectral data, pressure-

volume curves of van der Waals gas (van der Waals isotherms), data from phase equilibria studies. Graphical solution of equations.

Module V: Numeric modelling

Simulation of pH metric titration curves. Excel functions LINEST and Least Squares. Numerical curve fitting, linear regression (rate constants from concentration time data, molar extinction coefficients from absorbance data), numerical differentiation (e.g., handling data from potentiometric and pH metric titrations, pKa of weak acid), integration (e.g., entropy/enthalpy change from heat capacity data).

Module VI: Statistical analysis

Gaussian distribution and Errors in measurements and their effect on data sets, Descriptive statistics using Excel, Statistical significance testing: The *t* test, The F test.

Module VII: Presentation

Presentation graphics.

Suggested Readings

1. Mathematics for Physical Chemistry, D. A. McQuarrie, University Science Books.
2. Mathematics for Physical Chemistry, R. Mortimer, Elsevier.
3. The Chemical Maths Book, E. Steiner, Oxford University Press.
4. Chemical calculations, P. Yates, CRC Press.
5. Quantitative Chemical Analysis, D. C. Harris, Freeman.
6. How to use Excel in analytical chemistry and in general scientific data analysis R. de Levie, , Cambridge University Press.
7. Physical chemistry on a Microcomputer, J. H. Noggle,. Little Brown & Co.
8. Programming in BASIC: Problem solving with structure and style, S. M. Venit, Jaico Publishing House: Delhi.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H		M	M	H	M	
CO 2	M	M		H	M	M	
CO 3	M			M	M		
CO 4	H						
CO 5		H		M	M		
CO 6		H					H

CHCS0137: Chemical Technology & Society (2-0-0)

Course Outcomes

1. Recall principles of techniques used in chemical industries. (Remembering)
2. Explain the principles of the techniques involved in distillation, separation processes. (Understanding)
3. Explore the effect of chemical technology on the environment. (Applying)
4. Analyse the pros and cons of the technology. (Analysing)
5. Outline methods for carrying out scientific experiments in ways that are least harmful to the environment. (Creating)

Module I: Chemical Technology

Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators, scaling up operations in chemical industry, introduction to clean technology.

Module II: Society

Exploration of societal and technological issues from a chemical perspective, chemical and scientific literacy as a means to better understand topics like air and water (and the trace materials found in them that are referred to as pollutants); energy from natural sources (i.e.solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids, and molecular reactivity and interconversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs.

Suggested Reading

1. Chemistry for changing times, J. W. Hill, T. W. McCreary and D. K. Kolb.

Mapping of COs to Syllabus

	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H
CO 5		M

CHBS0138: Business Skills for Chemists (2-0-0)

Course Outcomes

1. To provide idea about market demanded business plans. (Remembering)
2. Explanation of IPR, Patents etc. and to understand their value. (Understanding)
3. Application and future scope of Chemistry in current research and global economics. (Applying)
4. Analyse financial aspects of business with case studies. (Analysing)
5. Designing valuable products or procedures for the patents. (Evaluating)
6. Develop entrepreneurial skills of chemistry. (Creating)

Module I: Business Basics

Key business concepts: Business plans, market need, project management and routes to market.

Module II: Chemistry in Industry

Current challenges and opportunities for the chemistry-using industries, role of chemistry inIndia and global economies.

Module III: Making money

Financial aspects of business with case studies.

Module IV: Intellectual property

Concept of intellectual property, patents.

Suggested Reading

www.rsc.org

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2				H
CO 3		H		
CO 4			H	
CO 5				H
CO 6		H		

CHCC0139: Inorganic Chemistry III: Coordination Chemistry (4-0-0)

Course Outcomes

1. Recall the properties of coordination compounds and transition elements. (Remembering)
2. Interpret the properties of transition elements. (Understanding)
3. Make use of different theories of coordination compounds to explain their properties. (Applying)
4. Compare the chemistry of Lanthanides and Actinides. (Evaluating)
5. Discuss the reaction mechanisms of square planar complexes. (Creating)

Module I: Coordination Chemistry (26 lectures)

Werner's theory, valence bond theory (inner and outer orbital complexes), electro neutrality principle and back bonding. Crystal field theory, measurement of 10 Dq (Δ_o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δ_o, Δt). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry, Qualitative aspect of Ligand field and MO Theory.

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

Module II: Transition Elements (14 lectures)

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f (Latimer diagrams), difference between the first, second and third transition series.

Chemistry of Cr, Mn, Fe and Co in various oxidation states with special reference to the following compounds: peroxo compounds of chromium, potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and sodium cobaltinitrite.

Module III: Lanthanoids and Actinoids (6 lectures)

Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

Module IV: Inorganic Reaction Mechanism (14 lectures)

Introduction to inorganic reaction mechanisms, substitution reactions in square planar complexes, trans-effect, theories of trans effect, thermodynamic and kinetic stability.

Suggested Readings

1. Inorganic Chemistry, K. F. Purcell and J. C. Kotz, W.B. Saunders Co.
2. Inorganic Chemistry, J. E. Huheey, Prentice Hall.
3. Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, Wiley-VCH.
4. Mechanisms of Inorganic Chemistry, F. Basolo, and R. C. Pearson, John Wiley & Sons, NY.
5. Chemistry of the Elements, N. N. Greenwood and A. Earnshaw, Butterworth- Heinemann.
6. Inorganic Chemistry(adapted), G. L. Miessler and D. A. Tarr, Pearson.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	H	M	
CO 2		H	M	
CO 3	H	L		
CO 4			H	
CO 5	M			H

CHHC0140: Organic Chemistry III: Heterocyclic Chemistry (4-0-0)

Course Outcomes

1. Preparation and reactions of amines, nitrile, isonitrile and nitro compounds etc. (Remembering)
2. Preparation and properties of polynuclear aromatic compounds. (Understanding)
3. Synthetic route for the preparation of heterocycles and applications in the present research. (Applying)
4. Structural elucidation of polynuclear aromatic compounds, alkaloids and terpens etc. (Analysing)
5. Total synthesis of important alkaloids. (Evaluating)
6. Development of alternative routes to manufacture natural products. (Creating)

Module I: Nitrogen Containing Functional Groups (18 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 (8 lectures)

Aromaticity of polynuclear hydrocarbons, structure elucidation of naphthalene; Preparation and properties of naphthalene, phenanthrene and anthracene.

Module III: Heterocyclic Compounds (22 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 (6 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.

Module V: Terpenes (6 lectures)

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

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4		H		H	H
CO 5	H			H	
CO 6					M

CHEL0141: Physical Chemistry IV: Electrochemistry (4-0-0)

Course Outcomes

1. Recall fundamental concepts of electrochemistry. (Remembering)
2. Explain principles associated with Faraday's laws of electrolysis. (Understanding)
3. Application of theories of conductance measurements. (Applying)
4. Distinguish between different types of electrochemical cells, electrodes. (Analysing)
5. Measurements of dipole moment and molecular polarizabilities. (Evaluating)

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 (28 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/Sb_2O_3 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).

Module III: Electrical & Magnetic Properties of Atoms and Molecules (12 lectures)

Basic ideas of electrostatics, Electrostatics of dielectric media, Clausius-Mosotti equation, Lorenz-Laurentz equation, Dipole moment and molecular polarizabilities and their measurements, diamagnetism, paramagnetism, magnetic susceptibility and its measurement, molecular interpretation.

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 Syllabus

	Module I	Module II	Module III
CO 1	H	H	
CO 2	L	H	
CO 3	H	L	
CO 4		H	
CO 5			H

CHAB0142: Analytical Clinical Biochemistry (1-0-1)

Course Outcomes

1. Recall properties of biological molecules. (Remembering)
2. Explain the classification of lipids, nucleic acids etc, their biological importance. (Understanding)
3. Identify and characterize carbohydrates, determine their iodine number etc. (Applying)
4. Relate the cause of diseases to deficiency or mutations of biomolecules. (Analysing)
5. Develop protocols for studying biomolecules. (Creating)

Module I: Basic understanding of the structures, properties and functions of carbohydrates, lipids and proteins

Review of concepts studied in the core course: *Carbohydrates:* Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations, Krebs cycle.

Isolation and characterization of polysaccharides, *Proteins:* Classification, biological importance; Primary and secondary and tertiary structures of proteins: α-helix and β- pleated sheets, Isolation, characterization, denaturation of proteins.

Enzymes: Nomenclature, Characteristics (mention of Ribozymes), Classification; Active site, Mechanism of enzyme action, Stereospecificity of enzymes, Coenzymes and cofactors, Enzyme inhibitors, Introduction to Biocatalysis: Importance in "Green Chemistry" and Chemical Industry.

Lipids: Classification. Biological importance of triglycerides and phosphoglycerides and cholesterol; Lipid membrane, Liposomes and their biological functions and underlying applications, Lipoproteins, properties, functions and biochemical functions of steroid hormones, biochemistry of peptide hormones.

Structure of DNA (Watson-Crick model) and RNA, Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation, introduction to Gene therapy.

Enzymes: Nomenclature, classification, effect of pH, temperature on enzyme activity, enzyme inhibition.

Module II: Biochemistry of disease: A diagnostic approach by blood/ urine analysis

Blood: Composition and functions of blood, blood coagulation. Blood collection and preservation of samples. Anaemia, Regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubin.

Urine: Collection and preservation of samples, formation of urine, composition and estimation of constituents of normal and pathological urine.

Experiments

a. Identification and estimation of the following:
b. Carbohydrates – qualitative and quantitative.
c. Lipids – qualitative.
d. Determination of the iodine number of oil.
e. Determination of the saponification number of oil.
f. Determination of cholesterol using Liebermann- Burchard reaction.
g. Proteins – qualitative.
h. Isolation of protein.
i. Determination of protein by the Biuret reaction.
j. Determination of nucleic acids

Suggested Readings

1. Tool of Biochemistry, T. G. Cooper.
2. Practical Biochemistry, K. Wilson and J. Walker.
3. Varley's Practical Clinical Biochemistry, A. H. Gowenlock,.
4. Textbook of Biochemistry, T. M. Devlin.
5. Biochemistry, J. M. Berg, J. L.Tymoczko and L. Stryer.
6. Textbook of Biochemistry and Human Biology, G. P. Talwar and M. Srivastava.
7. Biochemistry, A. L. Lehninger.
8. Laboratory Handbook of Chromatographic Method, O. Mikes, and R. A. Chalmers,

Mapping of COs to Syllabus

	Module I	Module II
CO 1	H	
CO 2	H	
CO 3	H	
CO 4		H
CO 5	H	M

CHGM0143: Green Methods in Chemistry (1-0-1)

Course Outcomes

1. Recall the different causes of environmental pollution. (Remembering)
2. Learn the twelve principles of Green Chemistry to solve environmental issues. (Understanding)
3. Apply their knowledge of green chemistry in the applied research field. (Applying)
4. Analyse some real-world cases in Green Chemistry. (Analysing)
5. Identify the causes of environmental degradation and find solutions for its protection. (Creating)

Module I: Tools of Green chemistry, Twelve principles of Green Chemistry, with examples.

The following Real-world Cases in Green Chemistry should be discussed:

a. A green synthesis of ibuprofen which creates less waste and fewer byproducts (Atom economy).
b. Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.
c. Environmentally safe antifoulant.
d. CO_2 as an environmentally friendly blowing agent for the polystyrene foam sheet packaging market.
e. Using a catalyst to improve the delignifying (bleaching) activity of hydrogen peroxide.
f. A new generation of environmentally advanced preservative: getting the chromium and arsenic out of pressure treated wood.
g. Right fit pigment: synthetic azo pigments to replace toxic organic and inorganic pigments.
h. Development of a fully recyclable carpet: cradle to cradle carpeting.

Suggested Readings

1. Environmental Chemistry, S. E. Manahan, CRC Press.
2. Environmental Science, G. T. Miller, Brooks/Cole.
3. Environmental Studies, A. Mishra, Selective and Scientific Books, New Delhi.

Mapping of COs to Syllabus

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

CHPC0144: Pharmaceutical Chemistry (1-0-1)

Course outcomes

1. Recall methodology of drug design and development. (Remembering)
2. Explain the theory behind the synthesis of a host of drugs. (Understanding)
3. Apply the principles for the preparation of a few selected drugs in the laboratory. (Application)
4. Know optimal preparation methods for different classes of drugs. (Analysing)
5. Compare aerobic and anaerobic fermentation processes. (Evaluation)

Module I: Drugs & Pharmaceuticals

Drug discovery, design and development, basic retrosynthetic approach, synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Module II: Fermentation

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii)Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Experiments

a. Preparation of Aspirin and its analysis.
b. Preparation of magnesium bisilicate (Antacid).

Suggested Readings

1. Introduction to Medicinal Chemistry, G. L. Patrick, Oxford University Press, UK.
2. Medicinal and Pharmaceutical Chemistry, Hakishan and V.K. Kapoor, Vallabh Prakashan, Pitampura, New Delhi.
3. Principles of Medicinal Chemistry, W. O. Foye, L. Thomas and D. A. L. William, B.I. Waverly Pvt. Ltd. New Delhi.

Mapping of COs to Syllabus

	Module I	Module II
CO 1	H	
CO 2	H	
CO 3	H	
CO 4	H	M
CO 5		H

CHMD0145: Molecular Modelling & Drug Design (4-0-0)

Course outcomes

1. Recall the concepts of molecular modelling. (Remembering).
2. Explain the concepts of molecular modelling and their significance. (Understanding).

3. Apply the concepts to evaluate and construct a comparative model to deduce the structure of proteins. (Application)
4. Differentiating between non-derivative, first derivative and second derivative minimization methods. (Analysing)
5. To predict the protein structures by employing different approaches. (Evaluating)
6. To design new hit molecules which can be used as lead molecules for drug design. (Creating)

Module I: Introduction to Molecular Modelling (10 lectures)

Introduction. Useful Concepts in Molecular Modelling: Coordinate Systems. Potential Energy Surfaces. Molecular Graphics, Surfaces, Computer Hardware and Software. The Molecular Modelling Literature.

Module II: Force Fields (14 lectures)

Fields: Bond Stretching, Angle Bending, Introduction to non-bonded interactions. Electrostatic interactions, van der Waals Interactions. Hydrogen bonding in Molecular Mechanics. Force Field Models for the Simulation of Liquid Water.

Module III: Energy Minimization and Computer Simulation (12 lectures)

Minimization and related methods for exploring the energy surface. Non-derivative method, First and second order minimization methods. Computer simulation methods. Simple thermodynamic properties and Phase Space. Boundaries. Analysing the results of a simulation and estimating Errors.

Module IV: Molecular Dynamics & Monte Carlo Simulation (12 lectures)

Molecular Dynamics Simulation Methods. Molecular Dynamics using simple models. Molecular Dynamics with continuous potentials. Molecular Dynamics at constant temperature and pressure. Metropolis method. Monte Carlo simulation of molecules. Mode issued in Monte Carlo simulations of polymers.

Module V: Structure Prediction and Drug Design (12 lectures)

Structure prediction - Introduction to comparative Modeling. Sequence alignment. Constructing and evaluating a comparative model. Predicting protein structures by 'Threading', Molecular docking. Structure based de novo ligand design, Drug Discovery – Chemoinformatics – QSAR.

Suggested Readings

1. Molecular Modelling Principles and Application, A. R. Leach, Longman.
2. Molecular Dynamics Simulation Elementary Methods, J. M. Haile, John Wiley and Sons.
3. QSAR and Molecular Modeling, S. P. Gupta, Springer – Anamaya Publishers.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H		H	
CO 2	M		M		
CO 3					H
CO 4			M		
CO 5					M
CO 6	M				M

CHIM0146: Instrumental Methods of Chemical Analysis (4-0-0)

Course Outcomes

1. Recalling various spectroscopic and separation techniques in chemistry. (Remembering)
2. Explain the principles of elemental analysis and separation techniques. (Understanding)
3. Application of various techniques. (Applying)
4. Analyse and draw conclusions based on experimental data. (Analysing)

Module I: Introduction to spectroscopic methods of analysis (4 lectures)

Recap of the spectroscopic methods covered in detail in the core chemistry syllabus:
Treatment of analytical data, including error analysis, classification of analytical methods and the types of instrumental methods, consideration of electromagnetic radiation.

Module II: Molecular spectroscopy (16 lectures)

Infrared spectroscopy: Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection),

interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR), samples and results expected, applications: Issues of quality assurance and quality control, special problems for portable instrumentation and rapid detection.

UV-Visible/ Near IR – emission, absorption, fluorescence and photo accoustic, excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photo accoustic, fluorescent tags).

Module III: Separation techniques (16 lectures)

Chromatography: Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid), Detection as a means of further analysis (use of tags and coupling to IR and MS), electrophoresis (plates and capillary) and use with DNA analysis.

Immunoassays and DNA techniques

Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole, resolution, time and multiple separations, detection and interpretation (how this is linked to excitation).

Module IV: Elemental analysis (8 lectures)

Mass spectrometry (electrical discharges).

Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence.

Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), wavelength separation and resolution (dependence on technique), Detection of radiation (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

Module V: NMR spectroscopy (4 lectures)

Principle, Instrumentation, factors affecting chemical shift, spin coupling, applications.

Module VI: Electroanalytical Methods (4 lectures)

Potentiometry & Voltammetry.

Module VII: Radiochemical Methods (4 lectures)

Module VIII: X-ray analysis and electron spectroscopy (surface analysis) (4 lectures)

Suggested Readings

1. Principles of Instrumental Analysis, D. A. Skoog, F. J. Holler and S. Crouch.
2. Instrumental Methods of Analysis, W. Merritt, D. Settle.
3. Physical Chemistry, P.W. Atkins.
4. Physical Chemistry, G.W. Castellan.
5. Fundamentals of Molecular Spectroscopy, C. N. Banwell.
6. Infrared Spectral Interpretations: A Systematic Approach, Smith, B.
7. Physical Chemistry, Moore, W. J.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1	H	H					M	
CO 2			M	M			H	
CO 3			H	M	M	M		H
CO 4		H	H	H				

CHSC0147: Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (4-0-0)

Course Outcomes

1. Recall the concepts of solutions, electrochemistry and phase equilibrium. (Remembering)
2. Explain the properties and reactivity of different organic compounds. (Understanding)
3. Solve problems on electrochemistry, phase equilibrium, solutions etc. (Applying)
4. Differentiating between the primary, secondary, tertiary and quaternary structure of proteins. (Analysing)
5. Decide which synthetic route to apply when solving problems on organic chemistry. (Evaluating)

Module I: Physical Chemistry (30 Lectures)

a. Solutions

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. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.

b. Phase Equilibrium

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) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $FeCl_3$-H_2O and Na-K only).

c. Conductance

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions.

Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. 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

Reversible and irreversible cells. Concept of EMF of a cell. 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. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. pH determination using hydrogen electrode and quinhydrone electrode. Potentiometric titrations - qualitative treatment (acid-base and oxidation-reduction only).

Module II: Organic Chemistry (30 Lectures)

a. Carboxylic acids and their derivatives (6 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.

Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

b. Amines and Diazonium Salts (6 Lectures)

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 (10 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). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C activating groups and Merrifield solid-phase synthesis.

d. Carbohydrates (8 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, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

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

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

CHCS0148: Chemistry of d-block elements, Quantum Chemistry & Spectroscopy (4-0-0)

Course outcomes

1. Recall properties of d- and f- block elements. (Remembering)
2. Explain the principles of quantum mechanics and spectroscopy. (Understanding)
3. Calculate positions of absorption lines of molecules and energies and wavefunctions. (Applying)
4. Differentiate between theories behind the formation of coordination compounds. (Analysing)
5. Assess the right approach to apply when predicting properties or calculating wavefunctions. (Evaluating)
6. Predict shapes and structure of molecules of coordination compounds. (Creating)

Module I: Inorganic Chemistry (30 Lectures)

a. Transition Elements (12 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 (8 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 (10 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. Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

Module II: Physical Chemistry (30 Lectures)

a. Quantum Chemistry & Spectroscopy (24 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. Rotational

Motion: Schrödinger equation of a rigid rotator and brief discussion of its results (solution not required). Quantization of rotational energy levels.

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). Quantization of vibrational energy levels. Selection rules, IR spectra of diatomic molecules. Structural information derived from vibrational spectra. Vibrations of polyatomic molecules. Group frequencies. Effect of hydrogen bonding (inter- and intramolecular) and substitution on vibrational frequencies.

Electronic Spectroscopy: Electronic excited states. Free Electron model and its application to electronic spectra of polyenes. Colour and constitution, chromophores, auxochromes, bathochromic and hypsochromic shifts.

b. Photochemistry (6 Lectures)

Laws of photochemistry. Lambert-Beer's law. Fluorescence and phosphorescence. Quantum efficiency and reasons for high and low quantum yields. 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

	Module I	Module II
CO 1	H	
CO 2		H
CO 3		H
CO 4	H	
CO 5		H
CO 6	H	

CHML0149: Molecules of Life (4-0-0)

Course outcomes

1. Recall the physicochemical properties of biomolecules. (Remembering)
2. Explain the properties and functions of the biomolecules they study. (Understanding)
3. Write mechanisms of biomolecular reactions. (Applying)
4. Differentiate between different biomolecules. (Analysing)
5. Assess the importance of biomolecules in specific processes. (Evaluating)

Module I: Carbohydrates (10 lectures)

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, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

Module II: Amino Acids, Peptides and Proteins (12 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 (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid phase synthesis.

Module III: Enzymes and correlation with drug action (12 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, -NH_2 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 (8 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. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

Module VI: Concept of Energy in Biosystems (8 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. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.

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

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M	M	H		
CO 2	H	M	H	M	M	H
CO 3		H		H		M
CO 4		M			M	
CO 5			H		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; service learning 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

	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

1. Recall the procedures followed to carry out the qualitative and quantitative analysis. (Remembering)
2. Explain the reason behind each step for Analysing mixtures and preparing compounds and metal nanoparticles. (Understanding)
3. Apply different spectroscopic methods to characterize coordination compounds. (Applying)
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

	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

1. Recall the theoretical concepts of experiments related to chemical kinetics and electrochemistry etc. (Remembering)
2. Explain the principles and the procedures for spectrophotometry based experiments. (Understanding)
3. Apply the theoretical knowledge for determination of rate constant, pH, emf etc. (Applying)
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

	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

1. Recall the procedures for qualitative analysis, separation of binary mixtures of organic compounds. (Remembering)
2. Explain the chemistry behind the preparation of some important organic compounds. (Understanding)
3. Apply different chromatographic techniques for the identification and purification of organic compounds. (Applying)
4. Analyse practical utility of chromatographic techniques. (Analysing)
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.

c. Chromatographic techniques

1. Qualitative TLC separation and identification.
2. Column chromatographic separation of a mixture of compounds.

d. 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

	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.

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)
2. Develop an understanding of the methods they use to carry out their research and why a certain set of methods is chosen. (Understanding)
3. Apply their understanding to steer their research in the right direction. (Applying)
4. Troubleshoot when a chosen approach does not yield the expected result. (Analysing)
5. Critically analyse the results they obtain to decide whether the data obtained proves or disproves a stated hypothesis. (Evaluating)
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 and components of the evaluation and the weightages attached to them shall be published by the department at the beginning of the semester.

CHAB6101: Inorganic Chemistry-I: Atomic Structure & Chemical Bonding (0-0-2)

Course Outcomes

1. Recall the knowledge related to primary and secondary standard solutions. (Remembering)
2. Explain the concept of molarity, normality, molality etc. (Understanding)
3. Apply the concept of acid-base titration for estimation. (Applying)
4. Analyse the amount of free alkali present in various soaps or detergents. (Analysing)
5. Estimate metals using internal and external indicators. (Evaluating)
6. Build the setup for the estimation of an unknown mixture of ions and interpretation of results. (Creating)

a. Titrimetric Analysis
   1. Calibration and use of apparatus.
   2. Preparation of solutions of different Molarity/Normality of titrants.

b. Acid-Base Titrations
   1. Estimation of carbonate and hydroxide present together in mixture.
   2. Estimation of carbonate and bicarbonate present together in a mixture.
   3. Estimation of free alkali present in different soaps/detergents.

c. Oxidation-Reduction Titrimetry
   1. Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution.
   2. Estimation of oxalic acid and sodium oxalate in a given mixture.
   3. Estimation of Fe(II) with K2Cr2O7 using internal (diphenylamine, anthranilic acid) and external indicator.

Suggested Readings

1. A Textbook of Quantitative Inorganic Analysis, A.I. Vogel, A Textbook of Quantitative Inorganic Analysis, ELBS.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c
CO 1	M		
CO 2	H		
CO 3		H	

CO 4		M	
CO5			H
CO6			M

CHSI6102: Physical Chemistry-I: States of Matter & Ionic Equilibrium – Lab (0-0-2)

Course Outcomes

1. Recall principles and methods to measure the properties of liquids. (Remembering)
2. Explain the principles of experiments related to pH meter. (Understanding)
3. Measure the properties of liquids and the dissociation constant of unknown weak acids. (Applying)
4. Analyse the results of the experiments. (Analysing)
5. Set up an experimental protocol for measuring the property of an unknown sample. (Creating)

a. Surface tension measurements.

1. Determine the surface tension by (a) drop number (b) drop weight method.
2. Study the variation of surface tension of detergent solutions with concentration.

b. **Viscosity measurement using Ostwald's viscometer**.

1. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature.
2. Study the variation of viscosity of sucrose solution with the concentration of solute.

c. Indexing of a given powder diffraction pattern of a cubic crystalline system.

d. pH metry

Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.

Preparation of buffer solutions of different pH

1. Sodium acetate-acetic acid.
2. ii. Ammonium chloride-ammonium hydroxide.

pH metric titration of

1. strong acid vs. strong base.
2. weak acid vs. strong base.
3. Determination of dissociation constant of a weak acid.

Any other experiment carried out in the class.

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 Syllabus

	Exp a	Exp b	Exp c	Exp d
CO 1	M	M		
CO 2				H
CO 3	H	H		H
CO 4	M	M	M	M
CO 5	M	M	M	M

CHBH6103: Organic Chemistry-I: Basics & Hydrocarbons Lab (0-0-2)

Course Outcomes

1. Recall the concept of purification techniques. (Remembering)
2. Understand the chromatographic technique for separation and purification of mixture of organic compounds. (Understanding)
3. Apply the concept of paper chromatography technique for separation of a mixture of two sugars. (Applying)
4. Analyse the compounds by comparing their retention factor with the standard. (Analysing)
5. Evaluate the purity of organic compounds. (Evaluating)
6. Identify unknown compounds by applying these already mentioned techniques. (Creating)

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. Chromatography:
    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).

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.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f
CO 1		H				H
CO 2		H				
CO 3		H				
CO 4		H				
CO 5	M		H	L	M	
CO 6			H			

CHCT6104: Physical Chemistry-II: Chemical Thermodynamics & its Applications Lab (0-0-2)

Course Outcomes

1. Recall principles and methods used to measure heats of reaction. (Remembering)
2. Explain methods and principles to carry out the thermodynamic measurements. (Understanding)
3. Measure heats of reactions following the appropriate procedures. (Applying)
4. Calculate the heats of reactions in each experiment. (Analysing)
5. Design experiments to measure enthalpy changes in the solution. (Creating)

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 ΔH.

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 Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g
CO 1	H	H	H	H			
CO 2	M	M	M	M	M	M	M
CO 3	H	H	H	H			
CO 4	H	H	H	H			
CO 5					M	H	H

CHAH6105: Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons Lab (0-0-2)

Course Outcomes

1. Recall the concept of titration and chromatography for estimation and separation. (Remembering)
2. Explain the principles of titration and chromatography. (Understanding)
3. Applying the concept of titration and chromatography to the estimation of samples. (Application)
4. Decide the method for appropriate chromatographic separation of organic molecules in a mixture. (Analysis)

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)
    1. 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.
    2. 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

	Section A	Section B
CO 1	H	H
CO 2		H
CO 3	H	H
CO 4		M

CHCF6106: Chemical Energetics, Equilibria and Functional Group Organic Chemistry Lab (0-0-2)

Course Outcomes

1. Recall principles and methods used to measure heats of reaction. (Remembering)
2. Explain methods and underlying principles used to carry out the experiments related to Ionic equilibria. (Understanding)
3. Learn to prepare specific organic compounds using appropriate procedures. (Applying)
4. Analyses of organic compounds possessing monofunctional groups. (Analysing)
5. Assess the advantages and drawbacks of the methods used for carrying out the experiments. (Evaluating)

a. 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.

b. 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

	Exp a	Exp b
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H
CO 5	M	M

CHOS6113: Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy Lab (0-0-2)

Course Outcomes

1. Qualitative analysis of the organic sample. (Remembering)
2. Explain the concepts of retention factors in chromatographic techniques. (Understanding)
3. Application of paper chromatography techniques. (Applying)

4. Preparation of transition metal complex and comparison of their conductance. (Analysing)
5. Derivative preparation and comparing the properties with literature. (Evaluating)
6. Functional group analysis and structure determination of unknown organic sample. (Creating)

a. 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.

b. 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 Syllabus

	Exp a	Exp b
CO 1		H
CO 2	H	
CO 3	H	
CO 4	H	
CO 5		H
CO 6		H

CHCK6114: Chemistry of s- and p- Block Elements, States of Matter and Chemical Kinetics Lab (0-0-2)

Course Outcomes

1. Gain knowledge about semi-micro qualitative analysis of salt. (Remembering)
2. Explanation of group analysis for basic radicals present in salt. (Understanding)
3. Apply the concept of salt analysis to identify ions present in a mixture of salts. (Applying)
4. Comparison of acidic strength by studying the kinetics of hydrolysis of the ester. (Analysing)
5. Surface tension and viscosity measurement by following standard methodology. (Evaluating)
6. Derivation of rate laws for various chemical reactions using the concept of chemical kinetics. (Creating)

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

	Exp a	Exp b
CO 1	H	
CO 2	H	
CO 3	H	
CO 4		H
CO 5		H
CO 6		H

CHBM6115: Organic Chemistry IV: Biomolecules Lab (0-0-2)

Course Outcomes

1. Recall principles of estimation of some amino acids and proteins. (Remembering)
2. Understand the principles involved in estimations of amino acids, proteins. (Understanding)
3. Apply the principles they learn to carry out the aforementioned estimations. (Applying)
4. Analyse the experimental data of these experiments. (Analysing)
5. Evaluate experimental data as well as procedures to conclude. (Evaluating)

Experiments:

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.
f. Saponification value of an oil or a fat.
g. Determination of Iodine number of an oil/ fat.
h. 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.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g	Exp h
CO 1	H	H	H	H	H	H	H	H
CO 2	H	H	H					
CO 3	H	H	H					
CO 4	M	M	M	M	M	M	M	M
CO 5	M	M	M	M	M	M	M	M

CHQS6116: Physical Chemistry V: Quantum Chemistry and Spectroscopy Lab (0-0-2)

Course outcomes

1. Remember the laws to apply when carrying out UV-visible absorbance measurements. (Remembering)
2. Explain how the laws can be used to determine concentrations or molar extinction coefficients of molecules. (Understanding)
3. Carry out measurements of molecular absorption in the lab. (Applying)
4. Suggest alternative ways of carrying out experiments or analysis of data. (Creating)

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.
g. 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

	UV/Visible spectroscopy	Colorimetry
CO 1	H	
CO2		H
CO 3	H	
CO 4	M	M

CHAC6117: Application of Computers in Chemistry Lab (0-0-2)

Course Outcomes

1. Remember the concepts involved in the programming language. (Remembering)
2. Understand the aforementioned concepts. (Understanding)
3. Apply the concepts to write programs for chemical calculations. (Applying)
4. Analyse how different software can be used in chemistry. (Analysing)
5. Evaluate the written programs and the results. (Evaluating)

Experiments:

a. Roots of equations: (e.g. volume of gas using van der Waals equation and comparison with ideal gas, pH of a weak acid).
b. Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).
c. Numerical integration (e.g. entropy/ enthalpy changes from heat capacity data).
d. Probability distributions (gas kinetic theory) and mean values.
e. Matrix operations.

f. Graphic programs related to Chemistry problems. *e.g.* van der Waals isotherm, Compressibility versus pressure curves, Maxwell distribution curves, concentration-time graph, pH metric titration curve, conductometric titration curves, Lambert Beer's law graph, s, p, d orbital shapes, radial distribution curves, etc.

Use of Software Products

a. Computer Software like Scilab and Excel, etc. for data handling and manipulation.
b. Simple exercises using molecular visualization software like Chemsketch, Arguslab and Accelerys J Draw, geometry optimization and potential energy surface of molecules like carbon dioxide, water, ethane, cyclohexane and benzene (local and global minima).

Suggested Readings

1. Mathematics for Physical Chemistry, D. A. McQuarrie, University Science Books.
2. Mathematics for Physical Chemistry, R. Mortimer, Elsevier.
3. The Chemical Maths Book, E. Steiner, Oxford University Press.
4. Chemical Calculations, P. Yates, CRC Press.
5. Quantitative Chemical Analysis, D. C. Harris, Freeman.
6. How to use Excel in analytical chemistry and in general scientific data analysis, R. de Levie, Cambridge University Press.
7. Programming in BASIC: Problem solving with structure and style, S. M. Venit, Jaico Publishing House, Delhi.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f
CO 1						M
CO 2						M
CO 3						H
CO 4	M	M	M	M	M	
CO 5						M

CHAM6118: Analytical Methods in Chemistry Lab (0-0-2)

Course Outcomes

1. Recall the principles of different separation techniques. (Remembering)
2. Explain the ion exchange process. (Understanding)
3. Apply solvent extraction and partitioning method to perform experiments. (Applying)
4. Analyse the experimental data in the laboratory. (Analysing)
5. Discuss soil analysis. (Evaluating)

Separation Techniques

Chromatography:

a. Separation of mixtures
   i. Paper chromatographic separation of Co^{2+} and Ni^{2+}.
   ii. Separation and identification of the amino acids present in the given mixture by paper chromatography. Reporting the R_f values.

Solvent Extractions:

a. To separate a mixture of Ni^{2+}& Fe2+ by complexation with DMG and extracting the Ni2+- DMG complex in chloroform, and determine its concentration by spectrophotometry.

Analysis of soil:

a. Determination of pH of soil.
b. Total soluble salt.
c. Estimation of calcium, magnesium.
d. Qualitative detection of nitrate, phosphate.

Ion exchange:

a. Determination of exchange capacity of cation exchange resins and anion exchange resins.
b. Separation of amino acids from organic acids by ion exchange chromatography.

Spectrophotometry: Verification of Lambert-Beer's law and determination of concentration of a coloured species ($CuSO_4$, $KMnO_4$)

Suggested Readings

1. A Text book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others), A. I. Vogel, ELBS, Longman.
2. Instrumental Methods of Analysis, H. H. Willard, et al. Wadsworth Publishing Company, Belmont, California, USA.
3. Analytical Chemistry, G. D. Christian, John Wiley & Sons, New York.
4. Exploring Chemical Analysis, ed, 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 Asia Pvt. Ltd. Singapore.
7. Laboratory Hand Book of Chromatographic & Allied Methods, O. Mikes and R. A. Chalmers, Elles Horwood Ltd. London.

Mapping of COs to Syllabus

	Chromatography	Solvent Extractions	Analysis of soil	Ion exchange
CO 1	H			
CO 2				H
CO 3		H		
CO 4	M			M
CO 5			H	

CHNS6119: Novel Inorganic Solids Lab (0-0-2)

Course Outcomes

1. Explanation of the principle involved in the ion-exchange process. (Remembering)
2. Understand the chemistry behind the cation-exchange, co-precipitation and hydrogel process. (Understanding)
3. Application of co-precipitation method for synthesizing nanoparticles. (Applying)
4. Analysing the effect of concentration on the synthesis of gold and silver nanoparticles. (Analysing)
5. Methodology development for the determination of total difference of solids. (Evaluating)
6. Designing a green method for synthesis of nanomaterials. (Creating)

Experiments:

a. Determination of cation exchange method.
b. Determination of total difference of solids.
c. Synthesis of hydrogel by co-precipitation method.
d. Synthesis of silver and gold metal nanoparticles.

Suggested Readings

1. Materials Chemistry, B. D. Fahlman, Springer.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c	Exp d
CO 1	H			
CO 2	H		H	
CO 3			H	H
CO 4				H
CO 5		H		
CO 6				M

CHPC6120: Polymer Chemistry Lab (0-0-2)

Course Outcomes

1. Recall different methods of preparing, characterizing and analysing polymers. (Remembering)
2. Understand the aforementioned methods. (Understanding)
3. Carry out preparations and characterization of polymers in the lab. (Applying)

4. Analyse and interpret experimental results. (Analysing)
5. Suggest alternative methods for the preparation and characterization of polymers. (Creating)

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).

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.

Polymer analysis

a. Estimation of the amount of HCHO in the given solution by sodium sulphite method.
b. Instrumental Techniques.
c. IR studies of polymers.
d. DSC analysis of polymers.
e. Preparation of polyacrylamide and its electrophoresis.

*at least 7 experiments to be carried out.

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 Syllabus

		Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g	Exp h
CO 1	Synthesis	M	M	M	M	M	M	M	M
CO 2		H	H	H	H				
CO 3		H	H	H	H	H	H	H	H
CO 4		L	L	H					
CO 5		H	H	H	H	H	H	H	H

		Exp a	Exp b	Exp c	Exp d	Exp e

CO 1	Characterisation	M	M	M	M	M
CO 2			H	H	H	
CO 3		H	H	H	H	H
CO 4		L	H			
CO 5		H	H	H	H	H

		Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	Analysis	M		M	M	M
CO 2		H	M	H	M	H
CO 3				H	M	
CO 4		H	H	H	H	H
CO 5				H		

CHOC6121: Inorganic Chemistry IV: Organometallic Chemistry Lab (0-0-2)

Course Outcomes

1. Recall the principles of separating and identifying ions in a mixture. (Remembering)
2. Interpret the chemistry of the reactions for separation and identification of ions. (Understanding)
3. Apply the principles to carry out the separation of ions in a mixture in the laboratory. (Applying)
4. Analyse the experimental results in the laboratory. (Analysing)
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 Syllabus

	Qualitative analysis	Chromatography
CO 1	M	
CO 2	M	
CO 3	H	
CO 4		M
CO 5		H

CHSP6122: Organic Chemistry V: Spectroscopy Lab (0-0-2)

Course Outcomes

1. Recall the principles involved in the extraction of organic compounds. (Remembering)
2. Explain the procedure for the extraction of caffeine from tea leaves. (Understanding)
3. Carry out extractions and preparation of specific organic compounds. (Applying)
4. Analyse organic compounds with the help of chemical tests and spectroscopic techniques. (Analysing)

Experiments:

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.
d. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).
e. Preparation of methyl orange.

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

	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H				
CO 2	H				
CO 3	H				H
CO 4			H	H	

CHGC6123: Green Chemistry Lab (0-0-2)

Course Outcomes

1. Recall principles of Green Chemistry. (Remembering)
2. Understand the principles. (Understanding)
3. Apply the principles of green chemistry in the laboratory. (Applying)
4. Analyse and interpret experimental data. (Analysing)
5. Suggest alternative procedures for experiments done in the lab. (Creating)

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

	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
CO 4	M	M	M	M	M	M
CO 5	M	M	M	M	M	M

CHII6124: Inorganic Materials of Industrial Importance Lab (0-0-2)

Course Outcomes

1. Recall the principles of inorganic estimation. (Remembering)
2. Understand the aforementioned principles. (Understanding)
3. Apply knowledge and understanding in carrying out lab experiments. (Applying)
4. Analyse and interpret experimental data. (Analysing)
5. Suggest alternative procedures of doing experiments. (Creating)

Experiments:

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. Electroless metallic coatings on ceramic and plastic material.
e. Determination of composition of dolomite (by complexometric titration).
f. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
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
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	H
CO 4	M	M	M	M	M	M	M	M
CO 5	M	M	M	M	M	M	M	M

CHCE6125: Industrial Chemicals & Environment Lab (0-0-2)

Course Outcomes

1. Recall the various processes required for measuring environmental pollutants. (Remembering)
2. Understand the principle involved in the estimations of water quality parameters. (Understanding)
3. Estimation of total alkalinity of water samples using the standard method. (Applying)
4. Study of some of the common bio-indicators of pollution. (Analysing)
5. Estimation of harmful pollutants using standard methodology. (Evaluating)
6. Designing innovative technology for controlling environmental pollution. (creating)

Experiments:

a. Determination of dissolved oxygen in water.
b. Determination of Chemical Oxygen Demand (COD).
c. Determination of Biological Oxygen Demand (BOD).
d. Percentage of available chlorine in bleaching powder.
e. Measurement of chloride, sulphate and salinity of water samples by simple titration method ($AgNO_3$ and potassium chromate).
f. Estimation of total alkalinity of water samples (CO_3^{2-}, HCO_3^-) using double titration method.
g. Measurement of dissolved CO_2.
h. Study of some of the common bio-indicators of pollution.
i. Estimation of SPM in air samples.
j. Preparation of borax/ boric acid.

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. Handbook of Industrial Chemistry, J. A. K. Riegel, CBS Publishers, New Delhi.
4. A Textbook of Engineering Chemistry, S. S. Dara, S. Chand & Company Ltd. New Delhi.
5. Environmental Chemistry, K. De, New Age International Pvt., Ltd, New Delhi.
6. Environmental Pollution Analysis, S. M. Khopkar, Wiley Eastern Ltd, New Delhi.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g	Exp h	Exp i	Exp j
CO 1	H	M	M		H	H	H		H	
CO 2	H	H	H	H	H	H	H			
CO 3						H	H			
CO 4								H		
CO 5									H	
CO 6	M	M	M	M	M	M	M	M	M	M

CHSP6126: Inorganic Chemistry II: s- and p-block elements Lab (0-0-2)

Course Outcomes

1. Recall the idea of different types of estimations of inorganic compounds. (Remembering)
2. Explain the principles of different types of Iodimetric titrations. (Understanding)
3. Utilize the methods of preparation of some inorganic complexes. (Applying)
4. Analyse the principle of complexometric titrations for the estimation of inorganic compounds. (Analysing)

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

	Exp a	Exp b	Exp c
CO 1	M	M	
CO 2	H		
CO 3			H
CO 4		H	

CHOG6127: Organic Chemistry II: Oxygen Containing Functional Groups Lab (0-0-2)

Course Outcomes

1. Recall principles and procedures involved in functional group detection of organic compounds and preparations. (Remembering)
2. Explain the chemistry behind the detection of functional groups. (Understanding)
3. Carry out reactions to transform functional groups. (Applying)
4. Assess optimal conditions for organic reactions. (Evaluating)
5. Design conditions for oxidation of an alcohol, benzoylation of an amine etc. (Creating)

Experiments:

a. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.
b. Organic preparations:
    1. 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

	Exp a	Exp b
CO 1	H	H
CO 2	H	
CO 3	H	
CO 4		M
CO 5		M

CHPC6128: Physical Chemistry III: Phase Equilibria and Chemical Kinetics Lab (0-0-2)

Course Outcomes

1. Recall the determination of the rate constant for chemical reactions. (Remembering)
2. Explain the concepts and methods for determining critical solution temperature (CST). (Understanding)
3. Measure the distribution coefficient of liquids, CST and equivalence points through potentiometric titrations. (Applying)
4. Find out how CST of the phenol-water system is affected by impurities. (Analysing)
5. Construct phase diagrams of different types of systems. (Creating)
6. Explain the different isotherms using adsorption techniques. (Understanding)

Experiments:

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. Integrated rate method:
      i. Acid hydrolysis of methyl acetate with hydrochloric acid.
      ii. Saponification of ethyl acetate.
   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 Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f
CO 1					H	
CO 2	H					
CO 3	H		H	H		
CO 4	M					
CO 5		M				
CO 6						H

CHCC6129: Inorganic Chemistry III: Coordination Chemistry Lab (0-0-2)

Course Outcomes

1. Recall principles and methods for gravimetric analysis of inorganic compounds. (Remembering)
2. Explain the principle of gravimetric estimation of some transition metal complexes. (Understanding)
3. Apply the principles and methods to know the properties of complexes. (Applying)
4. Adopt suitable methods to prepare inorganic compounds. (Creating)

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

	Exp a	Exp b	Exp c
CO 1	M	M	
CO 2	H		
CO 3			H
CO 4		H	

CHHC6130: Organic Chemistry III: Heterocyclic Chemistry Lab (0-0-2)

Course Outcomes:

1. Gain knowledge about Qualitative analysis of organic compounds. (Remembering)
2. Explain the chemistry of various tests used in the detection of functional groups and elements present in an organic sample. (Understanding)
3. Qualitative analysis for the identification of organic compounds from mixtures. (Applying)
4. Analyse the melting point of the compound and its derivative for the determination of its exact structure. (Analysing)
5. Purify organic compound via recrystallization and estimate their purity via melting point comparison with literature data. (Evaluating)

Experiments:

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 Syllabus

	Exp a	Exp b
CO 1		H
CO 2	H	
CO 3		H
CO 4		H
CO 5		H

CHEL6131: Physical Chemistry IV: Electrochemistry Lab (0-0-2)

Course Outcomes

1. Recall the basic concepts of conductometry and potentiometry. (Remembering)
2. Explain the principles of conductometric and potentiometric titrations. (Understanding)
3. Determine the cell constant, conductivity, equivalence points through conductometry. (Applying)
4. Analysing and the data obtained from conductometric and potentiometric titrations. (Analysing)
5. Design experiments to measure the equivalence point of an acid-base reaction conductometrically. (Creating)

Conductometry

a. Determination of cell constant.
b. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

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:

c. 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

	Conductometry	Potentiometry
CO 1	H	H
CO 2	H	H
CO 3	H	
CO 4	H	H
CO 5	M	

CHMD6132: Molecular Modelling & Drug Design Lab (0-0-2)

Course outcomes

1. Recall principles and techniques of molecular modelling. (Remembering)
2. Explain the underlying theories of molecular modelling. (Understanding)

3. Use different simulations techniques on macromolecules to calculate various properties. (Applying)
4. Analysing the results from the computations. (Analysing)
5. Assessing the theoretical and practical challenges in computational modelling. (Evaluating)
6. To create a test and training set for studying structure-activity relationship. (Creating)

Experiments:

a. Compare the optimized C-C bond lengths in ethane, ethene, ethyne and benzene. Visualize the molecular orbitals of the ethane σ bonds and ethene, ethyne, benzene and pyridine π bonds.
b. (i) Perform a conformational analysis of butane. (ii) Determine the enthalpy of isomerization of *cis* and *trans*2-butene.
c. Visualize the electron density and electrostatic potential maps for LiH, HF, N_2, NOand CO and comment. Relate to the dipole moments. Animate the vibrations of these molecules.
d. (i) Relate the charge on the hydrogen atom in hydrogen halides with their acid character. (ii) Compare the basicity's of the nitrogen atoms in ammonia, methylamine, dimethylamine and trimethylamine.
e. (i) Compare the shapes of the molecules: 1-butanol, 2-butanol, 2-methyl-1-propanol, and 2-methyl-2-propanol. Note the dipole moment of each molecule. (ii) Show how the shapes affect the trend in boiling points: (118 ºC, 100 ºC, 108 ºC, 82 ºC, respectively).
f. Build and minimize organic compounds of your choice containing the following functional groups. Note the dipole moment of each compound: (a) alkyl halide (b)aldehyde (c) ketone (d) amine (e) ether (f) nitrile (g) thiol (h) carboxylic acid (i) ester(j) amide.
g. (i) Determine the heat of hydration of ethylene. (ii) Compute the resonance energy of benzene by comparison of its enthalpy of hydrogenation with that of cyclohexene.
h. Arrange 1-hexene, 2-methyl-2-pentene, (*E*)-3-methyl-2-pentene, (*Z*)-3-methyl-2-pentene, and 2,3-dimethyl-2-butene in order of increasing stability.
i. (i) Compare the optimized bond angles H_2O, H_2S, H_2Se. (ii) Compare the HAH bond angles for the second row dihydrides and compare with the results from qualitative MO theory.

Note: Software: Chem Sketch, Argus Lab (www.planaria-software.com), TINKER 6.2(dasher.wustl.edu/ffe), Web Lab Viewer, Hyperchem, or any similar software.

Suggested Readings

1. Molecular Modelling Principles and Application, A. R. Leach, Longman.
2. Molecular Dynamics Simulation Elementary Methods, J. M. Haile, John Wiley and Sons.
3. QSAR and Molecular Modeling, S. P. Gupta, Springer – Anamaya Publishers.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g	Exp h	Exp i
CO 1	H								
CO 2	M	M							
CO 3	M		H			M	H		
CO 4	H	M	M	H	M	M	M	H	
CO 5	M	L							H
CO 6	M								H

CHIM6133: Instrumental Methods of Chemical Analysis Lab (0-0-2)

Course outcomes

1. Recall the safety practices in the Chemistry laboratory. (Remembering)
2. Explain the principle involved in the determination of chemical properties. (Understanding)
3. Use of various techniques to determine unknown property. (Applying)
4. Assess the advantages and drawbacks of the various methods. (Evaluating)

Experiments:

a. Safety Practices in the Chemistry Laboratory.
b. Determination of the isoelectric pH of a protein.
c. Titration curve of an amino acid.
d. Determination of the void volume of a gel filtration column.

e. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.).
f. Study of Electronic Transitions in Organic Molecules (i.e., acetone in water).
g. IR Absorption Spectra (Study of Aldehydes and Ketones).
h. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption.
i. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride).
j. Separation of Carbohydrates by HPLC.
k. Determination of Caffeine in Beverages by HPLC.
l. Potentiometric Titration of a Chloride-Iodide Mixture.
m. Cyclic Voltammetry of the Ferrocyanide/Ferricyanide Couple.
n. Nuclear Magnetic Resonance.
o. Use of fluorescence to do "presumptive tests" to identify blood or other body fluids.
p. Use of "presumptive tests" for anthrax or cocaine.
q. Collection, preservation, and control of blood evidence being used for DNA testing.
r. Use of capillary electrophoresis with laser fluorescence detection for nuclear DNA (Y chromosome only or multiple chromosome).
s. Use of sequencing for the analysis of mitochondrial DNA.
t. Laboratory analysis to confirm anthrax or cocaine.
u. Detection in the field and confirmation in the laboratory of flammable accelerants or explosives.
v. Detection of illegal drugs or steroids in athletes.
w. Detection of pollutants or illegal dumping.
x. Fibre analysis.

At least 10 experiments to be performed.

Suggested Readings

1. Principles of Instrumental Analysis, D. A. Skoog, F. J. Holler, and S. Crouch.
2. Instrumental Methods of Analysis, Merritt Willard, Settle Dean.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g	Exp h	Exp i	Exp j	Exp k	Exp l
CO 1	H											
CO 2		H		H	H	M	M	H	M	M	H	H
CO 3		H		H		H						
CO 4		M	M	M	M	M	M	M	M	M	M	M

	Exp m	Exp n	Exp o	Exp p	Exp q	Exp r	Exp s	Exp t	Exp u	Exp v	Exp w	Exp x
CO 1												
CO 2	H	M	M	M	M	M	M	M	M	M	M	M
CO 3	M	M	M							M	M	M
CO 4	M	M	M	M	M	M	M	M	M	M	M	M

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

	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)

a. **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.
b. **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

	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		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; service learning 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

3. Service-Learning Essentials: Questions, Answers, and Lessons Learned, B. Jacoby, Jossey-bass.
4. Where's the Learning in Service-Learning? J. Eyler, and D. E. Giles Jr., Jossey-bass.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H		
CO 2		M	H
CO 3			M
CO 4	M		

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 – BSC 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: 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 Mathematics (Honours)

PSO 1: **Solid Foundation in Knowledge:** Bachelor Degree in Mathematics is the culmination of in-depth knowledge of many core branches of mathematics, viz. Algebra, Calculus, Geometry, Differential Equations, Mechanics, Real and Complex Analysis including some related areas like Computer Science and Statistics. Thus, this programme helps students in building a solid foundation for further higher studies and research in Mathematics.

PSO 2: **Competency in Skills:** The skills and knowledge gained has intrinsic beauty, which leads to proficiency in analytical reasoning, critical understanding, analysis and synthesis in order to solve theoretical and practical problems. This can orient students towards applications of mathematics in other disciplines and moreover, can also be utilised in modelling and solving real life problems.

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 vague ideas 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 for Government jobs, jobs in banking, insurance and investment sectors, data analysis jobs, and jobs in various other public and private enterprises.

Courses offered in BSc Mathematics (Honours)

Sl. No.	Course Name
1.1	Calculus
1.2	Calculus-Lab
1.3	Algebra
1.4	English Communication
1.5	Generic Elective I
1.6	Value Added Course
2.1	Real Analysis
2.2	Differential Equations
2.3	Differential Equations Lab
2.4	Environmental Studies
2.5	Generic Elective II
2.6	Mathematics and Service -Learning
2.7	Value Added Course
3.1	Theory of Real Functions
3.2	Group Theory I
3.3	Numerical Methods
3.4	Numerical Methods Lab
3.5.1	Programming in C
3.5.2	Logic and sets
3.6	Generics Elective III
3.7	Value-added Course
4.1	PDE and Systems of ODE
4.2	PDE and Systems of ODE Lab
4.3	Multivariate Calculus
4.4	Group Theory II
4.5.1	Computer Graphics

4.5.2	Graph Theory
4.6	Generic Elective IV
4.7	Value-Added Course
5.1	Metric Space and Complex analysis
5.2	Ring Theory and Linear Algebra I
5.3.1	Probability and Statistics
5.3.2	Linear Programming
5.3.3	Analytical Geometry
5.4.1	Number Theory
5.4.2	Portfolio Optimization
5.4.3	Industrial Mathematics
5.4.4	Hydromechanics
5.6	Value-Added Course
6.1	Riemann Integration and series of functions
6.2	Ring Theory and Linear Algebra II
6.3.1	Theory of Equations
6.3.2	Mechanics
6.3.3	Mathematical Finance
6.4.1	Bio-Mathematics
6.4.2	Differential Geometry
6.4.3	Integral Transforms
6.5	Project work
6.6	Value Added Course

BSc Mathematics (Honours) Mapping of courses with POs/PSOs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5
1.1	H	M							L	M	H	L			M
1.2	H	M							H	L		M	M		
1.3	M	M						L		L	M	M		H	
1.4	H		H	M		M		L							H
1.5	M	M								L		M		M	L
1.6	M		M		M	H			M			M			H
2.1	M	H	M		L						M	M		L	
2.2		M					H			M	H	M	L		
2.3	H	M							H	L		M	M		
2.4				L	M	M	H					M			M
2.5	M	M								L		M		M	L
2.6	M		M			H		L				M			H
2.7	M		M		M	H			M			M			H
3.1	M	M	L						L	L	H	M	L		M

3.2	M	M	L	L			L				M	M		M	
3.3		M	M					M	M	H	M	H	L		M
3.4	H	M							H	L		M	M		
3.5.1		M	L						M	M		M	M	M	
3.5.2	M	M	L						M	M		M	M	M	
3.6	M		M			H		L				M			H
3.7	M		M		M	H			M			M			H
4.1	M		L				H		L	H	M	M	M	M	
4.2	H	M							H	L		M	M		
4.3	H	H	M	M			L			L	M	M	H		L
4.4	M	M	L	L			L				M	M		M	
4.5.1			M	L	M	H						H	M		M
4.5.2		M	M	L	M	H						H	M		M
4.6		M	L						M	M		M	M	M	
4.7	M		M		M	H			M			M			H
5.1	H	H	M					M		M	M		H	L	
5.2	M	M		L					L	H	M	M		H	
5.3.1	H	M	M	L				H		M		H	M	M	L
5.3.2	H	M	M	L				H		M		H	M	M	L
5.3.3	H	M	M	L				H		M		H	M	M	L
5.4.1		M	M	L				H		M		H	M	M	L
5.4.2	H	M	M	L				H		M		H	M	M	L
5.4.3	H	M	M	L				H		M		H	M	M	L
5.4.4	H	M	M	L				H		M		H	M	M	L
5.6	M		M		M	H			M			M			H
6.1	M	M	L							M	M	M	L		
6.2	M	M		L					L	H	M	M		H	
6.3.1		H	M			M	M		M	H	M	H	M		M
6.3.2	H	M	M	L				H		M		H	M	M	L
6.3.3	H	M	M	L				H		M		H	M	M	L
6.4.1		H	M			M	M		M	H	M	H	M		M
6.4.2	H	M	M	L				H		M		H	M	M	L
6.4.3	H	M	M	L				H		M		H	M	M	L
6.5	M	M	M	M	M	M	M	M	M	H	M	H	M	M	M
6.6	M		M		M	H			M			M			H

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 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 behaviour 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 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 Chemistry- Mapping of Courses to PO/PSO

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	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

1. Classify the convergence of sequences and series of real numbers, and study various tests. (Understanding)
2. Recall the fundamental properties of continuity and uniform continuity. (Remembering)
3. Test for uniform convergence of sequence and series of real valued functions. (Analysing)
4. Solve problems of the Riemann integrals and improper integrals. (Evaluating)
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

	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

1. Find the fundamental concepts and properties associated with vector spaces. (Remembering)
2. Demonstrate the algebra of matrices, eigenvalues and eigenvectors. (Understanding)
3. Develop the representation between linear transformations and Matrix theory. (Applying)
4. Choose various examples in Inner product spaces and study the applications to various problems. (Evaluating)
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, Linear Transformations.

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

	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

1. Find the concepts of Group theory and the application of Sylow theorems. (Understanding)
2. Categorize among unique factorization domain, Euclidean domain, Principal ideal domain and irreducible criteria.

(Analysing)
3. Organize the characteristics of field extensions, Algebraic extension, Galois theory. (Applying)
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

	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

1. Find the classification of differential equations with existence and uniqueness criteria. (Remembering)
2. Develop appropriate methods to solve linear differential equations. (Applying)
3. Examine the solvability of differential equation and partial differential equation. (Analysing)
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

	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

1. Explain basic numerical methods to solve algebraic and transcendental equations. (Understanding)
2. Classify interpolation formulae and solve different numerical problems. (Applying)
3. Make use of Interpolation formulae to solve numerical differentiation and integration. (Evaluating)
4. Compose various methods to obtain numerical solutions of ODE and PDE. (Creating)
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

	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

1. Demonstrate the basic characteristics and properties of metric spaces. (Understanding)
2. Categorize the various properties related to Topological Spaces. (Creating)
3. Examine the Connectedness and Compactness of Topological Spaces. (Analysing)
4. Deduct various results from separation axioms and Metrization theorem. (Evaluation)
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 spaces of 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

	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

1. Define the concept analytic functions and the significance of CR-equations. (Remembering)
2. Explain the basic concepts and theorems associated with complex functions. (Understanding)
3. Apply Cauchy Integrals formulae and Residue theorem to evaluate real and complex integrals. (Applying)
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 points in 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, Open Mapping 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

	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

1. Explain the concept of algebra of sets, measure and Lebesgue measure. (Understanding)
2. Demonstrate understanding of the statement and proofs of monotone convergence theorems and their applications. (Understanding)
3. Explain the axioms and properties of probability theory. (Understanding)
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

	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

1. Gain the knowledge fundamentals concepts of calculus of variation and integral equations and their applications. (Understanding)
2. Use concept of Laplace and Fourier transform in solving science and engineering problems. (Applying)
3. Analyse and classify Differential Equations, Partial Differential Equations and Integral Equations and their solutions by various methods. (Analysing)
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, American Mathematical Society.

Mapping of COs to Syllabus

	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

1. Learn and understand the fundamental of motion and its governing equations. (Understanding)
2. Extend the concept of rigid body in two dimensions. (Understanding)
3. Apply concepts of Lagrangian and Hamiltonian methods to model various practical situations. (Applying)
4. Analyse diverse physical motions by studying the properties of mathematical model. (Analysing)
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, application of 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:

	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

1. Explain how to work with some of the discrete structures which include sets, relations, functions, graphs and recurrence relation. (Understanding)
2. Construct mathematical statements using logical connectives and quantifiers. (Creating)
3. Apply basic counting techniques to solve combinatorial problems. (Applying)
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, Tata McGraw-Hill.
4. Discrete Mathematics, N. Biggs, Oxford University Press.

Mapping of COs to Syllabus

	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

1. Interpret the concepts of C language's syntax. (Understanding)
2. Choose the loops and the decision-making statements to solve various problems. (Applying)
3. Implement standard algorithms and translate pseudo-codes into C programs. (Applying)
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, New Delhi.
5. Primes and Programming – An Introduction to Number Theory with Programming, Goblin P., 1993, Cambridge University Press.

Mapping of COs to Syllabus

	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

1. Learn and understand some basic concepts of research and its methodologies. (Remembering)
2. Compare different results and identify appropriate research topics with the help of literature review. (Understanding)
3. Select and define appropriate research problem and parameters. (Applying)
4. Organize and conduct research (advanced project) in a more appropriate manner. (Evaluating)
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

	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

1. Define the key notions of field theory and outline their interrelation. (Remembering)
2. Demonstrate the key concepts by interpreting them under various hypotheses. (Understanding)
3. Identify perfect fields using separable extensions, construct examples of automorphism group of a field. (Applying)
4. Analyse the proof a theorem by imposing the rules of commutative algebra. (Analysing)
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

	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

1. Identify and analyse different types of divisibility tests, Euler's theorem, Wilson theorem etc and solve various related problems. (Applying)
2. Apply Quadratic Reciprocity law and other methods to classify numbers as primitive roots, quadratic residues, and quadratic nonresidues. (Applying)
3. Evaluate primitive roots and Pell's equation with the use of continued fraction. (Evaluating)
4. 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

	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

1. Interpret any Mathematical statement into the language of logic. (Understanding)
2. Analyse various methods of proofs and deduction theorems. (Analysing)
3. Interpret the syntax of first-order logic and semantics of first-order languages. (Understanding)
4. Analyse the validity a problem by means of completeness and consistency. (Analysing)
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

	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

1. Classify the crisp and fuzzy set theorems. (Understanding)
2. Apply fuzzy set theory in modelling and analysing uncertainty in a decision problem. (Applying)
3. Analyse and examine the difference between the crisp set and fuzzy set concepts. (Analysing)
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

	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

1. Develop an appreciation for the properties of Newtonian fluids. (Remembering)
2. Understand the dynamics of fluid flows and the governing non-dimensional parameters. (Understanding)
3. Apply concepts of mass, momentum and energy conservation to flows. (Applying)
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

	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

1. Recall the concept of calculating length of a curve and area of a domain in manifold *M.* (Remembering)
2. Explain the Riemannian metric on surfaces embedded in Euclidean space. (Understanding)
3. Apply the properties of geodesics on a Riemannian manifold in Euclidean space and for Lobachevski plane. (Applying)
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

	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

1. Define matrix norm, normed linear space and related results. (Remembering)
2. Classify initial value problems (IVPs) and Boundary Value Problems (BVPs). (Understanding)
3. Apply different numerical methods to PDEs. (Applying)
4. Analyse accuracy of common numerical methods. (Analysing)
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 Age International.

Mapping of COs to Syllabus

	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

1. Explain basic of fundamental number theoretic algorithms. (Understanding)
2. Apply finite field theory in cryptography. (Applying)
3. Analyse primality testing algorithms and their uses in Cryptography. (Analysing)
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 of a 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

	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

1. Classify Initial conditions and boundary conditions specific to the problem. (Understanding)
2. Apply different numerical methods to ODEs. (Applying)
3. Analyse accuracy of iterative numerical methods. (Analysing)
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 K Jain.

Mapping of COs to Syllabus

	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

1. Define the different types of special functions and their properties. (Remembering)
2. Apply the properties of special functions in the mathematical analysis, functional analysis etc. (Applying)
3. Analyse properties of special functions by their integral representations and symmetries. (Analysing)
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 function of 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 series manipulations, 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

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

CAMF0043: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE (4-0-0)

COURSE OUTCOMES

1. Discuss application of mathematical logic to solve problems. (Remembering, Understanding)
2. Describe basic concept of set theory, graph theory and Group theory. (Understanding)
3. Derive the solution of a problem using deductive logic and prove the solution based on logical inference. (Applying)
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra. (Evaluating)
5. Develop the given problem as graph networks and solve with techniques of graph theory. (Applying)

Module I: (13 lectures)

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: Predicate logic, Free & Bound variables, Rules of inference, Consistency, proof of contradiction.

Module II: (20 lectures)

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 lectures)

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 lectures)

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.
2. Graph Theory by Narsingh Deo, Prentice-Hall of India publications.
3. Discrete Mathematical Structures, Theory and Applications. D.S. Malik, Thomson Learning.
4. Discrete Mathematics for Computer Science, Haggard, Thomson Learning.
5. Discrete Mathematics and Its Applications, Kenneth H Rosen, Tata McGraw-Hill Publications.
6. Mathematical foundation of Computer Science by Y. N Sings. New Age international Publishers.
7. Discrete Mathematical structures, Bernard Kolman, Robert. C. Busby & Sharon Ross, Prentice Hall of India.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	H	H		H
CO 3	H		H	
CO 4		M	H	
CO 5				H

MAAS0046: ADVANCED ANALYSIS (4-0-0)

COURSE OUTCOMES

1. Apply Holder and Minkowski inequalities in $L_p$spaces and understand completeness of L_p-spaces. (Applying)
2. Explain the concepts of Banach algebras, culminating in the Gelfand-Naimark theorem. (Understanding)
3. Define the concept of signed measure and significance of Hahn decomposition theorem. (Remembering)
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

	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

1. Relate various basic terminologies, properties and results of graph theory. (Remembering)
2. Classify different types of trees according to their properties. (Understanding)
3. Analyse different properties of factorization, covering and colorability of graphs. (Analysing)
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

	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

1. Demonstrate an understanding of the concepts of multivariate and vector-valued functions and their applications. (Understanding)
2. Examine differentiability of vector valued functions on R^n and understand the relation between directional derivative and differentiability. (Analysing)
3. Learn about generalisation of concept of integration and ability to solve higher dimension integrals. (Understanding)
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

	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

1. Demonstrate Field extensions and characterization of finite normal extensions as splitting fields and study prime fields. (Understanding)
2. Illustrate cyclotomic polynomials, cyclic extensions, Radical field extensions and Ruler & Compass constructions. (Understanding)
3. Analyse the role of Minkowski's theorem towards the proof of Four-square theorem. (Analysing)
4. Know the important applications of Galois Theory. (Applying))
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

	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

1. Explain the concept of Newtonian and non-Newtonian fluid. (Understanding)
2. Relate entropy principle to various thermal engineering applications. (Understanding)
3. Apply the concept of second law efficiency and exergy principle to various thermal engineering applications. (Applying)
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 body force, 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.

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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

	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

1. Define principles, axioms and hypothesis of governing equations of continuum mechanics. (Remembering)
2. Extend the same principles to solve deformed and un-deformed configuration of particles. (Understanding)
3. Develop the general theory to formulate and solve problems in hydrodynamics. (Applying)
4. Examine the concept of macroscopic behaviour of particles. (Analysing)
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

	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

1. Recall the fundamental principles of inertial frames and uniform motion in relativistic mechanics. (Remembering)
2. Illustrate the concept of vacuum and various physical quantities in flat space as well as curved space time. (Understanding)
3. Apply the concept of relativistic mechanics to define physical quantities in various coordinate system. (Applying)
4. Analyse the path of motion of particles in presence of curved space-time. (Analysing)
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, New York.
4. Essential Relativity – W. Rindler, Springer-Verlag.
5. General Relativity – R.M. Wald, University of Chicago Press.

Mapping of COs to Syllabus

	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

1. Learn and relate some basic concept of variational methods and finite element method. (Remembering)
2. Relate simple problems into finite elements. (Understanding)
3. Develop finite element models. (Applying)
4. 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

	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

1. Learn the formal definition and importance of analysis of an algorithm and their asymptotic bounds. (Remembering)
2. Outline different design strategies for the design of algorithms. (Understanding)
3. Develop and analyse algorithms for given problems. (Applying)
4. Compare and analysis different design strategies. (Analysing)
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

	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

1. Define the terms and concepts of symmetric key ciphers. (Remembering)
2. Identify the importance of modular arithmetic, modulo operator and algebraic structures in symmetric key cipher. (Applying)
3. Discuss some asymmetric-key cryptography, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem. (Analysing)
4. Discuss some primality test algorithms and their efficiencies. (Analysing)
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 of a 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

	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

1. Define the concepts of nonlinearity, iterated functions, fixed points, differential equations, metric space and topology. (Remembering)
2. Interpret the link between regular systems and unpredictable systems with chaotic nature. (Understanding)
3. Classify and interpret the dynamical properties for a given problem in a dynamical system. (Analysing)
4. Derive the model on of given physical situations to prove the basic dynamic behaviour with the existence of chaos. (Applying)
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.
4. 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

	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

1. Define some basic concept of functions and operations research. (Remembering)
2. Analyse and solve a given a mathematical problem, classifying its algebraic structure. (Analysing)
3. Derive the solution of a problem using mathematical methods and computing approach. (Applying)
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 and sensitivity 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

	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

1. Define some basics of game theory, concepts of players, strategies, payoff etc. (Remembering)
2. Illustrate different types of game strategies. (Understanding)
3. Apply different methods to solve games and recommend which strategy to implement. (Applying)
4. Analyse real life competitive situations using game theoretic techniques. (Analysing)
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

	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:

1. Show the correspondence between algebraic objects and their geometric counterparts. (Remembering)
2. Explain the interplay between algebraic geometry and commutative algebra. (Understanding)
3. Analyse the connection between algebraic objects and geometric properties. (Analysing)
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

	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

1. Learn some basic concept of numerical methods and operations. (Remembering)
2. Illustrate the different optimization problem and their solving methods. (Understanding)
3. Classify the algebraic structure and the solution procedure for a given a mathematical problem. (Analysing)
4. Derive the solution of a problem using computing approach. (Applying)
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

	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

1. Explain the basic concepts of Machine learning, Data Mining and AI and their importance in real life. (Understanding)
2. Illustrate the various characteristics machine learning. (Understanding)
3. Utilize the ML algorithms for finding solutions of real-life problem. (Applying)
4. Analyse ML methods for identifying problems. (Analysing)
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

	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

MASL0100: MATHEMATICS AND SERVICE LEARNING (THEORY AND PRACTICE) (2-0-0)

COURSE OUTCOMES

1. Understanding the relation between service learning and mathematical applications. (Understanding)
2. Apply theoretical knowledge to address real life issues in service learning. (Applying)
3. Analyse mathematically the expected result. (Analysing)
4. Evaluate the practical outcomes in a systematic manner. (Evaluating)

Module I: (10 lectures)

Meaning of service learning, Service Learning as Higher Education Pedagogy, How service-learning effect students, Academic benefits of service learning, Personal benefits of service learning, Democratic purpose of Higher education, Cognitive Development theories, Leadership Responsibilities.

Module II: (10 lectures)

Institutionalizing Service- learning in Higher Education, The Future of Service learning, embracing a Scholarship of Engagement in Higher Education, Higher education trends and implications for service learning.

Module III: (10 lectures)

Concepts of community**,** Community engagement, Models and Frameworks, Principles of Community engagement, Successful examples in the Field, managing organizational support for community engagement, Challenges and Social Networking in Improving Community engagement in Research.

Module IV: Field Works

(i) By visiting a local school/ college/ academic institution, take a test (both written and oral) on science education, and explain the outcome by using Statistical methods / appropriate other methods,

(ii) By visiting a nearby hospital/ clinic, take data of the number of patients visited the hospital during the last one month, explain the outcome, social ideology, etc. of the doctors and the medical team by adopting appropriate scientific tools.

(iii) By visiting a social media/ TV channel, take data of new news forecasted during last one month and explain the effects of these news in society/ general public by adopting scientific tools.

(iv) By visiting a Newspaper office, take the data of new news for the last one month published in that paper, and explain the effects of these news in society/ general public by adopting scientific tools.

(v) By visiting a local village, take the data of the education, monthly income, etc, and explain the data by adopting scientific methods along with suggestions for better development of that community.

(vi) Any other suitable project related to the Community engagement and development with scientific exposition.

Suggested Readings

1. Service Learning in Theory and Practice: The Future of Community Engagement in Higher Education: Dan W. Butin, Palgrave: Macmillan.

2. Service Learning as Civic Pedagogy, A Narrative Inquiry Exploring the Community College Student Experience, Keith E Robinder, PhD Thesis, Colorado State University, USA.
3. The Complete Guide to Service Learning, [Proven, Practical ways to Engage Students in Civic Responsibility, Academic Curriculum and Social Action], Cathryn Berger Kaye, Free Spirit Publishing.
4. Service Learning, A guide to Planning, Implementing, and Assessing Student Projects, Sally Berman, Skyhorse Publishing.

Mapping of COs to Syllabus

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

MACS0101: CALCULUS (4-0-2)

COURSE OUTCOMES

1. Apply derivative test in optimization problems appearing in social science, physical sciences etc.(Applying)
2. Determine area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas. (Evaluating)
3. Use mathematical properties in different coordinate systems of reference, sketch curves in a plane. (Analysing)
4. Illustrate of the properties of curve tracing, conics and vector function. (Understanding)

Module I: (18 lectures)

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, L'Hospital's rule, applications in business, economics and life sciences.

Module II: (16 lectures)

Reduction formulae, derivations and illustrations of reduction formulae of the type, volumes by slicing, disks and washers 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 lectures)

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: (14 lectures)

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. Calculus, G.B. Thomas and R.L. Finney, Pearson Education, Delhi.
2. Calculus, M.J. Strauss, G.L. Bradley and K. J. Smith, Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi.
3. Calculus, H. Anton, I. Bivens and S. Davis, John Wiley and Sons (Asia) P. Ltd., Singapore.
4. Introduction to Calculus and Analysis (Volumes I & II), R. Courant and F. John, Springer-Verlag, New York, Inc.

Mapping of COs to Syllabus

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

MAAG0102: ALGEBRA (5-1-0)

COURSE OUTCOMES

1. Apply De Moivre's theorem in a number of applications to solve numerical problems. (Applying)
2. Learn division algorithm and apply Euclid's algorithm and backwards substitution to find greatest common divisor. (Applying)
3. Illustrate the concepts of Inequality and the use of Fundamental theorem of algebra. (Understanding)
4. Solve a System of Linear equations stressing on various methods to determine the result. (Evaluating)

Module I: (17 lectures)

Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications.

Module II: (20 lectures)

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: (23 lectures)

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: (30 lectures)

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. Complex Numbers from A to Z, Titu Andreescu and Dorin Andrica, 2006, Burkhouse.
2. Discrete Mathematics with Graph Theory, 3rd Ed., Edgar G. Goodaire and Michael M. Parmenter, 2005, Pearson Education (Singapore) P. Ltd., Indian Reprint.
3. Linear Algebra and its Applications, 3rd Ed., Indian Reprint, David C. Lay, Pearson Education Asia.

Mapping of COs to Syllabus

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

MAER0103: REAL ANALYSIS (5-1-0)

COURSE OUTCOMES

1. Learn the basic properties of Real number $\mathbb{R}$. (Remembering)
2. Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence. (Understanding)
3. Test for convergence and absolute convergence of an infinite series of real numbers. (Analysing)

Module I: (30 lectures)

Review of Algebraic and Order Properties of R, neighbourhood of a point in R, Idea of countable sets, uncountable sets and uncountability of R. Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of R, The Archimedean Property, Density of Rational (and Irrational) numbers in R, Intervals. Limit points of a set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for sets.

Module II: (30 lectures)

Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

Module III: (30 lectures)

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Gauss test , Cauchy's nth root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

Suggested Readings

1. Introduction to Real Analysis, R.G. Bartle and D. R. Sherbert, John Wiley and Sons (Asia) Pvt. Ltd., Singapore.
2. An Introduction to Analysis, Gerald G. Bilodeau, Paul R. G.E. Keough, Jones & Bartlett.
3. Elementary Real Analysis, Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Prentice Hall.
4. A First Course in Real Analysis, S.K. Berberian, Springer Verlag, New York.

Mapping of COs to Syllabus

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

MADQ0104: DIFFERENTIAL EQUATIONS (4-0-2)

COURSE OUTCOMES

1. Learn basics of differential equations and formulate Differential Equations for various Mathematical models. (Creating)
2. Solve first order non-linear differential equation and linear differential equations of higher order using various techniques. (Evaluating)
3. Apply these techniques to solve and analyse various mathematical models. (Applying)

Module I: (18 lectures)

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: (20 lectures)

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: (22 lectures)

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. Mathematical Modelling with Case Studies, A Differential Equation Approach using Maple and MATLAB, Belinda Barnes and Glenn R. Fulford, Taylor and Francis group, London and New York.
2. Differential Equations and Boundary Value problems Computing and Modelling, C.H. Edwards and D.E. Penny, Pearson Education India.
3. Differential Equations, S.L. Ross, John Wiley and Sons, India.
4. Differential Equations with MATHEMATICA, Martha L Abell, James P Braselton, Elsevier Academic Press.

Mapping of COs to Syllabus

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

MACD0105: CALCULUS AND DIFFERENTIAL EQUATIONS (5-1-0)

COURSE OUTCOMES

1. Find the concept of nth derivatives of the function and consequences of mean value theorems. (Remembering)
2. Evaluate integral value of function by using appropriate reduction formulae. (Evaluating)
3. Apply integral formulae to determine length, area, surface area and volume of a revolution of curves. (Applying)
4. Identify, analyse and subsequently solve physical situations whose behaviour can be described by ordinary differential equations. (Analysing)
5. Determine solutions to second order homogeneous and non-homogeneous differential equations with constant coefficients. (Evaluating)

Module I: (17 lectures)

a) Derivatives, higher order derivatives, successive differentiation and Leibnitz's rule and its applications; Mean value Theorem, Taylor 's Theorem, tangents and normals, concavity and inflection points, curvature, L' Hospital's rule.

b) 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.

Module II: (16 lectures)

Standard methods of integration, integration of irrational function, reduction formulae, derivations and illustrations of the type.

Module III: (12 lectures)

Applications of Integrals: Area of plane curves, volume and surface area of solids of revolution, parametrization of a curve, arc length of parametric curves.

Module IV: (17 lectures)

Differential equations; 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 V: (18 lectures)

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.

Suggested Readings

1. Calculus - G.B. Thomas and R.L. Finney, Pearson Education, Delhi.
2. Calculus - M.J. Strauss, G.L. Bradley and K. J. Smith, Dorling Kindersley (India) P. Ltd (Pearson Education), Delhi.
3. Differential Equations - S.L. Ross, John Wiley and Sons, India.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3		M	H		
CO 4			M	H	
CO 5				M	H

MALG0106: ALGEBRA (5-1-0)

COURSE OUTCOMES

1. Apply De Moivre's theorem in a number of applications to solve numerical problems. (Applying)
2. Develop the knowledge of a matrix and learn to solve systems of linear equations and application problems requiring them. (Understanding)
3. Relate the fundamental concepts of Groups and symmetrical figure. (Remembering)
4. Learn about the fundamental theory of two objects, namely - rings and vector spaces. (Understanding)

Module I: (24 lectures)

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 lectures)

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: (24 lectures)

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: (24 lectures)

Rings and subrings in the context of C[0,1], simple 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. Contemporary Abstract Algebra, J. A. Gallian, Brooks Cole.
2. A First Course in Abstract Algebra, J. B. Fraleigh, Pearson
3. Linear Algebra and its Applications, David C. Lay, Pearson Education Asia, Indian Reprint
4. Linear Algebra, K. Hoffman and R. Kunze, Prentice Hall,
5. Complex Numbers from A to Z, Titu Andreescu and Dorin Andrica, Burkhouse.

Mapping of COs to Syllabus

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

MARF0109: THEORY OF REAL FUNCTIONS (5-1-0)

COURSE OUTCOMES

1. Demonstrate a rigorous understanding of the concept of limit of a functions. (Understanding)
2. Define continuity and uniform continuity of functions and interpret geometrical properties of continuous functions on closed and bounded intervals. (Analysing)
3. Analyse the consequence of various mean value theorem for differentiable functions. (Analysing)

Module I: (30 lectures)

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 II: (30 lectures)

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.

Module III: (30 lectures)

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. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, ln(1 + x), 1/ax+b and (1 +x)n.

Suggested Readings

1. Introduction to Real Analysis, R. Bartle and D.R. Sherbet, John Wiley and Sons.
2. Elementary Analysis: The Theory of Calculus., K.A. Ross, Springer.
3. Introduction to Analysis, A. Mattuck, Prentice Hall.
4. A Course in Calculus and Real Analysis, S.R. Ghorpade and B.V. Limaye, Springer.

Mapping of COs to Syllabus

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

MAGT0110: GROUP THEORY I (5-1-0)

COURSE OUTCOMES

1. Relate the fundamental concepts of groups and symmetries of geometrical objects. (Remembering)
2. Gain the basic knowledge of subgroups, normal subgroups and cyclic groups. (Understanding)
3. Make Use of Lagrange's Theorem to analyse the cyclic subgroups of a group. (Applying)
4. Evaluate the external direct product of two groups and its order. (Evaluating)
5. Illustrate mapping structure between groups and their consequences. (Understanding)

Module I: (20 lectures)

Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups.

Module II: (30 lectures)

Subgroups and examples of subgroups, centralizer, normalizer, centre of a group, product of two subgroups. Properties of cyclic groups, 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 III: (20 lectures)

External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

Module IV: (20 lectures)

Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.

Suggested Readings

1. A First Course in Abstract Algebra, John B. Farleigh, Pearson.
2. Abstract Algebra, M. Artin, Pearson.
3. Contemporary Abstract Algebra, Joseph A. Gallian, Narosa Publishing House New Delhi.
4. An Introduction to the Theory of Groups, Joseph J. Rotman, Springer Verlag.
5. Topics in Algebra, I.N. Herstein, Wiley Eastern Limited, India.

Mapping of COs to Syllabus

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

MAMC0111: MULTIVARIATE CALCULUS (5-1-0)

COURSE OUTCOMES

1. Learn about the differentiation and integration of the functions of two or more variables together with their various applications. (Understanding)
2. Relate inter-relationship amongst the line integral, double and triple integral formulations. (Remembering)
3. Apply multi variable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc. (Applying)
4. Evaluate double and triple integrals by applying change of variables theorems. (Evaluating)
5. Apply Greens, divergence, and Stokes theorems by combining vector differential calculus and vector integral calculus. (Applying)

Module I: (25 lectures)

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, Definition of vector field, divergence and curl.

Module II: (20 lectures)

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: (25 lectures)

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.

Module IV: (20 lectures)

Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.

Suggested Readings

1. Calculus, G.B. Thomas and R.L. Finney, Pearson Education, Delhi.
2. Calculus, M.J. Strauss, G.L. Bradley and K. J. Smith, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
3. Basic Multivariable Calculus, E. Marsden, A.J. Tromba and A. Weinstein, Springer (SIE), Indian reprint.
4. Multivariable Calculus, Concepts and Contexts, James Stewart, Brooks /Cole, Thomson Learning, USA.

Mapping of COs to Syllabus

	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

MAPC0112: PROGRAM MAPC0112: PROGRAMMING IN C (2-0-0)

COURSE OUTCOMES

1. Demonstrate the understanding of the concepts of C language syntax. (Understanding)
2. Choose the loops and the decision-making statements to solve various problems. (Applying)
3. Implement standard algorithms and translate pseudo-codes into C programs. (Applying)
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: (5 lectures)

C Fundamentals:-Elementary data types , variables, constants and identifiers. Integer, character floating point and string constants . variable declarations. Syntax and semantics. Reserved word. Initialization of variable during declarations Constant data types.

Module II: (7 lectures)

Expression, precedence and associativity of operators, unary, binary and ternary operators. Arithmetic operators, assignment operators, relational operators, logical operators and bit –wise operators, Expression statement.

Module III: (10 lectures)

Conditional Statement-if, if-else. Iterative Statement-while, do-while, for. Other Statement –break, continue, goto, return, switch. Structures and Unions.

Module IV: (8 lectures)

Functions, -call by value, call by reference. Array – declaration and use, 2D Array-declaration and use.

Suggested Readings

1. Computer Fundamentals and Programming in C, Thareja, R., Oxford University Press, New Delhi.
2. Computing Fundamentals and C programming; Balaguruswamy E.; Tata McGraw Hill Publishing Company Limited New Delhi.
3. Let us C; Kanetkar Y, BPB Publications, New Delhi.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		M
CO 3		M	H	
CO 4		M	H	M
CO 5				H

MALS0113: LOGIC AND SETS (2-0-0)

COURSE OUTCOMES

1. Gain the knowledge of interpreting any Mathematical statement into the language of logic. (Remembering)
2. Explain the notion of logic and set which is fundamental in every branch of Science. (Understanding)
3. Apply the methodologies of sets in problems arising in other branches of Mathematics like combinatorics and algebra. (Applying)
4. Analyse validity of a given statements by means of principles of logic. (Analysing)

Module I: (14 lectures)

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: (7 lectures)

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: (9 lectures)

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. Discrete Mathematics and Combinatorial Mathematics, R.P. Grimaldi, Pearson Education.
2. Naive Set Theory, P.R. Halmos, Springer.
3. Theory of Sets, E. Kamke, Dover Publishers.

Mapping of COs to Syllabus

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

MAPE0114: PDE and Systems of ODE (4-0-2)

COURSE OUTCOMES

1. Define various types of partial differential equations and transform into canonical form. (Remembering)
2. Explain the relationship of various functions in differential problems. (Understanding)
3. Develop derivative techniques to predict the behaviour of nonlinear phenomena and find solution. (Applying)
4. Analyse boundary conditions of problems which are not solvable initially. (Analysing)
5. Assess various higher order methods for the solution of complex problem. (Evaluating)

Module I: (14 lectures)

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: (18 lectures)

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: (10 lectures)

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 lectures)

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. Linear Partial Differential Equations for Scientists and Engineers, S.L. Ross Springer, Indian reprint, Tyn Myint-U and Lokenath Debnath.
2. Differential equations, John Wiley and Sons, India.
3. Differential equations with MATHEMATICA, Martha L Abell, James P Braselton, Elsevier Academic Press.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		
CO 3		M	H	
CO 4			M	M
CO 5				H

MANM0115: NUMERICAL METHODS (4-0-2)

COURSE OUTCOMES

1. Solve an algebraic or transcendental equation using an appropriate numerical method. (Evaluating)
2. Apply the different numerical methods for interpolation, differentiation, integration and solving set of ordinary differential equations. (Applying)
3. Perform an error analysis for a given numerical method. (Analysing)
4. Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions. (Applying)

Module I: (20 lectures)

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: (22 lectures)

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: (18 lectures)

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.

Suggested Readings

1. A Friendly Introduction to Numerical Analysis, Brian Braide, Pearson Education, India.
2. Numerical Methods for Scientific and Engineering Computation, M.K. Jain, S.R.K. Iyengar and R.K. Jain, New age International Publisher, India.
3. Applied Numerical Analysis, C.F. Gerald and P.O. Wheatley, Pearson Education, India.
4. A First Course in Numerical Methods, Uri M. Ascher and Chen Greif, PHI Learning Private Limited.
5. Numerical Methods using MATLAB, John H. Mathews and Kurtis D. Fink, PHI Learning Private Limited.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3	M	M	M
CO 4		M	H

MAMC0116: MECHANICS (5-1-0)

COURSE OUTCOMES

1. Define basic mechanical concepts related to force and equilibrium of systems. (Remembering)
2. Illustrate the laws and relation between discrete and continuous mechanical systems. (Understanding)
3. Describe planar and spatial motion of a rigid body. (Remembering)
4. Analyse the motion of a system of particles using conservation laws. (Analysing)

Module I: (30 lectures)

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: (30 lectures)

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: (30 lectures)

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. Engineering Mechanics: Statics and Dynamics, I.H. Shames and G. Krishna Mohan Rao, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
2. Engineering Mechanics: Statics and Dynamics, R.C. Hibbeler and Ashok Gupta, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H		
CO 2	M	H	
CO 3		H	
CO 4		M	H

MACG0117: COMPUTER GRAPHICS (2-0-0)

COURSE OUTCOMES

1. Explain the basic concepts and the functioning of graphic processors. (Understanding)
2. Implement various algorithms to scan, convert the basic geometrical transformations. (Applying)
3. Analyse graphics devices to produce a graphics image of desired quality. (Analysing)
4. Evaluate the utility of a certain graphics model by writing a program. (Evaluating)

Module I (14 lectures)

Development of computer Graphics: Raster Scan and Random Scan graphics storages, displays processors and character generators, colour display techniques, interactive input/output devices.

Module II (16 lectures)

Points, lines and curves: Scan conversion, line-drawing algorithms, circle and ellipse generation, conic-section generation, polygon filling antialiasing. Two-dimensional viewing: Coordinate systems, linear transformations, line and polygon clipping algorithms.

Suggested Readings

1. Computer Graphics, 2nd Ed., D. Hearn and M.P. Baker, 2004, Prentice–Hall of India.
2. Hughes, Computer Graphics: Principals and Practices, 2nd Ed., J.D. Foley, A van Dam, S.K. Feiner and J.F. Addison, 1990, Wesley, MA.
3. Procedural Elements in Computer Graphics, D.F. Rogers, McGraw Hill Book Company.
4. Mathematical Elements in Computer Graphics, D.F. Rogers and A.J. Admas, McGraw Hill Book Company.

Mapping of COs to Syllabus

	Module I	Module II
CO 1	H	
CO 2	H	M
CO 3	M	H
CO 4		H

MAGY0118: GRAPH THEORY (2-0-0)

COURSE OUTCOMES

1. Define basic concepts of graphs and properties of graphs. (Remembering)
2. Apply Dijkstra's algorithm to find a shortest path spanning tree in a graph or digraph. (Applying)

Module I (15 lectures)

Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bi-partite graphs, isomorphism of graphs, paths and circuits, Eulerian circuits, Hamiltonian cycles.

Module II (15 lectures)

The adjacency matrix, weighted graph, travelling salesman's problem, shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm.

Suggested Readings

1. Introduction to Lattices and Order, B.A. Davey and H.A. Priestley, Cambridge University Press.
2. Discrete Mathematics with Graph Theory, Edgar G. Goodaire and Michael M. Parmenter, Pearson Education (Singapore) P. Ltd.
3. Applied Abstract Algebra- Undergraduate Texts in Mathematics, Rudolf Lidl and Gunter Pilz, Springer (SIE).

Mapping of COs to syllabus

	Module I	Module II
CO 1	H	
CO 2	M	H

MAMC0126: METRIC SPACES AND COMPLEX ANALYSIS (5-1-0)

COURSE OUTCOMES

1. Explain the basic concepts of metric spaces and these concepts to their counter parts in real analysis. (Understanding)
2. Understand several concepts of metric spaces, their properties and connectedness. (Understanding)
3. Identify the continuity of a function in complex problems. (Applying)
4. Apply Cauchy Residue theorem to evaluate Contours integrals. (Applying)

Module I: (23 lectures)

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: (12 lectures)

Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Homeomorphism, Contraction mappings, Banach Fixed point Theorem. Connectedness, connected subsets of R.

Module III: (30 lectures)

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: (25 lectures)

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.

Suggested Readings

1. Metric Spaces, Satish Shirali and Harikishan L. Vasudeva, Springer Verlag, London.
2. Topology of Metric Spaces, 2nd Ed., S. Kumaresan, Narosa Publishing House.
3. Introduction to Topology and Modern Analysis, G.F. Simmons, McGraw-Hill.
4. Complex Variables and Applications, James Ward Brown and Ruel V. Churchill, McGraw– Hill International Edition.
5. Complex Analysis, Joseph Bak and Donald J. Newman, Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York.

Mapping of COs to Syllabus

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

MART0127: RING THEORY AND LINEAR ALGEBRA I (5-1-0)

COURSE OUTCOMES

1. Develop the fundamental concept of Rings, Fields, subrings, integral domains and the corresponding morphisms. (Understanding)
2. Recall ring homomorphism and isomorphism theorems of rings. (Remembering)
3. Elaborate the concept of linear independence of vectors over a field, the idea of a finite dimensional vector space, basis of a vector space and the dimension of a vector space. (Creating)
4. Learn about basic concepts of linear transformations, matrix of a linear transformation, algebra of transformations and the change of basis. (Understanding)

Module I: (24 lectures)

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 II: (18 lectures)

Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of quotients.

Module III: (24 lectures)

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors,linear span, linear independence, basis and dimension, dimension of subspaces.

Module IV: (24 lectures)

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. A First Course in Abstract Algebra, John B. Fraleigh, Pearson.
2. Abstract Algebra, M. Artin, Pearson.
3. Linear Algebra, S. H. Friedberg, A. J. Insel, L. E. Spence, Prentice-Hall of India Pvt. Ltd., New Delhi.
4. Contemporary Abstract Algebra, J. A. Gallian, Narosa Publishing House, New Delhi.
5. Introduction to Linear Algebra, S. Lang, Springer.
6. Linear Algebra and its Applications, Gilbert Strang, Thomson Book/Cole.
7. Linear Algebra- A Geometric Approach, S. Kumaresan, Prentice Hall of India.
8. Linear Algebra, Kenneth Hoffman, Ray Alden Kunze, Prentice-Hall of India Pvt.Ltd.
9. Groups, Rings and Fields, D.A.R. Wallace, Springer Verlag London Ltd.

Mapping of COs to Syllabus

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

MANT0128: NUMBER THEORY (5-1-0)

COURSE OUTCOMES

1. Prove some results including the prime number theorem, Chinese remainder theorem, Wilson's theorem and their consequences. (Evaluating)
2. Identify and understand different types of divisibility tests, and reduced set of residue problems.(Applying)

3. Learn about number theoretic functions, modular arithmetic and their applications. (Understanding)
4. Find primitive roots of prime and composite numbers. (Evaluating)

Module I: (29 lectures)

Divisibility, The division algorithm theorem, Linear Diophantine equation, prime counting function.

Module II: (25 lectures)

Fundamental Theorem of arithmetic, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues, Chinese Remainder theorem, Fermat's Little theorem, Wilson's theorem.

Module III: (18 lectures)

Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatest integer function.

Module IV: (18 lectures)

Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function. The order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots; Definition of quadratic residue of an odd prime, and Euler's criterion.

Suggested Readings

1. Elementary Number Theory, David M. Burton, Tata McGraw-Hill.
2. Elementary Number Theory. G. A. Jones and J. Mary Jones, Undergraduate Mathematics Series (SUMS).
3. Beginning Number Theory, Neville Robins, Narosa Publishing House Pvt. Ltd. Delhi.
4.

Mapping of COs to Syllabus

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

MAGT0129: GROUP THEORY II (5-1-0)

COURSE OUTCOMES

1. Explain basic concepts such as automorphism, classifications of groups, conjugacy, class equation, simplicity, etc. (Understanding)
2. Analyse finite groups in terms properties of direct product of groups leading to fundamental theorem of finite abelian groups. (Analysing)
3. Illustrate how a group is interpreted in terms of a symmetric group by means of Cayley's theorem. (Understanding)
4. Apply the notion of simple group in Galois theory which leads to determine the solvability of polynomial equations. (Applying)
5. Evaluate the simplicity of a group based on various non-simplicity test. (Evaluating)

Module I: (18 lectures)

Automorphisms and Properties: Automorphism, inner automorphism, 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 II: (18 lectures)

Properties of external direct products, the group of units modulo n as an external direct product,
internal direct products, classifications of groups of order p^2, p is prime,Fundamental Theorem of finite abelian groups.

Module III: (24 lectures)

Group actions: Group actions and permutation representations; stabilizers and kernels, permutation representation associated with a given group action, Applications of group actions: Generalized Cayley's theorem, Index theorem.

Module IV: (30 lectures)

Conjugacy class, The class equation, *p*-groups, Sylow's theorems and consequences, 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.

Suggested Readings

1. A First Course in Abstract Algebra, J.B. Fraleigh, Pearson.
2. Abstract Algebra, M. Artin, Pearson.
3. Contemporary Abstract Algebra, J. A. Gallian, Narosa Publishing House, New Delhi.

Mapping of COs to Syllabus

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

MALP0130: LINEAR PROGRAMMING (5-1-0)

COURSE OUTCOMES

1. Recall several possible solutions of linear programming problems, unconstrained and constrained problems etc. (Remembering)
2. Explain the concept of convex set and extreme points. (Understanding)
3. Apply the concept of LPP to game problems. (Understanding)
4. Analyse the primal and dual problems, and sensitivity analysis of LPP. (Analysing)
5. Formulate an optimization problem from its physical consideration to Linear programming problem. (Analysing)

Module I: (24 lectures)

The Linear Programming Problem: Standard, Canonical and matrix forms, Graphical solution. Hyperplanes, Extreme points, Convex and polyhedral sets. Basic solutions; Basic Feasible Solutions; Reduction of any feasible solution to a basic feasible solution; Correspondence between basic feasible solutions and extreme points.

Module II: (30 lectures)

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: (18 lectures)

Duality, Formulation of Dual problem; Primal-Dual relationships; economic interpretation of the dual.

Module IV: (18 lectures)

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. Linear Programming and Network Flows, Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, John Wiley and Sons, India.
2. Operations Research, An Introduction, Hamdy A. Taha, Prentice-Hall India.
3. Linear Programming, G. Hadley, Narosa Publishing House, New Delhi.
4. Introduction to Operations Research, F.S. Hillier and G.J. Lieberman, Tata McGrawHill, Singapore.
5. An Introduction to Linear Programming and Game Theory, Thie, Paul R., & Keough, G. E., Wiley India Pvt. Ltd.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2	M	H		
CO 3			H	
CO 4			H	
CO 5	M			H

MARI0131: RIEMANN INTEGRATION AND SERIES OF FUNCTIONS (5-1-0)

COURSE OUTCOMES

1. Discuss the properties of Riemann integrable functions, and the applications of the fundamental theorems of integration. (Creating)
2. Importance of improper integrals including Beta and Gamma functions. (Evaluating)
3. Apply different tests to check the convergence of the different functions and improper integrals. (Applying)
4. Examine the advantages and limitations convergence of power series. (Analysing)

Module I:(25 lectures)

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: (20 lectures)

Improper integrals; Convergence of Beta and Gamma functions.

Module III: (24 lectures)

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: (21 lectures)

Power series, radius of convergence, Abel's Theorem; Weierstrass Approximation Theorem.

Suggested Readings

1. Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, K.A. Ross, Springer (SIE).
2. Introduction to Real Analysis, R.G. Bartle D.R. Sherbet, John Wiley and Sons (Asia) Pvt. Ltd., Singapore.
3. Elements of Real Analysis, Student Edition, Charles G. Denlinger, Jones & Bartlett.

Mapping of COs to Syllabus

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

MART0132: RING THEORY AND LINEAR ALGEBRA II (5-1-0)

COURSE OUTCOMES

1. Discuss the properties of Riemann integrable functions, and the applications of the fundamental theorems of integration. (Creating)
2. Importance of improper integrals including Beta and Gamma functions. (Evaluating)
3. Apply different tests to check the convergence of the different functions and improper integrals. (Applying)
4. Examine the advantages and limitations convergence of power series. (Analysing)

Module I: (18 lectures)

Polynomial rings over commutative rings, division algorithms and consequences, principal ideal Domains.

Module II: (20 lectures)

Factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion, unique factorization in Z[x]. Divisibility in integral domains, irreducibles, primes, unique factorization domains, Euclidean domains.

Module III: (29 lectures)

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.

Mod IV: (23 lectures)

Inner product spaces and norms, Gram-Schmidt orthogonalisation 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. Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, K.A. Ross, Springer (SIE).
2. Introduction to Real Analysis, R.G. Bartle D.R. Sherbet, John Wiley and Sons (Asia) Pvt. Ltd., Singapore.
3. Elements of Real Analysis, Charles G. Denlinger, Jones & Bartlett.

Mapping of COs to syllabus

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

MAIM0133: INDUSTRIAL MATHEMATICS (5-1-0)

COURSE OUTCOME

1. Recall and facilitate mathematical concepts in solving the problems of daily life. (Remembering)
2. Develop the competency in using mathematical tools to study geological anomalies. (Applying)
3. Analyse the different types of mathematical simulation used in the medical diagnosis. (Analysing)
4. Evaluate processing of X-ray scan output using Mathematical Algorithms. (Evaluating)
5. Apply math and algebraic theories, concepts and skills to Image Reconstruction Technology. (Applying)
6. Evaluate the applications of different transformations like IFT in image reconstructions. (Evaluating)

Module I: (18 lectures)

Medical Imaging and Inverse Problems. The content is based on Mathematics of X-ray and CT scan based on the knowledge of calculus, elementary differential equations, complex numbers and matrices.

Module II: (24 lectures)

Introduction to Inverse problems: Why should we teach Inverse Problems? Illustration of Inverse problems through problems taught in Pre-Calculus, Calculus, Matrices and differential equations. Geological anomalies in Earth's interior from measurements at its surface (Inverse Problems for Natural disaster) and Tomography.

Module III: (19 lectures)

X-ray: Introduction, X-ray behaviour and Beer's Law (The fundamental question of image construction) Lines in the place.

Module IV: (12 lectures)

Radon Transform: Definition and Examples, Linearity, Phantom (Shepp - Logan Phantom -Mathematical phantoms).

Module V: (5 lectures)

Back Projection: Definition, properties and examples.

Module VI: (12 lectures)

CT Scan: Revision of properties of Fourier and inverse Fourier transforms and applications of their properties in image reconstruction. Algorithms of CT scan machine. Algebraic reconstruction techniques abbreviated as ART with application to CT scan.

Suggested Readings

1. The Mathematics of Medical Imaging, A Beginners Guide, Springer Under Graduate Text in Mathematics and Technology, Timothy G. Feeman, Springer.
2. Inverse Problems, Activities for Undergraduates, C.W. Groetsch, the Mathematical Association of America.
3. An Introduction to the Mathematical Theory of Inverse Problems, Andreas Kirsch, Springer.

Mapping of COs to Syllabus

	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					M	
CO 5					H	M
CO 6						H

MAMF0134: MATHEMATICAL FINANCE (5-1-0)

COURSE OUTCOMES

1. Explain the basics of financial markets and derivatives including options and futures. (Understanding)
2. Relate the concepts Pricing and hedging of options, interest rate swaps and no-Arbitrage pricing concept. (Remembering)
3. Importance of stochastic analysis of stock price and the Black–Scholes model. (Evaluating)
4. Learn about pricing and hedging of options, as well as interest rate swaps. (Understanding))
5. Learn the concepts of trading strategies and valuation of currency swaps. (Understanding)

Module I: Interest Rates (17 lectures)

Types of rates, Measuring interest rates, Zero rates, Bond pricing, Forward rate, Duration, Convexity, Exchange traded markets and OTC markets, Derivatives—Forward contracts, Futures contract, Options, Types of traders, Hedging, Speculation, Arbitrage.

Module II: Mechanics and Properties of Options (23 lectures)

No Arbitrage principle, Short selling, Forward price for an investment asset, Types of Options, Option positions, Underlying assets, Factors affecting option prices, Boundson option prices, Put-call parity, Early exercise, Effect of dividends.

Module III: Stochastic Analysis of Stock Prices and Black-Scholes Model (25 lectures)

Binomial option pricing model, Risk neutral valuation (for European and American options on assets following binomial tree model), Lognormal property of stock prices, Distribution of rate of return, expected return, Volatility, estimating volatility from historical data, Extension of risk neutral valuation to assets following GBM, Black-Scholes formula for European options.

Module IV: Hedging Parameters, Trading Strategies and Swaps (25 lectures)

Hedging parameters (the Greeks: Delta, Gamma, Theta, Rho and Vega), Trading strategies involving options, Swaps, Mechanics of interest rate swaps, Comparative advantage argument, Valuation of interest rate swaps, Currency swaps, Valuation of currency swaps.

Suggested Readings

1. Investment Science, David G. Luenberge, Oxford University Press, Delhi.
2. Options, Futures and Other Derivatives, John C. Hull, Prentice-Hall India.
3. An Elementary Introduction to Mathematical Finance, Sheldon Ross, Cambridge.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2		H		
CO 3			H	
CO 4			M	M
CO 5				H

MABM0135: BIO- MATHEMATICS (5-1-0)

COURSE OUTCOMES

1. How to put the relationship of different parameters, and then their physical interpretation. (Remembering)
2. For a given a mathematical problem, classify the problems based on solution procedure and then study their significance in the practical fields. (Analysing)
3. Derive the solution of a problem by using the existed methods and interpret the results.(Creating)
4. Evaluate the mathematical and biological system solution procedure and analyse the results.(Evaluating)
5. Develop the new solution methods for the new problems and models. (Creating)

Module I: (20 lectures)

Continuous Population Models: Mathematical Biology and the modelling 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: (15 lectures)

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: (15 lectures)

Models for Interacting Populations: Predator-Prey Models: Lotka- Volterra Systems, Complexity and Stability, Analysis of a Predator-Prey model with Limit Cycle, Periodic Behaviour, Parameter Domains of Stability. Discrete Growth Models for Interacting Populations, Predator –Prey Models: Detailed Analysis.

Module IV: (15 lectures)

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: (15 lectures)

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 Polyclonality and Cell Mutation.

Suggesting Readings

1. Mathematical Biology, Vol I and II, J. D. Murray, Springer.
2. Mathematical Models in Biology, L.E. Keshet, SIAM.
3. Biomechanics, Y.C. Fung, Springer-Verlag.
4. Mathematical Epidemiology, F. Brauer, P.V.D. Driessche and J. Wu, Springer.
5. Elements of Mathematical Ecology, M. Kot, Cambridge University Press.

Mapping of COs to Syllabus

	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		H

MADG0136: DIFFERENTIAL GEOMETRY (5-1-0)

COURSE OUTCOMES

1. Recall various properties of space curves and their applications. (Remembering)
2. Interpret geometrical orientation of parametric curves and surfaces. (Understanding)
3. Develop the physical mapping and nature of geodesic curves. (Applying)
4. Analyse the different characteristics of Christoffel symbols and their transformation. (Analysing)

Module I: (18 lectures)

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: (24 lectures)

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.

Developables: Developable associated with space curves and curves on surfaces, Minimal surfaces.

Module III: (24 lectures)

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: (24 lectures)

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. An Introduction to Differential Geometry, T.J. Willmore, Dover Publications.
2. Elementary Differential Geometry, B. O'Neill, Academic Press.
3. Differential Geometry of Three Dimensions, C.E. Weather burn, Cambridge University Press.
4. Lectures on Classical Differential Geometry, D.J. Struik, Dover Publications.
5. Fundamentals of Differential Geometry, S. Lang, Springer.
6. Tensor Calculus: A Concise Course, B. Spain, Dover Publications.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		
CO 3		M		
CO 4			H	M
CO 5				H

MAPS0137: PROBABILITY AND STATISTICS (5-1-0)

COURSE OUTCOMES

1. Recall the basic principles of Probability Theory and Statistics. (Remembering)
2. Understand the concept of random variables and types of distribution. (Understanding)
3. Applying discrete and continuous Atas to compute the probabilities of events. (Applying)
4. Perform a regression analysis, and compute and interpret the coefficient of correlation. (Evaluating)

Module I: (17 lectures)

Probability axioms, sample spaces, events, law of total probability, conditional probability, Bayes' theorem and independence.

Module II: (18 lectures)

Real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function.

Module III:(30 **lectures)**

Discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential. Joint probability distributions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables.

Module IV: (25 lectures)

The correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables. Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers, Central Limit theorem.

Suggested Readings

1. Introduction to Mathematical Statistics, Robert V. Hogg, Joseph W. McKean and Allen T., Pearson Education, Asia.
2. Mathematical Statistics with Applications, Irwin Miller and Marylees Miller, John E. Freund, Pearson Education, Asia.
3. Introduction to Probability Models, Sheldon Ross, Academic Press, Indian Reprint.
4. Introduction to the Theory of Statistics, Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, Tata McGraw-Hill, Reprint.

Mapping of COs to Syllabus

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

MANA0138: NUMERICAL ANALYSIS (5-1-0)

COURSE OUTCOMES

1. Solve an algebraic or transcendental equation using an appropriate numerical method. (Evaluating)
2. Apply the different numerical methods for interpolation, differentiation, integration and solving set of ordinary differential equations. (Applying)
3. Perform an error analysis for a given numerical method. (Analysing)
4. Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions. (Applying)

Module I: (20 lectures)

Transcendental and Polynomial equations: Bisection method, Regula-Falsi Methods, Newton's method, Secant method.

Module II: (30 lectures)

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 III: (25 lectures)

Numerical differentiation**:** First and second order derivatives; Numerical integration**:** Trapezoidal Rule, Simpson's rule, finding eigenvalues by Iterations.

Module IV: (15 lectures)

Ordinary differential equation**:** Euler's method, Modified Euler's methods, . Runge-Kutta methods of orders two and four.

Suggested Readings

1. Applied Numerical Methods with MATLAB for Engineers and Scientists - Chapra, Steven C., McGraw-Hill Education.
2. Applied Numerical Analysis Using MATLAB, Fausett, Laurene V., Pearson. India.
3. Numerical Methods for Scientific and Engineering Computation, Jain, M. K., Iyengar, S. R. K., Jain R. K., New Age International Publishers. Delhi.

Mapping of COs to Syllabus

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

MAVC0139: VECTOR CALCULUS AND CO-ORDINATE GEOMETRY (5-1-0)

COURSE OUTCOMES

1. Explain the cartesian and Polar coordinate system to study 2D, 3D and shapes. (Understanding)
2. Learn about vector valued functions and to apply them to velocity, acceleration, arclength and curvature. (Understanding)
3. Formulate a physical problem using differential equation and find solution. (Applying)

Module I: (30 lectures)

Transformation of coordinate axis, pair of straight lines Parabola, parametric coordinates, tangent and Normal, Ellipse and conjugate diameters with properties; general conics: tangents, condition of tangency, pole and polar, centre of a conic, equation of pair of tangents, reduction to standards forms, central conics, equation of axes and length of the axes,

polar equation of a conic.

Module II: (30 lectures)

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, gradient, curl and divergence.

Module III: (30 lectures)

Simultaneous linear differential equations, total differential equations. Partial differential equations of first order, Lagrange's solutions, some special types of equations which can be solved by methods other than the general method, Charpit's general methods of solution.

Suggested Readings

1. Differential Equations, H.T.H. Piaggio, G. Bell & Sons Ltd.
2. Analytical Geometry of two and three dimension and vector calculus, R. M. Khan, New Central Book Agency.
3. Ordinary and partial differential equations, M.D. Raisinghania, S.Chand and Co.

Mapping of COs to Syllabus

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

MAAG0140: ANALYTICAL GEOMETRY (5-1-0)

COURSE OUTCOMES

1. Define conic sections and transform co-ordinate systems. (Remembering)
2. Explain the ideas of conics to explain many natural phenomena. (Understanding)
3. Apply the properties of conics to solve problems in real life situations. (Applying)
4. Learn analytical geometry of 2 and 3 dimensions which include study of conics, planes, lines, sphere, cone and cylinder. (Understanding)

Module I: (26 Lectures)

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 II: (30 Lectures)

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: (34 Lectures)

Rectangular coordinates in 3-space, Spheres and Cylindrical surfaces, Vector viewed geometrically, Vectors in coordinates system, Vectors determine by length and angle, Dot product, Cross product and their geometrical properties, Parametric equations of lines in 2-space and 3-space.

Suggested Readings

1. Analytical Geometry of Two and Three Dimension And Vector Analysis -R. M. Khan, New Central Book agency.
2. Calculus, Anton, Howard, Bivens, Irl & Davis, Stephen, John Wiley & Sons Singapore Pvt.Ltd., Wiley India Pvt. Ltd. Delhi.
3. The Analytical Geometry of The Conic Sections, E. H., Nabu Press.
4. Coordinate Solid Geometry, R. J. T. Bell, Macmillan.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H	M	
CO 2		H	
CO 3			M
CO 4	M		H

MAMM0141: MATHEMATICAL MODELLING (5-1-0)

COURSE OUTCOMES

1. Recall some basic concept of power series solution of a differential equation and learn about Legendre's and Bessel's equations. (Remembering)
2. Apply Laplace transform and inverse transform for solving initial value problems. (Applying)
3. Learn about various models such as Monte Carlo simulation models, queuing models, and linear programming models. (Understanding)
4. Explain various linear programming models. (Understanding)

Module I: (20 Lectures)

Power series solution of a differential equation about an ordinary point, solution about a regular singular point, Bessel's equation and Legendre's equation.

Module II: (20 Lectures)

Laplace transform and inverse transform, application to initial value problem up to second order.

Module III:(25 lectures)

Monte Carlo Simulation Modelling: Simulating deterministic behaviour (area under a curve, volume under a surface), Generating Random Numbers: middle square method, linear congruence, Queuing Models: harbor system, morning rush hour.

Module IV: (10 Lectures)

Overview of optimization modelling: Linear Programming Model: geometric solution algebraic solution, simplex method, sensitivity analysis.

Suggested Readings

1. Linear Partial Differential Equation for Scientists and Engineers, Tyn Myint-U and Lokenath Debnath, Springer, Indian reprint.
2. A First Course in Mathematical Modelling, Frank R. Giordano, Maurice D. Weir and William P. Fox, Thomson Learning, London and New York.

Mapping of COs to Syllabus

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

MAPO0142: PORTFOLIO OPTIMIZATION (5-1-0)

COURSE OUTCOMES

1. Demonstrate idea of portfolio optimization. (Understanding)
2. Analyse difference between various sources of risk and the concept of diversification. (Analysing)
3. Explain concept of optimal capital allocation and portfolio choice decisions on real-data set. (Understanding)
4. Demonstrate measures to evaluate a portfolio's performance and concepts of capital asset pricing model. (Understanding)

Module I: (30 lectures)

Financial markets. Investment objectives. Measures of return and risk. Types of risks. Risk free assets. Mutual funds. Portfolio of assets. Expected risk and return of portfolio. Diversification.

Module II: (30 lectures)

Mean-variance portfolio optimization- the Markowitz model and the two-fund theorem, risk-free assets and one fund theorem, efficient frontier. Portfolios with short sales. Capital market theory.

Module III: (30 lectures)

Capital assets pricing model- the capital market line, beta of an asset, beta of a portfolio, security market line. Index tracking optimization models. Portfolio performance evaluation measures.

Suggested Readings

1. Investment Analysis and Portfolio Management, F. K. Reilly, Keith C. Brown, South-Western Publishers.

2. Mean-Variance Analysis in Portfolio Choice and Capital Markets, H.M. Markowitz, Basil Blackwell, New York.
3. Portfolio Optimization, M.J. Best, Chapman and Hall, CRC Press.
4. Investment Science, D.G. Luenberger, Oxford University Press.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H		
CO 2	H	M	
CO 3		H	M
CO 4		M	H

MAHM0143: HYDROMECHANICS (5-1-0)

COURSE OUTCOMES

1. Find the fluid pressure on immerse surface and learn about Pressure equation and rotating fluids. (Evaluating)
2. Learn about Fluid pressure on plane surfaces, resultant pressure on curved surfaces, Gas law, mixture of gases.(understanding)
3. Learn about the Eulerian and Lagrangian methods of describing fluid motion. (Understanding)
4. Explain analytical techniques to solve fluid flow equations for different boundary conditions. (Understanding)

Module I: (24 lectures)

Pressure equation, condition of equilibrium, lines of force, homogeneous and heterogeneous fluids, elastic fluids, surface of equal pressure, fluid at rest under action of gravity, rotating fluids.

Module II: (18 lectures)

Fluid pressure on plane surfaces, centre of pressure, resultant pressure on curved surfaces.

Module III: (18 lectures)

Gas law, mixture of gases, internal energy, adiabatic expansion, work done in compressing a gas, isothermal atmosphere.

Module IV: (30 lectures)

Lagrangian and Eulerian methods of describing fluid motion; velocity of a fluid particle; material, local and convective derivatives; acceleration of a fluid particle; streamline motion and turbulent motion; steady flow; streamlines and path lines; velocity potential; vorticity vector; flux of a fluid; equation of continuity by Euler's method; equation of continuity by Lagrange's method; equivalence of the Eulerian and Lagrangian forms of the equation of continuity; equation of continuity in cartesian, spherical polar and cylindrical coordinates; certain symmetrical forms of the equation of continuity; boundary surface.

Suggested Readings

1. A Treatise on Hydromechanics, W.H. Besant and A.S. Ramsey.
2. Hydrostatics, M. Ray, S.Chand and Co.
3. Hydro-dynamics, B. G. Verma & K. P. Gupta, Pragati Prakashan, Meerut (U.P.).
4. Text Book of Hydrodynamics, D. K. Jha, Discovery Publishing House Pvt. Ltd.
5. Hydrostatics, M. Ray and H. S. Sharma, S. Chand Publications.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module Iv
CO 1	H	M	M	
CO 2		H		M
CO 3			H	H
CO 4				

MATE0144: THEORY OF EQUATIONS (5-1-0)

COURSE OUTCOMES

1. Explain the general properties of polynomial equations. (Understanding)
2. Analyse the idea of symmetric function in algebraic equations. (Analysing)
3. Estimate the integral roots of an equation by using algebraic Method. (Evaluating)
4. Interpret the conditions for obtaining roots of numerical equations. (Understanding)

Module I: (30 lectures)

General properties of polynomials, Graphical representation of a polynomial, maximum and minimum values of a polynomials, General properties of equations, Descartes's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations.

Module II: (24 lectures)

Symmetric functions, Applications of symmetric function of the roots, Transformation of equations. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Properties of the derived functions.

Module III: (18 lectures)

Symmetric functions of the roots, Newton's theorem on the sums of powers of roots, homogeneous products, limits of the roots of equations.

Module IV: (18 lectures)

Separation of the roots of equations, Strum's theorem, Applications of Strum's theorem,Conditions for reality of the roots of an equation and biquadratic. Solution of numerical equations.

Suggested Readings

1. The Theory of Equations W.S. Burnside and A.W. Panton, Dublin University Press.
2. Theory of Equations, C. C. McDuffie, John Wiley & Sons Inc.

Mapping of COs to Syllabus

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

MAIT0145: INTEGRAL TRANSFORMS (5-1-0)

COURSE OUTCOMES

1. Illustrate various methods of solving differential equations. (Understanding)
2. Construct mathematical models to solve complex problems. (Applying)
3. Classify periodic functions in terms of sine and cosine functions and its application to boundary value problem. (Understanding)
4. Utilize the knowledge of Laplace and Fourier transforms in finding the solutions of initial value problems and boundary value problems. (Applying)

Module I: (18 lectures)

Polynomials-Orthogonal Polynomial-Lagrange's, Chebyshev polynomials; Trigonometric polynomials; Laplace transform, Properties of Laplace transform, Laplace transform of periodic functions. Evaluations of integrals by Laplace transform.

Module II: (24 lectures)

Inverse Laplace Transforms: Finding inverse Laplace transform by different methods, convolution theorem. Applications of Laplace transform in linear differential equations, solving ODEs and PDEs
by Laplace transform method.

Module III: (24 lectures)

Fourier Series: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Sawtoothed wave, Triangular wave. Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period $2l$, Dirichlet's conditions, Sum of Fourier

series. Theorem for the convergence of Fourier Series Fourier Series of a function with its periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity. Examples.

Module IV: (24 lectures)

Fourier Transform: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples. Fourier Transform of Derivatives. Examples. Convolution Theorem (statement only), Inverse of Fourier Transform.

Suggested Readings

1. Introduction to Theory and Application of Laplace Transforms, Doetsch G., Springer Verlag.
2. Theory and problems of Laplace transforms - Schum's Outline Series , Murray Spiegel, Tata Mac Graw hill.
3. Integral Transforms & their applications, Brian Daries, Springer.
4. Integral Transforms & their Applications, L Debnath, D Bhatta, Chapman & Hall/CRC .
5. Fourier analysis and its applications , G.B. Follone, 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, volume 102, Mark A. Pinsky, American Mathematical Society.

Mapping of COs to Syllabus

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

MAEN0146: ECONOMETRICS (5-1-0)

COURSE OUTCOMES

1. Recall concept sampling distribution and have greater confidence in its application. (Understanding)
2. Discuss the assumptions upon which different econometric methods are based and their implications. (Understanding)
3. Tells the differences between simple linear regression analysis and multiple linear regression analysis. (Remembering)
4. Compare regression models with the help of measures like R^2 and adjusted R^2.(Analysing)
5. Explain the nature of heteroscedasticity and understand the causes and consequences of heteroscedasticity, perform tests to determine whether a regression model has heteroscedastic errors. (Understanding)

Module I: (29 lectures)

Statistical Concepts Normal distribution; chi-square, t and F-distributions; estimation of parameters; properties of estimators; testing of hypotheses: defining statistical hypotheses; distributions of test statistics; testing hypotheses related to population parameters; Type I and Type II errors; power of a test; tests for comparing parameters from two samples.

Module II: (19 lectures)

Simple Linear Regression Model: Two Variable Case Estimation of model by method of ordinary least squares; properties of estimators; goodness of fit; tests of hypotheses; scaling and units of measurement; confidence intervals; Gauss-Markov theorem; forecasting.

Module III: (18 lectures)

Multiple Linear Regression Model Estimation of parameters; properties of OLS estimators; goodness of fit - R2 and adjusted R2 ; partial regression coefficients; testing hypotheses –individual and joint; functional forms of regression models; qualitative (dummy) independent variables.

Module IV: (24 lectures)

Violations of Classical Assumptions: Consequences, Detection and Remedies Multicollinearity; heteroscedasticity; serial correlation. Specification Analysis Omission of a relevant variable; inclusion of irrelevant variable; tests of specification errors.

Suggested Readings

1. Probability and Statistics for Engineers, Jay L. Devore, Cengage Learning.
2. Mathematical Statistics, John E. Freund, Prentice Hall.
3. An Introduction to Mathematical Statistics and its Applications, Richard J. Larsen and Morris L. Marx, Prentice Hall.
4. Essentials of Econometrics, D. N. Gujarati and D.C. Porter, McGraw Hill, International Edition.
5. Introduction to Econometrics, Christopher Dougherty, Oxford University Press.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2		M	M	
CO 3		H		M
CO 4			H	
CO 5				H

MAFE0147: Finite Element Methods (5-1-0)

COURSE OUTCOMES

1. Recall some basic concept of finite element method. (Remembering)
2. Illustrate the role and significance of shape functions in finite element formulations and its interpolation. (Understanding)
3. Develop the ability to generate the governing finite elements governed by ordinary differential equations. (Applying)
4. Analyse finite element method in higher order problems. (Analysing)

Module I: (25 lectures)

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 lectures)

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 lectures)

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 lectures)

Interpolation functions, numerical integration, and modelling considerations. Solution of two dimensional partial differential equations under different Geometric conditions.

Suggested Readings

1. Introduction to the Finite Element Methods, J.N. Reddy, Tata McGraw-Hill.
2. Finite Element Procedures, K.J. Bathe, Prentice-Hall.
3. Concepts and Applications of Finite Element Analysis, R.D. Cook, D.S. Malkus and M.E. Plesha, John Wiley and Sons.
4. The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Thomas J.R. Hughes, Dover Publication.
5. Finite Element Analysis, George R. Buchanan, McGraw Hill.

Mapping of COs to Syllabus:

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

MADS0148: DESCRIPTIVE STATISTICS (5-1-0)

COURSE OUTCOMES

1. Discuss the meaning of statistics along with its utilities, discuss method of collecting data. (Understanding)
2. Organize, and present statistical data and analyse statistical data graphically using frequency distributions and cummulative frequency distributions. (Applying)
3. Apply the basic statistical tools like measures of central tendency, correlation and regression to solve social and scientific problems. (Applying)
4. Test appropriate statistical methods to summarize and analyses data. (Analysing)
5. Examine the strength and direction of a linear relationship between two variables and using correlation and regression method. (Analysing)
6. Discuss how to deal with qualitative data statistically. (Understanding)

Module I: (23 lectures)

Definition of statistics, Statement about statistics, Statistical prospective, Functions of Statistics, Method of collecting data, Types of statistical data, Primary and Secondary data, Statistical survey, Questionnaire and schedule, Kinds of statistical investigation, Errors, Laws, Approximation of values, Complete Enumeration, controlled experiments, observational studies and sample surveys, quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Editing of data, Presentation of the data- tabular, graphical. Histogram, ogives, box plots, grouping of data, concept of frequency, stem and leaf display of data consistency and independence of data with special reference to attributes.

Module II: (23 lectures)

Measures of Central Tendency: concept and definition mathematical and positional, properties, functions, limitations, arithmetic mean (AM), weighted mean, geometric mean(GM), harmonic mean(HM), relation between AM, GH and HM, median mode, quartile, decile, percentile. Measures of Dispersion: requisites of a good measure, uses, range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, absolute moments, relation between central and raw moments, skewness and kurtosis, Sheppard's correction.

Module III: (22 lectures)

Bivariate data: Definition, correlation, scatter diagram, Karl Pearson coefficient of correlation, Limits, assumptions of Correlation Coefficient, simple, partial and multiple correlation,(3 variables only), rank correlation; Simple linear regression, properties of regression coefficient, lines of regression, principle of least squares and fitting of polynomials and exponential curves.

Module IV: (22 lectures)

Theory of attributes: Introduction, Notations, Dichotomy, classes and class frequencies, consistency of data, conditions of consistency, independence and association of attributes, measures of association and contingency.

Suggested Readings

1. Statistics: A Foundation for Analysis in the Health Sciences. Daniel, Wayne W., Bio John Wiley.
2. Fundamentals of statistics, Vol.-I & II, Goon, A.M., Gupta M.K. & Das Gupta, The World Press Private Limited.
3. Design and analysis of experiments, Dass, M. N. &Giri, N. C, John Wiley.
4. Basic Statistics: A primer for the Biomedical Sciences, Dunn, O.J, John Wiley.
5. Introduction to Bio-Statistics, Bancroft, Holdom, P.B. Hoe bar New York.
6. A Biostatistics-An introductory text, Goldstein, The McMillion New York.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H			
CO 3		H	M	
CO 4	M	H		
CO 5			H	
CO 6				H

MAIP0149: INTRODUCTION TO PROBABILITY THEORY (5-1-0)

COURSE OUTCOMES

1. Define the basic principles of Probability Theory and Statistics and calculate probabilities by applying probability laws and theoretical results. (Remembering)
2. Discuss the ideas of probability and random variables, various discrete and continuous probability distributions and their properties. (Understanding)
3. Identify an appropriate probability distribution for a given discrete or continuous random variable and use its properties to calculate probabilities. (Remembering).
4. Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits. (Evaluating)
5. Discuss convergence of sequences of random variables and its applications to statistics and stochastic processes.(Creating)

Module I: (23 lectures)

Elementary Probability: Introduction, Types of Events, random experiments, sample space, events and algebra of events, pairwise independence of events.

Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, Additive, Multiplicative laws of probability, independent events, theorem of total probability, Bayes'
theorem and its applications.

Module II: (22 lectures)

Random Variables: Discrete and continuous random variables, distribution functions, Cumulative Distribution function, p.m.f., p.d.f., Illustrations of random variables and its properties. Expectation, variance, moments and moment generating function.

Module III: (23 lectures)

Standard probability distributions: Binomial, Poisson, geometric, negative binomial, hypergeometric, uniform, Normal, Exponential, Beta, Gamma.

Module IV: (22 lectures)

Convergence in probability, almost sure convergence, Chebyshev's inequality: application and solved problems, weak law of large numbers, De-Moivre Laplace and Lindeberg-Levy Central Limit Theorem (C.L.T.) and some physical examples.

Suggested Readings

1. Probability and Statistical Inference, Seventh Ed, Hogg, R.V., Tanis, E.A. and Rao J.M, Pearson Education, New Delhi,
2. Mathematical Statistics with Applications, Miller, Irwin and Miller, Marylees, John E., Freund's Pearson Education, Asia.
3. Introductory Probability and Statistical Applications, Myer, P.L., Oxford & IBH Publishing, New Delhi

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3			H	
CO 4			M	M
CO 5				H

MACA0150: COMPLEX ANALYSIS (5-1-0)

COURSE OUTCOMES

1. Define the concept analytic functions and the significance of CR-equations. (Remembering)
2. Explain the basic concepts and theorems associated with complex functions. (Understanding)
3. Derive fundamental principles of contour integrals and its various versions. (Evaluating)
4. Apply Cauchy Integrals formulae and Residue theorem to evaluate real and complex integrals. (Applying)

Module I: (24 Lectures)

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 II: (18 lectures)

Elementary Functions and Integrals**:** Exponential function, Logarithmic function, Branches and derivatives of logarithms, Trigonometric function, Derivatives of functions, Definite integralsof functions, Contours, Contour integrals and its examples, Upper bounds for moduli of contour integrals.

Module III: (24 lectures)

Cauchy's Theorems: Definite integrals of functions Antiderivatives, 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.

Module IV: (24 lectures)

Series and Residues**:** Taylor series and Laurent series and its examples, Absolute and uniform convergence of power series, Uniqueness of series representations of power series, Isolatedsingular points, Residues, Cauchy's residue theorem, residue at infinity; Types of isolated singular points, Residues at poles and its examples.

Suggested Readings

1. Complex Variables and Applications, Brown, James Ward, & Churchill, Ruel V., McGraw-Hill Education. New York.
2. A First Course in Complex Analysis with Applications. Zills, Dennis G., & Shanahan, Patrick D., Jones & Bartlett Publishers, Inc.
3. Complex Analysis for Mathematics and Engineering, Mathews, John H., & Howell, Rusell W., Jones & Bartlett Learning. Narosa, Delhi. Indian Edition.
4. Complex Analysis, Undergraduate Texts in Mathematics, Joseph Bak and Donald J. Newman, Springer-Verlag New York, Inc.

Mapping of COs to Syllabus

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

MACM0151: COMBINATORIAL MATHEMATICS (5-1-0)

COURSE OUTCOMES

1. Apply basic counting techniques to solve combinatorial problems. (Applying)
2. Define generating function of sequence and solve second order recurrence relations by finding the corresponding generating functions. (Applying)
3. Formulate recurrence relations to solve problems involving an unknown sequence. (Creating)
4. Explain the applications of graph theory in the study of shortest path algorithms. (Understanding**)**

Module I: (25 lectures)

Basic counting principles, Permutations and Combinations (with and without repetitions), Binomial theorem, Multinomial theorem, counting subsets, Set-partitions, Stirling numbers, Principle of Inclusion and Exclusion, Derangements, Inversion formulae, pigeon-hole principle and applications.

Module II: (20 lectures)

Generating functions: Algebra of formal power series, generating function models, Calculating generating functions, Exponential generating functions.

Module III: (20 lectures)

Recurrence relations: Recurrence relation models, Divide and conquer relations, Solution of recurrence relations, Solutions by generating functions. Integer partitions, Systems of distinct representatives.

Module IV: (25 Lectures)

Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Coloring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges; trees.

Suggested Readings

1. A Course in Combinatorics, J.H. van Lint and R.M. Wilson, Cambridge University Press.
2. Combinatorics, Theory and Application, V. Krishnamurthy, Affiliated East-West Press.
3. Combinatorics, Topics, Techniques, Algorithms, P.J. Cameron, Cambridge University Press.
4. Combinatorial Theory, M. Jr. Hall, John Wiley & Sons.
5. Combinatorial Techniques, S.S. Sane, Hindustan Book Agency.
6. Introductory Combinatorics, R.A. Brualdi, Pearson Education Inc.

Mapping of COs to Syllabus

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

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

	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

1. Explain the basis necessity and application of Statistics in different fields of Science and Social Sciences. (Remembering and understanding)
2. Develop the significance of data analysis and interpretation. (Applying)
3. Categorize Correlation and Regression, and interpret graphical representation. (Analysing and creating)
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

	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

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

	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

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)

i. Visiting nearby villages to collect data on the percentage of students enrolling into schools per year and represent the same using various Mathematical models.
ii. 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

1. Where's the learning in service learning, J. Eyler, D.E. Giles Jr.

Mapping of COs to Syllabus

	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

1. Find the steps required to do research and projects (Remembering)
2. Illustrate the methodology of research and journaling. (Understanding)
3. Apply the research presentation skills in seminars and conferences. (Applying)
4. List topics to pursue research in the field of pure and applied mathematics. (Analysing)
5. Defend their research dissertations and reports. (Evaluating)
6. Develop research topics and present the research ideas. (Creating)

MACP6002: COMPUTER PROGRAMMING IN C LAB (0-0-1)

COURSE OUTCOMES

1. Understand the fundamentals of OS, file handling, creating and editing simple C programs. (Understanding)
2. Develop programming skills using the fundamentals and basics of C Language. (Applying)
3. Develop programs using the basic elements like control statements, Arrays and Strings. (Applying)
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≠0.
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

	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)

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

1. Identify different areas of research in the field of Mathematical sciences or in computing. (Remembering)
2. Explain the importance of research in the chosen topic of interest. (Understanding)
3. Apply theoretical knowledge to find out an appropriate topic of importance for research in the graduate level. (Applying)
4. Analyse when a chosen approach does not yield the expected result. (Analysing)
5. Evaluate the project and present in an appropriate form. (Evaluating)
6. Learn to choose a methodology or technique or approach to fulfil a set of objectives or prove or disprove a hypothesis. (Creating)

MACS6101: CALCULUS LAB (0-0-2)

COURSE OUTCOMES

1. Recall the expansion of mathematical functions to solve complex equations with the help of software. (Remembering)
2. Classify Initial Value Problems (IVPs) and Boundary Value Problems (BVPs) and representing them through graphical representation . (Understanding)
3. Apply software tools to solve second order complex PDEs. (Applying)
4. Analyse accuracy of analytical solution by software tools. (Analysing)
5. Evaluate solution of curve and verifying them graphically using software tools. (Evaluating)

LIST OF EXPERIMENTS (USING MATHEMATICA/MATLAB SOFTWARE)

1. 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 .
2. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
3. Sketching parametric curves (E.g., Trochoid, cycloid, epicycloids, hypocycloid)
4. Obtaining surface of revolution of curves.
5. Tracing of conics in cartesian coordinates/ polar coordinates.
6. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, hyperbolic paraboloid using cartesian coordinates.
7. Matrix operation (addition, multiplication, inverse, transpose).

Mapping of COs to Syllabus

	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp. 6	Exp. 7
CO 1	M	M			H		M
CO 2	H	H					
CO 3		M	M	M		H	
CO 4			H		M		M
CO 5		H		M	M		

MADQ6102: DIFFERENTIAL EQUATIONS LAB (0-0-2)

COURSE OUTCOMES

1. Recall Differential Formulae using Inbuilt software tools. (Remembering)
2. Classify Initial Value Problems (IVPs) and Boundary Value Problems (BVPs) and representing them through graphical representation . (Understanding)

3. Apply software tools to solve nth order ODEs and PDEs. (Applying)
4. Analyse accuracy of analytical solution by software tools. (Analysing)
5. Evaluate solution of curve and verifying them graphically using software tools. (Evaluating)

LIST OF EXPERIMENTS (USING MATHEMATICA/MATLAB SOFTWARE)

1. Plotting of second order solution family of differential equation.
2. Plotting of third order solution family of differential equation.
3. Growth model (exponential case only).
4. Decay model (exponential case only).
5. Lake pollution model (with constant/seasonal flow and pollution concentration).
6. Case of single cold pill and a course of cold pills.
7. Limited growth of population (with and without harvesting).
8. Predatory-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator).
9. Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers).
10. Battle model (basic battle model, jungle warfare, long range weapons).
11. Plotting of recursive sequences.
12. Study the convergence of sequences through plotting.
13. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequence from the plot.
14. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
15. Cauchy's root test by plotting nth roots.
16. Ratio test by plotting the ratio of nth and (n+1)th term.

Mapping of COs to Syllabus

	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp. 6	Exp. 7	Exp. 8
CO 1	H	M			M			
CO 2	H							
CO 3		M		M		H	H	M
CO 4			H		M			
CO 5		H			M			

	Exp. 9	Exp. 10	Exp. 11	Exp. 12	Exp. 13	Exp. 14	Exp. 15	Exp. 16
CO 1	H			M				
CO 2					H		M	
CO 3						H		
CO 4		H		M				
CO 5		H						M

MANM6103: NUMERICAL METHODS LAB (0-0-2)

COURSE OUTCOMES

1. Recall Numerical Formulae using Inbuilt software tools. (Remembering)
2. Mapping of theoretical concepts and practical applications. (Understanding)
3. Apply software tools to solve problems using inbuilt numerical methods. (Applying)
4. Analyse accuracy of numerical solution by software tools. (Analysing)
5. Evaluate numerical solution of curve using numerical methods and verifying them graphically using software tools. (Evaluating)

LIST OF EXPERIMENTS (USING MATHEMATICA/MATLAB SOFTWARE)

1. Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 +---------- + 1/ N.
2. To find the absolute value of an integer.
3. Enter 100 integers into an array and sort them in an ascending order.
4. Bisection Method.
5. Newton Raphson Method.
6. Secant Method.
7. Regula Falsi Method.

8. LU Decomposition Method.
9. Gauss Jacobi Method.
10. SOR method or Gauss Seidel Method.
11. Lagrange Interpolation or Newton Interpolation .
12. Simpson's rule.

Mapping of COs to Syllabus

	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp. 6
CO 1		M			M	
CO 2	M					H
CO 3		M		M		
CO 4			H		M	
CO 5	M	H			M	

	Exp. 7	Exp. 8	Exp. 9	Exp. 10	Exp. 11	Exp. 12
CO 1			H			M
CO 2						
CO 3		M				
CO 4	H					M
CO 5				H	H	

MAPE6104: PDE AND SYSTEMS OF ODE LAB (0-0-2)

COURSE OUTCOMES

1. Recall Partial and Ordinary Differential Formulae using mathematical software tools. (Remembering)
2. Classifying various initial value and boundary value points and representing them through graphical representation. (Understanding)
3. Apply software tools to solve higher order ODEs and PDEs. (Applying)
4. Analyse complex differential equations using the software tools. (Analysing)
5. Evaluate complex functions within a short span of time. (Evaluating)

LIST OF EXPERIMENTS (USING MATHEMATICA/MATLAB SOFTWARE)

1. Solution of Cauchy problem for first order PDE.
2. Finding the characteristics for the first order PDE.
3. Plot the integral surfaces of a given first order PDE with initial data.
4. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c2\frac{\partial^2 u}{\partial x^2} = 0$ 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 Syllabus

	Exp. 1	Exp. 2	Exp. 3	Exp. 4
CO 1	H	M		
CO 2	H			
CO 3		M		M
CO 4			H	
CO 5		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 physical phenomena by emphasizing on the correlation between theory and observation.
- To spark creative interest towards the pursuit of innovative research in fundamental and applied physics.

Program Outcomes – BSC 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 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 perspectives; 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.

Programme Specific Outcomes-BSc Physics(Honours)

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.

Courses offered in BSc Physics (Honours)

Sl. No.	Course Name
1.1	Mathematical Physics I
1.2	Mechanics
1.3	Mathematical Physics I Laboratory
1.4	Mechanics Laboratory
1.5	English Communication
1.6	Generic Elective I
1.7	Value Added Course
2.1	Electricity and Magnetism
2.2	Waves and Optics
2.3	Electricity and Magnetism Laboratory
2.4	Waves and Optics Laboratory
2.5	Environmental Studies
2.6	Generic Elective II
3.1	Mathematical Physics II
3.2	Thermal Physics
3.3	Digital Systems and Applications
3.4	Mathematical Physics II Laboratory
3.5	Thermal Physics Laboratory
3.6	Digital Systems and Applications Laboratory
3.7	Computational Physics Skills
3.8	Electrical circuits and Network Skills
3.9	Elements of Service Learning in Physics
3.10	Generic Elective III
3.11	Value Added Course
4.1	Mathematical Physics III
4.2	Elements of Modern Physics
4.3	Analog Systems and Applications
4.4	Mathematical Physics III Laboratory
4.5	Elements of Modern Physics Laboratory
4.6	Analog Systems and Applications Laboratory
4.7	Basic Instrumentation Skills
4.8	Radiation Safety
4.9	Generic Elective IV
5.1	Quantum Mechanics and Applications

5.2	Solid State Physics
5.3	Quantum Mechanics and Applications Laboratory
5.4	Solid State Physics Laboratory
5.5	Embedded systems- Introduction to Microcontroller
5.6	Embedded systems- Introduction to Microcontroller Laboratory
5.7	Physics of Devices and Instruments
5.8	Physics of Devices and Instruments Laboratory
5.9	Classical Dynamics
5.10	Communication Electronics
5.11	Communication Electronics Laboratory
5.12	Value Added Course
6.1	Electromagnetic Theory
6.2	Statistical Mechanics
6.3	Electromagnetic Theory Laboratory
6.4	Statistical Mechanics Laboratory
6.5	Nuclear and Particle Physics
6.6	Nano Materials and Applications
6.7	Nano Materials and Applications Laboratory
6.8	Digital Signal Processing
6.9	Digital Signal Processing Laboratory
6.10	Astronomy and Astrophysics

BSc Physics (Honours) Mapping of Courses with POs/PSOs

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
1.1	M	H					H	M	H	H	H	H		M
1.2	M	H	M					M	M		H	H		M
1.3	M	H	M						H		M	H	H	H
1.4	M	M	M	M		M		M	M	M		M	H	M
1.5	H		H	M		M		L						H
1.6	M	M								M	H			M
1.7	H	H							H					H
2.1	H	H	M					H		M	H	H		H
2.2	M	M	M					M	M		H	M		M
2.3	M					H		H				H	H	H
2.4	M	M	M	M		M		M	M	M		M	H	M
2.5				L	M	M	H					M		M
2.6	M	M								L	H			H
3.1	H	H	M						M		M	H	L	M
3.2	H	H	M					H	M	L	H	H		H

3.3	H	H	M					H	M	L	H	H		H
3.4	M	H	M						H		M	H	H	H
3.5	M					H		H				H	H	H
3.6	M					H		H	M			H	H	H
3.7	M	H	M					H	H	M		M	M	M
3.8	H	H	M					H	M	L	H	H		H
3.9			H	H	H	H	H	L	M					M
3.10	M	M								M	M			M
3.11	H	H							H					H
4.1	H	H	M						M		M	H	L	M
4.2	H	H	M					H	M	L	H	H		H
4.3	H	H	M					H	M	L	H	H		H
4.4	M	H	M						H		M	H	H	H
4.5	M					H		H				H	H	H
4.6	M					H		H				H	H	H
4.7		M	M					M	M	M			M	M
4.8	H	M	M		H	H	H	M	M	L	H	H	L	H
4.9	M	M								M	M			M
5.1	H	H	H						M		H	H	L	H
5.2	H	H	M					H	M	L	H	H		H
5.3	H	H	M						H		H	H	H	H
5.4	M	M	M	M				M	M	M		M	H	M
5.5	H	H	M					H	M	L	H	H		H
5.6	M					H		H				H	H	H
5.7	M	M	M					M	M	M	M	M		M
5.8	M	M	M	M		M		M	M	M		M	H	M
5.9		M									H			
5.10	H	M					M	H	H	M	M	M	H	
5.11	H	M					M	H	H	M	M	M	H	
5.12	H	H							H					H
6.1	H	H	M					H	M	L	H	H		H
6.2	H	H	M					H	M	L	H	H		H
6.3	M					H		H				H	H	H
6.4	M					H		H				H	H	H
6.5	H	H	M					H	M	L	H	H		H
6.6	H	M					M	H	H	M	H	M	H	
6.7	H	M					M	H	H	M	H	M	H	
6.8	H	M					M	H	H	M	M	M	H	
6.9	H	M					M	H	H	M	M	M	H	

6.10	H	H	M					H	M	L	H	H		H

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 Skill: 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 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 for MSc Physics

PSO 1. Understand the advanced theoretical concept of physics: Understand the advanced theoretical principles of physics.

PSO 2. Acquire analytical and logical skill for research: Acquire the ability to analyse critical research oriented problems 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

DETAILED SYLLABUS

THEORY COURSES

PSCM0020: CLASSICAL MECHANICS (4-0-0)

COURSE OUTCOMES

1. Explain Hamilton's and Lagrange's equations and use them for solving problems in physics. (Understanding)
2. Build the concepts of Canonical transformation. (Creating)
3. Explain the motion of rigid body and visualise the Euler rotations. (Understanding)
4. Solve rigid body problems. (Applying)
5. Develop the theory of special relativity in terms of four vector notation. (Creating)

Module I: (12lectures)

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 in relativistic 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

	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

1. Conceptualise different interpretations of quantum mechanics. (Understanding)
2. Apply the concepts of quantum mechanics to different problems in physics. (Applying)
3. Make use of variational method and WKB approximation. (Applying)
4. Inspect how to encounter spin. (Analysing)
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

	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	

PSMP0022: MATHEMATICAL PHYSICS (4-0-0)

COURSE OUTCOMES

1. Explain the concepts and applications of the function of complex variables. (Remembering)
2. Apply the advanced concepts of vector spaces in solving physical problems. (Applying)
3. Utilize the concepts and applications of some special functions. (Applying)
4. Illustrate some of the basic concepts of probability and statistics. (Understanding)
5. Analyse physical scenarios using the concepts of Laplace and inverse Laplace transform. (Analysing)

Module I: (15lectures)

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: (13 lectures)

Vectors and matrices: linear vector spaces; linear operators; matrices; coordinate transformations; eigenvalue problems; diagonalisation of matrices; spaces of infinite dimensionality.

Module III: (16 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.

Module V: (8lectures)

Probability and statistics: fundamental laws of probability; binomial, Poisson and Gaussian distributions; general properties of probability distributions.

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.

Mapping of COs to Syllabus

	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	

PSQM0024: QUANTUM MECHANICS II (4-0-0)

COURSE OUTCOMES

1. Explain relativistic quantum mechanics. (Understanding)
2. Interpret path integral approach to quantum mechanics. (Understanding)
3. Apply the concept of quantum mechanics to the problems of scattering. (Applying)
4. Build concept about perturbation theory. (Applying)
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: (5lectures)

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

	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

1. Explain about crystal structure in details. (Understanding)
2. Illustrate physics of phonons. (Understanding)
3. Identify free electron and nearly free electron models. (Applying)
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: (9lectures)

Phonons: quantisation of lattice vibrations, dispersion relation for acoustic and optical phonon, energy gap, density of states, heat capacity, thermal conductivity and thermal expansion.

Module III: (8lectures)

Free electron Fermi gas: Fermi energy, density of states, heat capacity, thermal conductivity and electrical conductivity. Wiedemann-Franz law.

Module IV: (10lectures)

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

	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

1. Explain various phenomena from the standpoint of electrodynamics. (Remembering)
2. Outline the origin and propagation of electromagnetic waves. (Understanding)
3. Explain the nature of electromagnetic radiation. (Understanding)
4. Infer the extension of classical electrodynamics to the generalized 4-dimensional case. (Analysing)
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)

Magnetostatics: introduction; Biot and Savart Law; Ampere's Law; vector potential; vector potential and magnetic induction for a circular current loop.

Module III: (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 IV: (15 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 V: (13 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 VI: (9 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

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H				
CO 2			M	M	M	
CO 3			M	M	M	
CO 4						H
CO 5	M	M	M	M	M	M

PSAM0028: ATOMIC AND MOLECULAR PHYSICS (4-0-0)

COURSE OUTCOMES

1. Explain atomic and molecular spectroscopy in details. (Understanding)
2. Understand interaction of radiation with atoms. (Understanding)
3. Analyse bond formation. (Analysing)
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

	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

1. Explain the concept of numerical methods. (Understanding)
2. Apply numerical techniques to solve different problems in Physics. (Applying)
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 quadrature formula.

b) 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

1. Theory and problems of Programming with FORTRAN, Seymour Lipschutz and Arthur Poe, McGraw-Hill.
2. FORTRAN 77 and numerical methods, C. Xavier and R. Rajaraman, New Age International Publishers
3. FORTRAN 77 Programming, V. Rajaraman, Prentice Hall of India.
4. Numerical Analysis, V. Rajaraman, Wiley Eastern.
5. Numerical Recepies in FORTRAN, W. H. Press, S. S. Tenkulsky, W. T. Wettering and B. P. Flannery, Cambridge University Press.
6. Introductory Methods of Numerical Analysis, S. Sastry, Prentice Hall of India.
7. Numerical Methods for Scientific and Engineering Computation, M. K. Jain et al., New Age International Publications.
8. Introduction to Numerical Analysis, F. B. Hildebrand, McGraw-Hill Book Company Inc.

Mapping of COs to Syllabus

	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

1. Appreciate the connection between statistical mechanics and thermodynamics. (Analysing)
2. Conceptualise quantum statistical mechanics. (Understanding)
3. Understand the physics of phase transition. (Understanding)
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; universality of 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: Fundamental and 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

	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

1. Understand and explain the basic theoretical concepts of plasma physics. (Remembering)
2. Understand the behaviour of a single charged particle in electric and magnetic fields. (Understanding)
3. Understand the purpose, principles and techniques of various plasma diagnostic. (Application)
4. Understand the underlying principles of some laboratory and naturally occurring plasma. (Analysing)
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

	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

1. Know about different types of transistors. (Understanding)
2. Understand the application of transistors for circuit design. (Application)
3. Utilize Describe devices like thyristors, operational amplifiers,oscillators, etc. (Analysing)
4. Understand the digital electronics design using analog devices. (Understanding)
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.
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.

b) 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

	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

1. Explain different properties of nanomaterials. (Understanding)
2. Know about different methods for the synthesis of nanomaterials. (Applying)
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 (Tauc plot).

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

	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

1. Relate the concepts from special theory of relativity with generalized tensor calculus. (Remembering)
2. Explain Einstein's field equation from basic principles. (Understanding)
3. Illustrate the implications of the general theory of relativity. (Understanding)
4. Extend Einstein's gravity to the cosmological scale. (Understanding)
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

	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

1. Define and spell out fundamental concepts of Astronomy. (Remembering)
2. Outline the various parameters describing the behaviour of stars and their evolution. (Understanding)
3. Classify the various types of interstellar media. (Analysing)
4. Explain the physical processes underlying the energy generation in stars. (Understanding)
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

	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

1. Understand fluid and kinetic model of plasma and their uses in the study of plasma. (Understanding)
2. Explain the theory of various kinds of waves existing in plasma. (Understanding)
3. Explain the phenomenon of diffusion in plasma and its consequences. (Analysis)
4. Explain some basic instabilities and non linear phenomena in plasma. (Remembering)
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

	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

1. Illustrate advanced topics of digital electronics. (Understanding)
2. Explain microprocessor, microcontroller and assembly language. (Understanding)
3. Apply the knowledge in advanced digital structures. (Applying)
4. Understand digital circuit design (Application)
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 of a 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

1. Digital Logic and computer Design, M. Mano, PHI.
2. Modern Digital Electronics, R. P. Jain, TMGH.
3. Digital Fundamentals, Jain and Floyd, Pearson Education.
4. Digital Electronics, Malvino and Leach, Pearson Education.
5. Digital Computer Electronics, Malvino, TMGH.
6. Digital Design, Principles and Practices, Morris Mano, Pearson Education.
7. Digital Circuits and Design, S. Salivahanan and S. Arivazhagan, Vikash Publishing House Pvt. Ltd.
8. Digital Techniques, P. H. Talukdar, N. L. Publications.
9. Fundamentals of Digital Circuits, Anand Kumar, PHI.
10. Introduction to Microprocessors, Gaonkar, New age Publication.
11. Fundamentals of Microprocessor, B. Ram, Dhanpat Rai.
12. 8085 Microprocessor Programming and Interfacing, N. K. Srinath, PHI.
13. Microprocessor Based Design, Slater, PHI.
14. Microprocessors, Gilmore, McGraw Hill Publication.

Mapping of COs to Syllabus

	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

1. Explain properties of nanomaterials in detail. (Understanding)
2. Explain quantum effects on nanostructures. (Understanding)
3. Give outline nanomechanics. (Understanding)
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

	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

1. Explain about passive components and DC networks, digital electronics (Understanding)
2. Understanding physics of electronic devices and circuits (Understanding)
3. Explain electronic communication. (Understanding)
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 and need, 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

	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

1. Explain basic concepts of nanophysics. (Remembering)
2. Explain the working principle of various characterization techniques. (Understanding)
3. Explain various fabrication techniques. (Understanding)
4. Analyse the relation between nanoparticles size and their properties. (Analysing)
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: geometric surface 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

	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

1. Understand the meaning, significance and ethics of research. (Understanding)
2. Conduct literature survey. (Understanding)
3. Present and defend their project accurately, both orally and written. (Applying)
4. Present and defend their research results accurately, both orally and written at specialized levels. (Creating)
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 University Press.
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

	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

1. Summarize the mathematical skills like group theory, tensors, kinematics, etc. (Understanding)
2. Explain different groups like Lorentz group, Lie group and their algebra. (Understanding)
3. Explain scalar field quantisation. (Analysing)
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

	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

1. Explain gauge theories. (Understanding)
2. Familiarise with physics of spontaneous symmetry breaking and Higgs mechanism. (Analysing)
3. Explain standard model and physics beyond standard model. (Understanding)
4. Build the theory of neutrino physics. (Analysing)
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

	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

1. Explain the properties of nucleus in details. (Understanding)
2. Describe Shell model and learn to calculate the spin and parity of nuclear ground state. (Analysing)
3. Knowledge of nuclear reaction and learn the selection rules for nuclear transitions. (Analysing)
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

	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

PSMY0101: MATHEMATICAL PHYSICS-I (4-0-0)

COURSE OUTCOMES

1. Demonstrate the concept of curvilinear coordinates. (Understanding)
2. Apply some advanced topics of vectors. (Applying)
3. Develop an understanding of different types of differential equations and find their solutions.
    a. (Applying)
4. Utilize some basic concepts of probability and distribution functions. (Applying)
5. Inspect Dirac delta function and some of its properties. (Analysing)

Module I: Calculus (21 lectures)

Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only).

First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. 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 II: Vector Calculus (27 lectures)

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields.

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 identities. Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. 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 III: Orthogonal Curvilinear Coordinates (6 lectures)

Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

Module IV: Introduction to Probability (4 lectures)

Independent random variables: Probability distribution functions; binomial, Gaussian, and Poisson, with examples. Mean and variance.

Dependent events: Conditional Probability. Bayes' Theorem and the idea of hypothesis testing.

Module V: Dirac Delta Function and its Properties (2 lectures)

Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular 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, D. G. Zill and W. S. Wright, Jones and Bartlett Learning.
7. Mathematical Physics, Goswami, Cengage Learning.
8. Engineering Mathematics, S. Pal and S. C. Bhunia, Oxford University Press.
9. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India.

10. Essential Mathematical Methods, K. F. Riley and M. P. Hobson, Cambridge Univ. Press.
11. Advanced Engineering Mathematics, H. K. Das, S. Chand.

Mapping of COs to Syllabus

	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

PSMC0102: MECHANICS (4-0-0)

COURSE OUTCOMES

1. Explain the concepts of Newtonian Mechanics. (Remembering)
2. Explain the concepts of work, energy and forces. (Understanding)
3. Explain the concepts of rotational and periodic motions. (Understanding)
4. Apply the laws of motions for solving problems. (Applying)
5. Analyse the concepts of Special Theory of relativity. (Analysis)

Module I: Fundamentals of Dynamics (13 lectures)

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 (15 lectures)

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 (11 lectures)

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 (11 lectures)

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 lectures)

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 Lectures, 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

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	H				
CO 3		H		H	
CO 4	M	L	L	M	
CO 5					H

PSEM0103: ELECTRICITY AND MAGNETISM (4-0-0)

COURSE OUTCOMES

1. Summarize the fundamental concepts of electric and magnetic fields. (Remembering)
2. Explain the electric and magnetic properties of matter. (Understanding)
3. Explain the laws governing electromagnetic inductance. (Understanding)
4. Analyse the working of electrical circuits. (Analysing)
5. Apply the concepts of electromagnetism to physical scenarios. (Applying)

Module I: Electric Field and Electric Potential (22 lectures)

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.

Module II: Dielectric Properties of Matter (8 lectures)

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 III: Magnetic Field (9 lectures)

Magnetic force between current elements and definition of Magnetic Field B. 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.

Module IV: Magnetic Properties of Matter (4 lectures)

Magnetization vector (M). Magnetic Intensity(H). Magnetic Susceptibility and permeability. Relation between B, H, M. Ferromagnetism. B-H curve and hysteresis.

Module V: Electromagnetic Induction (6 lectures)

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.

Module VI: Electrical Circuits (4 lectures)

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. CDR.

Module VII: Network theorems (4 lectures)

Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.

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 Lectures, 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

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H		H				
CO 2		H		H			
CO 3					H		
CO 4						H	H
CO 5	M	M	M	M	M	M	M

PSWO0104: WAVES AND OPTICS (4-0-0)

COURSE OUTCOMES

1. Utilize the principle of superposition of harmonic motions and waves in different scenarios. (Analysing)
2. Summarize the principles of various wave motions. (Remembering)
3. Understand the theory of interference. (Understanding)
4. Understand the theory of diffraction. (Understanding)
5. Apply the principle of interference and diffraction in various optical instruments. (Application)

Module I: Superposition of Harmonic oscillations (10 lectures)

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.
Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses.

Module II: Wave Motion (11 lectures)

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. Water Waves: Ripple and Gravity Waves.
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 : Superposition of Two Harmonic Waves (7 lectures)

Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves.

Module IV:Interference (16 lectures)

Electromagnetic nature of light. Definition and properties of 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. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index.
Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3)

Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer.

Module V: Diffraction (16 lectures)

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.

Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Point source holograms.

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

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

PSMS0105: MATHEMATICAL PHYSICS-II (4-0-0)

COURSE OUTCOMES

1. Apply the concepts of Fourier series to different physical problems. (Applying)
2. Demonstrate the power series solutions to ordinary differential equations. (Understanding)
3. Apply the concepts of errors and special integrals. (Applying)
4. Utilize partial differential equations for solving various problems of physics. (Applying)
5. Analyse various special functions and their applications. (Analysing)

Module I: Fourier Series (10 lectures)

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. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity.

Module II: Frobenius Method and Special Functions (24 lectures)

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 III: Some Special Integrals (4 lectures)

Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral).

Module IV: Partial Differential Equations (14 lectures)

Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes. Diffusion Equation.

Module V: Theory of Errors (6 lectures)

Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. Least-squares fit. Error on the slope and intercept of a fitted line.

Suggested Readings

1. Mathematical Methods for Physicists, Arfken, Weber and Harris, Elsevier.
2. Fourier Analysis, M. R. Spiegel, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, Thomson Brooks/Cole.
4. Differential Equations, George F. Simmons, Tata McGraw-Hill.
5. Partial Differential Equations for Scientists & Engineers, S. J. Farlow, Dover Pub.
6. Engineering Mathematics, S. Pal and S. C. Bhunia, Oxford University Press.
7. Mathematical methods for Scientists & Engineers, D. A. McQuarrie, Viva Books.

Mapping of COs to Syllabus

	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		

PSPT0106: THERMAL PHYSICS (4-0-0)

COURSE OUTCOMES

1. Explain the concept of thermodynamic potential. (Understanding)
2. Illustrate Maxwell's thermodynamic relations (Understanding)
3. Apply different laws of thermodynamics to different physical problems. (Applying)
4. Combine the concepts of thermodynamics to those of statistical mechanics. (Creating)
5. Understand kinetic theory of gases. (Understanding)

Module I: Zeroth and First Law of Thermodynamics (8 lectures)

Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient.

Module II: Second Law of Thermodynamics (10 lectures)

Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance,

2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale.

Module III: Entropy (7 lectures)

Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero.

Module IV: Thermodynamic Potentials (14 lectures)

Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations

Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of C_P-C_V, (3) TdS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process.

Module V: Distribution of Velocities (7 lectures)

Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases.

Module VI: Molecular Collisions (4 lectures)

Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance.

Module VII: Real Gases (10 lectures)

Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO_2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. P-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion. Joule- Thomson Cooling.

Suggested Readings

1. Heat and Thermodynamics, M. W. Zemansky and Richard Dittman, McGraw-Hill.
2. A Treatise on Heat, MeghnadSaha, and B. N. Srivastava, Indian Press.
3. Thermal Physics, S. Garg, R. Bansal and Ghosh, Tata McGraw-Hill.
4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
5. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears and Salinger, Narosa.
6. Concepts in Thermal Physics, S. J. Blundell and K. M. Blundell, Oxford University Press.
7. Thermal Physics, A. Kumar and S. P. Taneja, R. Chand Publications.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H	H	H	H			
CO 2	H	H	H	H			
CO 3	H	M	M	M			
CO 4					M	M	M
CO 5					H	H	H

PSDA0107: DIGITAL SYSTEMS AND APPLICATIONS (4-0-0)

COURSE OUTCOMES

1. Explain the construction and working of a CRO. (Remembering)
2. Summarize the principles of various digital circuits. (Understanding)
3. Apply Boolean algebra for solving problems. (Application)
4. Analyse the functions of Timers, registers and counters. Analysing)
5. Explain the organization of computers and microprocessors. (Understanding)

Module I: Introduction to CRO, Integrated Circuits and Digital Circuits (12 lectures)

Block Diagram of CRO. Electron Gun, Deflection System and Time Base. Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference.

Qualitative treatment only): Active & Passive components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital lCs.

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity Checkers.

Module II: Boolean Algebra and Arithmetic Circuits (11 lectures)

De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.

Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor.

Module III : Data Processing Circuits and Sequential Circuits (10 lectures)

Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders.

SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop.

Module IV: Timers, Shift Registers and Counters (8 lectures)

IC 555: block diagram and applications: Astablemultivibrator and Monostable multivibrator.

Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.

Module V : Computer Organization and Microprocessor Architecture (16 lectures)

Input/Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map.

Main features of 8085. Block diagram. Components. Pin-out diagram. Buses. Registers. ALU. Memory. Stack memory. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI.

1 byte, 2 byte& 3 byte instructions.

Suggested Readings

1. Digital Principles and Applications, A. P. Malvino, D. P.Leach and Saha, Tata McGraw.
2. Fundamentals of Digital Circuits, Anand Kumar, PHI Learning Pvt. Ltd.
3. Digital Circuits and systems, Venugopal, Tata McGraw Hill.
4. Digital Electronics, G. K. Kharate, Oxford University Press.
5. Digital Systems: Principles & Applications, R. J. Tocci, N. S. Widmer, PHI Learning.
6. Logic circuit design, Shimon P. Vingron, Springer.
7. Digital Electronics, Subrata Ghoshal, Cengage Learning.
8. Digital Electronics, S. K. Mandal, McGraw Hill.
9. Microprocessor Architecture Programming & applications with 8085, R. S. Goankar, Prentice Hall.
10. Principles of Electronic Instrumentation, A. James Diefenderfer, Saunders College Pub.

Mapping of COs to Syllabus

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

PSMP0108: MATHEMATICAL PHYSICS III (4-0-0)

COURSE OUTCOMES

1. Explain the basics of complex analysis. (Remembering)
2. Solve physical problems using the concepts of complex analysis. (Applying)
3. Understand the concepts of integral transforms. (Understanding)
4. Apply Fourier transforms to various physical scenarios. (Applying)
5. Make use of Laplace transforms in simplifying various problems. (Applying)

Module I: Complex Analysis (30 lectures)

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. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals.

Module II: Integrals Transforms (15 lectures)

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.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations.

Module III: Laplace Transforms (15 lectures)

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. Application of Laplace Transforms to 2nd order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits, Coupled differential equations of 1st order. Solution of heat flow along infinite bar using Laplace transform.

Suggested Readings

1. Mathematical Methods for Physics and Engineers, K. F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press.
2. Mathematics for Physicists, P. Dennery and A. Krzywicki, Dover Publications.
3. Complex Variables, A. S. Fokas and M. J. Ablowitz, Cambridge Univ. Press.
4. Complex Variables, A. K. Kapoor, Cambridge Univ. Press.
5. Complex Variables and Applications, J. W. Brown and R. V. Churchill, Tata McGraw-Hill.
6. First course in complex analysis with applications, D. G. Zill and P. D. Shanahan, Jones & Bartlett.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H		
CO 2	H		
CO 3		M	M
CO 4		H	
CO 5			H

PSEP0109: ELEMENTS OF MODERN PHYSICS (4-0-0)

COURSE OUTCOMES

1. Build the foundational knowledge of quantum mechanics. (Applying)
2. Develop a sound understanding of LASER. (Applying)
3. Analyse the physics of atomic nucleus. (Analysing)

Module I: (29 lectures)

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.

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 II: (10 lectures)

One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as example; Quantum mechanical scattering and tunnelling in one dimension-across a step potential & rectangular potential barrier.

Module III: (6 lectures)

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers.

Module IV: (8 lectures)

Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus.

Module V: (3 lectures)

Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions).

Module VI: (4 lectures)

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

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

PSAS0110: ANALOG SYSTEMS AND APPLICATIONS (4-0-0)

COURSE OUTCOMES

1. Explain the working of diodes, transistors, amplifiers, oscillators and Op-Amps.(Understanding)
2. Illustrate the theoretical concepts of the corresponding electronic circuits. (Understanding)
3. Apply the concept of conversation. (Applying)
4. Analysing application of electronic devices for digital circuits (Application)
5. Analysing concept of analog sensors. (Analysing)

Module I: Semiconductor Diodes (10 lectures)

P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. Current Flow Mechanism in Forward and Reverse Biased Diode.

Module II: Two-terminal Devices and their Applications (6 lectures)

(1) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, C-filter (2) Zener Diode and Voltage Regulation. Principle and structure of (1) LEDs, (2) Photodiode and (3) Solar Cell.

Module III: Bipolar Junction transistors (6 lectures)

n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions.

Module IV: Amplifiers (18 lectures)

Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers.

Two stage RC-coupled amplifier and its frequency response.

Effects of Positive and Negative Feedback on Input Impedance, Output Impedance, Gain, Stability, Distortion and Noise.

Module V: Operational Amplifiers (Black Box approach) and its applications (8 lectures)

Characteristics of an Ideal and Practical Op-Amp. (IC 741) Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground.

(1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossing detector (8) Wein bridge oscillator.

Module VI :Sinusoidal Oscillators and Conversion (8 lectures)

Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency. Hartley & Colpitts oscillators.

Resistive network (Weighted and R-2R Ladder). Accuracy and Resolution. A/D Conversion (successive approximation)

Suggested Readings

1. Integrated Electronics, J. Millman and C. C. Halkias, Tata Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J. D. Ryder, Prentice Hall.
3. Solid State Electronic Devices, B. G. Streetman and S. K.Banerjee, PHI Learning.
4. SElectronic Devices & circuits, Salivahanan and N. S. Kumar, Tata Mc-Graw Hill.
5. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, Prentice Hall.
6. Microelectronic circuits, A. S. Sedra, K. C. Smith and A. N. Chandorkar, Oxford University Press.
7. Electronic circuits: Handbook of design & applications, U. Tietze and C. Schenk, Springer.
8. Semiconductor Devices: Physics and Technology, S. M. Sze, Wiley India.
9. Microelectronic Circuits, M. H. Rashid, Cengage Learning.
10. Electronic Devices, Thomas L. Floyd, Pearson India.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H	H			
CO 2	M	H	H	H	M	
CO 3					M	H
CO 4			H	H	H	
CO 5			M	H	H	H

PSCP0111: COMPUTATIONAL PHYSICS SKILLS (2-0-0)

COURSE OUTCOMES

1. Explain the concept of high level language in computer programming. (Understanding)
2. Use FORTRAN programming language for solving problems in Physics. (Applying)
3. Use LaTeX for document preparation. (Applying)
4. Use Gnuplot for plotting graphs. (Applying)

Module I: Introduction (4 lectures)

Importance of computers in Physics, paradigm for solving physics problems for solution. Usage of linux as an Editor. Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin(x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal.

Module II: Scientific Programming (5 lectures)

Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, 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 III: Control Statements (6 lectures)

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. Programming: 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 sources 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.

Module IV: Scientific Word Processing (6 lectures)

Introduction to LaTeX: TeX/LaTeX word processor, preparing a basic LaTeX file, Document classes, Preparing an input file for LaTeX, Compiling LaTeX File, LaTeX tags for creating different environments, Defining LaTeX commands and environments, Changing the type style, Symbols from other languages. Equation representation: Formulae and equations, Figures and other floating bodies, Lining in columns- Tabbing and tabular environment, Generating table of contents, bibliography and citation, Making an index and glossary, List making environments, Fonts, Picture environment and colors, errors.

Module V: Visualization (9 lectures)

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 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 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 a data and saving the output for seeing on the screen. Saving it as an eps file and as a pdf file. 9. To find the roots of a quadratic equation. 10. Motion of a projectile using simulation and plot the output for visualization. 11. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization. 12. Motion of particle in a central force field and plot the output for visualization.

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, c-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

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

PSEN0112: ELECTRICAL CIRCUITS AND NETWORK SKILLS (2-0-0)

COURSE OUTCOMES

1. Explain the basics of electrical circuits. (Remembering)
2. Explain the working principle of motors, generators and transformers. (Understanding)

3. Explain the working principle of solid state devices. (Understanding)
4. Analyse the functions of various electrical protections. (Analysis)
5. Apply the various concepts of electrical wiring. (Application)

Module I: Basic Electricity Principles and Electrical Circuits (11 lectures)

Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

Main electric circuit elements and their combination. Rules to Analyse DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to Analyse AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop.

Module II : Generators, Transformers and Electric Motors (7 lectures)

DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor.

Module III: Solid-State Devices, Electrical Protection and Electrical Wiring (12 lectures)

Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources.

Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device)

Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

Suggested Readings

1. A text book in Electrical Technology, B. L. Theraja, S Chand & Co.
2. A text book of Electrical Technology, A. K. Theraja.
3. Performance and design of AC machines, M. G. Say, ELBS Edn.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3			H
CO 4			H
CO 5	M		M

PSBI0113: BASIC INSTRUMENTATION SKILLS (2-0-0)

COURSE OUTCOMES

1. Explain the concepts of various performance characteristics of measuring instruments. (Remembering)
2. Explain the underlying principle of CRO and its uses. (Application)
3. Analyse the functions of signal generators, electronic voltmeter and bridges. (Analysis)
4. Explain the underlying principle of multimeter and its uses. (Understanding)
5. Understand the basic concepts behind digital instruments. (Understanding)

Module I: Basic of Measurement, Digital Instruments and Electronic Voltmeter (9 lectures)

Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects.

Principle and working of digital meters. Comparison of analog& digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.

Advantage over conventional multimeter for voltage measurement with respect to 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 II: Cathode Ray Oscilloscope (8 lectures)

Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), 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 principle of working.

Module III : Signal Generators, Analysis Instruments, Impedance Bridges & Q-Meters (7 lectures)

Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

Block diagram of bridge. working principles of basic (balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges.

Module IV: Digital Multimeter: (6 lectures)

Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current 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.

Suggested Readings

1. A text book 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

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H
CO 5	M	M	M	M

PSRS0114: RADIATION SAFETY (2-0-0)

COURSE OUTCOMES

1. Understand the basic concept of Atomic and Nuclear Physics. (Remembering)
2. Explain the theories of interaction of radiation with matter. (Understanding)
3. Explain the working principles and functioning of radiation detection devices. (Understanding)
4. Analyse the various issues with Radiation Safety Management. (Analysis)
5. Explain the underlying principles of various applications of nuclear physics. (Application)

Module I: Basics of Atomic and Nuclear Physics (6 lectures)

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 lectures)

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 (7 lectures)

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 (7 lectures)

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.

Module V: Application of Nuclear Techniques (5 lectures)

Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. Industrial Uses: Tracing, Gauging, Material Modification, Sterilization, Food preservation.

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	Module V
CO 1	H	L			LF
CO 2		H			
CO 3			H		
CO 4				H	
CO 5					H

PSGP0115: GENERAL THERMAL PHYSICS (4-0-0)

COURSE OUTCOMES

1. Explain the concept of thermodynamic potential. (Understanding)
2. Illustrate Maxwell's thermodynamic relations. (Understanding)
3. Apply different laws to thermodynamics to different physical problems. (Applying)
4. Combine the concepts of thermodynamics to those of statistical mechanics. (Creating)
5. Understand kinetic theory of gases and theory of radiation. (Understanding)

Module I: Laws of Thermodynamics (22 lectures)

Thermodynamic Description of system: 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 (10 lectures)

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 (10 lectures)

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 (6 lectures)

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 (12 lectures)

Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell- Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

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.
7. University Physics, Ronald Lane Reese, Thomson Brooks/Cole.
8. Thermal Physics, A. Kumar and S. P. Taneja, R. Chand Publications.

Mapping of COs to Syllabus

	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	

PSGM0116: GENERAL ELEMENTS OF MODERN PHYSICS (4-0-0)

COURSE OUTCOMES

1. Build foundational knowledge of quantum mechanics and atomic physics. (Applying)
2. Analyse theconcept ofnuclear physics. (Analysing)

Module I: (8 lectures)

Planck's quantum, Planck's constant and light as a collection of photons; Photo- electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment.

Module II: (4 lectures)

Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra.

Module III: (4 lectures)

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.

Module IV: (11 lectures)

Two slit interference experiment with photons, atoms & 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 wavefunction, probabilities and normalization; Probability and probability current densities in one dimension.

Module V: (12 lectures)

One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier.

Module VI: (21 lectures)

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy.

Radioactivity: stability of nucleus; Law of radioactive decay; Mean life and half-life; alpha decay; beta decay - energy released, spectrum and Pauli's prediction of neutrino; gamma-ray emission.

Fission and fusion - mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions.

Suggested Readings

1. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
2. Modern Physics, J. R. Taylor, C. D. Zafiratos, M. A. Dubson, PHI Learning.
3. Six Ideas that Shaped Physics:Particle Behave like Waves, Thomas A. Moore, McGraw Hill.
4. Quantum Physics, Berkeley Physics,Vol.4., E.H. Wichman, Tata McGraw- Hill Co.
5. Modern Physics, R. A. Serway, C. J. Moses, and C. A. Moyer, Cengage Learning.
6. Modern Physics, G. Kaur and G. R. Pickrell, McGraw Hill.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H	H	H	H	M
CO 2						H

PSQM0115: QUANTUM MECHANICS AND APPLICATIONS (4-0-0)

COURSE OUTCOMES

1. Interpret the significance of the Schrödinger wave equation. (Understanding)
2. Solve problems involving bound states in arbitrary potential. (Applying)
3. Explain the behaviour of simple atoms using quantum theory. (Understanding)
4. Examine the quantum behaviour of atoms in external fields. (Analysing)
5. Extend fundaments concepts from quantum theory to many-electron systems. (Understanding)

Module I: Time Dependent Schrödinger Equation (6 lectures)

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; Expectation values of position and momentum. Wave Function of a Free Particle.

Module II: Time Independent Schrödinger Equation (10 lectures)

Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; 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.

Module III: Bound States in an Arbitrary Potential (12 lectures)

Continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method; Hermite polynomials; ground state, zero point energy & uncertainty principle.

Module IV: Quantum Theory of Hydrogen-like Atoms (10 lectures)

Time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; 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.

Module V: (12 lectures)

Electron angular momentum. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only).

Module VI: (10 lectures)

Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total angular momentum. Vector Model. Spin-orbit coupling in atoms- L-S and J-J couplings. Hund's Rule. Term symbols. Spectra of Hydrogen and Alkali Atoms (Na etc.).

Suggested Readings

1. A Text book 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

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H				
CO 2			H			
CO 3				H		
CO 4					H	
CO 5						H

PSSS0116: SOLID STATE PHYSICS (4-0-0)

COURSE OUTCOMES

1. Learn about crystal structure in details. (Understanding)
2. Understand physics of phonons. (Understanding)
3. Conceptualise free electron and nearly free electron models. (Applying)
4. Know about advanced topics like superconductivity, ferroelectric properties, etc. (Analysing)

Module I: Crystal Structure (12 lectures)

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.

Module II: Elementary Lattice Dynamics (10 lectures)

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 III: Magnetic Properties of Matter (8 lectures)

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.

Module IV: Dielectric Properties of Materials (8 lectures)

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. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons, TO modes.

Module V: Ferroelectric Properties of Materials (6 lectures)

Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

Module VI: Elementary Band Theory (10 lectures)

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.

Module VII: Superconductivity (6 lectures)

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. Introduction to Solid State Physics, Charles Kittel, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J. P. Srivastava, Prentice-Hall of India
3. Introduction to Solids, Leonid V. Azaroff, Tata Mc-Graw Hill.
4. Solid State Physics, N. W. Ashcroft and N. D. Mermin, Cengage Learning.
5. Solid-state Physics, H. Ibach and H. Luth, Springer.
6. Solid State Physics, Rita John, McGraw Hill.
7. Elementary Solid State Physics, M. Ali Omar, Pearson India.
8. Solid State Physics, M. A. Wahab, Narosa Publications.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H						
CO 2		H					
CO 3			H	H	H	H	
CO 4					H		H

PSES0117: EMBEDDED SYSTEM: INTRODUCTION TO MICROCONTROLLERS (4-0-0)

COURSE OUTCOMES

1. Interpret the actual concept of computer hardware program. (Understanding)
2. Analyse the physics of automation. (Analysing)
3. Relate the concept of processors used in mobile and computers. (Understanding)
4. Apply the programmes to make automation and embedded systems. (Applying)
5. Apply the knowledge of timers and counters for making high precision systems. (Applying)

Module I: Embedded System Introduction and Review of Microprocessors (8 lectures)

Introduction to embedded systems and general purpose computer systems, architecture of embedded system, classifications, applications and purpose of embedded systems, challenges & design issues in embedded systems, operational and non-operational quality attributes of embedded systems, elemental description of embedded processors and micocontrollers.

Organization of Microprocessor based system, 8085µp pin diagram and architecture, concept of data bus and address bus, 8085 programming model, instruction classification, subroutines, stacks and its implementation, delay subroutines, hardware and software interrupts.

Module II: 8051 Microcontroller and I/O Port Programming (16 lectures)

Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming, Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions.

Introduction of I/O port programming, pin out diagram of 8051 microcontroller, I/O port pins description & their functions, I/O port programming in 8051 (using assembly language), I/O programming: Bit manipulation.

Module III: Programming (12 lectures)

8051 addressing modes and accessing memory using various addressing modes, assembly language instructions using each addressing mode, arithmetic and logic instructions, 8051 programming in C: for time delay & I/O operations and manipulation, for arithmetic and logic operations, for ASCII and BCD conversions.

Module IV: Timer and Counter Programming (3 lectures)

Programming 8051 timers, counter programming.

Module V: Serial Port Programming With and Without Interrupt and Interfacing 8051 Microcontroller to Peripherals (8 lectures)

Introduction to 8051 interrupts, programming timer interrupts, programming external hardware interrupts and serial communication interrupt, interrupt priority in the 8051.

Parallel and serial ADC, DAC interfacing, LCD interfacing.

Module VI: Programming Embedded Systems, Design & Development (13 lectures)

Structure of embedded program, infinite loop, compiling, linking and locating, downloading and debugging.

Embedded system development environment, file types generated after cross compilation, disassembler/ decompiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.

Pin diagram and description of Arduino UNO. Basic programming.

Suggested Readings

1. Embedded Systems: Architecture, Programming & Design, R.Kamal, Tata McGraw Hill.
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M. A. Mazidi, J. G. Mazidi, and R. D. McKinlay, Pearson Education India.
3. Embedded microcomputor system: Real time interfacing, J. W. Valvano, Brooks/Cole.
4. Microcontrollers in practice, I. Susnea and M. Mitescu, Springer.
5. Embedded Systems: Design & applications, S. F. Barrett, Pearson Education India.
6. Embedded Microcomputer systems: Real time interfacing, J. W. Valvano, Cengage Learning.

Mapping of COs to Syllabus

	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
CO 5				H		

PSDI0118: PHYSICS OF DEVICES AND INSTRUMENTS (4-0-0)

COURSE OUTCOMES

1. Explain the physics of semiconductor devices. (Remembering)
2. Explain the function of different components of a power supply. (Understanding)
3. Explain different techniques used in the fabrication of semiconductor devices. (Applying)
4. Explain the procedures of standard digital data communication processes. (Understanding)
5. Explain the process of digital communication. (Understanding)

Module I: Devices (14 lectures)

Characteristic and small signal equivalent circuits of UJT and JFET. Metal-semiconductor Junction. Metal oxide semiconductor (MOS) device. Ideal MOS and Flat Band voltage. SiO2-Si based MOS. MOSFET– their frequency limits. Enhancement and Depletion Mode MOSFETS, CMOS. Charge coupled devices. Tunnel diode.

Module II: Power Supply and Filters (6 lectures)

Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators, Line and load regulation, Short circuit protection. Active and Passive Filters, Low Pass, High Pass, Band Pass and band Reject Filters.

Module III: Multivibrators (3 lectures)

Continuity Astable and Monostable Multivibrators using transistors.

Module IV: Phase Locked Loop (PLL) (5 lectures)

Basic Principles, Phase detector(XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor). Loop Filter–Function, Loop Filter Circuits, transient response, lock and capture. Basic idea of PLL IC (565 or 4046).

Module V: Processing of Devices (12 lectures)

Basic process flow for IC fabrication, Electronic grade silicon. Crystal plane and orientation. Defects in the lattice. Oxide layer. Oxidation Technique for Si. Metallization technique. Positive and Negative Masks. Optical lithography. Electron lithography. Feature size control and wet anisotropic etching. Lift off Technique. Diffusion and implantation.

Module VI: Digital Data Communication Standards (5 lectures)

Serial Communications: RS232, Handshaking, Implementation of RS232 on PC. Universal Serial Bus (USB): USB standards, Types and elements of USB transfers. Devices (Basic idea of UART). Parallel Communications: General Purpose Interface Bus (GPIB), GPIB signals and lines, Handshaking and interface management, Implementation of a GPIB on a PC. Basic idea of sending data through a COM port.

Module VII: Introduction to communication systems (15 lectures)

Block diagram of electronic communication system, Need for modulation. Amplitude modulation. Modulation Index. Analysis of Amplitude Modulated wave. Sideband frequencies in AM wave. CE Amplitude Modulator. Demodulation of AM wave using Diode Detector. basic idea of Frequency, Phase, Pulse and Digital Modulation including ASK, PSK, FSK.

Suggested Readings

1. Physics of Semiconductor Devices, S. M. Sze & K. K. Ng, John Wiley & Sons.
2. Electronic devices and integrated circuits, A. K. Singh, PHI Learning Pvt. Ltd.
3. Op-Amps & Linear Integrated Circuits, R. A.Gayakwad, PHI Learning Pvt. Ltd.
4. Electronic Devices and Circuits, A. Mottershead, PHI Learning Pvt. Ltd.
5. Electronic Communication systems, G. Kennedy, Tata McGraw Hill.
6. Introduction to Measurements & Instrumentation, A. K. Ghosh, PHI Learning Pvt. Ltd.
7. Semiconductor Physics and Devices, D. A. Neamen, McGraw Hill.
8. PC based instrumentation; Concepts & Practice, N. Mathivanan, Prentice-Hall of India.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H		H	H			
CO 2		H					
CO 3					H		
CO 4						H	H
CO 5						H	H

PSCD0119: CLASSICAL DYNAMICS (5-1-0)

COURSE OUTCOMES

1. Understand the motion and trajectory of a charged particle in an electromagnetic field. (Understanding)
2. Understand Lagrangian and Hamiltonian formalism of classical mechanics. (Understanding)
3. Know the importance of small oscillations. (Evaluating)
4. Distinguish between classical and relativistic particles and understand and learn the mathematical tools needed to analyse relativistic particles. (Analysing)
5. Understand the tensor analysis and four vector which will help them to write shorthand notations for different mathematical terms and expressions. (Understanding)
6. Apply the laws of fluid dynamics in their practical life as well as to build technologies. (Applying)

Module I: Classical Mechanics of Point Particles: (22 lectures)

Review of Newtonian Mechanics; Application to the motion of a charge particle in external electric and magnetic fields-motion in uniform electric field, magnetic field- gyroradius and gyrofrequency, motion in crossed electric and magnetic fields. Generalized coordinates and velocities, Hamilton's 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; applications to simple systems such as coupled oscillators Canonical momenta & Hamiltonian. Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator, solution of Hamilton's equation for Simple Harmonic Oscillations; particle in a central force field- conservation of angular momentum and energy.

Module II: Small Amplitude Oscillations (10 lectures)

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 (33 lectures)

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: space-like, time-like and light-like. Four-velocity and acceleration. Metric and alternating tensors. Four-momentum and energy-momentum relation. Doppler effect from a four-vector perspective. Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle.

Module IV: Fluid Dynamics (10 lectures)

Density ρ and pressure P 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. Classical Mechanics, H. Goldstein, C. P. Poole and J. L. Safko, Pearson Education.
2. Mechanics, L. D. Landau and E. M. Lifshitz, Pergamon.
3. Classical Electrodynamics, J. D. Jackson, Wiley.
4. The Classical Theory of Fields, L. D. Landau and E. M .Lifshitz, Elsevier.
5. Introduction to Electrodynamics, D. J. Griffiths, Pearson Education.
6. Classical Mechanics, P. S. Joag, N. C. Rana, McGraw Hall.
7. Classical Mechanics, R. Douglas Gregory, Cambridge University Press.
8. Classical Mechanics: An introduction, Dieter Strauch, Springer.
9. Solved Problems in classical Mechanics, O. L. Delange and J. Pierrus, Oxford Press.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H			
CO 3		H		
CO 4			H	
CO 5			H	
CO 6				H

PSCE0120: COMMUNICATION ELECTRONICS (4-0-0)

COURSE OUTCOMES

1. Analyse the concept of modulation and antenna requirement for communication. (Analysing)
2. Analyse the requirement of modulation technique used in mobile communication. (Analysing)
3. Apply the theories for making AM, FM and Digital communication system. (Applying)
4. Understand the quality differences in communication technique with analog and digital modulation. (understanding)
5. Understand the concept of different generation in communication industry and use it for further improvement. (understanding)

Module I: Electronic Communication (8 lectures)

Introduction to communication – means and modes. Need for modulation. Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI). Electromagnetic communication spectrum, band designations and usage. Channels and base-band signals. Concept of Noise, signal-to-noise (S/N) ratio.

Module II: Analog Modulation (12 lectures)

Amplitude Modulation, modulation index and frequency spectrum. Generation of AM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side band generation and detection. Frequency Modulation (FM) and Phase Modulation (PM), modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM using VCO, FM detector (slope detector), Qualitative idea of Super heterodyne receiver.

Module III: Analog Pulse Modulation (9 lectures)

Channel capacity, Sampling theorem, Basic Principles- PAM, PWM, PPM, modulation and detection technique for PAM only, Multiplexing.

Module IV: Digital Pulse Modulation (10 lectures)

Need for digital transmission, Pulse Code Modulation, Digital Carrier Modulation Techniques, Sampling, Quantization and Encoding. Concept of Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Binary Phase Shift Keying (BPSK).

Module V: Introduction to Communication and Navigation Systems (10 lectures)

Satellite Communication– Introduction, need, Geosynchronous satellite orbits, geostationary satellite advantages of geostationary satellites. Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink.

Module VI: Mobile Telephony System (10 lectures)

Basic concept of mobile communication, frequency bands used in mobile communication, concept of cell sectoring and cell splitting, SIM number, IMEI number, need for data encryption, architecture (block diagram) of mobile communication network, idea of GSM, CDMA, TDMA and FDMA technologies, simplified block diagram of mobile phone handset, 2G, 3G and 4G concepts (qualitative only).

Module VII: GPS Navigation System (1 hour)

Qualitative idea of GPS navigation system.

Suggested Readings

1. A Text book of Quantum Mechanics, P. M. Mathews and K. Venkatesan, McGraw Hill.
2. Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
3. Advanced Electronics Communication Systems, Tomasi, Prentice Hall.
4. Electronic Communication systems, G. Kennedy, Tata McGraw Hill.
5. Principles of Electronic communication systems, Frenzel, McGraw Hill.
6. Communication Systems, S. Haykin, Wiley India.
7. Electronic Communication system, Blake, Cengage.
8. Wireless communications, Andrea Goldsmith, Cambridge University Press.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H	L	L	L			
CO 2		H	H	H			
CO 3		H	H	H			
CO 4		H	H	H			
CO 5					H	H	H

PSET0121: ELECTROMAGNETIC THEORY (4-0-0)

COURSE OUTCOMES

1. Apply the Maxwell's equations in solving problems related to various physical phenomena. (Applying)
2. Explain physical phenomena involving electric charges and currents from the standpoint of electromagnetic theory. (Understanding)
3. Analyse the behaviour of physical systems using electromagnetic theory. (Analysing)

Module I: Maxwell Equations (12 lectures)

Review of 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 (10 lectures)

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 (10 lectures)

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 (12 lectures)

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.

Module V: Rotatory Polarization (5 lectures)

Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation. Calculation of angle of rotation. Experimental verification of Fresnel's theory. Specific rotation. Laurent's half-shade polarimeter.

Module VI: Wave Guides (8 lectures)

Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves. Field energy and Power transmission.

Module VII: Optical Fibres (3 lectures)

Numerical Aperture. Step and Graded Indices (Definitions Only). Single and Multiple Mode Fibres (Concept and Definition Only).

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

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1	H							
CO 2		H	H	H	H	H		
CO 3							H	H

PSSM0122: STATISTICAL MECHANICS (4-0-0)

COURSE OUTCOMES

1. Understand the connection between statistical mechanics and thermodynamics. (Understanding)
2. Differentiate between Classical and quantum theory of Radiation. (Analysing)
3. Explain the classical and quantum statistical mechanics. (Understanding)
4. Applying quantum statistics in various systems to overcome the shortcomings of classical statistics. (Applying)

Module I: Classical Statistics (18 lectures)

Macrostate& Microstate, Elementary Concept of Ensemble, Phase Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) – Applications to Specific

Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature.

Module II: Classical Theory of Radiation (9 lectures)

Properties of Thermal Radiation. Blackbody Radiation. Pure temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. Wien's Displacement law. Wien's Distribution Law. Saha's Ionization Formula. Rayleigh-Jean's Law. Ultraviolet Catastrophe.

Module III: Quantum Theory of Radiation (5 lectures)

Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Experimental Verification. Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law.

Module IV: Bose-Einstein Statistics (13 lectures)

B-E distribution law, Thermodynamic functions of a strongly Degenerate Bose Gas, Bose Einstein condensation, properties of liquid He (qualitative description), Radiation as a photon gas and Thermodynamic functions of photon gas. Bose derivation of Planck's law.

Module V: Fermi-Dirac Statistics (15 lectures)

Fermi-Dirac Distribution Law, Thermodynamic functions of a Completely and strongly Degenerate Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, White Dwarf Stars, Chandrasekhar Mass Limit.

Suggested Readings

1. Statistical Mechanics, R. K. Pathria and Butterworth Heinemann, Oxford University Press.
2. Berkeley Physics Course, F. Reif, Statistical Physics, Tata McGraw-Hill.
3. Statistical and Thermal Physics, S. Lokanathan and R. S. Gambhir, Prentice Hall.
4. Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, Narosa.
5. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, Springer.
6. An Introduction to Statistical Mechanics & Thermodynamics, R. H. Swendsen, Oxford Univ. Press.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	H		
CO 3			H	H	H
CO 4		M	H		

PSNP0123: NUCLEAR AND PARTICLE PHYSICS (5-1-0)

COURSE OUTCOMES

1. Understand the basic properties of nuclei, their reactions and different models to explain nuclear structure. (Understanding)
2. Explain the phenomena of radioactive decays of different nuclei. (Evaluating)
3. Illustrate the energy loss mechanism when nuclear radiation passes or interacts with matter. (Understanding)
4. Categorize the working of sophisticated nuclear detectors to detect nuclear particles or Radiations. (Analysing)
5. Analyse the physics of elementary particles. (Analysing)

Module I: General Properties of Nuclei Equation (10 lectures)

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, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

Module II: Nuclear Models (12 lectures)

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 III: Radioactivity Decay (10 lectures)

(a) Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttall law, α-decay

spectroscopy.
(b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis.
(c) Gamma decay: Gamma rays emission & kinematics, internal conversion.

Module IV: Nuclear Reactions (8 lectures)

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction, Coulomb scattering (Rutherford scattering).

Module V: Interaction of Nuclear Radiation with Matter and Detection (16 lectures)

Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.
Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector.

Module VI: Particle Physics (19 lectures)

Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.
Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

Suggested Readings

1. Introductory nuclear Physics, Kenneth S. Krane, Wiley India Pvt. Ltd.
2. Concepts of nuclear physics, Bernard L. Cohen, Tata Mcgraw Hill.
3. Introduction to the physics of nuclei & particles, R. A. Dunlap, Thomson Asia.
4. Introduction to High Energy Physics, D. H. Perkins, Cambridge Univ. Press.
5. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons.
6. Quarks and Leptons, F. Halzen and A. D. Martin, Wiley India.
7. Basic ideas and concepts in Nuclear Physics - An Introductory Approach, K. Heyde, IOP- Institute of Physics Publishing.
8. Radiation detection and measurement, G. F. Knoll, John Wiley & Sons.
9. Physics and Engineering of Radiation Detection, Syed Naeem Ahmed, Academic Press, Elsevier.
10. Theoretical Nuclear Physics, J. M. Blatt & V. F. Weisskopf, Dover Pub.Inc.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H		H		
CO 2			H			
CO 3					H	
CO 4					H	
CO 5						H

PSNA0124: NANO MATERIALS AND APPLICATIONS (4-0-0)

COURSE OUTCOMES

1. Understand and appreciate the properties of materials at nano level. (Understanding)
2. Explain different techniques used in the synthesis of nanomaterials. (Remembering)
3. Explain the theory behind different techniques and instruments used in the study of nano Materials. (Applying)
4. Explain the optical properties and phenomena of electron transport of materials at nanoscale. (Understanding)
5. Understand and appreciate few applications of nanoparticles. (Applying)
6. Understand the difference between nanotechnology and nanoscience. (Understanding)
7. Interpret the concept of charecterisation for synthesis of desired materials. (Understanding)
8. Apply the nanomaterials for design and development of nano-sensors. (Applying)

Module I: Nanoscale Systems (10 lectures)

Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band

structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences.

Module II: Synthesis of Nanostructure Materials (8 lectures)

Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electro deposition. Spray pyrolysis. Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dots.

Module III: Characterization (8 lectures)

X-Ray Diffraction. Optical Microscopy. Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy.

Module IV: Optical Properties (14 lectures)

Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging effects. Radiative processes: General formalization-absorption, emission and luminescence. Optical properties of heterostructures and nanostructures.

Module V: Electron Transport (6 lectures)

Carrier transport in nanostrcutures. Coulomb blockade effect, thermionic emission, tunneling and hoping conductivity. Defects and impurities: Deep level and surface defects.

Module VI: Applications (14 lectures)

Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron transfer devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS).

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

	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
CO 6	H					H
CO 7		H	H			
CO 8						H

PSDP0125: DIGITAL SIGNAL PROCESSING (4-0-0)

COURSE OUTCOMES

1. Analyse the theories of signals and systems. (Analysing)
2. Relate the different filters for better signal processing. (Remembering)
3. Understand the concept of fourier transform. (Understanding)
4. Apply the filter concept in making noise free signals. (Applying)

5. Apply the transform technique in system design. (Applying)

Module I: Discrete-Time Signals and Systems (10 lectures)

Classification of Signals, Transformations of the Independent Variable, Periodic and Aperiodic Signals, Energy and Power Signals, Even and Odd Signals, Discrete-Time Systems, System Properties. Impulse Response, Convolution Sum; Graphical Method; Analytical Method, Properties of Convolution; Commutative; Associative; Distributive; Shift; Sum Property System Response to Periodic Inputs, Relationship Between LTI System Properties and the Impulse Response; Causality; Stability; Invertibility, Unit Step Response.

Module II: Discrete-Time Fourier Transform (15 lectures)

Fourier Transform Representation of Aperiodic Discrete-Time Signals, Periodicity of DTFT, Properties; Linearity; Time Shifting; Frequency Shifting; Differencing in Time Domain; Differentiation in Frequency Domain; Convolution Property. The z-Transform: Bilateral (Two-Sided) z-Transform, Inverse z-Transform, Relationship Between z-Transform and Discrete-Time Fourier Transform, z-plane, Region-of-Convergence; Properties of ROC, Properties; Time Reversal; Differentiation in the z-Domain; Power Series Expansion Method (or Long Division Method); Analysis and Characterization of LTI Systems; Transfer Function and Difference-Equation System. Solving Difference Equations.

Module III: Filter Concepts (5 lectures)

Phase Delay and Group delay, Zero-Phase Filter, Linear-Phase Filter, Simple FIR Digital Filters, Simple IIR Digital Filters, All pass Filters, Averaging Filters, Notch Filters.

Module IV: Discrete Fourier Transform (10 lectures)

Frequency Domain Sampling (Sampling of DTFT), The Discrete Fourier Transform (DFT) and its Inverse, DFT as a Linear transformation, Properties; Periodicity; Linearity; Circular Time Shifting; Circular Frequency Shifting; Circular Time Reversal; Multiplication Property; Parseval's Relation, Linear Convolution Using the DFT (Linear Convolution Using Circular Convolution), Circular Convolution as Linear Convolution with aliasing.

Module V: Fast Fourier Transform (5 lectures)

Direct Computation of the DFT, Symmetry and Periodicity Properties of the Twiddle factor (WN), Radix-2 FFT Algorithms; Decimation-In-Time (DIT) FFT Algorithm; Decimation-In-Frequency (DIF) FFT Algorithm, Inverse DFT Using FFT Algorithms.

Module VI: Realization of Digital Filters (15 lectures)

Non Recursive and Recursive Structures, Canonic and Non Canonic Structures, Equivalent Structures (Transposed Structure), FIR Filter structures; Direct-Form; Cascade-Form; Basic structures for IIR systems; Direct-Form I. Finite Impulse Response Digital Filter: Advantages and Disadvantages of Digital Filters, Types of Digital Filters: FIR and IIR Filters; Difference Between FIR and IIR Filters, Desirability of Linear-Phase Filters, Frequency Response of Linear-Phase FIR Filters, Impulse Responses of Ideal Filters, Windowing Method; Rectangular; Triangular; Kaiser Window, FIR Digital Differentiators. Infinite Impulse Response Digital Filter: Design of IIR Filters from Analog Filters, IIR Filter Design by Approximation of Derivatives, Backward Difference Algorithm, Impulse Invariance Method.

Suggested Readings

1. Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press.
2. Digital Signal Processing, S. K. Mitra, McGraw Hill.
3. Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University Press.
4. Fundamentals of Digital Signal processing using MATLAB, R. J. Schilling and S. L. Harris, Cengage Learning.
5. Fundamentals of signals and systems, P. D. Cha and J. I. Molinder, Cambridge University Press.
6. Digital Signal Processing Principles Algorithm & Applications, J. G. Proakis and D. G. Manolakis, Prentice Hall.

Mapping of COs to Syllabus

	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					H	

PSAA0126: ASTRONOMY AND ASTROPHYSICS (5-1-0)

COURSE OUTCOMES

1. Define and recall fundamental concepts in astronomy. (Remembering)
2. Illustrate the working of various tools used in observational astronomy. (Understanding)
3. Explain the dynamics of the Sun and the solar system. (Understanding)
4. Classify stars based on their spectra. (Analysing)
5. Outline the astrophysics at grander scales. (Understanding)
6. Solve astrophysical problems using fundamental concepts. (Applying)

Module I: Astronomical Scales (24 lectures)

Astronomical Distance, Mass and Time, Scales, Brightness, Radiant Flux and Luminosity, Measurement of Astronomical Quantities Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature. Basic concepts of positional astronomy: Celestial Sphere, Geometry of a Sphere, Spherical Triangle, Astronomical Coordinate Systems, Geographical Coordinate Systems, Horizon System, Equatorial System, Diurnal Motion of the Stars, Conversion of Coordinates. Measurement of Time, Sidereal Time, Apparent Solar Time, Mean Solar Time, Equation of Time, Calendar. Basic Parameters of Stars: Determination of Distance by Parallax Method; Brightness, Radiant Flux and Luminosity, Apparent and Absolute magnitude scale, Distance Modulus; Determination of Temperature and Radius of a star; Determination of Masses from Binary orbits; Stellar Spectral Classification, Hertzsprung-Russell Diagram.

Module II: Astronomical Techniques (9 lectures)

Basic Optical Definitions for Astronomy (Magnification Light Gathering Power, Resolving Power and Diffraction Limit, Atmospheric Windows), Optical Telescopes (Types of Reflecting Telescopes, Telescope Mountings, Space Telescopes, Detectors and Their Use with Telescopes (Types of Detectors, detection Limits with Telescopes). Physical principles: Gravitation in Astrophysics (Virial Theorem, Newton versus Einstein), Systems in Thermodynamic Equilibrium.

Module III: The Sun and it's family (7 lectures)

Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity, Basics of Solar Magneto-hydrodynamics. Helioseismology.

Solar System: Facts and Figures, Origin of the Solar System: The Nebular Model, Tidal Forces and Planetary Rings, Extra-Solar Planets.

Module IV: Stellar Spectra and Classification Structure (4 lectures)

Atomic Spectra Revisited, Stellar Spectra, Spectral Types and Their Temperature Dependence, Black Body Approximation, H. R. Diagram, Luminosity Classification.

Module V: Galaxies(21 lectures)

Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way (Differential Rotation of the Galaxy and Oort Constant, Rotation Curve of the Galaxy and the Dark Matter, Nature of the Spiral Arms), Stars and Star Clusters of the Milky Way, Properties of and around the Galactic Nucleus.

Galaxy Morphology, Hubble's Classification of Galaxies, Elliptical Galaxies (The Intrinsic Shapes of Elliptical, de Vaucouleurs Law, Stars and Gas). Spiral and Lenticular Galaxies (Bulges, Disks, Galactic Halo) The Milky Way Galaxy, Gas and Dust in the Galaxy, Spiral Arms.

Module VI: Large Scale Structure & Expanding Universe (10 lectures)

Cosmic Distance Ladder (An Example from Terrestrial Physics, Distance Measurement using Cepheid Variables), Hubble's Law (Distance- Velocity Relation), Clusters of Galaxies (Virial theorem and Dark Matter).

Suggested Readings

1. Modern Astrophysics, B. W. Carroll and D. A. Ostlie, Addison-Wesley Publishing Co.
2. Introductory Astronomy and Astrophysics, M. Zeilik and S. A. Gregory, Saunders College Publishing.
3. The physical universe: An introduction to astronomy, F. Shu, University Science Books.
4. Fundamental of Astronomy, H. Karttunen et al., Springer.
5. Astro Physics a modern perspective, K. S. Krishnasamy, New Age International (p) Ltd.
6. An introduction to Astro physics, BaidyanathBasu, Prentice Hall of India Private limited.
7. Textbook of Astronomy and Astrophysics with elements of cosmology, V. B. Bhatia, Narosa Publication.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	L	L			
CO 2		H				

CO 3			H			
CO 4				H		
CO 5					H	H
CO 6	M	M	M	M		

PSSL0100: ELEMENTS OF SERVICE LEARNING IN PHYSICS (2-0-0)

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

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

PSPS0200: PHYSICS AND SERVICE LEARNING (2-0-0)

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)
4. Illustrate CBPR. (Understanding)
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

	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

1. Explain the characteristics of SCR. (Understanding)
2. Find out resistivity of a semiconductor. (Application)
3. Determine of difference in wavelengths of Na using Fabry-Perot interferometer. (Application)
4. Verify the Beer-Lambert law using UV visible spectrometer. (Analysis)
5. Use nuclear radiation detectors. (Application)
6. Understand phonon dispersion using simulator. (Understanding)
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 a gamma-ray spectrometer.
9. To calibrate the scintillation spectrometer and determine the energy of gamma rays from 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 electronic analogue 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

	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

1. Demonstrate the validity of various network theorems. (Understanding)
2. Explain the working of various circuits containing semiconductor devices. (Understanding)
3. Construct various rectifier circuits. (Applying)
4. Build various filter circuits. (Applying)
5. Illustrate the working of various transistor circuits. (Understanding)
6. Explain the behaviour of Op-Amp circuits. (Understanding)
7. Demonstrate the working of logic circuits. (Understanding)
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

	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

	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

1. Find out inverse, eigenvalues and eigenvectors of a matrix. (Application)
2. Perform numerical integration and differentiation and solution of differential equations. (Application)
3. Understand special functions and orbitals. (Understanding)
4. Numerical solutions of algebraic equations. (Application)
5. Numerical solutions of simultaneous equations. (Application)
6. Understand chaos. (Understanding)
7. Apply Monte-Carlo simulations. (Application)
8. Study LCR circuits. (Application)
9. Model data. (Analysing)
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 so on.
   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 Cosine Transformations.
    c. To compute Fourier transform of a given function in two or more dimensions.

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	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

PSPP6011: 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:
1. LaTeX

PSPR6012: PROJECT PHASE II
(5 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.

PSPM6013: PLASMA PHYSICS LABORATORY (0-0-4)

COURSE OUTCOMES

1. Explain the breakdown mechanism of gasses. (Remembering)
2. Understand the electrical properties of a gas discharge. (Understanding)
3. Operate and conduct experiments in plasma devices. (Application)
4. Collect and analyse data from plasma devices. (Analysing)
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

	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	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

1. Explain transistor operation. (Remembering)
2. Understand amplifier design using transistor. (Understanding)
3. Operational Amplifier and Timer applications. (Application)
4. Analyse Logic Gates. (Analysis)
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

	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

1. Calculations of molarity. (Remembering)
2. Understanding hydrothermal synthesis. (Understanding)
3. Understanding characterization techniques. (Understanding)
4. Application of characterization techniques on synthesized material. (Application)
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 direct seeding 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 a nanoparticle coated surface.
10. Synthesize CdS nanoparticles using hydrothermal process. Observe colour variations with size when 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

	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

	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 educational institutes 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**.**

PSMY6101: MATHEMATICAL PHYSICS-I LABORATORY (0-0-2)

COURSE OUTCOMES

1. Explain the fundamentals of scientific computing. (Understanding)
2. Outline the basics of programming in C and C++ programming languages. (Understanding)
3. Organize computations efficiently using data structures. (Applying)
4. Utilize file handling for input and output of physical data. (Applying)
5. Develop computational models for physical problems. (Applying)
6. Model real-world physics using object-oriented programming. (Applying)

At least 10 experiments to be performed from the following:

Experiments	Description with Applications
1. Introduction and Overview	Computer architecture and organization, memory and Input/output devices
2. Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflow- emphasize the importance of making equations in terms of dimensionless variables, Iterative methods
3. Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
4. Review of C & C++ Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (If-statement. If-else Statement. Nested if

	Structure. Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops), Arrays (1D & 2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects
5. Programs	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search
6. Random number generation	Area of circle, area of square, volume of sphere, value of pi (π)
7. Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods	Solution of linear and quadratic equation, solving$\alpha = tan\ \alpha$; $I = I_0(sin\ \alpha\ /\alpha\ )^2$in optics
8. Interpolation by Newton Gregory, Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions e.g. sin θ, cos θ, tan θ, etc.
9. Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop
10. Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods	First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source • Newton's law of cooling • Classical equations of motion • Attempt following problems using RK 4 order method: • Solve the coupled differential equations$\frac{dx}{dt} = y + x - \frac{x^3}{3}$; $\frac{dy}{dx} = -x$ for four initial conditions x(0) = 0, y(0) = -1, -2, -3, -4. Plot x vs y for each of the four initial conditions on the same screen for 0≤ t≤15 The differential equation describing the motion of a pendulum is $\frac{d^2\theta}{dt^2} = -sin\ \theta$. The pendulum is released from rest at an angular displacement α, i. e. θ(0) = α and θ'(0) = 0. Solve the equation for α = 0.1, 0.5 and 1.0 and plot θ as a function of time in the range 0≤ t≤ 8π. Also plot the analytic solution valid for small θsin(θ) = θ

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

PSMA6102: MECHANICS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Measure distances and angles accurately. (Application)
2. Measure various properties of solid matters. (Application)

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 travelling microscope.
2. Study the random error in observations.
3. Determine the height of a building using a Sextant.
4. Study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
5. Determine the Moment of Inertia of a Flywheel.
6. Determine g and velocity for a freely falling body using Digital Timing Technique
7. Determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
8. Determine the Young 's Modulus of a Wire by Optical Lever Method.
9. Determine the Modulus of Rigidity of a Wire by Maxwell's needle.
10. Determine the elastic Constants of a wire by Searle's method.
11. Determine the value of g using Bar Pendulum.
12. Determine the value of g using Kater 's Pendulum.

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	M									
CO 2				M	M		M	M	M	M		
CO 3						M					M	M

PSEM6103: ELECTRICITY AND MAGNETISM LABORATORY (0-0-2)

COURSE OUTCOMES

1. Demonstrate the operation of electrical measuring instruments. (Understanding)
2. Measure various parameters of electrical devices and circuits. (Evaluating)
3. Measure physical quantities using established methods and apparatus. (Evaluating)
4. Measure fields using electrical apparatus. (Evaluating)
5. Demonstrate the validity of various network theorems in practical applications. (Understanding)
6. Utilize the concept of induction to study various AC circuits. (Applying)

At least 10 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.
11. Study the response curve of a parallel LCR circuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q.
12. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer
13. Determine a high resistance by leakage method using Ballistic Galvanometer.
14. Determine self-inductance of a coil by Rayleigh's method.
15. Determine the mutual inductance of two coils by Absolute method.

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8
CO 1	H							
CO 2	M	H						
CO 3			H	H	H			
CO 4						H		
CO 5							H	H

	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15
CO 2		M	M				
CO 3	M			H	H	M	M
CO 6	H	H	H	M	M	H	H

PSWO6104: WAVES AND OPTICS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Measure frequency of different types of oscillators. (Application)
2. Determine experimentally the properties of optical devices. (Application)
3. Measure wavelength of monochromatic light by different techniques. (Application)

At least 10 experiments to be performed from the following:

1. Determine the frequency of an electric tuning fork by Melde's experiment and verify λ2 –T law.
2. Investigate the motion of coupled oscillators.
3. Study Lissajous Figures.
4. Familiarization with: Schuster`s focusing; determination of angle of prism.
5. Determine refractive index of the Material of a prism using sodium source.
6. Determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
7. Determine the wavelength of sodium source using Michelson's interferometer.
8. Determine wavelength of sodium light using Fresnel Biprism.
9. Determine wavelength of sodium light using Newton's Rings.
10. Determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
11. Determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
12. Determine dispersive power and resolving power of a plane diffraction grating.

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	M									
CO 2				M	M	M						M
CO 3							M	M	M	M	M	

PSMS6105: MATHEMATICAL PHYSICS-II LABORATORY (0-0-2)

COURSE OUTCOMES

1. Outline the basics of scientific computing using Scilab. (Understanding)
2. Demonstrate the principles of curve fitting using physical applications. (Understanding)
3. Utilize concepts from linear algebra to solve physical problems. (Applying)
4. Demonstrate the solutions and plots of special functions. (Understanding)
5. Solve physical problems using ordinary and partial differential equations. (Applying)

6. Model physical scenarios using Scicos/Xcos simulations. (Applying)

At least 10 experiments to be performed from the following.

Topics	Description with Applications
1. Introduction to Numerical computation software Scilab	Introduction to Scilab, Advantages and disadvantages, Scilab environment, Command window, Figure window, Edit window, Variables and arrays, Initialising variables in Scilab, Multidimensional arrays, Subarray, Special values, Displaying output data, data file, Scalar and array operations, Hierarchy of operations, Built in Scilab functions, Introduction to plotting, 2D and 3D plotting (2), Branching Statements and program design, Relational & logical operators, the while loop, for loop, details of loop operations, break & continue statements, nested loops, logical arrays and vectorization (2) User defined functions, Introduction to Scilab functions, Variable passing in Scilab, optional arguments, preserving data between calls to a function, Complex and Character data, string function, Multidimensional arrays (2) an introduction to Scilab file processing, file opening and closing, Binary I/o functions, comparing binary and formatted functions, Numerical methods and developing the skills of writing a program (2).
2. Curve fitting, Least square fit, Goodness of fit, standard deviation	Ohms law to calculate R, Hooke's law to calculate spring constant
3. Solution of Linear system of equations by Gauss elimination method and Gauss Seidal method. 4. Diagonalization of matrices, Inverse of a matrix, Eigen vectors, eigen values problems	Solution of mesh equations of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses)
5. Generation of Special functions using User defined functions in Scilab	Generating and plotting Legendre Polynomials Generating and plotting Bessel function
6. Solution of ODE 7. First order Differential equation Euler, modified Euler and Runge-Kutta second order methods 8. Second order differential equation Fixed difference method	First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source Newton's law of cooling • Classical equations of motion Second order Differential Equation • Harmonic oscillator (no friction) • Damped Harmonic oscillator • Over damped • Critical damped • Oscillatory • Forced Harmonic oscillator • Transient and • Steady state solution • Apply above to LCR circuits also • Solve $x^2 \frac{d^2y}{dx^2} - 4x(1 + x)\frac{dy}{dx} + 2(1 + x)y = x^3$ with the boundary conditions at $x = 1$, $y = \frac{1}{2}e^2$, $\frac{dy}{dx} = -\frac{3}{2}e^2 - 0.5$, in the range 1 ≤ x ≤ 3 . Plot y and dy against x in the given range on

9. Partial differential equations	the same graph. Partial Differential Equation: • Wave equation • Heat equation • Poisson equation • Laplace equation
10. Using Scicos / xcos	• Generating square wave, sine wave, saw tooth wave • Solution to harmonic oscillator • Study of beat phenomenon • Phase space plots

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

PSPT6106: THERMAL PHYSICS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Measure mechanical equivalent of heat. (Application)
2. Determine thermal conductivity. (Application)
3. Use Platinum Resistance Thermometer. (Application)
4. Understand thermo-emf and thermocouple. (Understanding)
5. Understand the relationship between heat and mechanical work. (Understanding)

At least 5 experiments to be performed from the following:

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
CO 1	H						
CO 2		H	H	H			
CO 3					H		
CO 4						H	H
CO 5	H				M		

PSDA6107: DIGITAL SYSTEMS AND APPLICATIONS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Use of CRO and measurement of different parameters. (Remembering)
2. Understanding digital measuring equipments. (Understanding)
3. Understanding logic gates. (Understanding)
4. Analysis of Digital circuits circuits. (Analysis)
5. Execution of 8085 microprocessor programming. (Understanding)

At least 5 experiments to be performed from the following:

1. To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.
2. To test a Diode and Transistor using a Multimeter.
3. To design a switch (NOT gate) using a transistor.
4. To verify and design AND, OR, NOT and XOR gates using NAND gates.
5. To design a combinational logic system for a specified Truth Table.
6. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
7. To minimize a given logic circuit.
8. Half Adder, Full Adder and 4-bit binary Adder.
9. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
11. To build JK Master-slave flip-flop using Flip-Flop ICs.
12. To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.
13. To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs.
14. To design an astablemultivibrator of given specifications using 555 Timer.
15. To design a monostable multivibrator of given specifications using 555 Timer.
16. Write the following programs using 8085 Microprocessor.
    a. Addition and subtraction of numbers using direct addressing mode
    b. Addition and subtraction of numbers using indirect addressing mode c) Multiplication
    b. by repeated addition.
    a. Division by repeated subtraction.
    b. Handling of 16-bit Numbers.
    c. Use of CALL and RETURN Instruction.
    d. Block data handling.
    e. Other programs (e.g. Parity Check, using interrupts, etc.).

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

PSMP6108: MATHEMATICAL PHYSICS III LABORATORY (0-0-2)

COURSE OUTCOMES

1. Develop numerical solutions of ordinary differential equations. (Applying)
2. Develop numerical solutions of definite integrals. (Applying)
3. Make use of Scilab for evaluating integral transforms. (Applying)
4. Evaluate approximations of the Dirac delta function. (Evaluating)

5. Make use of Scilab for complex analysis. (Applying)
6. Make use of Scilab for experimental error analysis. (Applying)

At least 5 experiments to be performed from the following:

1. Solve differential equations:
   a. $\frac{dy}{dx} = e^{-x}$ with y = 0 for x = 0
2. Dirac Delta Function:
   a. Evaluate $\frac{1}{\sqrt{2\pi\sigma^2}} \int e^{-\frac{(x-2)^2}{2\sigma^2}} (x+3) dx$ for σ = 1, 0.1, 0.01 and show it tends to 5.
3. Fourier Series:
   a. Program to sum $\sum_{n=1}^{\infty} (0.2)^n$
   b. Evaluate the Fourier coefficients of a given periodic function (square wave)
4. Frobenius method and Special functions:
   a. $\int_{-1}^{+1} P_n(\mu) P_m(\mu) d\mu = \delta_{n,m}$
   b. Plot $P_n(x)$, $j_v(x)$
   c. Show recursion relation
5. Calculation of error for each data point of observations recorded in experiments done in previous
   a. semesters (choose any two).
6. Calculation of least square fitting manually without giving weightage to error. Confirmation of
   a. least square fitting of data through computer program.
7. Evaluation of trigonometric functions e.g. sin θ, Given Bessel's function at N points find its value
   a. at an intermediate point. Complex analysis: Integrate $1/(x^2+2)$ numerically and check with
   b. computer integration.
8. Compute the n^{th} roots of unity for n = 2, 3, and 4.
9. Find the two square roots of −5+12j.
10. Integral transform: FFT of e^{-s^2}
11. Solve Kirchoff's Current law for any node of an arbitrary circuit using Laplace's transform.
12. Solve Kirchhoff's Voltage law for any loop of an arbitrary circuit using Laplace's transform.
13. Perform circuit analysis of a general LCR circuit using Laplace's transform.

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

PSEP6109: ELEMENTS OF MODERN PHYSICS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Measure Planck's constant by various techniques. (Application)
2. Explain the phenomenon of photo electric effect. (Understanding)
3. Measure the e/m value of electrons. (Application)
4. Measure physical properties of certain elements and devices. (Application)
5. Measure wavelength of monochromatic light by different techniques. (Application)

At least 10 experiments to be performed from the following:

1. Measurement of Planck's constant using black body radiation and photo-detector.
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
3. To determine work function of material of filament of directly heated vacuum diode.

4. To determine the Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the ionization potential of mercury.
7. To determine the absorption lines in the rotational spectrum of Iodine vapour.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To show the tunneling effect in tunnel diode using I-V characteristics.
11. To determine the wavelength of laser source using diffraction of single slit.
12. To determine the wavelength of laser source using diffraction of double slits.
13. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating.

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

PSAS6110: ANALOG SYSTEMS AND APPLICATIONS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Understanding analog devices. (Understanding)
2. Applications of analog devices. (Application)
3. Application of Op Amp. (Application)
4. Analysis of analog circuits. (Analysing)
5. Understanding device characteristics under different circuit condition. (Understanding)

At least 10 experiments to be performed from the following:

1. To study V-I characteristics of PN junction diode, and Light emitting diode.
2. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
3. Study of V-I & power curves of solar cells, and find maximum power point & efficiency.
4. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
5. To study the various biasing configurations of BJT for normal class A operation.
6. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
7. To study the frequency response of voltage gain of a RC-coupled transistor amplifier.
8. To design a Wien bridge oscillator for given frequency using an op-amp.
9. To design a phase shift oscillator of given specifications using BJT.
10. To study the Colpitt`s oscillator.
11. To design a digital to analog converter (DAC) of given specifications.
12. To study the analog to digital convertor (ADC) IC.
13. To design an inverting amplifier using Op-amp (741,351) for dc voltage of given gain
14. To design inverting amplifier using Op-amp (741,351) and study its frequency response
15. To design non-inverting amplifier using Op-amp (741,351) & study its frequency response
16. To study the zero-crossing detector and comparator
17. To add two dc voltages using Op-amp in inverting and non-inverting mode
18. To design a precision Differential amplifier of given I/O specification using Op-amp.
19. To investigate the use of an op-amp as an Integrator.
20. To investigate the use of an op-amp as a Differentiator.
21. To design a circuit to simulate the solution of a 1st/2nd order differential equation.

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

	Exp 12	Exp 13	Exp 14	Exp 15	Exp 16	Exp 17	Exp 18	Exp 19	Exp 20	Exp 21
CO 1	M	M	M	M						
CO 2	M	M	M	H	M	M	M	M	M	
CO 3		H	H	H	M	M	M	M	M	M
CO 4	H	M	M	M	M	M	M	M	M	M
CO 5	M	M	M	M	M	M	M	M	H	M

PSGP6111: GENERAL THERMAL PHYSICS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Measure mechanical equivalent of heat. (Application)
2. Determine thermal conductivity. (Application)
3. Use Platinum Resistance Thermometer. (Application)
4. Understand thermo-emf and thermocouple. (Understanding)
5. Understand the relationship between heat and mechanical work. (Understanding)
6. Determine different physical constants. (Application)
7. Calibrate Resistance Temperature Device. (Application)

At least 8 experiments to be performed from the following:

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and Analyse the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system.
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off- Balance Bridge.

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
CO 1	H									
CO 2				H	H	H				
CO 3							H			
CO 4								H	H	
CO 5	H							M		
CO 6		H	H							
CO 7										H

PSGM6112: GENERAL ELEMENTS OF MODERN PHYSICS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Measure Planck's and Boltzmann constant. (Application)
2. Measure properties of various types of elements and devices. (Application)
3. Measure the e/m value of electrons. (Application)

At least 8 experiments to be performed from the following:

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine the ionization potential of mercury.
4. To determine value of Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. To study the diffraction patterns of single and double slits using laser and measure its intensity variation using Photosensor & compare with incoherent source – Na.
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
9. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
10. To setup the Millikan oil drop apparatus and determine the charge of an electron.

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
CO 1	H			H						
CO 2		M	M		M	M	M	M		
CO 3									H	H

PSQM6111: QUANTUM MECHANICS AND APPLICATIONS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Make use of Scilab to solve the s-wave radial Schrodinger wave equation for atoms (Applying)
2. Demonstrate electron spin resonance and its applications (Understanding)
3. Simulate interaction between spectral lines and external fields (Understanding)
4. Make use of Scilab to demonstrate the evolution of the wave function under a potential (Applying)
5. Demonstrate photon-matter interactions (Understanding)

At least 5 experiments should be performed from the following:

1. Solve the s-wave Schrodinger equation for the ground state and the first excited state of the hydrogen atom:
$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2}[V(r) - E] where\ V(r) = -\frac{e^2}{r}$$
Here, m is the reduced mass of the electron. Obtain the energy eigenvalues and plot the corresponding wavefunctions. Remember that the ground state energy of the hydrogen atom is ≈ -13.6 eV. Take e = 3.795 $(eVÅ)^{1/2}$, fic = 1973 (eVÅ) and m = 0.511x10^6 eV/c^2.
2. Solve the s-wave radial Schrodinger equation for an atom:
$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2}[V(r) - E]$$
where m is the reduced mass of the system (which can be chosen to be the mass of an electron), for the screened coulomb potential
$$V(r) = -\frac{e^2}{r}e^{-r/a}$$
Find the energy (in eV) of the ground state of the atom to an accuracy of three significant digits. Also, plot the corresponding wavefunction. Take e = 3.795 $(eVÅ)^{1/2}$, m = 0.511x10^6 eV/c^2, and a = 3 Å, 5 Å, 7 Å. In these units fic = 1973 (eVÅ). The ground state energy is expected to be above -12 eV in all three cases.
3. Solve the s-wave radial Schrodinger equation for a particle of mass m:

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2m}{\hbar^2}[V(r) - E]$$

For the anharmonic oscillator potential

$$V(r) = -\frac{1}{2}kr^{2} + \frac{1}{3}br^{3}$$

for the ground state energy (in MeV) of particle to an accuracy of three significant digits. Also, plot the corresponding wave function. Choose m = 940 MeV/c^2, k = 100 MeV fm^{-2}, b = 0, 10, 30 MeV fm^{-3}In these units, cfi = 197.3 MeV fm. The ground state energy I expected to lie between 90 and 110 MeV for all three cases.

4. Solve the s-wave radial Schrodinger equation for the vibrations of hydrogen molecule:

$$\frac{d^2y}{dr^2} = A(r)u(r), A(r) = \frac{2\mu}{\hbar^2}[V(r) - E]$$

Where μ is the reduced mass of the two-atom system for the Morse potential

$$V(r) = D(e^{-2\alpha r^{'}} - e^{-\alpha r^{'}}), \quad r' = \frac{r - r_0}{r}$$

Find the lowest vibrational energy (in MeV) of the molecule to an accuracy of three significant digits. Also plot the corresponding wave function.
Take: m = 940x10^6eV/C^2, D = 0.755501 eV, α = 1.44, r_o = 0.131349 Å.

5. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency.
6. Study of Zeeman effect: with external magnetic field; Hyperfine splitting.
7. To show the tunneling effect in tunnel diode using I-V characteristics.
8. Quantum efficiency of CCDs.

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8
CO 1	H	H	H	H				
CO 2					H			
CO 3						H		
CO 4							H	
CO 5								H

PSSS6112: SOLID STATE PHYSICS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Learn about magnetic properties of matter. (Understanding)
2. Analyse dielectric properties of materials. (Applying)
3. Understand and analyse few topics related to semiconductor physics. (Analysing)

At least 8 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 determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR).
6. To determine the refractive index of a dielectric layer using SPR.
7. To study the PE Hysteresis loop of a Ferroelectric Crystal.
8. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
9. 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.
10. To determine the Hall coefficient of a semiconductor sample.

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
CO 1	H	H	M				M	M		M
CO 2				H	H	H	M			
CO 3									M	M

PSES6113: EMBEDDED SYSTEM: INTRODUCTION TO MICROCONTROLLERS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Use 8051 microcontroller for various applications. (Application)
2. Use Arduino microcontroller for various applications. (Application)

At least 10 experiments should be performed from the following:

(8051 microcontroller based Programs and experiments)

1. To find that the given numbers are prime or not.
2. To find the factorial of a number.
3. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
4. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's .
5. Program to glow the first four LEDs then next four using TIMER application.
6. Program to rotate the contents of the accumulator first right and then left.
7. Program to run a countdown from 9-0 in the seven segment LED display.
8. To interface seven segment LED display with 8051 microcontroller and display 'HELP' in the seven segment LED display.
9. To toggle '1234' as '1324' in the seven segment LED display.
10. Interface stepper motor with 8051 and write a program to move the motor through a given angle in clock wise or counter clockwise direction.
11. Application of embedded systems: Temperature measurement, some information on LCD display, interfacing a keyboard.

(Arduino based programs and experiments)

12. Make a LED flash at different time intervals.
13. To vary the intensity of LED connected to Arduino.
14. To control speed of a stepper motor using a potential meter connected to Arduino.
15. To display "PHYSICS" on LCD/CRO.

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	M	M	M	M	M	M				
CO 2												M	M	M	M

PSDI6114: PHYSICS OF DEVICES AND INSTRUMENTS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Design and develop rectifiers, filters, modulators etc. (Application)
2. Explain the characteristics of various electronics components. (Understanding)
3. Use SPICE/MULTISIM simulations for electrical networks and electronic circuits analysis. (Analysing)

At least 10 experiments should be performed from the following:

1. To design a power supply using bridge rectifier and study effect of C-filter.
2. To design the active Low pass and High pass filters of given specification.
3. To design the active filter (wide band pass and band reject) of given specification.
4. To study the output and transfer characteristics of a JFET.
5. To design a common source JFET Amplifier and study its frequency response.
6. To study the output characteristics of a MOSFET.
7. To study the characteristics of a UJT and design a simple Relaxation Oscillator.
8. To design an Amplitude Modulator using Transistor.
9. To design PWM, PPM, PAM and Pulse code modulation using ICs.

10. To design an Astablemultivibrator of given specifications using transistor.
11. To study a PLL IC (Lock and capture range).
12. To study envelope detector for demodulation of AM signal.
13. Study of ASK and FSK modulator.
14. Glow an LED via USB port of PC.
15. Sense the input voltage at a pin of USB port and subsequently glow the LED connected with another pin of USB port.
    (The following are SPICE/MULTISIM simulations for electrical networks and electronic circuits)
16. To verify the Thevenin and Norton Theorems.
17. Design and analyse the series and parallel LCR circuits.
18. Design the inverting and non-inverting amplifier using an Op-Amp of given gain.
19. Design and Verification of op-amp as integrator and differentiator.
20. Design the 1st order active low pass and high pass filters of given cutoff frequency.
21. Design a Wein`s Bridge oscillator of given frequency.
22. Design clocked SR and JK Flip-Flop`s using NAND Gates.
23. Design 4-bit asynchronous counter using Flip-Flop ICs.
24. Design the CE amplifier of a given gain and its frequency response.
25. Design an Astablemultivibrator using IC555 of given duty cycle.

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
CO 1	H	H								
CO 2	M	H	H	H	M	M	M	M	M	M
CO 3										

	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15	Exp 16	Exp1 7	Exp 1 8	Exp 19	Exp 20
CO 1										
CO 2	M	M	H	H	M	M	M	M	M	M
CO 3	M					H	H	H	H	H

	Exp 21	Exp 22	Exp 23	Exp 24	Exp 25
CO 1					
CO 2	M	H	H	H	M
CO 3					

PSCE6115: COMMUNICATION ELECTRONICS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Design of modulators and multiplexing technique. (Application)
2. Explain different techniques of Analog wave modulation. (Understanding)
3. Explain different techniques of pulse modulation. (Understanding)
4. Explain different techniques of digital modulation. (Understanding)

At least 8 experiments should be performed from the following:

1. To design an Amplitude Modulator using Transistor.
2. To study envelope detector for demodulation of AM signal.
3. To study FM - Generator and Detector circuit.
4. To study AM Transmitter and Receiver.

5. To study FM Transmitter and Receiver.
6. To study Time Division Multiplexing (TDM).
7. To study Pulse Amplitude Modulation (PAM).
8. To study Pulse Width Modulation (PWM).
9. To study Pulse Position Modulation (PPM).
10. To study ASK, PSK and FSK modulators.

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
CO 1	H	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H					
CO 3							H	H	H	
CO 4										H

PSET6116: ELECTROMAGNETIC THEORY LABORATORY (0-0-2)

COURSE OUTCOMES

1. Know about the physics of polarization of electromagnetic waves. (Understanding)
2. Build clear concept of wave properties of electromagnetic wave and its application to various systems / media. (Understanding and Applying)
3. Analyse the physics of radiation. (Analysing)

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 sugar solution using Polarimeter.
3. To analyse 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 determine the refractive index of liquid by total internal reflection using Wollaston's air-film.
9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.
10. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
11. To verify the Stefan`s law of radiation and to determine Stefan's constant.
12. To determine the Boltzmann constant using V-I characteristics of PN junction diode.

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	H	H	M				H			H		
CO 2					M	H	H	M	M	M		
CO 3				M							M	M

PSET6117: STATISTICAL MECHANICS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Realize numerical techniques to handle systems with large number of particles and to study their statistics. (Understanding)
2. Conceptualize numerically the classical and quantum statistical mechanics. (Understanding)
3. Analyse the knowledge of classical and quantum theory of radiation numerically. (Analysing)

At least 3 experiments should be performed from the following:
(Use C/C^{++}/Scilab/other numerical simulations for solving the problems)

1. Computational analysis of the behaviour of a collection of particles in a box that satisfy Newtonian mechanics and interact via the Lennard-Jones potential, varying the total number of particles N and the initial conditions:
   a) Study of local number density in the equilibrium state (i) average; (ii) fluctuations.
   b) Study of transient behaviour of the system (approach to equilibrium.
   c) Relationship of large N and the arrow of time.
   d) Computation of the velocity distribution of particles for the system and comparison with the Maxwell velocity distribution.
   e) Computation and study of mean molecular speed and its dependence on particle mass.
   f) Computation of fraction of molecules in an ideal gas having speed near the most probable speed.
2. Computation of the partition function Z(β) for examples of systems with a finite number of single particle levels (e.g., 2 level, 3 level, etc.) and a finite number of non-interacting particles N under Maxwell-Boltzmann, Fermi-Dirac and Bose- Einstein statistics:
   a) Study of how Z(β), average energy <E>, energy fluctuation ΔE, specific heat at constant volume C_V, depend upon the temperature, total number of particles N and thespectrum of single particle states.
   b) Ratios of occupation numbers of various states for the systems considered above.
   c) Computation of physical quantities at large and small temperature T and comparison ofvarious statistics at large and small temperature T.
3. Plot Planck's law for Black Body radiation and compare it with Raleigh-Jeans Law at high temperature and low temperature.
4. Plot Specific Heat of Solids (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature and low temperature and compare them for these two cases.
5. Plot the following functions with energy at different temperatures:
   a) Maxwell-Boltzmann distribution
   b) Fermi-Dirac distribution
   c) Bose-Einstein distribution

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5
CO 1	H	M			
CO 2		M		M	H
CO 3			H		

PSNA6118: NANO MATERIALS AND APPLICATIONS LABORATORY (0-0-2)

COURSE OUTCOMES

1. Synthesis nanoparticles. (Analysis)
2. Develop the concept of metal nanoparticle. (Understanding)
3. Study the effect of size on color of nanomaterials. (Application)
4. Learn different process of analysing nanoparticle. (Analysis)
5. Learn the concept of quantum dots. (Application)

At least 8 experiments should be performed from the following:

1. Synthesis of metal nanoparticles by chemical route.
2. Synthesis of semiconductor nanoparticles.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.
4. XRD pattern of nanomaterials and estimation of particle size.
5. To study the effect of size on colour of nanomaterials.
6. To prepare composite of CNTs with other materials.
7. Growth of quantum dots by thermal evaporation.
8. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.

9. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.
10. Prepare a thin film capacitor and measure capacitance as a function of temperature or frequency.
11. Fabricate a PN diode by diffusing Al over the surface of N-type Si and study its V-I characteristic.

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

PSDP6119: DIGITAL SIGNAL PROCESSING LABORATORY (0-0-2)

COURSE OUTCOMES

1. Explain Unit sample sequence, unit step sequence, ramp sequence, real valued exponential sequence. (Understanding)
2. Compute the convolution sum of a rectangle signal. (Analysis)
3. Calculate and plot the steady state response and frequency response. (Application)
4. Learn to design digital filter to eliminate the lower frequency sinusoidal. (Application)
5. Design a digital FIR differentiator. (Application)

At least 8 experiments should be performed from the following:
(Scilab based simulations experiments based problems)

1. Write a program to generate and plot the following sequences: (a) Unit sample sequence $\delta(n)$, (b) unit step sequence u(n), (c) ramp sequence r(n), (d) real valued exponential sequence x(n) = $(0.8)^n u(n)$ for $0 \leq n \leq 50$.
2. Write a program to compute the convolution sum of a rectangle signal (or gate function) with itself for N = 5
   $x(n) = rect\left(\frac{n}{2N}\right) = \Pi\left(\frac{n}{2N}\right) = \begin{cases} 1 & -N \leq n \leq N \\ 0 & otherwise \end{cases}$
3. An LTI system is specified by the difference equation
   $$y(n) = 0.8y(n-1) + x(n)$$
   (a) Determine $H(e^{jw})$
   (b) Calculate and plot the steady state response $y_{ss}(n)$ to $x(n) = cos\ cos\ (0.5\pi n)\ u(n)$
4. Given a casual system
   $$y(n) = 0.9y(n-1) + x(n)$$
   (a) Find H(z) and sketch its pole-zero plot
   (b) Plot the frequency response $|H(e^{jw})|$ and $\angle H(e^{jw})$
5. Design a digital filter to eliminate the lower frequency sinusoid of $(t) = sin\ sin\ 7t + sin\ sin\ 200t$.
   The sampling frequency is $f_s = 500\ Hz$. Plot its pole zero diagram, magnitude response, input and output of the filter.
6. Let x(n) be a 4-point sequence:
   $x(n) = \underset{\uparrow}{\{1,1,1,1\}} = \begin{cases} 1 & 0 \leq n \leq 3 \\ 0 & otherwise \end{cases}$
   Compute the DTFT $X(e^{jw})$ and plot its magnitude
   (a) Compute and plot the 4 point DFT of x(n)
   (b) Compute and plot the 8 point DFT of x(n) (by appending 4 zeros)
   (c) Compute and plot the 16 point DFT of x(n) (by appending 12 zeros)
7. Let x(n) and h(n) be the two 4-point sequences,
   $x(n) = \underset{\uparrow}{\{1,2,2,1\}}$

$h(\mathrm{n}) = \underset{\uparrow}{\{1, -1, -1, 1\}}$

Write a program to compute their linear convolution using circular convolution.

8. Using a rectangular window, design a FIR low-pass filter with a pass-band gain of unity, cut off frequency of 1000 Hz and working at a sampling frequency of 5 KHz. Take the length of the impulse response as 17.
9. Design an FIR filter to meet the following specifications:
   passband edge F_p = 2 KHz
   stopband edge F_s = 5 KHz
   Passband attenuation A_p = 2 dB
   Stopband attenuation A_s = 42 dB
   Sampling frequency F_s = 20 KHz
10. The frequency response of a linear phase digital differentiator is given by
    $$H_d(e^{jw}) = jwe^{-jcw} |w| \leq \pi$$
    Using a Hamming window of length M = 21, design a digital FIR differentiator.
    Plot the amplitude response.

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

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, 4th 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

	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

DETAILED SYLLABUS

DEPARTMENT OF BIOSCIENCES

PROGRAMME: MASTER OF SCIENCE (MSC) BIOCHEMISTRY

PROGRAMME OUTCOMES

PO1: **Skill Development**: Master academic, technical, managerial and crucial soft skills to qualify for careers in research, industry, education, administration and management or for higher studies where a holistic understanding of applied biosciences is required.

PO2: Research: Develop a scientific mindset with the capacity for analytical and innovative thinking and practical knowhow to formulate, design and ethically implement scientific research in frontier areas of Biochemistry, Biotechnology and Microbiology

PO3: Communication: Acquire effective communication and creative expression skills in the form of writing, design, presentation and networking to convincingly articulate scientific ideas in biosciences and related fields

PO4: **Employment and Entrepreneurship:** Acquire the necessary knowledge and proficiencies to become employable or get self-employed and thereby create job opportunities through entrepreneurship in heath, agriculture, industry, environment and allied areas of applied biosciences and thereby affirmatively contribute to scientific social responsibility.

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	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
Thermodynamics and Enzymology	H	H	L	M	H	M	L	M		
Cell Biology and Genetics	H	H	H	M	H	M	L	M	L	L
Fundamentals of Biochemistry	H	M	H	H	H	H	L	H	M	L
Analytical Techniques	H	H	M	H	H	H	M	H	L	L
Lab I- Fundamentals of Biochemistry	H	H	M	M	H	H	L	H	M	L
Lab II- Thermodynamics and Enzymology	H	H	M	M	H	M		M		
Lab III- Cell Biology and Genetics	H	H	H	M	H	H	L	H	M	L
Lab IV- Analytical Techniques	H	H	M	H	H	H	M	H	L	L
Industrial/ Laboratory visit	H	H		H	M	H		H	M	H
Genetic Engineering	H	H	L	M	M	H	M	M		L
Computer Applications and Bioinformatics	H	H	M	M	M	H	L	M		H
Basic Microbiology	L	H	L	L		H		L		
Molecular Biology	H	M	M	M	M	H	L	M	L	L
Fundamentals of Immunology	H	H	H	H	M	H	H	M	L	L
Lab I- Genetic Engineering	H	H	M	M	M	H	M	M		M
Lab II- Computer Applications and Bioinformatics	H	L	M	M		H		H		H

Lab III- Basic Microbiology	H	H	H	H		H		L		
Lab IV- Molecular Biology	H	H	M	M	M	H	L	H	L	L
Lab V- Fundamentals of Immunology	H	H	H	H	M	H	L	M	L	L
Waste Management (Skill Development course)	H	H	M	H	M	H	H	H	L	M
Fermentation and Food Micorbiology (Skill Development course)	H	H	H	H	M	H	H	L	H	L
Mushroom Cultivation (Skill Development course)	H	H	H	H	H	H	H	H	L	H
Herbal Drug Technology (Skill Development course)	H	H	M	H	L	H	H	H	L	M
Research Methodology & Biostatistics-common	M	H	H	M	L	M	H	H	L	L
Medical Biochemistry	H	H	M	H	H	H	H	H	H	L
Physiology	H	M	M	M	M	M	L	M	H	L
Lab I-Medical Biochemistry	M	H	M	H	H	H	H	H	H	L
Lab II- Physiology	H	M	L	M	M	M	L	M	H	L
Nutritional Biochemistry &Metabolism	H	H	M	H	M	M	M	H	H	L
Bioenergetics	M	H		L	H	M	L	H		M
Lab-I- Nutritional Biochemistry &Metabolism	H	H	M	H	M	M	M	H	H	L
Lab II- Bioenergetics	M	H	L		H	M	L			
Dissertation Phase I	H	H	H	H	H	H	H	H		
IPR &Entrepreneurship	M	H	H	H	M	H	M	M	L	L
Journal Club and scientific communications		H	H		H			H		M
Value Added Course- Clinical Laboratory Techniques	H	H	L	H	M	H			H	
Omics Biology and its Tools	H	H	H	H	H	H	H	H	M	H
Agriculture Technology (Elective)	H	M	M	H	H	H	H	M	M	M
Nanobiology (Elective)	M	H	M	L	H		M			
Bioresource Management (Elective)	H	M	L	M	L	M	M	H	L	L
Dissertation Phase II	H	H	H	H	H	H	H	H	H	H

DETAILED SYLLABUS

THEORY COURSES

BCBM0010: MEDICAL BIOCHEMISTRY (3-0-0)

Course Outcomes

1. Define the different disorders of the body related to carbohydrate metabolism, lipid metabolism, Nitrogen metabolism and digestive disorders (Remembering)
2. Develop an understanding o f how the different metabolism are interconnected (Understanding)
3. Classify disorders of each metabolism (Understanding)
4. Compare all metabolic disorders with their symptoms and etiology (Applying)
5. Examine the normal level of glucose, glycogen, protein, amino acid, nitrogen, diagnostic enzymes (Analysing)
6. Evaluate the genetic relation of each metabolic disorder with corresponding metabolism (Evaluating)
7. Discuss the link between the metabolic disorders and genetic make of patients (Creating)
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 urea clearance
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

	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

1. Define and have an enhanced knowledge of the fundamentals of physiology by recalling and relating (Remembering).
2. Summarize how the separate systems interact to yield integrated physiological responses (Understanding).
3. Implement the acquired knowledge of the various mechanisms in executing and constructing experiments and apply in their day to day life (Applying).
4. Analyze and report on experiments and observations in physiology (Analysing).

5. Evaluate by presenting and defending opinions by making judgments about the mechanisms and functioning of organs and organ systems (Evaluating).
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, heavy metals, 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

	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

1. Relate of the structural and functional aspects of biomolecules (Remembering)
2. Compare and draw the chemical structures of different biomolecules (Understanding)
3. Identify the monomers and polymers of biomolecules (Applying)
4. Analyse the interaction and importance of equilibrium maintenance of different biomolecules for health related issues (Analysing)
5. Estimate the different concentrations of biomolecules for biological applications (Evaluating)
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 synthesis of 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

	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

1. . Define the basic principles, concepts and applications of various analytical techniques used in biological sciences (Remembering)
2. . Apply the knowledge of centrifugation to separate a constituent from a complex mixture (Applying)
3. . Choose a suitable microscopic, electrophoretic, and chromatographic technique to identify and purify a target molecule from a complex mixture (Applying)
4. . Select an opposite spectroscopic technique to characterize a sample (Analysing)
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

	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

1. Define the principles of DNA replication, transcription and translation (Remembering)
2. Explain the structural and functional properties of biological macromolecules and to understand the role of gene regulation (Understanding)
3. To recognize Central Dogma from replication of DNA till translation of protein (Applying)
4. Distinguish between replication, transcription and translation (Analysing)
5. Execute quantitative analysis to interpret biological data (Evaluating)
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

	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

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)
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)
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)
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)
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

	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. To explain steps of herbal drug preparations
2. To perceive the application of herbs in formulation of herbal products
3. To design experiments for preparation various plant based products

Module I (2 lectures)
Definition of herb, herbal medicine, herbal medicinal product and herbal drug preparation, source of herbs, selection, identification and authentication of herbal materials, processing of herbal raw material

Module II (3 lectures)
Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

Module III (3 lectures)
Herbal Excipients – Significance of substances of natural origin as excipients, – colorants, sweeteners, binders, diluents, viscosity builders, dis-integrants, flavors & perfumes.

Module IV (2 lectures)
Stages involved in herbal formulations, Orthodox formulations and methods of delivery of herbal extracts, Novel formulations of herbal extracts

Module V (2 lectures)
General aspects, market, growth, scope and types of products available in the market, Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastrointestinal diseases.

Module VI (3 lectures)
Collection of herbs, preparation of herbal cosmetics, herbal excipients, formulations, decoctions, and nutrition based products.

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.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M	M	M	M	
CO2	M	H	H	H	H	
CO3						H

BCBE0018: BIOENERGETICS (3-0-0)

Course Outcomes

1. Summarise the basic concepts of free energy, standard free energy, redox potential and other thermodynamic concepts about biological systems (Understanding)
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

	Module I	Module II	Module III
CO I	H		
CO 2		H	H

BCNM0019: NUTRITIONAL BIOCHEMISTRY & METABOLISM (3-0-0)

Course Outcomes

1. To acquire the knowledge of the dietary requirement of vitamins and minerals in human body (Remembering).
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)
3. Interpret the significance of nutritional distribution of the carbohydrates, amino acids, and fats and their disturbances in the absence of its regulatory enzymes (Applying)
4. Infer the deficiency diseases and abnormalities in response to the dysfunction of enzymes associated with carbohydrates, lipids and amino acids metabolism (Analysing)
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

	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

1. Recall mapping and sequencing of genomes, transcriptome, proteome and metabolome (Remembering)
2. Illustrate the different sequencing techniques (Understanding)
3. Apply the tools of bioinformatics to analyze biological data (Applying)
4. Analyze the data with biostatistics software (Analysing)
5. Decide the type of spectroscopic method for sample analysis (Evaluating)
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 public health, 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

	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

1. Define and have an enhanced knowledge of the fundamentals of bioresources by recalling and relating with the surrounding environment (Remembering).
2. 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).
3. Implement the acquired knowledge of bioresources through different conservation methods (Applying).
4. Analyze, observe and recognize how their sustainability will safeguard the future of humans and the ecosystem on the planet (Analysing).
5. Evaluate by presenting and defending opinions by making judgments about the human activities and assess the benefits, opportunities, and challenges of bioresources in today's economy (Evaluating)

Module I (12 lectures)

Basics of Bioresources: Concept, kinds, importance, economy- environment nexus. Management, scope and importance of human resource management (HRM) and personnel management; employment and utilization of natural resources; measures of rural poverty and human development; human development index (HDI); sustainable rural development, Community based management of Bioresources

Module II (18 lectures)

Bioresource Management, and their ultilisation: Sustainable agriculture, Climate change and its impact on crop productivity, Bioresource management through land use planning, Post harvest management of agricultural produce, Significance and methods of biodiversity conservation; concepts of hot spots, red data book; traditional knowledge and biodiversity conservation; Earthworm technology: a tool for sustainable agriculture, Integrated farming, Induced breeding , Captive breeding, Sericulture, Integrated pest management, 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

Concept and hands on training on formulation of biopesticides, bioinsecticides, bio weedicides, bio manure, bio cosmetics, bioplastics, biofuel generation from natural sources. Field visit and Report Writing: Conservation Centres / small scale industry etc.

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

	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

1. To understand the essence of learning through community service
2. To realise and identify the needs of community
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

1. Practically estimate lipoprotein, bilirubin, blood urea, creatine phosphokinase from a serumsample (Applying)
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

	P1	P2	P3	P4	P5	P6
CO 1	H		H	H	H	H
CO 2		H				

***P: Practical**

BCPY6005: PHYSIOLOGY LAB

Course Outcome

1. To be able to understand and master the conceptual and practical physiological functions of systems (Understanding)
2. To acquire basic knowledge and perform experiments in physiology (Applying)
3. To be able to determine, estimate and report on experiments and observations in physiology (Evaluating)
3. To be able to perform an assay, analyse and report on experiments and observations in physiology (Analysing)
4. 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

	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

1. Interpret how cells manufacture energy-ATP generation (Evaluating)
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

	P1	P2	P3	P4
CO1	H			
CO2		H	H	H

***P: Practical**

BCDI6007: 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 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

	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

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

1. Scientific review and research articles published in respective specialized area of research.

Mapping of COs to Syllabus

	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

1. Estimate and prepare buffer solutions for different experiments
2. Quantify various biomolecules at different concentrations for future research experiments
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

	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

1. Recall and perform the laboratory analysis in accordance with Good Laboratory Practices, in conditions of hygiene and safety (Remembering)
2. Describe the principles and the theoretical concepts of the instruments (Understanding)
3. Choose an appropriate separation technique for analysis of the samples (Applying)
4. Ability to undergo a comparative analysis of different identification and purification protocols that can best suit a particular experiment (Analysing)
5. To evaluate the spectrophotometric parameter for understanding the nature of the biological sample (Evaluating)
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

	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

1. To discuss the effect of pH and temperature on enzyme activity (Understanding).
2. To analyze the saponification value (Analysing)
3. To measure the content of vitamins in food sample (Evaluating)
4. To estimate the acidity in milk and evaluate its causes (Evaluating)
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

	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

1. Define the principles for isolation of DNA from bacteria, plant and animal (Remembering)
2. Demonstrate the knowledge of laboratory practices in molecular biology and conduct independent work in laboratory (Understanding)
3. Apply practical knowledge to perform isolation of genomic and chromosomal DNA from bacteria (Applying)
4. Test for DNA amplification by PCR and observe the amplicons of gel electrophoresis (Analysing)
5. Execute quantitative analysis to interpret clear and concise communication of biological data and evaluate student progress with guided enquires (Evaluating)
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

	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

1. Visualize the types of cells present in the blood and understand their normal and abnormal percentage as a sign of infection
2. Analyze the basic difference between serum and blood plasma
3. Determine antigen antibody interaction
4. Determine immunodiagnostic application
5. Understand the type and detection of antibodies present in body secretions
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

	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

BCJS6016: JOURNAL CLUB AND SCIENTIFIC COMMUNICATIONS (0-0-1)

Course Outcomes

1. . Assess published data, critically read, interpret, and present it (Analysing)
2. Compare the strengths and weaknesses of publications (Evaluating)
3. Develop skills in interpreting and evaluating scientific data (Creating)
4. Demonstrate ethics in research and related good laboratory practices (Understanding)
5. Relate the relevance of personality for boosting overall confidence (Understanding)
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

	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

***P: Practical**

PROGRAMME: MASTER OF SCIENCE (MSC) BIOTECHNOLOGY

PROGRAMME OUTCOMES

PO1: **Skill Development**: Master academic, technical, managerial and crucial soft skills to qualify for careers in research, industry, education, administration and management or for higher studies where a holistic understanding of applied biosciences is required.
PO2: Research: Develop a scientific mindset with the capacity for analytical and innovative thinking and practical knowhow to formulate, design and ethically implement scientific research in frontier areas of Biochemistry, Biotechnology and Microbiology
PO3: Communication: Acquire effective communication and creative expression skills in the form of writing, design, presentation and networking to convincingly articulate scientific ideas in biosciences and related fields
PO4: **Employment and Entrepreneurship:** Acquire the necessary knowledge and proficiencies to become employable or get self-employed and thereby create job opportunities through entrepreneurship in heath, agriculture, industry, environment and allied areas of applied biosciences and thereby affirmatively contribute to scientific social responsibility.

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	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
Thermodynamics and Enzymology	H	H	L	M	H	M	L	M		
Cell Biology and Genetics	H	H	H	M	H	M	L	M	L	L
Fundamentals of Biochemistry	H	M	H	H	H	H	L	H	M	L
Analytical Techniques	H	H	M	H	H	H	M	H	L	L
Lab I- Fundamentals of Biochemistry	H	H	M	M	H	H	L	H	M	L
Lab II- Thermodynamics and Enzymology	H	H	M	M	H	M		M		
Lab III- Cell Biology and Genetics	H	H	H	M	H	H	L	H	M	L
Lab IV- Analytical Techniques	H	H	M	H	H	H	M	H	L	L
Industrial/ Laboratory visit	H	H		H	M	H		H	M	H
Genetic Engineering	H	H	L	M	M	H	M	M		L
Computer Applications and Bioinformatics	H	H	M	M	M	H	L	M		H
Basic Microbiology	L	H	L	L		H		L		
Molecular Biology	H	M	M	M	M	H	L	M	L	L
Fundamentals of Immunology	H	H	H	H	M	H	H	M	L	L
Lab I- Genetic Engineering	H	H	M	M	M	H	M	M		M
Lab II- Computer Applications and Bioinformatics	H	L	M	M		H		H		H
Lab III- Basic Microbiology	H	H	H	H		H		L		
Lab IV- Molecular Biology	H	H	M	M	M	H	L	H	L	L

Lab V- Fundamentals of Immunology	H	H	H	H	M	H	L	M	L	L
Waste Management (Skill Development course)	H	H	M	H	M	H	H	H	L	M
Fermentation and Food Micorbiology (Skill Development course)	H	H	H	H	M	H	H	L	H	L
Mushroom Cultivation (Skill Development course)	H	H	H	H	H	H	H	H	L	H
Herbal Drug Technology (Skill Development course)	H	H	M	H	L	H	H	H	L	M
Research Methodology & Biostatistics-common	M	H	H	M	L	M	H	H	L	L
Bioprocess Engineering	H	H	H	H	H	H	M	H	L	
Plant Biotechnology	H	H		H	M	H		H	M	
Animal Biotechnology	H	H	L	M	M	H		H	M	
Pharmaceutical &Environmental Biotechnology	H	H	M	H	M	H	M	L	H	L
Lab I- Animal Biotechnology	H	H	M	M	M	H		H		
Lab II- Bioprocess Engineering	H	H	H	H	H	H	M	M	H	L
Lab III- Plant Biotechnology	H	H		H	M	H		H		
Lab IV-Pharmaceutical &Environmental Biotechnology		H	M	H	M	H	M	L	H	L
Dissertation Phase I	H	H	H	M	M	H	H	H	H	M
IPR &Entrepreneurship	M	H	H	H	M	H	M	L	M	L
Journal Club and scientific communications		H	H		H					H
Value Added Course- Clinical Laboratory Techniques	H	H	L	H	M	H			H	
Trends in Biotechnology	H	H	H	H	H	H	M	M	M	H
Agriculture Technology (Elective)	H	M	M	H	H	H	H	M	M	M
Nanobiology (Elective)	M	H	M	L	H		M			
Bioresource Management (Elective)	H	M	L	M	L	M	M	H	L	L
Dissertation Phase II	H	H	H	H	H	H	H	H	H	H

BTRM0003: RESEARCH METHODOLOGY AND BIOSTATISTICS (4-0-0)

Course Outcomes

1. Recall and classify the different forms of research – basic, applied, interdisciplinary, etc. Scientific literatures (Remembering)
2. Summarize an understanding of various kinds of research, objectives of doing research, research process, research design and sampling, scientific problems (Understanding)
3. Apply statistical methods of data analysis and interpretation. (Applying)
4. Explain ethical conduct of research and its communication. (Analysing)
5. Recommend adequate knowledge of hypothesis testing procedures, measurement, scaling techniques and quantitative data analysis (Evaluating)
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 squares and 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

	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

	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

	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

	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 –progressive alignment 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

	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

	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

	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

	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

	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

	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

	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)
2. 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, New Delhi.
4. Textbook of Agricultural Biotechnology, 1st Edition, Nag, A., 2008, Prentice Hall India Learning Private Limited, New Delhi.

Mapping of COs to Syllabus

	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

	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

1. Molecular Cloning: A Laboratory Manual,3rd Edition, Sambrook J and Russell DW, 2001, Cold Spring Harbor Laboratory Press

Mapping of COs to Syllabus

	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

	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

1. Scientific review and research articles published in respective specialized area of research.

Mapping of Course outcomes to Syllabus

	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

1. Scientific review and research articles published in respective specialized area of research.

Mapping of COs to Syllabus

	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

	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 the various 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

1. Bioinformatics. A Practical Approach. Shui Qing Ye, Chapman and Hall/CRC

Mapping of COs to Syllabus

	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

1. Hiren Kumar Sherathiya Practical manual for Plant Tissue Culture, Munich, GRIN Verlag.

Mapping of COs to Syllabus

	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
- Assay of vitamin B_{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

	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

	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**

PROGRAMME: MASTER OF SCIENCE (MSC) MICROBIOLOGY

PROGRAMME OUTCOMES

PO1: **Skill Development**: Master academic, technical, managerial and crucial soft skills to qualify for careers in research, industry, education, administration and management or for higher studies where a holistic understanding of applied biosciences is required.

PO2: Research: Develop a scientific mindset with the capacity for analytical and innovative thinking and practical knowhow to formulate, design and ethically implement scientific research in frontier areas of Biochemistry, Biotechnology and Microbiology

PO3: Communication: Acquire effective communication and creative expression skills in the form of writing, design, presentation and networking to convincingly articulate scientific ideas in biosciences and related fields

PO 4: **Employment and Entrepreneurship:** Acquire the necessary knowledge and proficiencies to become employable or get self-employed and thereby create job opportunities through entrepreneurship in heath, agriculture, industry, environment and allied areas of applied biosciences and thereby affirmatively contribute to scientific social responsibility.

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 scientificcommunity 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	PO 1	PO 2	PO 3	PO 4	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
Thermodynamics and Enzymology	H	H	L	M	H	M	L	M		
Cell Biology and Genetics	H	H	H	M	H	M	L	M	L	L
Fundamentals of Biochemistry	H	M	H	H	H	H	L	H	M	L
Analytical Techniques	H	H	M	H	H	H	M	H	L	L
Lab I- Fundamentals of Biochemistry	H	H	M	M	H	H	L	H	M	L
Lab II- Thermodynamics and Enzymology	H	H	M	M	H	M		M		
Lab III- Cell Biology and Genetics	H	H	H	M	H	H	L	H	M	L
Lab IV- Analytical Techniques	H	H	M	H	H	H	M	H	L	L
Industrial/ Laboratory visit	H	H		H	M	H		H	M	H
Genetic Engineering	H	H	L	M	M	H	M	M		L
Computer Applications and Bioinformatics	H	H	M	M	M	H	L	M		H
Basic Microbiology	L	H	L	L		H		L		
Molecular Biology	H	M	M	M	M	H	L	M	L	L
Fundamentals of Immunology	H	H	H	H	M	H	H	M	L	L
Lab I- Genetic Engineering	H	H	M	M	M	H	M	M		M
Lab II- Computer Applications and Bioinformatics	H	L	M	M		H		H		H
Lab III- Basic Microbiology	H	H	H	H		H		L		
Lab IV- Molecular Biology	H	H	M	M	M	H	L	H	L	L
Lab V- Fundamentals of Immunology	H	H	H	H	M	H	L	M	L	L
Waste Management (Skill Development course)	H	H	M	H	M	H	H	H	L	M
Fermentation and Food Micorbiology (Skill Development course)	H	H	H	H	M	H	H	L	H	L
Mushroom Cultivation (Skill Development course)	H	H	H	H	H	H	H	H	L	H
Herbal Drug Technology (Skill Development course)	H	H	M	H	L	H	H	H	L	M
Research Methodology & Biostatistics-common	M	H	H	M	L	M	H	H	L	L

Virology & Mycology	H	H	H	H	H	H	H	M	H	L
Environment Microbiology	M	H	H	M		M	M	H		M
Medical Microbiology	M	H	H	M		H	M	L	H	
Infection and Molecular Diagnostics	H	H	H	H	H	H	H	M	H	L
Lab I- Virology & Mycology	H	H	L	H	H	H	H	M	L	L
Lab II- Environment Microbiology	H	H	H	L	L	H		H		M
Lab III- Medical Microbiology	H	H	H	L	L	H			H	
Lab IV- Infection and Molecular Diagnostics	H	H	H	H	H	H	H	M	H	L
Dissertation Phase I	H	H	H	M	M	H	H	H	H	M
IPR &Entrepreneurship	M	H	H	H	M	H	M	L	M	L
Journal Club and scientific communications		H	H		H					H
Value Added Course- Clinical Laboratory Techniques	H	H	L	H	M	H			H	
Industrial & Food Microbiology	L	M	H	H		H	L	L		H
Agriculture Technology (Elective)	H	M	M	H	H	H	H	M	M	M
Nanobiology (Elective)	M	H	M	L	H		M			
Bioresource Management (Elective)	H	M	L	M	L	M	M	H	L	L
Dissertation Phase II	H	H	H	H	H	H	H	H	H	H

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

	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.
c) Application of bacteria in agriculture: nitrogen fixing organisms – nitrogenase system and nif genes. Bio fertilizers – Bacterial, Azotobacter and vermiform compost

Module IV (10 lectures)

a) 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

	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)

1. Human Microflora: Normal microbiota in human body, role of resident microbial flora.
2. Transmission: Routes of transmission, community and nosocomial infections, opportunistic infections
3. Detection strategies and protocol: Collection, transportation and processing of clinical samples, Quality control of a medical microbiology laboratory

Module II (15 lectures)

1. 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.
2. 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)

1. 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.
2. 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)

1. Antibiotic therapy: antibiotic sensitivity assays - Stokes method, Agar dilution method, Broth dilution method, E-strip method, efficacy; pharmacokinetics and side-effects, prophylaxis.
2. 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

1. Essentials of Medical Microbiology, 3rd Edition, Sastry AS, Bhat S, 2020, Jaypee Brothers Medical Publishers (P) Ltd.
2. Review of Medical Microbiology, 27th Edition, Jawitz, Melnick and Adelberg, 2015, Mc Graw Hill education.

Mapping of Cos to Syllabus

	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

	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. Understand the waste management systems with respect to its physical properties and associated critical considerations in view of emerging technology (Remembering)
2. To p repare an outline with methods of s a m p l e handling, storage a n d d i s p o s a l of various waste(Understanding)
3. To apply the concepts of zero waste (Applying)
4. To select an appropriate method for disposal of hazardous solid waste (Analysing)
5. To choose an appropriate method to recycle waste (Evaluate)
6. To synthesize the recycling approaches towards economic growth (Creating)

Module1 (4 lectures)

Overview of waste management: Basic concepts and principle of waste management; sources of waste; waste management hierarchy; management strategies; challenges and opportunities; contribution to economic growth.

Module II (2 lectures)

Training on sustainable approaches to solid waste management

Module III (3 lectures)

Training on Waste water processing treatment

Module IV (2 lectures)

Training on Reuse and Recycling Techniques to convert thrash to thrive

Module V (2 lectures)

Field visits to explore waste management processing.

Module VI (2 lectures)

Waste management awareness program

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M	M		H	
CO 2	H	H	M			H
CO 3	M	H	M	H		
CO 4	H	L	M			
CO 5	M	H	H	H		

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

	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).

Syllabus

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, CO2 fixation 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:

	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

	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

	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)

1. Microbes: Isolation and Screening of industrially important microorganisms, improvement of microbial strains, qualities of an industrially important microbe, preservation and maintenance of industrial strains.
2. 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, fermentation kinetics.
3. 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)

1. 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.
2. Biofuel: Production of gaseous fuel – biohydrogen and biomethane; liquid fuel – bioethanol, biodiesel and biobutanol.
3. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).

Module III (15 hours)

1. 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.

2. 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)

1. 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.
2. 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

1. An Introduction of Industrial Microbiology, 1st Edition, Sivakumaar PK, Joe MM, Sukesh K, 2010, S Chand Publishing.
2. Food Microbiology, 5th Edition, Frazier WC, Westhoff DC, Vanitha NM, 2014, McGraw Hill Education.
3. Biotechnology, 1st Edition, Satyanarayana U, Chakrapani U, 2020, Books & Allied Ltd.

Mapping of COs to Syllabus

	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,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, Sinauer Associates Inc. US.

Mapping of COs to Syllabus

	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, New Age International Publishers.

Mapping of COsto syllabus:

	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:

	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, New Age International Publishers.

Mapping of COs to Syllabus

	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

	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:

	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

	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

1. Scientific review and research articles published in respective specialized area of research.

Mapping of COs to Syllabus

	P1	P2	P3	P4
CO 1	H	L	M	
CO 2	H	M	H	L
CO 3		H	H	H

***P: Practical**

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

PSO1: 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.

PSO2: 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.

PSO3: 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.

PSO4: Conservation strategies: Recognize the importance of conservation and encourage designing of effective strategies to address 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:

CO1: Identify the forms of research – basic, applied, interdisciplinary, etc. (Analysing)

CO2: Explain Ethical conduct of research and its communication (Understanding)

CO3: Determination of Statistical methods of data analysis and interpretation (Evaluating)

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, 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 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 and degrees of freedom, models and types of ANOVA

Mapping of COs to Syllabus

	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)

Course Outcomes
1. Summarize the mechanisms underlying the process of development. (Remembering)
2. Distinguish different mechanisms of cellular dynamics through experimental embryology. (Analyzing)
3. Apply the concepts of stem cells in relation to health sciences. (Applying)
4. Analyze the various teratogenic agents and environmental estrogens. (Analyzing)
5. Evaluate the interactions of maternal effect of gene, gap gene, pair-rule gene, and hox- gene in development with respect to Drosophila. (Evaluating)
6. 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 prevention of phylogeny
b) General concept of Induction: mesoderm development, Determination: Imaginal disc of insects, Differentiation: Formation of fruiting bodies in Dictyostelium
c) Neo-cytoplasmic interaction in development of unicellular organisms and in early development and differentiations of multicellular organisms, importance and role of cytoplasm, hybridization experiments, nature of changes in nuclei, cell hybridization, 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); Environmental

estrogens.

b) Infertility- In vitro fertilization and embryo transfer. Cloning experiments- Amphibians and Mammals. Embryonic stem cells and their applications; ethical issues

c) Sex determination-Timing and gene expression in mammalian sex determination, Brain sex determination pathways in invertebrates and flies, Hormone disruptors and sex determination problems, Temperature-dependent sex determination in turtles, Evolution of sex from invertebrate to vertebrate; ethical issues.

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

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	L					
CO2		H				
CO3				H		
CO4						H
CO5			H		H	
CO6						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. To develop the skill required to properly collect and identify adult insects to family level, (Creating)
4. Acquire knowledge to understand the various modifications and adaptations such as head, legs, wings, antennae and mouthparts and also the sense organs (Understanding)
5. Explain the evolutionary and ecological relationships of insects with other life forms (Understanding)

Module I (20 hours)

a) Origin and evolution of insects

b) Segmentation of insect: head, thorax and abdomen; Type of mouthparts, antennae, legs, their modifications and functional significance

c) Wings: wing structure, venation and wing coupling; Insect flight taking Drosophila as a model. The energy demand for insect flight, mechanism stores carbohydrate resources, proline as a fuel for flight, mobilization and use of lipid for flight energy.

d) Insect muscle: Structure and function, attachment to exoskeleton, physiology of contraction

e) Insect eye: Structure and function, physiology of vision.

Module II (20 hours)

a) Classification of insect up to family with example: i) Coleoptera, Diptera, Hymenoptera; ii) Lepidoptera, Odonata; iii) Orthoptera, Hemiptera and Isoptera

b) Insect molecular taxonomy-DNA as a new tool for insect identification; Basic concept of surveillance and sampling of insect

Module III (10 hours)

a) Insect integument: Structure, chemical composition, bio-composition of chitin, function of integument

Module IV (10 hours)

a) Receptor organ in insects (Chemoreceptors, mechanoreceptors and photoreceptors)
b) Sound and Light producing organs in insects
c) Locomotion in insects

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

	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: Explain the development and physiology of different systems; hormones and pheromones. (Understanding)
2: Compare the morphology of insect organ systems. (Analysing)
3: Examine how the morphology of an organ is related to its function and how these systems help the insects to adapt to the environment. (Analysing)
4: Develop a sound knowledge on the insect metabolism, muscle and the physiology of insect vision (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 and plastron 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

	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. Define the structure and working of various components of the cell such as biomembrane structure and organization; genes and gene regulation and protein hierarchical structure. (Remembering).
2. Describe the various types of protein in the cell organization. (Understanding)
3. Study the positive and negative control of gene expression and also the molecular structure of chromosomes. (Analysing)
4. Recommend the use, Ramachandran plot for the prediction of secondary structure of protein. (Evaluating, creating)

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

	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. Define the basic concepts of the immune system and its components. (Remembering)
2. Analyze the antigen-antibody reactions. (Analyzing)
3. Demonstrating the general organization and inheritance of major histocompatibility complex. (Understanding)
4. Recommend the list of various agents responsible for hypersensitivity reaction Develop a network of various components and complexes of the immune system and make a checklist of organ specific and systemic autoimmune diseases. (Evaluating)

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

	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. Demonstrate the knowledge of non-piscine fishery resources and their importance in fisheries. (Understanding)
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) 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 and functional anatomy:** General characters of crustaceans and mollusks; Food, feeding habits and adaptations of cultured prawn and shrimps; Food, feeding habits and adaptations of cultured Mollusks; 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

	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. Compare various freshwater fish culture methodologies and their significance. (Understanding)
2. Utilize the knowledge on the process of fishery and aquaculture management for development of future entrepreneurship. (Applying)
3. Utilize the knowledge of nutritional requirements in fishery and development of skill on fish feed formulation for a profitable fish farming system. (Applying)
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 Culture, Application of biotechnological tools: Recombinant DNA, Trans genesis and Andro genesis Cell lines and cell culture; production of monoclonal antibodies. 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

	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. Define basic ecological concepts and have a deep understanding of the theories of ecology. (Remembering)
2. Explain the concepts of landscape ecology, its importance in designing protected areas, reasons of difference in species diversity across different habitats, role of humans in fragmented habitats of wildlife. (Understanding)
3. Examine the quality of Wildlife habitat, document and monitor different biodiversity around themselves and to Identify different types of animal signs through animal mark and sign analysis. (Applying, Analysing)
4. Outline the different theories and processes of Biogeography, dispersal of species and barriers to their dispersal and Case studies which would provide them a deep insight to Indian biogeography. (Understanding)

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 of Interspecific Competition, Ecological equivalents.
c) Species diversity, Species richness, Global patterns in species richness, Theories of species richness, Invasive species and its effect 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 anthropogenic factors influencing habitats.
b) Introduction to Landscape Ecology: Edge, ecotones, Edge effect interspersion and juxtaposition. Habitat fragmentation and its 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 habitat use.

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

	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, phytoresource utilization and their importance, threatened plants of India with respect to Northeast India. (Understanding)

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-formal conservation 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; Need for 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 reference to 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

	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 (18 hours)

a) Dynamics of insect life system-determinants of insect abundance, population change, birth rate, Death rate, movements;
b) Effect Of Environment on Insect Development-effect of light, temperature and humidity,
c) Regulation of insect populations
d) Dominance of insect-cause of success; Adaptation of insect- aquatic, terrestrial, soil, boring wood

Module II (10hours)

Dominance of insect-cause of success; Adaptation of insect- aquatic, terrestrial, soil, boring wood

Module III (14 hours)

a) Insect biodiversity, threats to insect biodiversity, impact of climate change on insect communities;
b) Natural history of dragonfly, leaf insect, hawk moth, milkweed butterfly, sal stem borer, golden beetle.
c) Insect plant interaction, Plant resistance to insects/Parallel evolution of Insect and angiosperm, 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. Behavioural defence, chemical defence; Breeding behavior.
b) Insect association: Passive insect association, active association, aestivating aggregation, protective aggregation, swarming aggregation, sleeping aggregation, dissociation, social aggregations.

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

	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	

ZGPM0018: 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. Apply the latest knowledge of pesticides application equipment. (Applying)
3. Determine latest concepts of the principles of biological control, rearing, screening, and conservation of natural enemies and their problems in biological control. (Evaluating)

Module I (23 hours)

a) Concept of pest and pest status, kinds of pest; Household pest: Cockroach, lepisma, bedbug, their life history and control; Stored grain pest: Sitophilusoryzae, Triboliumcastaneum, *Trogoderma granarium*, *Sitotroga cerealella*, *Callobruchus chinensis*, life history and control; Major pest of rice, vegetables, tea, jute and pulses- classification upto family, life history, nature and damage control (two each);

b) Forest insects: defoliators, borers and suckers of teak, sal and gamari classification upto family, life history and control (two each), Insect damage and sign categories of forest insects.

Module II (12 hours)

a) **Pest management:** Economic decision level for pest population- Concept of economic injury level, economic threshold, crop susceptibility to injury, Pre insecticide era, insecticide era, concept of pest management.

Module III (25 hours)

a) Primary control measure: Physical, mechanical, traditional and legislative measure.

b) Chemical control: concept of LD 50 and LC 50, Classification and mode of action of important insecticides, Insecticide toxicity to humans, drawbacks of chemical control, Insect resistance to pesticides, Fumigants application and operation precautions, insecticide law and regulations. Pheromonal control.

c) Biological and genetic control: Use of parasites, parasitoids, predators and pathogenic organisms, sterile insect techniques, lethal mutations, inherited sterility, cytoplasmic incompatibility; Integrated Pest Management and a case study

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

	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)

a) 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/STAT and 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 and genetic 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

	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. Define the basic organization and expression of the immunoglobulin genes. (Remembering)
2. Understanding the role of various cytokines related to diseases. (Understanding)
3. Make use of avirrulent strain of microorganism for the development of vaccine and Analyzing the role of immune responses to various infectious diseases. (Analysing)
4. Recommend 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)

a) 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 germline V, 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; Protozoan diseases; 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 vector vaccines; 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

	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. Explain about the capture fishery resources of the country and the managerial practices for sustainable utilization of

these aquatic resources. (Understanding)
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. Explain about the various fishing gears and crafts used in various water bodies of the country. (Understanding)
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; Production of 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 of Agricultural 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

	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 essential element 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 in space 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

	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. Explain different threatened categories and conservation history in India. (Understanding)
2. Define forestry and explain different conservation movements (Remembering)
3. Analyse the threats on different species and identify different laws for their protection (Analyzing)
4. Identify the structure and demography of wildlife population and apply different sampling techniques. (Applying)

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 Wildlife Conservation 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

	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 population dynamics.
b) Assessment of condition, health and nutritional status in free-ranging populations. Disease control operations, Planning and management 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 Human Dominated Landscape

Mapping of COs to Syllabus

	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. (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. Apply bioinformatics tools used for evolutionary studies. (Applying)
5. Justify the role of isolating mechanisms in speciation, estimate, construction of evolutionary trees, and measurement of genetic relationship among organisms. (Evaluating)
6. Create evolutionary trees to understand the evolution of primates. (Creating)

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, Molecular clock of evolution, Molecular phylogeny; Origin and
c) Evolution of Primates.

Module V: Evolutionary Bioinformatics (10 hours)

a) Concept of databases: Biological databases - Primary, secondary, composite databases; Databases for Literature, Sequence and structure; Searching and their retrieval.
b) Bioinformatics for phylogenetic analysis. DNA and Protein sequence alignments- pairwise alignment, dot plot, global and local alignment algorithms; Multiple sequence alignment;Multiple sequence alignment based database searching–PSI-Blast
c) Homology modeling.

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

	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 and summarize the organization of the cell. (Understanding)
2. Define cell division and signaling pathways. (Remembering)
3. Explain the different cellular biology with complicated biochemical and physiological processes. (Understanding)
4. Apply immunological techniques. (Applying)
5. Demonstrate molecular techniques to understand underlying cellular composition. (Analyzing)
6. Evaluate the regulation of cell cycle and its control. (Evaluating)

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

	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. Define the structure of nucleic acids. (Remembering)
2. Explain gene expression. (Understanding)
3. Construct and analyze pedigree. (Analyzing)
4. Analyze the various patterns of genetic inheritance. (Analyzing)
5. Apply bioinformatics tools to archive, retrieve, and analyze biological data. (Analyzing)
6. Analyze macromolecules using electrophoretic techniques. (Analyzing)

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-Cell fusion 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 and markers, 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

	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. Recall the physiology of digestion, different glands involved in the process, their secretions. (Remember)
2. Explain about the physiology of Respiration, interpret the Oxygen dissociation curve and to understand the regulation of respiration. (Understanding)
3. Develop a clear concept of mammalian blood chemistry, the blood clotting mechanism, musculature in vertebrates, molecular mechanism and regulation of muscle contraction, nerve physiology, and physiology of excretion. (Applying)
4. Analyze the mechanism of digestion, absorption of various biomolecules and the role of gastrointestinal hormones in digestion. (Analyzing)
5. Analyze the integration of the systems. (Analyzing)

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 excess solutes, 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 transfer across 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

	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. Explain the effects of abiotic environment on plants and animals to understand the distribution and abundance of life on earth (Understanding)
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, biodiversity conservation, 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

	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 amphibian metamorphosis
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

	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: Associate the concepts in Zoology with the core principles of Sustainable Development. (Understanding)

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, bee products, 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, meat processing and meat products, Poultry by products

ModuleI IV: Parasitology (10 hours)

Parasitism and types of parasites, primary and secondary hosts, transmission of parasitic infection. Host-parasite interactions–parasitic effects benefiting the parasites, parasitic effects benefiting the host.

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.: 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 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

	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.
d) 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

	Module I	Module II	Module III	Module IV
CO1	L	L	L	
CO2	L			
CO3		H		
CO4				H
CO5		H		
CO6			H	

ZGSL0100: FOUNDATIONS OF SERVICE LEARNING (2 CREDITS) (L-T-P: 2-0-0)

COURSE OUTCOMES

CO1: Develop an understanding about the importance of service to community. (Understanding)
CO2: Identify the needs of a community. (Applying)
CO3: Apply skills acquired in Zoology to render service to community. (Creating)
CO4: 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

	Module I	Module II
CO 1	H	L
CO 2	L	M
CO 3	L	H
CO 4	M	H

ZGPP0101: NON-CHORDATES I: PROTISTA TO PSEUDOCOELOMATES (4 CREDITS: 60 HOURS/ L-T-P: 4-0-0)

COURSE OUTCOMES

CO1: Illustrate the evolution and history of the phylum (Understand).
CO2: Identify the distinguishing characters of the protists and pseudocoelomates (Applying).
CO3: Define the life cycles of important representative organisms belonging to these phyla (Remembering).
CO4: Analyze the pathogenicity of selected non-chordate/ pseudocoelomate organisms (Analyzing).

Module I : Protista, Parazoa and Metazoa (19 Hours)

General characteristics and Classification up to classes Study of Euglena, Amoeba and Paramecium Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica* Locomotion and Reproduction in Protista Evolution of symmetry and segmentation of Metazoa

Module II : Porifera (7 Hours)
General characteristics and Classification up to classes. Canal system and spicules in sponges.

Module III : Cnidaria (12 Hours)
General characteristics and Classification up to classes Metagenesis in Obelia Polymorphism in Cnidaria, Corals and coral reefs.

Module IV : Ctenophora (4 Hours)
General characteristics and Evolutionary significance

Module V : Platyhelminthes (10 Hours)
General characteristics and Classification up to classes Life cycle and pathogenicity of *Fasciola hepatica* and *Taenia solium*

Module VI : Nemathelminthes (8 Hours)
General characteristics and Classification up to classes Life cycle, and pathogenicity of *Ascaris lumbricoides* and *Wuchereria bancrofti* Parasitic adaptations in helminthes

Note: *Classification to be followed from "Barnes, R.D. (1982). Invertebrate Zoology, V Edition"*

SUGGESTED READINGS

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt SaundersInternational Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). TheInvertebrates: A New Synthesis, III Edition, Blackwell Science Barrington
3. E.J.W. (1979) Invertebrate Structure and Functions. II Edition, E.L.B.S.and Nelson

Mapping of COs to Syllabus

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

ZGPE0102: PERSPECTIVES IN ECOLOGY (4 CREDITS: 60 HOURS/ L-T-P: 4-0-0)

COURSE OUTCOMES

CO 1: Distinguish the mechanism of various biological interactions (Understanding).
CO 2: Describe the relationship between biotic and abiotic factors (Remembering).
CO 3: Analyze different population dynamics and interactions (Analyzing).
CO 4: Evaluate ecosystem energetics with reference to food chain (Evaluating).
CO 5: Apply conservation and management strategies for local endangered species (Applying).

Module I : Introduction to Ecology (6 Hours)
History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Module II : Population (24 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 (12 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 (14 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 (4 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

	Module I	Module II	Module III	Module IV	Module V
CO 1	M	M		H	
CO 2	H	L	M		
CO 3	L	H			
CO 4	L			H	
CO 5			H		H

ZGCL0103: NON-CHORDATES II: COELOMATES (4 CREDITS: 60 HOURS/ L-T-P: 4-0-0)

COURSE OUTCOMES

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

CO 1: Summarize the evolution of body cavity in coelomates (Understand).
CO 2: Identify the distinguishing characters of the coelomates (Remembering).
CO 3: Comprehend the different larval forms of important representative organisms belonging to these phyla (Understanding).
CO 4: Analyze the unique physiology of selected representative non-chordate/ coelomate organisms (Analyzing).

Module I : Introduction to Coelomates (2 Hours)
Evolution of coelom and metamerism

Module II: Annelida (10 Hours)
General characteristics and Classification up to classes Excretion in Annelida

Module III: Arthropoda (17 Hours)
General characteristics and Classification up to classes, Vision and Respiration in Arthropoda Metamorphosis in Insects Social life in bees and termites

Module IV: Onychophora (4 Hours)
General characteristics and Evolutionary significance

Module V: Mollusca (15 Hours)
General characteristics and Classification up to classes, Respiration in Mollusca Torsion and detorsion in Gastropoda, Pearl formation in bivalves, Evolutionary significance of trochophore larva.

Module VI : Echinodermata (12 Hours)
General characteristics and Classification up to classes, Water-vascular system in Asteroidea, Larval forms in Echinodermata, Affinities with Chordates

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 SaundersInternational 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

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

ZGCB0104: CELL BIOLOGY (4 CREDITS: 60 HOURS/ L-T-P: 4-0-0)

COURSE OUTCOMES

CO 1: Define the composition and function of membrane structure (Remembering).
CO 2: Distinguish the different cell types viz prokaryotes, eukaryotes and viroids (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).
CO 5: Identify the three primary components of the cytoskeleton and their role in affecting cell shape, function and movement (Remembering).

Module I : Overview of Cells (3 Hours)
Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions

Module II : Plasma Membrane (7 Hours)
Various 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 (10 Hours)
Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes

Module IV : Mitochondria and Peroxisomes (8 Hours)
Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis Peroxisomes

Module V : Cytoskeleton (8 Hours)
Structure and Functions: Microtubules, Microfilaments and Intermediate filaments

Module VI : Nucleus (12 Hours)
Structure of Nucleus: Nuclear envelope, nuclear pore complex, Nucleolus Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome)

Module VII : Cell Division (8 Hours)
Mitosis, Meiosis, Cell cycle and its regulation

Module VIII : Cell Signaling (4 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 James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1		H						
CO 2	H							
CO 3			H	H				
CO 4						H	H	H
CO 5					H			

ZGAD0105: ANIMAL DIVERSITY (4 CREDITS-60 HOURS) (L-T-P:4-0-0)

COURSE OUTCOMES (CO)

1. Explain the diversity and evolution of different non-chordate and chordate phyla, including birds and reptiles. (Understanding)
2. Illustrate the life cycle, pathogenicity, parasitic adaptations and social adaptations of selected non-chordates. (Understanding)
3. Summarize the increasing morphological complexity of different body forms pertaining to both non-chordates and chordates. (Understanding)
4. Identify the different animal phyla based on their general and unique characteristics. (Applying)
5. Compare the patterns of migration, parental care, terrestrial and flight adaptations and dentition in different vertebrate groups. (Analyzing)

Module I: Protista (4 Hours)
General characters of Protozoa; Life cycle of Plasmodium

Module II: Porifera (3 Hours)
General characters and canal system in Porifera

Module III: Radiata (3 Hours)
General characters of Cnidarians and polymorphism

Module IV: Acoelomates (3 Hours)
General characters of Helminthes; Life cycle of Taenia Solium

Module V: Pseudocoelomates (3 Hours)
General characters of Nemathelminthes; Parasitic adaptations

Module VI: Coelomate Protostomes (3 Hours)
General characters of Annelida ;Metamerism.

Module VII: Arthropoda (4 Hours)
General characters. Social life in insects.

Module VIII: Mollusca (3 Hours)
General characters of mollusca; Pearl Formation

Module IX: Coelomate Deuterostomes (3 Hours)
General characters of Echinodermata, Water Vascular system in Starfish.

Module X: Protochordata (2 Hours)
Salient features

Module XI: Pisces (4 Hours)

Osmoregulation, Migration of Fishes

Module XII: Amphibia (4 Hours)
General characters, Adaptations for terrestrial life, Parental care in Amphibia.

Module XIII: Amniotes (5 Hours)
Origin of reptiles. Terrestrial adaptations in reptiles.

Module XIV: Aves (5 Hours)
The origin of birds; Flight adaptations

Module XV: Mammalia (6 Hours)
Early evolution of mammals; Primates; Dentition in mammals.

Suggested Readings

1. Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
2. Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition, Thomson Brooks/Cole
3. Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
4. Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.
5. Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi.

Mapping of COs to Syllabus

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15
CO 1	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L
CO 2	L			L										M	
CO 3	L					M									
CO 4									L						
CO 5													H	H	H

ZGEP0106: ENVIRONMENT AND PUBLIC HEALTH (4 CREDITS-60 HOURS) (L-T-P:4-0-0)

Course Outcomes:

1. Illustrate the effects of air, water and noise pollution with regards to human health. (Understanding)
2. Identify the different types and sources of environmental hazards, their persistence, dose and exposure. (Applying)
3. Distinguish the different factors contributing to climate change and their effect in human health. (Analyzing)
4. Compile the various types of waste generated, their disposal and management. (Creating)

Module I: Introduction (10 Hours)
Sources of Environmental hazards, hazard identification and accounting, fate of toxic and persistent substances in the environment, dose Response Evaluation, exposure Assessment.

Module II: Climate Change (10 Hours)
Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health

Module III: Pollution (10 Hours)
Air, water, noise pollution sources and effects, Pollution control

Module IV: Waste Management Technologies (20 Hours)
Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, nuclear waste handling and disposal, Waste from thermal power plants, Case histories on Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and Three Mile Island accident and their aftermath.

Module V: Diseases (10 Hours)
Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid

Mapping of COs to Syllabus

	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

ZGDC0107: DIVERSITY OF CHORDATES (4 CREDITS: 60 HOURS) (L-T-P: 4-0-2)

COURSE OUTCOMES

CO1: Describe the origin and evolution of the phylum Chordata. (Remembering)
CO2: Distinguish the unique characteristics as well as life functions of different chordate subphylum. (Applying)
CO3: Evaluate the varied morphological, anatomical and physiological complexity in selected chordate organisms. (Applying)
CO4: Compare 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 Hemichordata, 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

Module X: Zoogeography (8 Hours)
Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different realms.

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.

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX	Module I 0
CO1	M	L	M	L						
CO2		H		H	H	H	H	H	H	
CO3				H	H	H	H	H	H	
CO4	M									H

ZGAP0108: ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS (4 CREDITS: 60 HOURS) (L-T-P: 4-0-2)

Objective: To understand structure and functions of different animal tissues and endocrine glands

COURSE 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 and muscle 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 (6 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 (10 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 (12 Hours)

Histology of different types of mutetanusscle; Ultrastructure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and

Module V: Reproductive System (10 Hours)

Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female

Module VI: Endocrine System (18 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 Edition. Lippincott W. & Wilkins.

Mapping COs to syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	L	L	L	L	L	L
CO2			H	H	H	H
CO3			H	H		
CO4			H			H

ZGFB0109: FUNDAMENTALS OF BIOCHEMISTRY (4 CREDITS: 60 HOURS) (L-T-P:4-0-0)

COURSE OUTCOMES

CO 1: Identify the structural and functional aspects of different biomolecules. (Applying)
CO 2: Illustrate and draw the chemical structures of different biomolecules. (Understanding)
CO 3: Interpret their inter-relationship as evident in the living system. (Evaluating)
CO 4: Elaborate the mechanism and regulation of enzyme action and their kinetics with reference to bi-substrate, multi-substrate and allosteric enzymatic reactions. (Creating)

Module I: Carbohydrates (8 Hours)

Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates

Module II: Lipids (8 Hours)
Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Glycolipids, Steroids

Module III: Proteins (14 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; Introduction to simple and conjugated proteins Immunoglobulins: Basic Structure, Classes and Function, Antigenic Determinants

Module IV: Nucleic Acids (12 Hours)
Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot Curves: Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA, Complementarity of DNA, Hpyo-Hyperchromicity of DNA

Module V: Enzymes (18 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, Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action

Suggested Readings

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 COs to syllabus

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

ZGRM0110: RESEARCH METHODOLOGY (2 CREDITS: 30 HOURS) (L-T-P: 2-0-0)

Objective: To introduce students to a few aspects of doing research

COURSE OUTCOMES

CO 1: Define various kinds 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 search tools. (Analyzing)
CO 4: Design solutions to varied biological problems. (Creating)
CO 5: Identify the ethical issues of research. (Applying)

Module I: Foundations of Research (5 Hours)
Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied

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, Allyn and 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 COs to syllabus

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

ZGCA0111: COMPARATIVE ANATOMY OF VERTEBRATES (4 CREDITS: 60 HOURS) (L-T-P:4-0-0)

COURSE OUTCOMES

CO1:Identify the distinct anatomical structures that comprise the vertebrate body (Applying)
CO2:Demonstrate the structural and functional similarities and differences of these organ systems amongst different vertebrate groups (Understanding)
CO3:Evaluate the pattern of organ development in various vertebrate groups (Evaluating)
CO4: Compare the functioning of these organ systems from lower to higher vertebrates (Understanding)

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
5. https://www.swayamprabha.gov.in/index.php/program_data/flipMore/G24/16

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module 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

ZGSS0112: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS (4 CREDITS: 60 HOURS) (L-T-P:4-0-0)

Objective: To understand different physiological mechanisms in Mammal

COURSE OUTCOMES

CO1:Define the organ systems responsible for maintaining a balanced physiological functioning of the mammalian body (Remembering)

CO2:Summarize the structure and function of the gastrointestinal tract, the lungs, the kidneys, the heart and other related organs (Understanding)

CO3:Evaluate the effects of organ systems compromised due to infection, disease or injury (Evaluating)

CO4:Correlate the inter-relationship of these organ systems to maintain a stable homeostasis in the body (Understanding)

CO5:Develop skills to determine basic blood parameters as a measure of a vigorous physiological system (Applying)

Module I: Physiology of Digestion (14 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 (12 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 (8 Hours)

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance

Module IV: Blood (14 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 (12 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

	Module I	Module II	Module III	Module IV	Module V
CO 1	L	L	L	L	L
CO 2	M	M	M		M
CO 3	H	H	H	H	H
CO 4	M	M	M	M	M
CO 5				H	

ZGBM0113: BIOCHEMISTRY OF METABOLIC PROCESSES (4 CREDITS: 60 HOURS) (L-T-P:4-0-0)

COURSE OUTCOMES

CO1: Define characteristic features of catabolic and anabolic pathways of metabolism (Remembering)

CO2: Demonstrate the differences of carbohydrate, lipid and protein metabolism and their inter-relationships (Understanding)

CO3: Infer the significance of the electron transport system in metabolic pathways (Analyzing)
CO4: Interpret the biochemistry of metabolic disorders (Evaluating)

Module I: Overview of Metabolism (10 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 (16 Hours)
Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis

Module III: Lipid Metabolism (14 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 (10 Hours)
Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids

Module V: Oxidative Phosphorylation (10 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

	Module I	Module II	Module III	Module IV	Module V
CO 1	M	M	M	M	M
CO 2	H	H	H		
CO 3					H
CO 4	H	H	H	H	H

ZGSE0114: SERICULTURE (2 CREDITS: 30 HOURS) (L-T-P:2-0-0)

Course Outcomes
CO1: 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)
CO2: Examine silkworm rearing techniques, with special importance given to those extensively reared in North East India (Analyzing)
CO3: Inspect the loss in silk production due to increased silkworm mortality as a result of pests and diseases (Analyzing)
CO4: 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 (3 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 (3 Hours)
Life cycle of Philosamia ricini Structure of silk gland and secretion of silk

Module III: Rearing of Silkworms (13 Hours)
Selection of a non-mulberry variety and establishment of garden Rearing house and rearing appliances Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types of mountages Spinning, harvesting and storage of cocoons

Module IV: Pests and Diseases (4 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 (2 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

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

ZGAF0115: AQUARIUM FISH KEEPING (2 CREDITS: 30 HOURS) (L-T-P:2-0-0)

Course Outcomes

CO1: Explain the biology of aquarium fishes, both freshwater and marine (Understanding)
CO2: Compare food formulation and feeding techniques (Analyzing)
CO3: Analyze the scope of the aquarium fish Industry as a means of livelihood (Analyzing)
CO4: Identify techniques and skills in fish transportation (Applying)
CO5: Designing and maintenance of aquaria (Creating)

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. Guide to tropical fish keeping: 1967 – Brymer, J.H. P. Ilifie.
2. Tropical marine aquaria: 1971 – Col, G.I. Harmlyn.
3. Tropical fish setting up & maintaining fresh water & marine aquarium: 1972 – Dutta R Octopus Books, LTD.
4. Aquarium fishes & setting: AmitaSaxena. Aquarium system: 1981 – Himlins A.D. (Ed.) Academic Press.
5. Living aquarium: 1981 – Hunnam F. Ward Lock.
6. Aquarium fishes & plants: 1971 – Rataj R and R. Zukal Hamlyn.
7. Sea water aquarium: 1979 – Spotte A. John Wiley.
8. Ornamental fish for Garden ponds and home aquarium: 1956 – Ray L.P. Home aquarium.
9. Complete aquarium: 1963 – Vagi D. and H. Wermuth Thomas

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	M	M			

CO 2			H		
CO 3	L			L	H
CO 4				H	
CO 5					H

ZGMB0116: MOLECULAR BIOLOGY [4 CREDITS: 60 HOURS, L-T-P: 4-0-0]

Course Outcome:

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)

Module1: Nucleic Acids (4 Hours)
Salient features of DNA and RNA Watson and Crick model of DNA

Module II : DNA Replication (12 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

Module III : Transcription (10 Hours)
RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors

Module IV : Translation (12 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 V : Post Transcriptional Modifications and Processing of Eukaryotic RNA (6 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 VI : Gene Regulation (10 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 VII : DNA Repair Mechanisms (3 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,
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 COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	L			L		L
CO2	M	H	H	H			
CO3			M	M	H	M	
CO4						H	
CO5					L	L	H

ZGPG0117: PRINCIPLES OF GENETICS [4 CREDITS: 60 HOURS, L-T-P: 4-0-0]

Course outcome:

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 (Analyzing, Understanding)

CO 5: Understand DNA recombinant technology and compare the methods of generation of transposons in bacteria, Drosophila, maize and humans. (Understanding)

Module I : Mendelian Genetics and its Extension (8 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 (12Hours)

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 (10 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 method, attached X method.

Module IV : Sex Determination (4 Hours)

Chromosomal mechanisms of sex determination in Drosophila and Man

Module V : Extra-chromosomal Inheritance (6 Hours)

Criteria for extra-chromosomal inheritance, Antibiotic resistance in Chlamydomonas, 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 (9 Hours)

Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

Module VIII : Transposable Genetic Elements (8 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

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	H	M		L	H	M	L	L
CO2	M	H	L					
CO3			H		L			
CO4				H	M	H		
CO5							H	H

ZGWM0118: WILDLIFE CONSERVATION AND MANAGEMENT [4 CREDITS: 60 HOURS, L-T-P: 4-0-0]

Couse Outcome:

CO1: Explain the importance of evaluation and management wildlife and their habitat. (understanding)
CO2: Identify characteristics of population and protected areas. (Analyzing)
CO3: Explain the importance of estimation of population characteristics. (Understanding)
CO4: Explain the management strategies to protect/unprotected areas. (Understanding)
CO5: Apply conservation and management strategies for local endangered species.(Applying)

Module I : Introduction (8 Hours)

Introduction to Wild Life, Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

Module II : Evaluation and management (10 Hours)

Evaluation and management of wild life Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS.

Module III : Management of habitats (8 Hours)

Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats

Module IV : Population estimation (10 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 V : Management and planning (8 Hours)

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 VI : Management of excess population (6 Hours)

Bio- telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal

Module VII : Management in Protected areas (10 Hours)

Protected areas National parks & sanctuaries, Community reserve; Important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.

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

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	H	H				M
CO2				M			
CO3	L			H			
CO4	L		L		H	H	
CO5	M	L			M	M	H

ZGAC0119: ANIMAL BEHAVIOUR AND CHRONOBIOLOGY [4 CREDITS: 60 HOURS, L-T-P: 4-0-0]

Course Outcome

CO1: Explain different types, causes and methods of recording of animal behaviour. (Understanding, Analyzing)
CO2: Define the different types and patterns of animal behavior and chronobiological events. (Remembering)
CO3: Interpret the various modes of communication, social and sexual behavior in animals.(Applying)
CO4: Explain and identify biological rhythms. (Understanding, Applying)
CO5: Apply the knowledge of biological rhythms in the field of chronobiology. (Applying)

Module I : Introduction to Animal Behaviour (8 Hours)

Origin and history of Ethology; Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behaviour, Methods and recording of a behaviour

Module II : Patterns of Behaviour (14 Hours)

Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learnt Behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.

Module III : Social and Sexual Behaviour (14 Hours)

Social Behaviour: Concept of Society; Communication and the senses; Altruism; Insects' society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance.
Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.

Module IV : Introduction to Chronobiology (14 Hours)

Historical developments in chronobiology; Biological oscillation: the concept of Average, amplitude, phase and period. Adaptive significance of biological clocks

Module V : Biological Rhythm (8 Hours)

Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Concept of synchronization and masking; Photic and non-photic zeitgebers; Circannual rhythms; Photoperiod and regulation seasonal reproduction of vertebrates; Role of melatonin.

Module VI : Biological Clocks (8 Hours)

Relevance of biological clocks; Chronopharmacology, Chronomedicine, Chronotherapy.

SUGGESTED READINGS

1. David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
2. Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
3. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
4. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
5. Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
6. Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rdEd) 2002 Barens and Noble Inc. New York, USA
7. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

Mapping of COs to Syllabus

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

ZGCB0120: COMPUTATIONAL BIOLOGY [4 CREDITS: 60 HOURS, L-T-P: 4-0-0]

Course Outcome:

CO1: Define the core concept and applications of bioinformatics and identify its different branches. (Remembering)
CO2: Illustrate the significance of the biological databases in managing and retrieving biological data.(Understanding)
CO3: Apply different bioinformatics tools and software in decoding nucleic acid and protein sequence, their structure and interactions, and also to correlate these data amongst different species. (Applying)
CO4: Analyze the evolutionary interrelationship amongst different organisms by aligning their nucleic acid or protein sequences using sequence alignment tools to predict their similarities and dissimilarities. (Analyzing)
CO5: Evaluate various statistical methods in data analysis and interpretation. (Evaluating)

Module I : Introduction to Bioinformatics (5 Hours)
Importance, Goal, Scope; Genomics, Transcriptomics, Functional Genomics, Metabolomics, Systems Biology, Molecular Phylogeny; Applications and Limitations of Bioinformatics

Module II : Biological Databases (10 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 (14 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 III : Basic Concepts of Sequence Alignment (14 Hours)
Scoring Matrices (PAM, BLOSUM), Methods of Alignment (Dot matrix, Dynamic Programming, BLAST and FASTA); Local and global alignment, pair wise and multiple sequence alignments; Similarity, identity and homology of sequences.

Module IV : Applications of Bioinformatics (7 Hours)
Structural Bioinformatics (3-D protein, PDB), Functional genomics (genomewide and high throughput approaches to gene and protein function), Drug discovery method (Basic concepts)

Module V : Biostatistics (10 Hours)
Introduction, calculation of standard deviation, standard error, Co-efficient of Variance, Chi-square test, Z test, t-Test

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. Zar, Jerrold H. (1999). Biostatistical Analysis, IV Edition, Pearson Education Inc and Dorling Kindersley Publishing Inc. USA
5. Antonisamy, B., Christopher S. and Samuel, P. P. (2010). Biostatistics: Principles and Practice. Tata McGraw Hill Education Private Limited, India.
6. Pagana, M. and Gavreau, K. (2000). Principles of Biostatistics, Duxberry Press, USA

Mapping of COs to Syllabus

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

ZGAB0121: ANIMAL BIOTECHNOLOGY [4 CREDITS: 60 HOURS, L-T-P: 4-0-0]

Course Outcome

CO1: Define the concept and scope of animal biotechnology. (Remembering)
CO2: Illustrate the basic molecular technique for gene manipulation. (Understanding)
CO3: Explain animal cell culture and gene therapy in molecular diagnosis of genetic diseases. (Understanding)
CO4: Analyze different techniques for the development of genetically modified organisms. (Analyzing)
CO5: 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 (24 Hours)
Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics).
Restriction enzymes: Nomenclature, detailed study of Type II.
Transformation techniques: Calcium chloride method and electroporation.
Construction of genomic and cDNA libraries and screening by colony and plaque hybridization Southern, Northern and Western blotting
DNA sequencing: Sanger method, Pyro-sequencing
Polymerase Chain Reaction, DNA Fingerprinting and DNA microarray

Module III . Genetically Modified Organisms (18 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.
Production of transgenic plants: Agrobacterium mediated transformation.
Applications of transgenic plants: insect and herbicide resistant plants.

Module IV . Culture Techniques and Applications (10 Hours)
Animal cell culture, Expressing cloned genes in mammalian cells, 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 COs to Syllabus

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

CO3				H
CO4			H	M
CO5		L	M	M

ZGDB0122: DEVELOPMENTAL BIOLOGY (4 CREDITS; 60 HOURS; 4-0-0)

Course outcome:

CO1: To demonstrate the mechanisms underlying the process of development. (Understanding)
CO2: To determine the evolutionary history of living species inferred through the phylogenetic molecular and morphological information using models. (Understanding)
CO3: Correlate the effects of different natural and artificial factors leading to developmental anomalies or congenital defects in humans. (Analyzing)
CO4: Interpret the different stages of development of frog, chick and culture preparation of Drosophila. (Analyzing)

Module I : Introduction (4 Hours)

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Cytoplasmic determinants and asymmetric cell division

Module II : Early Embryonic Development (28 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 (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers

Module III : Late Embryonic Development (8 Hours)

Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)

Module IV : Post Embryonic Development (12 Hours)

Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each); Ageing: Concepts and Theories

Module V : Implications of Developmental Biology (8 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 UniversityPress

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
1	M	M			
2			M		
3				M	
4				H	
5					H

ZGEB0123: EVOLUTIONARY BIOLOGY (4 CREDITS; 60HRS; 4-0-0)

Course Outcomes

CO1: Gain a deeper insight into evolutionary processes. (Understanding)
CO2: To determine the evolutionary history of living species inferred through the phylogenetic analysis of molecular and

morphological information using models. (Understanding).
CO3: To describe the basics of population genetics population evolution. (Understanding).
CO4: To interpret the concept of extinction. (Understanding)
CO5: Apply evolutionary principles in their research. (Applying)

Module I : Life's Beginnings (7 Hours)
Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes

Module II : Historical review of evolutionary concept (4 Hours)
Lamarckism, Darwinism, Neo-Darwinism

Module III : Evidences of Evolution (10 Hours)
Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesizing machinery, three domains of life, neutral theory of molecular evolution, molecular clock, example of globin gene family, rRNA/cyt c

Module IV : Sources of variations (8 Hours)
Heritable variations and their role in evolution

Module V : Population genetics (13 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, kin selection, 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 (6 Hours)
Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens, molecular analysis of human origin

Module IX: Phylogenetic trees (2 Hours)
Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees

Suggested Readings

1. Ridley,M (2004) Evolution III Edition Blackwell publishing
2. Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett Publishers.
3. Campbell, N.A. and Reece J.B (2011). Biology. IX Edition. Pearson, Benjamin, Cummings.
4. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
5. Snustad. S Principles of Genetics.
6. Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition WileyBlackwell

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX
1	M			M					
2		M							
3			M		M	M		M	
4							M		
5									H

ZGIM0124: IMMUNOLOGY (4 CREDITS; 60 HRS; 4-0-0)

Course Outcomes

CO1: Define the basic concepts of immunology and distinguish the two important facets of immunity, innate and adaptive. (Understanding)
CO2: Develop critical definition of the antigen and the self, antigen-antibody interactions and how the different barriers of the innate immune system work in relation to the adaptive immune response to eliminate the antigen. (Understanding)
CO3: Apply the concepts of immunology through various laboratory techniques. (Applying)
CO4: Analyze the importance of the Major Histocompatibility Complex proteins and their role in transplantation immunology. (Analyzing)
CO5: Describe the concept of hypersensitivity, types of cytokines and cytokines. (Understanding)
CO6: Demonstrating vaccine production against some major infectious diseases. (Understanding).

Module I : Overview of Immune System (8 Hours)
Historical perspective of Immunology, Early theories of Immunology, Cells and organs of the Immune system

Module II : Innate and Adaptive Immunity (13 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 (8 Hours)
Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes

Module IV : Immunoglobulins (10 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 (6 Hours)
Structure and functions of MHC molecules. Endogenous and exogenous pathways of antigen processing and presentation
Module VI : Cytokines (4 Hours)
Properties and functions of cytokines, Therapeutics Cytokines

Module VII : Complement System (4 Hours)
Components and pathways of complement activation.

Module VIII : Hypersensitivity (4 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

	Module I	Module 2	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX
1	M	M							
2			M						
3				M					
4					M	M	M	M	
5									H

ZGPA0125: PARASITOLOGY (4 CREDITS; 60 HRS; 4-0-0)

Course Outcomes

CO1: Define the basic concepts of parasitology and host-parasite interactions and mechanisms of parasitic transmissions. (Understanding)
CO2: Illustrate the different life cycles parasites. (Understanding
CO3: Articulate major helminth, arthropod and parasitic vertebrates, their morphology, epidemiology, treatment, pathogenicity and their importance. (Understanding)
CO4: Analyze different techniques for parasite control as well as treating parasitic diseases. (Analyzing)
CO5: Apply the knowledge for correct identification of parasites. (Applying)

Module I: Introduction to Parasitology (3 Hours)
Brief introduction of Parasitism, Parasite, Parasitoid and Vectors (mechanical and biological vector) Host parasite relationship

Module II : Parasitic Protists (15 Hours)
Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma gambiense*, *Leishmania donovani*.

Module III : Parasitic Platyhelminthes (15 Hours)
Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Fasciolopsis buski*, *Schistosoma haematobium*, *Taenia solium* and *Hymenolepis nana*

Module IV : Parasitic Nematodes (15 Hours)
Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti* and *Trichinella spiralis*. Study of structure, life cycle and importance of Meloidogyne (root knot nematode), Pratylenchus (lesion nematode)

Module V : Parasitic Arthropoda (10 Hours)
Biology, importance and control of ticks, mites, Pediculus humanus (head and body louse), Xenopsyllacheopis and Cimexlectularius
Module VI : Parasitic Vertebrates (2 Hours)
A brief account of parasitic vertebrates; Cookiecutter Shark, Candiru, Hood Mockingbird and Vampire bat

Suggested Readings

1. Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributors
2. E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition, Lea &Febiger
3. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor and Francis Group
4. Parija, S. C. Textbook of medical parasitology, protozoology& helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi
5. Rattan Lallchhpujani and Rajesh Bhatia. Medical Parasitology, III Edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi
6. Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers
7. K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBS Publishers & Distributors (P) Ltd.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
1	M					
2		M				
3			M			
4				H	H	
5						H

ZGFF0126: FISH AND FISHERIES (4 CREDITS; 60 HOURS; 4-0-0)

Course Outcomes

CO1: Classify fishes based on habitat, feeding habit and mode of reproduction. (Understanding)
CO2: Acquire basic knowledge on their morphology and physiology. (Understanding)

CO3: Compare the productivity of inland and marine fisheries, and the fishing gears and tools required for the same. (Understanding).
CO4: To describe the basic concept of aquaculture. (Understanding)
CO5: Develop skills in measuring the morphometric and meristic characters in fishes, identify their scales, breathing organs and other associated characters. (Applying)

Module I : Introduction and Classification (6 Hours)
General description of fish; Account of systematic classification of fishes (upto classes); Classification based on feeding habit, habitat and manner of reproduction.
Module II : Morphology and Physiology (18 Hours)
Types of fins and their modifications; Locomotion in fishes; Hydrodynamics; Types of Scales, Use of scales in Classification and determination of age of fish; Gills and gas exchange; Swim Bladder: Types and role in Respiration, buoyancy; Osmoregulation in Elasmobranchs; Reproductive strategies (special reference to Indian fishes); Electric organs; Bioluminescence; Mechanoreceptors; Schooling; Parental care; Migration

Module3: Fisheries (12 Hours)
Inland Fisheries; Marine Fisheries; Environmental factors influencing the seasonal variations in fish catches in the Arabian Sea and the Bay of Bengal; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations

Module IV : Aquaculture (20 Hours)
Sustainable Aquaculture; Extensive, semi-intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish, Fishery by-products

Module V : Fish in research (4 Hours)
Transgenic fish, Zebrafish as a model organism in research

Suggested Readings
1. Q Bone and R Moore, Biology of Fishes, Talyor and Francis Group, CRC Press, U.K.
2. D. H. Evans and J. D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK
3. von der Emde, R.J. Mogdans and B.G. Kapoor.The Senses of Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands C.B.L. Srivastava, Fish Biology, Narendra Publishing House
4. J.R. Norman, A history of Fishes, Hill and Wang Publishers
5. S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
1	M				
2		M			
3			M		
4				M	
5					H

ZGBI0127: BIOLOGY OF INSECTA (4 CREDITS; 60 HRS; 4-0-0)

Course/Outcomes
CO1: To demonstrate the concepts of insect biology including basic systematics of insects. (Understanding)
CO2: Illustrate the role of insects as vectors and pests. (Understanding)
CO3: Develop an understanding of insect plant interactions. (Understanding)
CO4: Acquire knowledge regarding morphology of insects and physiology of insect body systems. (Understanding)
CO5: Interpret the behavioral aspects of social insects. (Understanding)

Module I : Introduction (4 Hours)
General Features of Insects Distribution and Success of Insects on the Earth

Module II : Insect Taxonomy (4 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 (28 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 (6 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 (5 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 and Hall, 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

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
1	M	M		M			
2					M		
3						M	
4			M				
5							M

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

	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 successful entrepreneur & 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) and Critical 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

	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.

ZGJP6007: INTRODUCTION TO JOURNALISM AND 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 basis and 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

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)

Camera Basics, Operating a Camera, Types of Film, Exposure, Aperture & Shutter Speeds
TTL Light Meter, Depth of Field, Choosing Lenses, Types of lens, Lighting, Flash Photography
Filters, Steady Shooting, , Composition.

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, Light Room etc, a variety of photo content management tools (CMS) such as Photo Mechanic, and several online.

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: Photojournalism

Introduction to Photojournalism Ethics of Photojournalism How to photograph the single-image news and feature assignment Techniques for developing and structuring professional calibre long-form photo stories How to edit, caption, keyword and organize large numbers of photos. presentation tools such as iPhoto, Jux, and WordPress. Tools and standards for building a professional portfolio and presenting visual work online.

Mapping of COs to Syllabus

	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 Problem solving, 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

	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

	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

	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

	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 make a report

Mapping of COs to Syllabus

	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 unique representatives)
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

	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

	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

	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

	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. Sequence alignments, Blastn, Blastp, Psi-Blast, Clustal Omega
7. Homology modeling

8. Phylogenetic Analysis using academic software
9. Estimation of CO2, DO, Nitrites, total alkalinity and hardness of water sample.
10. Study of zooplanktons and its role in a pond ecosystem.
11. Analysis of physical parameters of soil.
12. 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. Usage of NCBI resources
8. Usage/Retrieval of sequence/structure from databases
9. Visualization of structures
10. Protein Docking and Docking of ligand receptors

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. Compare the differences between developmental stages of chick embryo. (Evaluating)
2. Identify characteristic features of different phases of the mouse estrous cycle. (Applying)
3. Utilize microtomy in histological study of different tissues (Applying)
4. Determine the physiological amounts of important biological macromolecules and plant antioxidant property through various estimation methods. (Evaluating)
5. Apply Henderson-Hasselbalch Equation for preparing buffers. (Applying)

Syllabus

1. In vivo/in vitro culture and study of chick embryo.
2. Study of developmental stages of Chick embryo from permanent slides.
3. Study of different stages of estrous cycle in mice.
4. Tissue processing, sectioning, staining, analysis of histological tissues
5. Preparation buffers of different pH using Henderson-Hasselbalch Equation and Its Verification using pH meter.
6. Quantitative estimation of amino acid using ninhydrin reagent.
7. Quantitative estimation of total protein by Lowry method.
8. Estimation of glucose in serum by glucose oxidase peroxidase method/tissue by Anthrone reagent
9. 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			

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

ZGPP6101 — NON-CHORDATES I: PROTISTA TO PSEUDOCOELOMATES LAB (2 CREDITS: 30 HOURS/ L-T-P: 0-0-2)

Course Outcomes

CO 1: Identify and classify the specimens under the protists and pseudoceolomates (Applying).
CO 2: Discover and identify the diversity of Protists in different areas (Analysing).
CO 3: Analyze the pathogenicity of selected non-chordate/ pseudocoelomate organisms (Analyzing).
CO 4: Create the permanent slides of specimens (Creating).
CO 5: Design a project for any related topic (Creating).

Syllabus

1. Study of whole mount of Euglena, Amoeba and Paramecium, Binary fission and Conjugation in Paramecium
2. Examination of pond water collected from different places for diversity in protista
3. Study of Sycon (T.S. and L.S.), Hyalonema, Euplectella, Spongilla
4. Study of *Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora*
5. One specimen/slide of any ctenophore
6. Study of adult *Fasciola hepatica*, *Taenia solium* and their life cycles (Slides/microphotographs)
7. Study of adult *Ascaris lumbricoides* and its life stages (Slides/micro-photographs)
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.

Note: *Classification to be followed from "Ruppert and Barnes (2006) Invertebrate Zoology, 8th edition, Holt Saunders International Edition"*

Suggested Readings

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt SaundersInternational 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 Barrington
3. E.J.W. (1979) Invertebrate Structure and Functions. II Edition, E.L.B.S.and Nelson

Mapping of COs to Syllabus

	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp. 6	Exp. 7	Exp. 8
CO 1	H		H	H				
CO 2		H						
CO 3						H	H	
CO 4					H			
CO 5								H

ZGPE6102 — PERSPECTIVES IN ECOLOGY LAB (2 CREDITS: 30 HOURS/ L-T-P: 0-0-2)

Course Outcomes

CO 1: Investigate life tables and survivorship curves of different types (Analyzing).
CO 2: Estimate and analyze 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 CO_2
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

	Experiment 1	Experiment 2	Experiment 3	Experiment 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

ZGCL6103 — NON-CHORDATES II: COELOMATES LAB (2 CREDITS: 30 HOURS/ L-T-P: 0-0-2)

Course 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 following specimens: Annelids - Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria Arthropods - Limulus, Palamnaeus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Philosamia, Periplaneta, Termites and honey bees, Onychophora–Peripatus, Molluscs - Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus Echinodermates - Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon
2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm
3. T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
4. Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta**
5. To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm)

Note: *Classification to be followed from "Ruppert and Barnes (2006) Invertebrate Zoology, 8th edition, Holt Saunders International Edition"*

Suggested Readings

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt SaundersInternational 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

ZGCB6104 — CELL BIOLOGY LAB (2 CREDITS: 30 HOURS/ L-T-P: 0-0-2)

Course 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).

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

	Experiment 1	Experiment 2	Experiment 3	Experiment 4
CO 1	H			
CO 2		H		
CO 3			H	H

ZGAD6105: ANIMAL DIVERSITY LAB (2 CREDITS) (L-T-P: 0-0-2)

Course Outcome

1. To familiar with the different types of invertebrate and vertebrate with the help of the preserved specimen available in the laboratory. (Applying)
2. To learn the techniques how to prepare the permanent slides. (Applying)
3. To understand the integument system with the help of preparing temporary slides. (Applying)
4. To know digestive system and nervous system with the help of dissections. (Understanding)

Syllabus:

1. Study of following specimens: Non Chordates: Euglena, Noctiluca, Paramecium, Sycon, Physalia, Tubipora, Metridium, Taenia, Ascaris, Nereis, Aphrodite, Leech, Peripatus, Limulus, Hermit Crab, Daphnia, Millipede, Centipede, Beetle, Chiton, Dentalium, Octopus, Asterias, and Antedon. Chordates: Balanoglossus, Amphioxus, Petromyzon, Pristis, Hippocampus, Labeo, Icthyophis/Uraeotyphlus, Salamander, Rhacophorus Draco, Uromastyx, Naja, Viper, model of Archaeopteryx, any three common birds-(Crow, duck, Owl), Squirrel and Bat.

2. Study of following Permanent Slides: Cross section of Sycon, Sea anemone and Ascaris(male and female). T. S. of Earthworm passing through pharynx, gizzard, and typhlosolar intestine. Bipinnaria and Pluteus larva.
3. Temporary mounts of Septal & pharyngeal nephridia of earthworm. Unstained mounts of Placoid, cycloid and ctenoid scales.
4. Dissections of Digestive and nervous system of Cockroach or Urinogenital system of Rat

Mapping of COs to Syllabus

	1	2	3	4
CO 1	H		L	
CO 2	M	H		
CO 3			H	M
CO 4				H

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.

ZGEP6106: ENVIRONMENT AND PUBLIC HEALTH LAB (2 CREDITS) (L-T-P: 0-0-2)

Course Outcome

1. To learn the procedure to find out the pH, Cl, SO_4 and NO_3 of soil of different location. (Applying)
2. To learn the procedure of determination of pH, DO and CO_2 in pond water. (Applying)

Syllabus

1. To determine pH, Cl, SO_4, NO_3 in soil samples from different locations.
2. To determine pH, CO_2, DO, Transparency and NO_3 in water samples from different locations.

Mapping of COs to Syllabus

	Module I	Module II
CO1	H	
CO2		H

ZGDC6107: DIVERSITY OF CHORDATES LAB (2 Credits: 30 hours) (L-T-P: 0-0-2)

Course 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: Balanoglossus, 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 animals from two different classes by students (may be included if dissections not given permission)

Mapping COs to syllabus

	1	2	3	4	5	6	7
CO1	H	H	H	H	H	H	H
CO2	M	M	M	M	M	M	M
CO3							**H**

ZGAP6108: ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS LAB (2 CREDITS: 30 HOURS) (L-T-P: 0-0-2)

Course 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)

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, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
5. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues

(*Subject to UGC guidelines)

Mapping COs to syllabus

	1	2	3	4	5
CO1	H	H			
CO2			H	H	H
CO3					H

ZGFB6109: FUNDAMENTALS OF BIOCHEMISTRY LAB (2 CREDITS) (L-T-P: 0-0-2)

Course Outcomes

CO 1: Estimate biochemical functional groups of different macromolecules. (Evaluating)
CO 2: Develop chromatography and electrophoresis skills for separation of amino acids and proteins (Evaluating)
CO 3: Determine the enzyme kinetics of given enzyme: salivary amylase. (Evaluating)

Syllabus

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH, temperature and inhibitors on the action of salivary amylase.
5. Demonstration of proteins separation by SDS-PAGE.

Mapping COs to syllabus

	1	2	3	4	5
CO1	H				
CO2		H			H
CO3			H	H	

ZGCA6110: COMPARATIVE ANATOMY OF VERTEBRATES LAB (2 Credits) (L-T-P: 0-0-2)

Course Outcomes

CO 1: Compare the different types of scales. (Analyzing)
CO 2: Demonstrate the structural and functional similarities and differences of these organ systems amongst different vertebrate groups (Understanding)
CO 3 : Compare the functioning of these organ systems from lower to higher vertebrates (Understanding)
CO 4: Explain the arterial and urogenital system. (Understanding)
CO 5: Identify internal organs. (Applying)

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

	1	2	3	4	5	6	7
CO 1	H						
CO 2			H	H			H
CO 3							
CO 4					H		
CO 5		H				H	

ZGAS6111: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS LAB (2 CREDITS) (L-T-P: 0-0-2)

Course Outcomes

CO1: Develop Skills to Determine Basic Blood Parameters As A Measure Of A Vigorous Physiological System (Applying)
CO2: Examine the anatomy of various internal organs. (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)

Mapping of COs to Syllabus

	1	2	3	4	5	6	7
CO 1	H	H	H	H	H	H	
CO 2							H

ZGBM6112: BIOCHEMISTRY OF METABOLIC PROCESSES (2 CREDITS) (L-T-P: 0-0-2)

Course Outcomes

CO1: Estimation of protein content (Evaluating)
CO2: Interpretation of enzyme activity (Evaluating)
CO3: Determination of metabolic pathways (Evaluating)

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 labelled C atoms of Acetyl-CoA till they evolve as CO_2in the TCA cycle

Mapping of COs to Syllabus

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

ZGMB6113: MOLECULAR BIOLOGY LAB [2 CREDITS: 30 HOURS, L-T-P: 0-0-2]

Course Outcome:

CO1: Explain the structure of chromosome. (Understanding)
CO2: Design the growth medium and estimate growth kinetics. (Creating)
CO3: Demonstrate antibiotic resistance and sensitivity. (Understanding)
CO4: Estimation of DNA and RNA using different analytical tools. (Evaluating)
CO5: 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 salmon sperm/calf thymus DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A260 measurement)
7. Quantitative estimation of RNA using Orcinol reaction
8. Study and interpretation of electron micrographs/ photograph showing (a) DNA replication (b) Transcription (c) Split genes

Mapping of COs to Syllabus

	1	2	3	4	5	6	7	8
CO1	H							
CO2		H	H	H				
CO3					H			
CO4						H	H	
CO5								H

ZGPG6114: PRINCIPLES OF GENETICS LAB [2 CREDITS: 30 HOURS, L-T-P: 0-0-2]

Course Outcome:

CO1: Explain the laws of Inheritance. (Evaluating)
CO2: Analyze organisms trait using Chi Square test. (Analyzing)
CO3: Construct linkage maps (Applying)
CO4: Construct human karyotype (Applying)
CO5: 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.

Mapping of COs to Syllabus

	1	2	3	4	5	6
CO1	H					
CO2		H				

CO3			H	H		
CO4					H	
CO5						H

ZGWM6115: WILDLIFE CONSERVATION AND MANAGEMENT LAB [2 CREDITS: 30 HOURS, L-T-P: 0-0-2]

Course Outcome:

CO1: Identify different flora and flora. (Applying)
CO2: Demonstrate and apply the equipment used for wildlife studies. (Understanding, applying)
CO3: Analyze animal signs (Analyzing)
CO4: Explain different field techniques (Understanding)
CO5: Perform vegetation analysis (Analysis)
CO6: Apply different survey techniques (Applying)

Syllabus:

1. Identification of flora, 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)

Mapping of COs to Syllabus

	1	2	3	4	5	6
CO1	H					
CO2		H				
CO3			H			
CO4				H		
CO5					H	
CO6						H

ZGAC6116: ANIMAL BEHAVIOUR AND CHRONOBIOLOGY LAB [2 CREDITS: 30 HOURS, L-T-P: 0-0-2]

Course Outcome:

CO1: Explain different types of nests and nesting habits. (Understanding)
CO2: Analyse different types of behavioral responses (Analyzing)
CO3: Create field reports with observational data (Creating)
CO4: Construct actogram for locomotory activity (Creating)
CO5: Analyse circadian rhythms (Analyzing)

Syllabus:

1. To study nests and nesting habits of the birds and social insects.
2. To study the behavioural responses of wood lice to dry and humid conditions.
3. To study geotaxis behaviour in earthworm.
4. To study the phototaxis behaviour in insect larvae.
5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.
6. Study and actogram construction of locomotor activity of suitable animal models.
7. Study of circadian functions in humans (daily eating, sleep and temperature patterns).

Mapping of COs to Syllabus

	1	2	3	4	5	6	7
CO1	H						

CO2		H	H	H			
CO3					H		
CO4						H	
CO5							H

ZGCB6117: COMPUTATIONAL BIOLOGY LAB [2 CREDITS: 30 HOURS, L-T-P: 0-0-2]

Course Outcome:

CO1: Choose different types of databases for their study (Applying)
CO2: Analyze nucleotide and protein sequences (Analyzing)
CO3: Make use of different bioinformatics software (Applying)
CO4: Analyse nucleotide sequences (Analyzing)
CO5: Evaluate various statistical methods in data analysis and interpretation

Syllabus

1. Accessing biological databases
2. Retrieval of nucleotide and protein sequences from the databases.
3. To perform pair-wise alignment of sequences (BLAST) and interpret the output
4. Translate a nucleotide sequence and select the correct reading frame of the polypeptide from the output sequences
5. Predict the structure of protein from its amino acid sequence.
6. To perform a “two-sample t- test” for a given set of data
7. To learn graphical representations of statistical data with the help of computers (e.g. MS Excel).

Mapping of COs to Syllabus

	1	2	3	4	5	6	7
CO1	H						
CO2		H			M		
CO3			H	H			
CO4					H		
CO5						H	H

GAB6118: ANIMAL BIOTECHNOLOGY LAB [2 CREDITS: 30 HOURS, L-T-P: 0-0-2]

Course Outcomes:

CO1: Explain and perform the process of DNA isolation (Understanding, Applying)
CO2: Experiment with DNA with different enzymes (Applying)
CO3: Construct restriction maps and analyse transformation efficiency (Creating)
CO4: Explain and interpret different biological techniques (Understanding)
CO5: Create report on methods of cell culture (Creating)

Syllabus:

1. Genomic DNA isolation from E. coli
2. Plasmid DNA isolation (pUC 18/19) from E. coli
3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data provided.
5. Calculation of transformation efficiency from the data provided.
6. To study following techniques through photographs
   a) Southern Blotting
   b) Northern Blotting
   c) Western Blotting
   d) DNA Sequencing (Sanger's Method)
   e) PCR
   f) DNA fingerprinting
7. Project report on animal cell culture

Mapping of COs to Syllabus

	1	2	3	4	5	6	7
CO1	H	H					
CO2			H				
CO3				H	H		
CO4						H	
CO5							H

ZGDB6119: DEVELOPMENTAL BIOLOGY LAB (2 CREDITS; 30HRS; 0-0-2)

Course outcome:

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)

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. Project report on Drosophila culture/chick embryo development

Mapping of COs to Syllabus

	1	2	3	4	5
1	M	M	M		
2				M	
3					H

ZGDB6120: EVOLUTIONARY BIOLOGY LAB (2 CREDITS; 30 HRS: 0-0-2)

Course Outcomes

CO1: To explain the details about fossils from different models. (Understanding).
CO2: To demonstrate the concept of homology and analogy and Hardy Weinberg Law. (Understading)
CO3: To demonstrate the role of various phenomenon of evolution. (Understading)
CO4: To create graphical representation of data various physiological data. (Creating)
CO5: To understand the concept of pohylogenetic tree and construct it. (Understanding and creating)

SYLLABUS

1. Study of fossils from models/ pictures
2. Study of homology and analogy from suitable specimens
3. Study and verification of Hardy-Weinberg Law by chi square analysis
4. Demonstration of role of natural selection and genetic drift in changing allele frequencies using simulation studies
5. Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to their age and sex.
6. Construction of phylogenetic trees with the help of bioinformatics tools (Clustal X, Phylip, NJ) and its interpretation.

Mapping of COs to Syllabus

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

ZGIM6121: IMMUNOLOGY LAB (2 CREDITS; 30 HRS; 0-0-2)

Course Outcomes

CO1: To describe the structure and function of the lymphoid organ, spleen, thymus, lymph node. (Understand)
CO2: To prepare blood film for various blood cell studies. (Creating)
CO3: Develop various methods for blood group determination. (Creating)
CO4: Demonstration of cell viability test. (Creating)
CO5: 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

	1	2	3	4	5	6	7
1	M	M					
2			H				
3					H		
4						H	
5				H			H

ZGPA6122: PARASITOLOGY LAB (2 CREDITS; 30 HRS; 0-0-2)

Course Outcomes

CO1: To demonstrate the life cycle of various invertebrate species. (Understanding)
CO2: To demonstrate various types of gills from marine and fresh water fish. (Creating)
CO3: To demonstrate the structure of nematode from intestine of poultry bird. (creating)

Syllabus

1. Study of life stages of *Entamoebahistolytica, Giardia intestinalis, Trypanosoma gambiense, Leishmania donovani* and *Plasmodium vivax* through permanent slides/micro photographs
2. Study of adult and life stages of *Fasciolopsis buski, Schistosoma haematobium, Taenia solium* and *Hymenolepis nana* through permanent slides/micro photographs
3. Study of adult and life stages of *Ascaris lumbricoides, Ancylostoma duodenale, Wuchereria bancrofti* and *Trichinella spiralis* through permanent slides/micro photographs
4. Study of plant parasitic root knot nematode, Meloidogyne from the soil sample
5. Study of *Pediculus humanus* (Head louse and Body louse), *Xenopsyll acheopis* and *Cimex lectularius* through permanent slides/ photographs
6. Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry]
7. Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a byproduct]

   Submission of a brief report on parasitic vertebrates

Mapping of COs to Syllabus

	1	2	3	4	5	6	7
1	M	M	M	M	M		
2						H	
3							H

ZGFF6123: FISH AND FISHERIES LAB (2 CREDITA; 30 HRS; 0-0-2)

Course Outcomes

CO1: To describe the morphological characters of fishes. (Understanding)
CO2: To demonstrate different fish species and fishing gears. (Understanding)
CO3: To demonstrate different types of scales. (Understanding)
CO4: To analyze the water quality by using various parameters. (Analyzing)
CO5: To demonstrate mechanism of breeding and breeding organ of fishes. (Understanding).
CO6: To describe the concept of induced breeding and parental care in fishes. (Understanding)
CO7: To prepare a report of any fish farm or rearing unit. (Creating)

Syllabus

1. Morphometric and meristic characters of fishes
2. Study of Petromyzon, Myxine, Pristis, Chimaera, Exocoetus, Hippocampus, Gambusia, Labeo, Heteropneustes, Anabas
3. Study of different types of scales (through permanent slides/ photographs).
4. Study of crafts and gears used in Fisheries
5. Water quality criteria for Aquaculture: Assessment of pH, conductivity, Total solids, Total dissolved solids
6. Study of air breathing organs in Channa, Heteropneustes, Anabas and Clarias
7. Demonstration of induced breeding in Fishes (video)
8. Demonstration of parental care in fishes (video)
9. Project Report on a visit to any fish farm/ pisciculture unit/Zebrafish rearing Lab.

Mapping of COs to Syllabus

	1	2	3	4	5	6	7	8	9
1	M								
2		M		M					
3			M						
4					M				
5						M			
6							M	M	
7									H

ZGBI6124 BIOLOGY OF INSECTA LAB (2 CREDITS; 30 HRS; 0-0-2)

Course Outcomes

CO1: To demonstrate on specimen from each order. (Understanding)
CO2: To demonstrate various morphological characteristics of insects. (Understanding)
CO3: Explain various taxonomic techniques. (Understanding)
CO4: Explaining different types of pest. (Applying)
CO5: Prepare a report on beneficial effect of insects. (Creating)

Syllabus

1. Study of one specimen from each insect order
2. Study of different kinds of antennae, legs and mouth parts of insects
3. Study of head and sclerites of any one insect
4. Study of insect wings and their venation.
5. Study of insect spiracles
6. Methodology of collection, preservation and identification of insects.
7. Morphological studies of various castes of Apis, Camponotus and Odontotermes
8. Study of any three insect pests and their damages
9. Study of any three beneficial insects and their products Field study of insects and submission of a project report on the insect diversity

Mapping of COs to Syllabus

	1	2	3	4	5	6	7	8	9
1	M								
2		M	M	M	M		M		

3						3			
4								M	
5									H

FOUNDATIONS OF SERVICE LEARNING PRACTICAL (2 CREDITS)(L-T-P: 0-0-2)

Course Outcomes

CO1: Demonstrate waste management practices. (Applying)
CO2: Demonstrate proper health and hygiene practices. (Applying)
CO3: 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

	1	2	3	4
CO 1	H	H		
CO 2			H	H
CO 3	L	M	L	L

DEPARTMENT OF BOTANY

PROGRAM OUTCOMES- BSC PROGRAMME

PO1.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.

PO2.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.

PO3.Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4.Effective Citizenship: Demonstrate empathetic social concern and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

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: Understand the issues of environmental contexts and sustainable development.

PO7.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)-BSc Botany (Honours)

PSO1. Understand the principles of identification and classification of various plants groups and microbes according to their morphology, anatomy and reproductive biology

PSO2. Understand the fundamental principles of life processes, biomolecules and genetic make-up

PSO3. Assessment of biodiversity, identification of the core threats to biodiversity and development of conservation strategies

PSO4. Familiarization with various classical and advanced laboratory techniques in plant biology

Courses offered in BSC BOTANY (HONOURS)

1.1 Algae and Microbiology
1.2 Algae and Microbiology Lab
1.3 Biomolecules and Cell Biology
1.4 Biomolecules and Cell Biology Lab
1.5 Biodiversity (Microbes, Algae, Fungi and Archegoniate) (GE1)
1.6 Biodiversity (Microbes, Algae, Fungi and Archegoniate) Lab (GE)
1.7 Plant Anatomy and Embryology (GE2)
1.8 Plant Anatomy and Embryology Lab (GE)
1.9 Service learning on ethno botanical practices
2.1 Mycology and Phytopathology
2.2 Mycology and Phytopathology Lab
2.3 Archegoniate
2.4 Archegoniate Lab
2.5 Plant Ecology and Taxonomy (GE)
2.6 Plant Ecology and Taxonomy Lab (GE)
3.1 Morphology and Anatomy
3.2 Morphology and Anatomy Lab
3.3 Economic Botany
3.4 Economic Botany Lab
3.5 Genetics
3.6 Genetics Lab
3.7 Plant Physiology and Metabolism (GE1)
3.8 Plant Physiology and Metabolism Lab
3.9 Environmental Biotechnology (GE2)
3.10 Environmental Biotechnology Lab

3.11 Ethno botany (Skill development 1)
3.12 Intellectual Property Rights (Skill development 2)
4.1 Molecular Biology
4.2 Molecular Biology Lab
4.3 Plant Ecology and Phytogeography
4.4 Plant Ecology and Phytogeography Lab
4.5 Plant Systematics
4.6 Plant Systematics Lab
4.7 Biofertilizers (Skill development 1)
4.8 Medicinal Botany (Skill development 2)
4.9 Economic Botany and Biotechnology (GE)
4.10 Economic Botany and Biotechnology Lab (GE)
5.1 Reproductive Biology of Angiosperms
5.2 Reproductive Biology of Angiosperms Lab
5.3 Plant Physiology
5.4 Plant Physiology Lab
5.5 Analytical Techniques in Plant Science (DSE1)
5.6 Analytical Techniques in Plant Science Lab
5.7 Biostatistics (DSE2)
5.8 Biostatistics Lab
6.1 Plant Metabolism
6.2 Plant Metabolism Lab
6.3 Plant Biotechnology
6.4 Plant Biotechnology Lab
6.5 Industrial and Environmental Microbiology (DSE1)
6.6 Industrial and Environmental Microbiology Lab
6.7 Bioinformatics (DSE2)
6.8 Bioinformatics Lab

Mapping of COs to PO/PSO

SN	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
1.1	L	M	L	L	L	L	H	H	L		M
1.2	M	L	L	L	L	L	H	M			M
1.3	H								H		
1.4	H								H		M
1.5	M			L		M	H	H	L		
1.6	M	L		L	L	M	H	H			H
1.7	L	L		L			H	H			
1.8	M	L					H	H	H		
1.9	H	H	H	H	M		H	L		H	
2.1	L	M	L	L	L	L	H	M	L		L
2.2	M			L	L	L	H	M			M
2.3	M	M	H	H	M	H	M	H	L		
2.4		L		L	M		H	H			H
2.5	L	L	L	M		H	H			M	L
2.6	M	L	L	M		H	L			M	H
3.1	M		L				L	H			
3.2	M							H			L
3.3	M			M		M	H	M		L	
3.4	M	L	L	M		M	H	M		L	L
3.5	H		M		M		H		H		M
3.6	M				M		H		H		H

3.7	M	L		L	L	L	H	H	M		L
3.8	M	L	L	L	L	L	H	L	M		M
3.9	M			H	H	H	M			M	L
3.10	M				M	M				M	M
3.11	M		H	H	H			M		M	
3.12	H	H	M		H		H			L	
4.1	H				L				M		H
4.2	H				L				M		H
4.3	M		L	L	M	H	M	L	L	H	L
4.4	M							L		H	H
4.5			M	M	L	H	M	H			
4.6	H				M	H	M	H			H
4.7			M	M		H	M	H			M
4.8		H	H	L	M	L	M			H	
4.9	L	L	L	M	L	M	H	M		L	
4.10	M	L	L	L		M	H	M		L	L
5.1	M		L				M	H	L		M
5.2	M							L			M
5.3	M					L			H		M
5.4	M					L			H		M
5.5	H		M		M		H		L		H
5.6	H				L		H		M		H
5.7	M	L			L		H			L	L
5.8	M	L			L		H			L	L
6.1	M				M		H		H		
6.2	M				L		H		H		H
6.3	H				H	M				H	H
6.4	H				H	M				H	H
6.5	M	L	L	M	L	H	M	L		L	L
6.6	M	L	L	M	M	H	M	L		H	M
6.7	L	L			L		H		L		
6.8	M				L		H		L		

PROGRAM OUTCOMES (POs)- MSC BOTANY

PO1. Reasoning and Reflective Thinking: Will enable in identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at the concepts and decisions from different perspectives

PO2. Productive Communication: Communication skills through effectual presentations and interactive sessions in the class.

PO3. Community based Interactivity: Knowledge of the community and health issues that plague the modern society, contributing in their own little ways, showing empathy and spreading awareness.

PO4. Effective Volunteering: Demonstrate empathetic social concern and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Morality: Recognize different value systems including our own, understand the moral dimensions of our decisions, and accept responsibilities for them.

PO6. Ecological Feasibility: Understand the issues of environmental contexts and sustainable development.

PO7. Independent and Long-Lasting Education: Interest in reading quality books so as to engage in a life-long learning process, helping all along the way, beginning with home and reaching society.

PO8. Skill Development: Develop expertise needed for teaching and research, problem-solving skills to help generate confidence for a more functional life.

PO9. Entrepreneurship: Prepare for entrepreneurship, self-employability and setting up of start-ups.

PO10. Creative Thinking: Propagation of creative technologies and novel ideas in biological science for betterment of the society.

PROGRAMME SPECIFIC OUTCOMES (PSOs)-MSC BOTANY

PSO1. Differentiate plant groups and microbes according to their morphology, anatomy and genetics

PSO2. Understand the advanced concept of plant taxonomy, physiology, biochemistry, molecular biology and ecology of plants and microbes

PSO3. Learn practical techniques for insightful study of plant cell structure, reproduction, anatomy, breeding procedures for hybridization. Maintain a high level of scientific excellence in botanical research with specific emphasis on the role of plants.

PSO4. Adapt scientific methods in plant research and create entrepreneurships. Prepare students for competitive exams.

Courses offered in MSC BOTANY

3.1 Mycology and Phycology
3.2 Bryophytes, Pteridophytes and Gymnosperms
3.3 Angiosperms
3.4 Phycology & Mycology Lab
3.5 Bryophytes, Pteridophytes, Gymnosperms & Angiosperms Lab
4.1 Cell and Molecular Biology
4.2 Plant Physiology and Biochemistry
4.3 Plant Microbiology and Plant Pathology
4.4 Cell and Molecular Biology, Plant Physiology and Biochemistry Lab
4.5 Plant Microbiology and Plant Pathology Lab
5.1 Cytogenetic and Plant Breeding
5.2 Plant Ecology and Phytogeography
5.3 Biochemicals, Molecular Techniques and Bioinformatics
5.4 Plant Cell and Tissue Culture
5.5 Cytogenetics, Molecular Techniques and Tissue Culture Lab
5.6 Plant Ecology Lab
6.1 Environmental Management, Research Methodology and Biostatistics
6.2 Departmental Elective/Specialization Paper 1
6.3 Departmental Elective/Specialization Paper 2

SN	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
3.1	H	M	-	M	L	H	H	H	M	H	H	H	M	M
3.2	H	-	M	-	L	H	H	M	-	M	H	M	M	H
3.3	H	M	-	-	M	H	H	M	M	H	M	H	M	M
3.4	H	H	-	-	M	H	H	H	M	M	M	M	H	M
3.5	H	H	-	-	-	H	H	H	M	M	M	M	H	M
4.1	H	-	L	-	H	M	H	H	M	H	-	M	L	H
4.2	H	-	-	-	M	L	H	L	L	M	-	H	L	M
4.3	H	M	-	-	M	H	H	M	M	H	M	H	M	H
4.4	H	L	L	-	M	L	H	M	-	H	-	H	M	M
4.5	H	M	-	-	M	H	H	M	M	H	M	H	M	H
5.1	M	-	-	-	-	-	H	-	-	H	H	-	H	M
5.2	H	-	M	H	M	H	M	M	M	H	-	H	H	M
5.3	H	M	-	-	M	-	M	H	-	M	-	H	H	H
5.4	H	M	L	L	H	M	H	H	H	H	-	-	H	H
5.5	H	-	-	-	-	-	M	H	-	H	H	H	H	M
5.6	H	M	L	M	L	H	L	H	M	M	-	M	-	H
6.1	M	L	M	L	M	H	L	H	H	L	-	H	H	-
6.2	H	M	H	M	H	M	H	H	M	H	-	H	M	H
6.3	H	M	H	M	H	M	H	H	M	H	-	H	M	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:

CO1: Understand general characteristics, classification and economic importance of fungi and algae (Remembering)

CO2: Able to compare the vegetative and reproduction structures among groups of fungi and algae (Understanding)

CO3: Able to tell the importance of algae in environment and agriculture (Evaluating)

CO4: 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 as bio-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 as Bioindicator, Willey Blackwell.
11. Dutta, T.C. and Dutta, A. C. A Class-Book of Botany. Oxford University Press

Mapping of COs to Syllabus

COs	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:

- **CO1:** Summarize the general characteristics, morphological and reproductive diversity among different groups of Bryophytes (Understanding)
- **CO2:** Compare the general characteristics, morphological and reproductive diversity among different groups of Pteridophytes (Understanding)
- **CO3:** Interpret the general characteristics, morphological and reproductive diversity among different groups of Gymnosperms (Understanding)
- **CO4:** Identify the different economic importance of the Bryophytes, Pteridophytes and Gymnosperms (Applying)
- **CO5:** 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), Moulik Library.
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

COs	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:

- **CO1:** Understand the concepts of plant identification, classification, nomenclature (Understanding)
- **CO2:** Understand the general morphology and distinguishing characteristics of different angiosperm families (Understanding)
- **CO3:** Identification of dicotyledons and monocotyledons plants with reference to specific key characters (Applying)
- **CO4:** Understand the internal organization of the tissue and cell structure of both vegetative and floral parts of angiosperm plants (Understanding)
- **CO5:** Understand the development of gametophytes, fertilization, endosperm, embryo, apomixis and parthenocarpy in angiospermic families (Understanding)
- **CO6:** 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'sSystem (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, 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 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, New Delhi.
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 Publising Co., New Delhi.
13. Bhojwani, S.S., Bhatnagar, S.P. and Dantu, P.K. The Embryology Angiosperms, Vikas Publishing

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					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:

- **CO1:** Memorize the key concepts of cell and its structural organization (Remembering)
- **CO2:** Analyse the process of DNA replication and compare various repair mechanism (Analysing)
- **CO3:** Gain better understanding of gene cloning and DNA libraries (Understanding)
- **CO4:** 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

COs	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:

- **CO1:** Highlights the mechanism of water and mineral transport in plants (Understanding)
- **CO2:** Apprises students of photosynthesis and transpiration and its importance (Understanding)
- **CO3:** The course will be help students analyze how abiotic stress affects the physiological response, photophysiology induced responses and role of photoperiodism in flowering process (Analysing)
- **CO4:** Explain the concepts of energetics, enzyme kinetics and biomolecules metabolisms (Understanding)
- **CO5:** Analyze the various biochemical reactions and processes undergoing in plants (Analyzing)

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, physiological effects 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, Kluwer Academic Publisher, Dordrecht, The Netherlands.
2. Nelson DL. and Cox MM. Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, USA.
3. Jordan BR. The Molecular Biology and Biotechnology of Flowering, 2nd Edition, CAB International, 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

COs	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:

- **CO1:** Classify various microorganisms and their reproduction and isolation methods (Understanding)
- **CO2:** Analyze the roles of microorganisms in environment (Analyzing)
- **CO3:** Identify and detect microbial plant diseases and decide control strategies (Applying)
- **CO4:** 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 and classification, 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 Publishing Company Ltd.
5. Singh RP. Plant Pathology, 2nd Edition, Kalyani Publishers.
6. Mehrotra RS, Aggarwal A. Fundamentals of Plant Pathology, Tata McGraw-Hill Publishing Company 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

COs	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

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:

- **CO1:** Infer eukaryotic genome organization structure of nucleosome, its assembly and deassembly (Understanding)
- **CO2:** Summarize the cytogenetics of haploids and their uses in plant breeding (Understanding)
- **CO3:** Compare euploids with aneuploids and explain chromosomal banding patterns (Understanding)
- **CO4:** Illustrate the role of plant breeding and transgenic research in crop improvement (Understanding)
- **CO5:** Outline the various methods of gene transfer (Understanding)
- **CO6:** 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 –From Genes 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 and Barlett publishers.
5. Lewin B. Genes IX, Jones and Barlett Publishers.
6. Strickberger MW. Genetics, 3rd Edition, Pearson (Prentice Hall).

Mapping of COs to Syllabus

COs	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

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:

- **CO1:** Understand the concepts and scope of ecology (Remembering).
- **CO2:** Understand about the fundamental structural and functional aspect of ecosystem (Understanding)
- **CO3:** Analyze the characteristic feature of plant population, dynamics and interrelationships (Analysis)
- **CO4:** Understand the concept of community, concept of climax, ecological succession (Understanding).
- **CO5:** Understanding the concept of ecological stability and perturbations (Understanding)
- **CO6:** Acquire detail knowledge on plant diversity, its status and threats, strategies for conservation (Remembering)
- **CO7:** 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-geographic regions 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. 5th edition.
3. Singh JS, Singh SP, Gupta S. Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
4. Wilkinson DM. Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University 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

COs	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**

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:

- **CO1:** Interpret different molecular biology techniques (Understanding)
- **CO2:** Compare various blotting techniques, summarize spectrometry and spectroscopy (Understanding)
- **CO3:** Interpret RNAi (Understanding)
- **CO4:** Demonstrate various chromatographic and microscopic techniques (Understanding)
- **CO5:** Utilize the knowledge on bioinformatics to use various biological databases and software (Applying)

Module 1: 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 2: 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 3: Basic principle of Gene silencing (5 Hours)
Gene silencing: RNA interference (RNAi)

Module 4: Chromatographic techniques (10 Hours)
Chromatography: Gel filtration, ion exchange & affinity chromatography, paper chromatography,TLC, HPLC, GC- basic concept

Module 5: Microscopic techniques (10 Hours)
Resolving powers of different microscopes, Microscopy: Phase contrast, confocal, fluorescence, scanning & transmission electron microscopy

Module 6: 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

COs	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H					
CO2		H				
CO3			H			
CO4				H	H	
CO5						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:

- **CO1:** Acquire the concepts of Environmental Management and Environmental Impact assessment (Understanding)
- **CO2:** Understand the salient features of EIA and safety norms (Understanding)
- **CO3:** Identify and argue the complex issues inherent in selecting a research problem, selecting an appropriate research design and implementing a research project (Applying)
- **CO4:** Understand the principal concepts in biostatistics (Understanding)
- **CO5:** 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 Analysisand 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, Sultan Chand & 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, New Delhi

Mapping of COs to Syllabus

COs	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 PAPER: 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:

- **CO1:** Grasp the insight of plant biotechnology (Remembering)
- **CO2:** Comprehend the underlying concept of tissue culture (Understanding)
- **CO3:** Learn and analyse the importance of genetic engineering in crop improvement (Analysing)
- **CO4:** 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 methods of 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, ecological aspects 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

COs	Module I	Module II	Module III	Module IV	Module V	Module VII
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:

CO1: Apply the concept of plant biotechnology into practice (Applying)
CO2: Work out the significance of tissue culture technique (Understanding)
CO3: Learn and analyze the importance of molecular techniques in up-scaling crop improvement (Understanding)
CO4: 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 for production 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

COs	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 PAPER: PLANT GENETICS

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:

CO1: Summarize the concepts of cell division and cell cycle (Understanding)
CO2: Interpret classical genetics (Understanding)

CO3: Illustrate the role of plant breeding in crop improvement (Understanding)
CO4: Outline the various techniques of plant genetic engineering (Understanding)
CO5: 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 of cell 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 Biology of 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, Oxford University Press
9. Gupta PK. Molecular Biology and Genetic Engineering, Rastogi Publications

Mapping of COs to Syllabus

COs	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:

CO1: Interpret the fundamental processes in biology (Understanding)
CO2: Summarize the concepts of gene silencing (Understanding)
CO3: Comprehend the notions of genome editing (Understanding)
CO4: Utilize the knowledge on bioinformatics to run various biological databases and soft-wares (Applying)

Module 1: Understanding the fundamental processes (20 Hours)
DNA replication, repair and recombination, RNA and protein syntheses and their processing, regulation of gene expression

Module 2: Gene silencing: Its concepts (10 Hours)
Transcriptional and post transcriptional gene silencing, RNAi: History, mechanism, enzymes involved; role of RNAi in crop improvement

Module 3: 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 4: 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 the Gene, 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 Laboratory Press, 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

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

SPECIALIZATION PAPER: PLANT MICROBIOLOGY

BOMG0036: MICROBIAL PHYSIOLOGY AND GENETICS

(4 Credits-60 Hours) (L-T-P: 4-0-0)

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

- **CO1:** Tell the chemistry and functions of microbial cells and organelles (Understanding)
- **CO2:** Understand and analyze various metabolic pathways of microbes (Analyzing)
- **CO3:** Understand the gene regulatory mechanisms and pathways and their functions (Understanding)
- **CO4:** Apply the concepts of vector and cloning mechanisms in plant improvement (Applying)

Module I: Microbial Cells and organelles (10 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 physiology (15 Hours)
Pathways of pyruvate generation from sugars (EMP, Gluconeogenesis, HMP, ED, PK); Aerobic respiration (Kreb's cycle, ETC (oxidative phosphorylation) in bacteria); Anaerobic respiration (reduction of nitrate and sulphate); Nitrifying bacteria, sulphur bacteria, iron bacteria and hydrogen bacteria; Fermentation pathways (outline of pathway and significance of lactic acid fermentation, ethanol fermentation, mixed acid fermentation, butanediol fermentation), Lipid and protein metabolism; photosynthesis in purple and green bacteria

Module III: Microbial Genetics (15 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

Module IV: Microbial stress biology and response (10 Hours)
Concept of stress in microorganism, response against stress; types of stress, stress mediated modification in metabolism, oxidative stress and redox metabolism, ROS and free radical production during stress, heat shock regulon, SOS regulon and Cps regulon

Module V: Microbial vectors in genetic Engineering (10 Hours)
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)

Suggested Readings

1. Brock T.D. and Madigan M., Biology of Microorganisms, Prentice Hall of India Pvt. Ltd.
2. Moat A.G. and Foster S.W., Microbial Physiology, John Wiley and Sons, New York.
3. Nelson David L. and Cox Michael M., Lehninger Principles of Biochemistry, Macmillan Press/Worth Publishers, New Delhi.
4. Pelczar M.J., Chan E.C.S. and Krieg N.R., Microbiology, Mc Graw Hill Company, New York.
5. Prescott Lansing M., Harley John P. and Klein Donald A., Microbiology, WCB McGraw Hill, New York.
6. Stainer R.Y., Ingraham J.L., General Microbiology, Prentice Hall of India Pvt. Ltd., New Delhi.
7. Watson James D., Recombinant DNA, Scientific American Books, New York.
8. Albert G. Moat and John W. Foster, Microbial Physisology, Wiley-Liss, A John Wiley& Sons, Inc. Publications.
9. Roberts, K., Lewis J., Alberts B., Walter P., Johnson A., and Raff. M., Molecular Biology of the Cell, 5th Edition, Garland Publishing Inc., 2008.
10. Lodish, H., Berk A., Kaiser C. A., Krieger M., Scott M.P., Bretscher A., Ploegh H., and Matsudaira P., Molecular Cell Biology, 6th Edition, Freeman, W. H. and Co., 2008

Mapping of COs to Syllabus

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

BOAM0037: 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:

- **CO1:** Understand the roles of microbes in industries and environment (Understanding)
- **CO2:** Detect and identify microorganisms from any samples (Evaluating)
- **CO3:** Use microbes in agriculture, industries and environmental protection (Applying)
- **CO4:** Develop diagnostic protocols for microbial diseases (Creating)

Module I: Microbes Preservation techniques (6 Hours)
Importance of preservation of microbes, types of preservation techniques, revival of microbes

Module II: Fermentation technology and microorganisms (15 Hours)
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 III: Environmental microbiology (15 Hours)
Microbes as tools for pollution abatement, bio-indicators, restoration of degraded ecosystem, biodegradation, bioremediation,

biogenic gases; microbes as causal agents of diseases; basic concepts of immunology, vaccines, immunotherapy, microbes in biological warfare

Module IV: Microorganisms and agriculture (8 Hours)
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 dairy industries (10 Hours)
Microbes in food and dairy industries: mushroom, fermented foods, microbial spoilage of food and dairy products

Module VI: Microorganisms and pharmaceutical industries (6 Hours)
Gene manipulation for production microbial toxin, types, biochemical and molecular basis of toxin production, mode of action, production of novel commercial products such as biopolymer and antibiotics

Suggested Reading

1. Willey JM, Sherwood L, Woolverton CJ (2013) Prescott's Microbiology, 9th edition, McGraw-Hill, New York.
2. Pelczar M.J., Chan E.C.S. and Krieg N.R. (2003) Microbiology. 5th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Waites MJ, Morgan NL, Rockey JS, Higton G. Industrial Microbiology: An Introduction, Wiley-Blackwell

Mapping of COs to Syllabus

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

SPECIALIZATION PAPER: 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:

- **CO1:** Understand the concepts of plant identification, classification, nomenclature and biosystematics (Understanding)
- **CO2:** Identification of plant with the help of keys and their relevant literatures(Applying)
- **CO3:** Comparison of classical plant taxonomy with modern experimental plant taxonomy (Analyzing)
- **CO4:** Summarize taxonomic hierarchy and principles and rules of botanical Nomenclature (Understanding)
- **CO5:** Application of numerical taxonomy and phylogenetic systematicin 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 and Character 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: Methodology of Cluster Analysis, Applications. Homology and Homoplasy; Monophyly, Paraphyly and Polyphyly; Primitive and Advanced; Phylogenomic

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 Institute TERI.
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, Vikas Publishing.
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

COs	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:

- **CO1:** Understand the nature of plant products, aspects and classification of economic important plants (Understanding)
- **CO2:** Taxonomic status of food plants, industrial plants and drug plants and its uses (Understanding)
- **CO3:** Understand the cultivation, extraction processes and uses of different economically useful plants (Understanding)
- **CO4:** Understand the need to conserve floristic and cultural diversity of the region (Understanding)
- **CO5:** 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 with special 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, Coffee processing 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*, *Saracaasoca*, *Rauwolfia serpentina*, *Mentha piperita*, *Aloe vera*, *Eclipta alba*, *Azadirachta indica*, *Centellaasiatica* 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, Dehra Dun.
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

COs	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 PAPER: 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:

- **CO1:** Understand about the fundamental characteristic, structural and functional aspect of ecosystem (Understanding)
- **CO2:** Understand environmental pollution its cause, effects and control (Understanding)
- **CO3:** Understand the scenario and mechanism of climate change and also various mitigation initiatives undertaken (Understanding)
- **CO4:** 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 of atmosphere; Air pollution: classification and major air pollutants, sources and effect of air pollution; 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. 8th edition
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, Cambridge University 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

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

BORE0041: RESTORATION ECOLOGY

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

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

- **CO1:** Understand the ecological perspectives of restoration including factors that regulate ecosystem function (Understanding)
- **CO2:** Understand the ecological theories that have molded restoration ecology (Understanding)
- **CO3:** Relate restoration practices and efforts to different ecological levels (Applying)
- **CO4:** Explores into the planning, execution, monitoring, and assessment of restoration work (Analysing)
- **CO5:** 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. United Kingdom: Wiley.

Mapping of COs to Syllabus

COs	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

BOAM0101: ALGAE AND MICROBIOLOGY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course outcomes

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

CO1: Understand different microorganisms and their importance (Understanding)
CO2: Able to identify and characterize microorganisms (Applying)
CO3: To assess the importance of microbial activities in food industry and therapeutics (Analyzing)
CO4: Able to identify beneficial and harmful microbes (Evaluating)

Module I: Introduction to Microbial World (7 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: Viruses (7 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, ascausal organisms of plant diseases

Module III: Bacteria (7 Hours)

Bacteria Discovery, general characteristics; Types-archaebacteria, 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 (fermentationand medicine)

Module IV: Algae (11 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 V: Cyanophyta and Xanthophyta (8 Hours)

Cyanophyta and Xanthophyta Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of *Nostoc* and *Vaucheria*

Module VI: Chlorophyta and Charophyta (8 Hours)

Chlorophyta and Charophyta General Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Chlamydomonas*, *Volvox,Oedogonium*, *Coleochaete*, *Chara*; Evolutionary significance of *Prochloron*

Module VII: Phaeophyta and Rhodophyta (12 Hours)

Phaeophyta and Rhodophyta Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Ectocarpus*, *Fucus* and *Polysiphonia*

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.
2. 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. ll
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	Module V	Module VI	Module VII
CO1	M	H	H	H	L		
CO2	L	M	M	M	H	H	H
CO3	M			H		L	
CO4	L	L	L	L	H	M	M

BOBC0102: BIOMOLECULES AND CELL BIOLOGY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course outcomes

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

- **CO1:** To recall the properties and economic importance of enzymes (Remembering)
- **CO2:** To memorize the general characteristics of carbohydrates, proteins, nucleic acids and lipids and how they are imported/exported to various organelles (Remembering)
- **CO3:** To acquire comprehensive knowledge on the general structure of proteins (Understanding)
- **CO4:** To interpret the basics of mode of actions of enzymes (Understanding)
- **CO5:** 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 (4 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 (6 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 (4 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 (16 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 (6 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		L	H		L		
CO2	H			L		M	L
CO3	H					L	
CO4			H				
CO5		H		H	H		H

BOMP0103: MYCOLOGY AND PHYTOPATHOLOGY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

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

CO1: Able to tell and name different fungi, allied fungi and lichens and their classification process/criteria (Remembering)
CO2: Able to explain fungal cell organization; illustrate their reproduction mechanisms (Understanding)
CO3: Make use of the knowledge gained to solve important fungal and other related diseases in plants (Applying)
CO4: Determine the application of fungi in food industries, pharmaceuticalpreparations and agriculture (Evaluating)

Module I: Introduction to True Fungi (6 Hours)

General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification

Module II: Chytridiomycota and Zygomycota (5 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; Life cycle, Heterokaryosis and Para sexuality; Life cycle and classification with reference to *Saccharomyces*, *Aspergillus*, *Penicillium*, *Alternaria*, *Neurospora* and *Peziza*

Module IV: Basidiomycota (8 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 (3 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 (4 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

Module VIII: Applied Mycology (10 Hours)

Role of fungi in biotechnology; Application of fungi in food industry (Flavour& texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology

Module IX: Phytopathology (10 Hours)

Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine. Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing; Fungal diseases – Early blight of potato, Black stem rust of wheat, White rust of crucifers

Suggested Readings:

1. Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
3. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.

4. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
5. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX
CO1	L	M	H	H	H	H	L	M	
CO2	M	H	H	H	H	H	L	M	
CO3	L	L	L	L	L	L	L	M	H
CO4			M	H			M	H	L

BOAR0104: ARCHEGONIATE (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course outcomes

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

CO1: Recall the unique features of archegoniate (Remembering)
CO2: Summarize the different land habits and alternation of generation inarchegoniates (Understanding)
CO3: Classify the different archegoniates and demonstrate their morphology,anatomy and reproduction (Understanding)
CO4: Illustrate the economic importance of bryophytes, pteridophytes andGymnosperms (Understanding)

Module I: Introduction (2 Hours)

Unifying features of archegoniates; Transition to land habit; Alternation of generations

Module II: Bryophytes (18 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 (18Hours)

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 (18 Hours)

General characteristics, classification (up to family), morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum*and *Ephedra*; (Developmental details not to be included) Ecological and economic importance

Module V: Economic Importance (4 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	M	L	L	L	
CO2	H				
CO3		H	H	H	
CO4					H

BOMA0105: MORPHOLOGY AND ANATOMY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

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

- **CO1:** Develop an understanding of concepts and fundamentals of plant anatomy (Understanding)
- **CO2:** Examine the internal anatomy of plant systems and organs (Remembering)
- **CO3:** Comprehend the concepts of organization and development of shoot and root apices (Understanding)
- **CO4:** Examine the structure and role of cambium (Analyzing)
- **CO5:** Studying the various concepts of wood and dendrochronology (Analyzing)
- **CO6:** Evaluate the adaptive and protective systems of plants (Evaluating)
- **CO7:** Evaluate the secretory systems in plants (Evaluating)

Module I Introduction and Scope of Plant anatomy (2 Hours)

Applications in systematics, forensics and pharmacognosy

Module II Tissues (12 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 (18 Hours)

Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structureof 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(17 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

Module X Secretory System (3 Hours)

Hydathodes, cavities, lithocysts and laticifers

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	Module VI
CO1	H					
CO2		H	H	H	M	M
CO3			H			
CO4		L		H		
CO5		M		H		
CO6					H	
CO7		L				H

BOEB0106: ECONOMIC BOTANY (4 CREDIT-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

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

- **CO1:** Tell the concept of origin of crops, crop domestication, evolution of new crops (Remembering)
- **CO2:** Perceive the ideas of different economically useful crops (Understanding)
- **CO3:** Execute the concepts developed in the class in their daily activities (Applying)
- **CO4:** Survey the uses of economically important plants (Analyzing)
- **CO5:** Modify and improve processing methods and techniques for essential oils and other useful crops (Creating)

Module I: Origin of Cultivated Plants (6 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

Module II Cereals (6 Hours)

Wheat and Rice (origin, morphology, processing & uses), brief account of millets

Module III Legumes (4 Hours)

General account, importance to man and ecosystem

Module IV Sugars & Starches (4 Hours)

Morphology and processing of sugarcane, products and by- products of sugarcane industry. Potato – morphology, propagation & uses

Module V: Spices (6 Hours)

Listing of important spices, their family and part used, economic importance with Special reference to fennel, saffron, clove and black pepper

Module VI: Beverages (4 Hours)

Tea, Coffee (morphology, processing & uses)

Module VII: Oils & Fats (8 Hours)

General description, classification, extraction, their uses and health implications groundnut, coconut, linseed and Brassica and Coconut (Botanical name, family & uses)

Module VIII: Essential Oils (4 Hours)

General account, extraction methods, comparison with fatty oils & their uses

Module IX: Natural Rubber (3 Hours)

Para-rubber: tapping, processing and uses

Module X: Drug-yielding plants (4 Hours)

Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Digitalis*, *Papaver* and *Cannabis*

Module XI: Tobacco (4 Hours)

Tobacco (Morphology, processing, uses and health hazards)

Module XII: Timber plants (3 Hours)

General account with special reference to teak and pine

Module XIII: Fibres (4 Hours)

Classification based on the origin of fibres, Cotton and Jute (morphology, extraction and uses)

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	Module XI	Module XII	Module XIII
CO1	H	M	L	L	L	L	L	L	L	L	L	L	L
CO2		H	H	H	H	M	H	H	H	H	H	H	H
CO3		L	M	L	M	H	M	H	M		M		M
CO4	M					L	M	H	M		M		M
CO5		M		M		M	H	M	H				M

BOGE0107: GENETICS (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

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

CO1: Summarize the concepts of Mendelian genetics (Understanding)
CO2: Infer the ideas behind extrachromosomal inheritance, linkage and crossing over (Understanding)
CO3: Explain numerical and structural chromosomal aberrations (Understanding)
CO4: Compare the various genetic mutations and explain DNA repair (Understanding)
CO5: Demonstrate the fine structure of the gene including complementation test (Understanding)
CO6: Rephrase the Hardy Weinberg Law (Understanding)
CO7: Solve numericals based on genetics (Applying)

Module I: Mendelian Genetics and Its Extension (16 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 (12 Hours)

Linkage and crossing over-Cytological basis of crossingover; 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 (8 Hours)

Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy

Module V: Gene Mutations (6 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 (6 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 (6 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	H						
CO2		H	H				
CO3				H			
CO4					H		
CO5						H	
CO6							H
CO7	M		M	L			H

BOET0108: ETHNOBOTANY (2 CREDITS-30 HOURS) (L-T-P: 2-0-0)

Course Outcomes

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

CO1: Demonstrate the concept, scope and objectives of ethnobotany with reference to tribal lifestyle (Understanding)
CO2: Interpret different ethnobotanical methodologies (Understanding)
CO3: Examine the role of various plants in traditional and modern medicine (Analyzing)
CO4: Infer the legal aspects of ethnobotany (Understanding)

Module I: Ethnobotany (6Hours)

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 (6 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 (10 Hours)

Medico-ethno botanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadiractha indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris*f) *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

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. Howrah._8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur-1996_9)

Mapping of COs to Syllabus

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

BOIP0109: INTELLECTUAL PROPERTY RIGHTS (2 CREDITS-30 HOURS) (L-T-P: 2-0-0)

Course Outcomes

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

- **CO1:** Interpret IPR and its philosophy (Understanding)
- **CO2:** Summarize copyrights and related rights and industrial property rights like designs, trademarks, patents and geographical indications (Understanding)
- **CO3:** Infer the importance of protecting traditional knowledge (Understanding)
- **CO4:** Explain the necessity to protect plant varieties (Understanding)
- **CO5:** Summarize the roles of information technology and biotechnology in the field of IPR (Understanding)
- **CO6:** Utilize the concepts of intellectual property rights in safeguarding innovations, products etc in future (Applying)

Module I: Introduction to Intellectual Property Right (IPR) (2 Hours)

Concept and kinds Economic importance IPR in India and world: Genesis and scope, some important examples. IPR and WTO (TRIPS, WIPO)

Module II: Patents and Copyrights (6 Hours)

Objectives, Rights, Patent Act 1970 and its amendments Procedure of obtaining patents, working of patents Infringement, Introduction, Works protected under copyright law, Rights, Transfer of Copyright, and Infringement

Module III: Trademarks and Industrial Designs (5 Hours)

Objectives, Types, Rights, Protection of goodwill, Infringement, Passing off, Defences, Domain name, Objectives, Rights, Assignments, Infringements, Defences of Design Infringement

Module IV: Geographical Indications (3 Hours)

Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position

Module V: Protection of Traditional Knowledge (4 Hours)

Objective, Concept of Traditional Knowledge, Holders, Issues concerning, Bio-Prospecting and Bio-Piracy, Alternative ways, Protectability, need for a Sui-Generis regime, Traditional Knowledge on the International Arena, at WTO, at National level, Traditional Knowledge Digital Library

Module VI: Protection of Plant Varieties (2 Hours)

Plant Varieties Protection-Objectives, Justification, International Position, Plant varieties protection in India Rights of farmers, Breeders and Researchers National gene bank, benefit sharing. Protection of Plant Varieties and Farmers' Rights Act, 2001

Module VII: Intellectual Property Rights: Information Technology & Biotechnology (8 Hours)

Computer Software and Intellectual Property, Database and Data Protection, Protection of Semi-conductor chips, Domain Name Protection, Patenting Biotech Inventions: Objective, Applications, Concept of Novelty, Concept of inventive step, Microorganisms, Moral Issues

Suggested Readings

1. N.S. Gopalakrishnan & T.G. Agitha, (2009) Principles of Intellectual Property Eastern Book Company, Lucknow.
2. Kerly's Law of Trade Marks and Trade Names (14th Edition) Thomson, Sweet &Maxweel.
3. AjitParulekar and Sarita D' Souza, (2006) Indian Patents Law – Legal & Business Implications; Macmillan India Ltd.
4. B.L.Wadehra (2000) Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India.
5. P. Narayanan (2010) Law of Copyright and Industrial Designs; Eastern law House, Delhi.

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H						
CO2		H	H	H			
CO3					H		
CO4						H	
CO5							H
CO6		H	L		L	L	H

BOMB0110: MOLECULAR BIOLOGY (4 CREDITS-60 HOURS) (L-T-P: 3-1-0)

Course Outcomes

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

CO1: Recall the various experiments proving DNA to be the carrier of genetic information (Remembering)
CO2: Perceive of structure of DNA and RNA and also central dogma and genetic code (Understanding)
CO3: Interpret the mechanism of DNA replication, transcription and translation in prokaryotes and eukaryotes (Understanding)
CO4: Summarize gene regulation (Understanding)
CO5: Inspect the concept of the processing and modification of RNA (Analyzing)

Module I: Nucleic acids: Carriers of Genetic Information (4 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 (10 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; Organization of DNA-Prokaryotes, Viruses, Eukaryotes. RNA: Types and Structure, Organelle DNA–mitochondria and chloroplast DNA. The nucleosome, chromatin structure–Euchromatin, Heterochromatin – Constitutive and Facultative heterochromatin

Module III:The Replication of DNA (10 Hours)

Chemistry of DNA synthesis (Kornberg's discovery); General principles– bidirectional, Semiconservative and semi discontinuous replication, RNA priming; various models of DNA replication, including rolling circle, θ (theta) mode of replication, 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: Mechanism of Transcription (8 Hours)

Mechanism of transcription in prokaryotes and eukaryotes, Role of transcription factors

Module VI: Processing and Modification of RNA (8 Hours)

Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I & group II intron splicing, alternative splicing eukaryotic mRNA processing (5' cap, 3' poly A tail); Ribozymes, exon shuffling; RNA editing and mRNA transport

Module VII: Translation (Prokaryotes and eukaryotes) (8 Hours)

Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; post-translational modifications of proteins

Module VIII: Regulation of Transcription in Prokaryotes and Eukaryotes (8 Hours)

Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in *E.coli*. Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing

Suggested Readings

1. 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
2. Snustad, D.P. and Simmons, M.J. (2010) Principles of Genetics, 5th edition John Wiley and Sons Inc., USA
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009) Concepts of Genetics, 9th edition, Benjamin Cummings USA
4. Russell, P. J. (2010) Genetics- a Molecular Approach, 3rd edition, Benjamin Cummings, USA
5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010) Introduction to Genetic Analysis. 10th edition, W. H. Freeman and Co., USA

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	H							
CO2		H		H				
CO3			H		H		H	
CO4								H
CO5						H		

BOPE0111: PLANT ECOLOGY AND PHYTOGEOGRAPHY (4 CREDITS-60 HOURS) (L-T-P: 3-1-0)

Course Outcomes

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

CO1: Recollect the concepts of ecology of individual, population, community and ecosystem (Remembering)

CO2: Perceive the basic knowledge of biotic and abiotic factors of environment their interaction, ecosystem and its functional aspects (Understanding)

CO3: Utilize the concepts of population dynamics and community succession in understanding the composition of a particular area (Applying)

CO4: Inspect the ideas on ecosystem and its functional aspects (Analyzing)

CO5: Check their knowledge on phytogeography (Evaluating)

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 (20 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; Precipitation types (rain, fog, snow, hail, dew); 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 (10 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 (6 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 (12 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	M		M	M	M	
CO2	L	H	H			
CO3				H	H	
CO4			H			
CO5						H

BOPS0112: PLANT SYSTEMATICS (4CREDITS-60 HOURS) (L-T-P: 3-1-0)

Course outcomes

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

CO1: Summarize the concepts of plant identification, classification, nomenclature and biosystematics (Understanding)

CO2: Outline taxonomic identification and hierarchy (Understanding)

CO3: Infer systematics as an interdisciplinary science (Understanding)

CO4: Summarize botanical nomenclature and various systems of classification (Understanding)
CO5: Explain biometrics, numerical taxonomy and cladistics (Understanding)
CO6: Summarize the phylogeny in angiosperms (Understanding)

Module I: Introduction to Plant Systematics (2 Hours)
Plant identification, Classification, Nomenclature; Biosystematics

Module II: Identification (6 Hours)
Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access

Module III: Systematics-An InterdisciplinaryScience (6 Hours)
Evidence from palynology, cytology, phytochemistry and molecular data

Module IV: Taxonomic Hierarchy (6 Hours)
Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary)

Module V: Botanical Nomenclature (10 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 (8 Hours)
Characters; Variations; OTUs, character weighting and coding; cluster analysis; Phenograms, cladograms (definitions and differences)

Module VIII: Phylogeny of Angiosperms (12 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, 3rdedition, 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	H	M	M		M			
CO2		H		H				
CO3			H					
CO4					H	H		
CO5							H	
CO6								H

BOBF0113: BIOFERTILIZERS (2 CREDITS-30 HOURS) (L-T-P: 2-0-0)

Course Outcomes

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

CO1: Recollect their knowledge on the role of microbes in producing biofertilizers (Remembering)

CO2: Perceive the concept of the various components of biological organisms used as biofertilizer (*Azospirillum*, cyanobacteria, VAM (Understanding)
CO3: Use the idea of organic farming in the field (Applying)
CO4: Survey the various ways of generating biofertilizers (Analyzing)

Module I: General Introduction (4 Hours)
General account about the microbes used as biofertilizer – *Rhizobium* – isolation, identification, mass multiplication, and carrier-based inoculants, Actinorrhizal symbiosis

Module II: Azospirillum and Azotobacter as Biofertilizer (8 Hours)
Azospirillum: isolation and mass multiplication – carrier-based inoculant, associative effect of different microorganisms, *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication

Module III: Blue Green Algae (4 Hours)
Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation

Module IV: VAM fungi (8 Hours)
Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants

Module V: Organic Farming (6 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 Application

Suggested Readings
1. Dubey, R.C., A Textbook of Biotechnology S. Chand & Co, New Delhi, 2005
2. Kumaresan, V., Biotechnology, Saras Publications, New Delhi, 2005
3. John Jothi Prakash, E., Outlines of Plant Biotechnology. Emkay-Publication, New Delhi. 2004
4. Sathe, T.V. Vermiculture and Organic Farming. Daya publishers, 2004
5. Subha Rao, N.S., Soil Microbiology, Oxford & IBH Publishers, New Delhi, 2000
6. 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	Module III	Module IV	Module V
CO1	H	M	L		
CO2	M			L	H
CO3			H		H
CO4	H			H	

BOMB0114: MEDICINAL 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: Interpret age-old systems of medicine (Understanding)
CO2: Infer the importance of conserving endangered and endemic medicinal plants (Understanding)
CO3: Make use of traditional and folk medicine for the betterment of the society (Applying)

Module I: General Introduction (10 Hours)
History, Scope and Importance of Medicinal Plants, Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e-tabiya, tumors treatments/ therapy, polyherbal formulations

Module II: Conservation Strategies (10 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

Module III: Ethnobotany (10 Hours)
Ethnobotany and Folk medicines Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany:

National interacts, Palaeo-ethnobotany, Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases

Suggested Readings

1. Trivedi P.C. (2006) Medicinal Plants: Ethnobotanical Approach, Agrobios, India
2. Purohit and Vyas. (2008) Medicinal Plant Cultivation: A Scientific Approach, 2nd edition, Agrobios, India

Mapping of COs to Syllabus

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

BOBV0115: BIODIVERSITY (MICROBES, ALGAE, FUNGI AND ARCHEGONIATE) (4CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course outcomes

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

- **CO1:** Summarize viruses with respect to their types, replication, life-cycle, reproduction and economic importance (Understanding)
- **CO2:** Illustrate the classification, morphology, anatomy and economic importance of algae (Understanding)
- **CO3:** Compare fungi, lichens and mycorrhiza (Understanding)
- **CO4:** Interpret the classification, morphology, anatomy, reproduction and economic importance of archegoniate (Understanding)

Module I: Microbes (10 Hours)

Viruses-Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria-Discovery, General characteristics and cell structure; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance

Module II: Algae (12 Hours)

General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life - cycles of the following: *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Fucus*, *Polysiphonia* Economic importance of algae

Module III: Fungi (12 Hours)

Introduction - General characteristics, ecology and significance, range of thallus organization, cell wall composition , nutrition, reproduction and classification; True Fungi – General characteristics, ecology and significance, life cycle of *Synchytrium* (Chytridiomycota), *Rhizopus* (Zygomycota) *Penicillium*, *Alternaria* (Ascomycota), *Puccinia*, *Agaricus* (Basidiomycota); Symbiotic Associations - Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

Module IV: Introduction to Archegoniate (2 Hours)

Unifying features of archegoniates, Transition to land habit, Alternation of generations

Module V: Bryophytes (10 Hours)

General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia* and *Funaria*(Developmental details not to be included) Ecology and economic importance of bryophytes with special mention of *Sphagnum*

Module VI: Pteridophytes (8 Hours)

General characteristics, classification, Early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum*and *Pteris*(Developmental details not to be included) Heterospory and seed habit, stellar evolution Ecological and economical importance of Pteridophytes

Module VII: Gymnosperms (6 Hours)

General characteristics, classification: Classification (up to family), morphology, anatomy and reproduction of *Cycas* and *Pinus*(Developmental details not to be included) Ecological and economical importance

Suggested Readings

1. Kumar, H.D. (1999). Introductory Phycology, Affiliated East - West, Press Pvt. Ltd. Delhi, 2nd edition

2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India
6. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India
7. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta, Central Book Depot, Allahabad

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H						
CO2		H					
CO3			H				
CO4				H	H	H	H

BOE0117: ENVIRONMENTAL BIOTECHNOLOGY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

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

CO1: Recall the basic knowledge of environment, its policies and how to protect it (Remembering)
CO2: Understand the concept of environmental hazards and how bioremediation helps in cleansing it (Understanding)
CO3: Analyze the basic concept of sustainable development (Analyzing)
CO4: Assess the various ways of microbial treatment to make the environment pollution free (Evaluating)

Module I: Environment (4 Hours)

Environment-basic concepts and issues, global environmental problems - ozone depletion, UV-B, greenhouse effect and acid rain due to anthropogenic activities, their impact and biotechnological approaches for management

Module II: Atmospheric Stratification (6 Hours)

An overview of atmosphere, hydrosphere, lithosphere and astrosphere - environmental problems Environmental pollution - types of pollution, sources of pollution, measurement of pollution, methods of measurement of pollution, fate of pollutants in the environment, Bioconcentration, bio/geomagnification

Module III: Microbial Treatment (8 Hours)

Microbiology of waste water treatment, aerobic process - activated sludge, oxidation ponds, trickling filter, towers, rotating discs, rotating drums, oxidation ditch. Anaerobic process - anaerobic digestion, anaerobic filters, up-flow anaerobic sludge blanket reactors,treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industries

Module IV: Anthropogenic Factors and its Bioremediation (10 Hours)

Xenobiotic compounds - organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants) and inorganic (metals, radionuclides, phosphates, nitrates). Bioremediation of xenobiotics in environment -ecological consideration, decay behaviour and degradative plasmids, molecular techniques in bioremediation

Module V: Biohazardous Substance (6 Hours)

Role of immobilized cells/enzymes in treatment of toxic compound; Biopesticides, bioreactors, bioleaching, biomining, biosensors, biotechniques for air pollution abatement and odour control

Module VI: Sustainable Development (8 Hours)

Sustainable Development: Economics and Environment: Economic growth, Gross National Productivity and the quality of life, Tragedy of Commons, Economics of Pollution control, Cost-benefit and cost effectiveness analysis, WTO and Environment, Corporate Social Responsibility, Environmental awareness and Education; Environmental Ethics

Module VII: Laws and Policies for Environment Protection (12 Hours)

International Legislations, Policies for Environmental Protection: Stockholm Conference (1972) and its declaration, WCED (1983) and Brundtland Report (1987), Rio Earth Summit-UNCED (1992) and its declaration, Montreal Protocol - 1987, Basel Convention (1989), Kyoto Protocol- 1997, Ramsar Convention 1971, National Legislations, Policies for Pollution Management: Salient features of Wild life protection act 1972, Water Pollution (Prevention and Control) Act-1974, Forest conservation act 1980, Air Pollution (Prevention and Control) Act-1981, National Environmental Policy - 2006, Central and State Pollution Control Boards: Constitution and power

Module VIII: Public Participation for Environmental Protection (6 Hours)
Public Participation for Environmental Protection: Environmental movement and people's participation with special references to Gandhamardan, Chilika and Narmada BachaoAndolan, Chipko and Silent valley Movement; Women and Environmental Protection, Role of NGO in bringing environmental awareness and education in the society

Suggested Readings

1. Waste water engineering - treatment, disposal and reuse, Metcalf and Eddy Inc., Tata McGraw Hill, New Delhi.
2. Environmental Chemistry, AK. De, Wiley Eastern Ltd, New Delhi.
3. Introduction to Biodeterioration, D.Allsopp and K.J. Seal, ELBS / Edward Arnold.
4. Bioremidation, Baaker, KH and Herson D.S., 1994. Mc.GrawHill Inc, NewYork.
5. Industrial and Environmental Biotechnology - Nuzhat Ahmed, Fouad M. Qureshi and
6. Obaid Y. Khan, _2006. Horizon Press.
7. Environmental Molecular Biology, Paul. A, Rochelle, 2001.Horizon Press.
8. Environmental Protection and Laws by Jadhav and Bhosale, V.M.Himalaya publ. House 13. Biodiversity Assessment and Conservation by PC Trivedi, Agrobios

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	H						L	H
CO2		H		M	H			
CO3						H		
CO4			H	M				

BOBB0118: ECONOMIC BOTANY AND 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:

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)
CO3: Apply the knowledge of plant tissue culture and DNA technologies in producing disease free plants (Applying)
CO4: Generate ideas and techniques on hybridoma technology and disease diagnosis (Creating)

Module I: Origin of Cultivated Plants (4 Hours)
Concept of centres of origin, their importance with reference to Vavilov's work

Module II: Cereals (4 Hours)
Wheat -Origin, morphology, uses

Module III: Legumes (6 Hours)
General account with special reference to Gram and soybean

Module IV: Spices (6 Hours)
General account with special reference to clove and black pepper (Botanical name, family, part used, morphology and uses).

Module V: Beverages (4 Hours)
Tea (morphology, processing, uses)

Module VI: Oils and Fats (4 Hours)
General description with special reference to groundnut

Module VII: Fibre Yielding Plants (4 Hours)
General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Module VIII: Introduction to biotechnology (2 Hours)

Module IX: Plant Tissue Culture (8 Hours)
Micropropagation; haploid production through androgenesis and gynogenesis; brief account of embryo and endosperm culture with their applications

Module X: Recombinant DNA Techniques (18 Hours)
Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR, Hybridoma and monoclonal antibodies, ELISA and Immunodetection Molecular diagnosis of human disease, Human gene Therapy

Suggested Readings

1. Kochhar, S.L. (2011) Economic Botany in the Tropics, 4th edition, MacMillan Publishers India Ltd., New Delhi
2. Bhojwani, S.S. and Razdan, M.K. (1996) Plant Tissue Culture: Theory and Practice, Elsevier Science Amsterdam, The Netherlands
3. Glick, B.R., Pasternak, J.J. (2003) Molecular Biotechnology- Principles and Applications of recombinant DNA, ASM Press, Washington

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	H	M	M	M	L	L	L			
CO2		M	M	M	M	L	H			
CO3								L	H	H
CO4								L	M	H

BORA0119: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS (4 CREDITS - 60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

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

CO1: Define and tell the basic ideas of anther, ovule, endosperm, and embryoand seed (Remembering)
CO2: Demonstrate and explain concepts of pollen biology, pollination and fertilization, self-incompatibility(Understanding).
CO3: Plan and develop protocols for studying pollination, fertilization and embryogenesis (Applying)
CO4: Categorize and distinguish different reproductive mechanisms in Angiosperm (Analyzing)
CO5: Compare and evaluate methods of pollination and self-incompatibility in plants (Evaluating)
CO6: 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

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 self-incompatibility: 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	M	M	M			M	M
CO2				H	H		
CO3				H	M	H	
CO4		L	L	M	L	L	L
CO5				M	M		
CO6							H

BOPP0120: 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:

CO1: Recall nutrient uptake and translocation in plants (Remembering)
CO2: Explain concepts of plant water relation and mineral nutrition (Understanding)
CO3: Interpret the concepts of photoperiodism, phytochrome and vernalization (Understanding)
CO4: Understand the models for diffusion and translocation studies (Applying)
CO5: Analyze the functions of growth regulators (Analyzing)
CO6: 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 (8 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 (8 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 (8 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 (14 Hours)

Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Abscisic acid, Ethylene, Brassinosteroids and Jasmonic acid, Biosynthetic pathways

Module VI: Physiology of Flowering (6 Hours)

Photoperiodism, flowering stimulus, ABC model and florigen concept, vernalization, seed dormancy

Module VII: Phytochrome (6 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			H	M			
CO2	H	M	L				
CO3						H	H
CO4				H			
CO5					H		
CO6					H		

BOAP0121: ANALYTICAL TECHNIQUES IN PLANT SCIENCES (4 CREDITS: 60 HOURS) (L-T-P: 4-0-0)

Course outcomes

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

CO1: Interpret various microscopic techniques (Understanding)
CO2: Compare the different centrifugation techniques (Understanding)
CO3: Apply radioisotopes and spectrophotometry in biological research (Applying)
CO4: Illustrate the various chromatographic and molecular techniques (Understanding)
CO5: Utilize the knowledge of biostatistics in solving related problems (Applying)

Module I: Imaging and Related Techniques (15 Hours)

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (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

Module II: Cell Fractionation (8 Hours)

Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl2gradient, analytical centrifugation, ultracentrifugation, marker enzymes

Module III: Radioisotopes (4 Hours)

Use in biological research, auto-radiography, pulse chase experiment

Module IV: Spectrophotometry (4 Hours)

Principle and its application in biological research

Module V: Chromatography (8 Hours)

Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography

Module VI: 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 VII: Biostatistics (15 Hours)

Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit

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. Zar, J.H. (2012) Biostatistical Analysis, 4th edition, Pearson Publication, USA

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H						
CO2		H					
CO3			H	H			
CO4					H	H	
CO5							H

BOBS0122: BIOSTATISTICS (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course outcomes

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

CO1: Define basic terminologies in Biostatistics (Remembering)
CO2: Explain the concepts of biostatistics and its use in biology (Understanding)
CO3: Apply the statistics tools for data analysis (Applying)
CO4: Design sampling methods to generate significant data (Creating)

Module I: Introduction (12 Hours)

Biostatistics - definition - statistical methods - basic principles Variables - measurements, functions, limitations and uses of statistics

Module II: Collection of Data (12 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 (14 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 (12 Hours)

Correlation - types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression

Module V: Statistical Inference (10 Hours)

Statistical inference - hypothesis - simple hypothesis - student't' test - chi square test

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

BOPM0123: PLANT METABOLISM (4 CREDITS-60 HOURS)(L-T-P: 4-0-0)

Course outcomes

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

- **CO1:** Interpret the ideas of metabolism (Understanding)
- **CO2:** Summarize photosynthesis and the different pathways involved (Understanding)
- **CO3:** Explain carbohydrate metabolism (Understanding)
- **CO4:** Rephrase respiration and the different pathways involved (Understanding)
- **CO5:** Explain the mechanisms of ATP synthesis and compare oxidative, substrate level and photophosphorylation (Understanding)
- **CO6:** Outline lipid and nitrogen metabolism (Understanding)
- **CO7:** Demonstrate signal transduction (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 (14 Hours)

Historical background, photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centers, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO2 reduction, photorespiration, C4pathways; Crassulacean acid metabolism; Factors affecting CO2 reduction

Module III: Carbohydrate Metabolism (2 Hours)

Synthesis and catabolism of sucrose and starch

Module IV: Carbon Oxidation (10 Hours)

Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration

Module V: ATP Synthesis (8 Hours)

Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase, Boyers conformational model, Racker's experiment, Jagendorf's experiment; role of uncouplers

Module VI: Lipid Metabolism (8 Hours)

Synthesis and breakdown of triglycerides, β-oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation

Module VII: Nitrogen Metabolism (8 Hours)

Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination

Module VIII: Mechanisms of Signal Transduction (4 Hours)

Calcium, phospholipids, cGMP, NO

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	Module VIII
CO1	H	L	L	L		L	L	
CO2		H						
CO3			H					
CO4				H				

CO5					**H**			
CO6						**H**	**H**	
CO7								**H**

BOPB0124: 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:

CO1: Memorize the various concepts of plant tissue culture (Remembering)

CO2: Explain Plant tissue culture & recombinant DNA Technology (Understanding).

CO3: Apply basic knowledge in plant tissue and modern techniques of micropropagation in their future research works (Applying)

CO4: Develop/improve protocols for better transgenic products (Creating)

Module I: Plant Tissue Culture (16 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 (30 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 (14 Hours)

GMOs, Pest resistant (Bt-cotton); herbicide resistant plants (Roundup Ready soybean); Transgenic crops with improved quality traits (FlavrSavr 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 & Sons Inc. USA

Mapping of COs to Syllabus

COs	Module I	Module II	Module III
CO1	**H**		
CO2	**H**	**M**	
CO3	**H**		**M**
CO4			**H**

BORM0125: RESEARCH METHODOLOGY FOR BOTANY

(4 Credits-60 Hours)(L-T-P: 4-0-0)

Course outcomes

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

CO1: Infer the basic idea of research (Understanding)

CO2: Interpret common laboratory calculations, handling of laboratory chemicals and instruments, maintenance of laboratory records and documentation of observations (Understanding)

CO3: Interpret various biological problems (Understanding)

CO4: Demonstrate various plant tissue culture and cytological techniques (Understanding)

CO5: Utilize the concepts of research methodology in presenting research data and writing research articles (Applying)

Module I: Basic concepts of research (10 Hours)

Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs emperical) Research methods vs methodology.Literature-review and its consolidation; Library research; field research; laboratory research

Module II: General laboratory practices (12 Hours)

Common calculations in botany laboratories, understanding the details on the label of reagent bottles molarity and normality of common acids and bases Preparation of solutions, Dilutions, Percentage solutions Molar, molal and normal solutions, technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling

Module III: Data collection and documentation of observations (6 Hours)

Maintaining a laboratory record; Tabulation and generation of graphs imaging of tissues specimens and application of scale bars, the art of field photography

Module IV: Overview of Biological Problems (6 Hours)

History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics- Transcriptional regulatory network

Module V: Methods to study plant cell/tissue structure (6 Hours)

Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections

Module VI: Plant microtechniques (12 Hours)

Staining procedures, classification and chemistry of stains, staining equipment, reactive dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags) Cytogenetic techniques with squashed plant materials

Module VII: The art of scientific writing and its presentation (8 Hours)

Numbers, units, abbreviations and nomenclature used in scientific writing, writing references, powerpoint presentation, Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism

Suggested Readings

1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.
2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
3. Ruzin, S.E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H						
CO2		H	H				
CO3				H			
CO4					H	H	
CO5							H

BOIE0126: INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course outcomes

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

CO1: Tell the basics of bioreactors and fermentation process (Remembering)
CO2: Explain the role of microbes in industry, agriculture and environment (Understanding)
CO3: Select suitable microbes for solving some environmental problems (Applying)
CO4: Compare various fermentation techniques applied in industry (Analyzing)
CO5: Assess and evaluate pollutants in environment (Evaluating)
CO6: Develop methods for fermentation (Creating)

Module I: Scope of Microbes in Industry and Environment (6 Hours)

Module II: Bioreactors/Fermenters and Fermentation Processes (12 Hours)

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, a visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations

Module III: Microbial Production of Industrial Products (12 Hours)

Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin)

Module IV: Microbial Enzymes of Industrial Interest and Enzyme Immobilization (8 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 V: Microbes and Quality of Environment (6 Hours)

Distribution of microbes in air; Isolation of microorganisms from soil, air and water

Module VI: Microbial Flora of Water (8 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 fecal coli form in water samples

Module VII: Microbes in Agriculture and Remediation of Contaminated Soils (8 Hours)

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	Module VI	Module VII
CO1	L	H	H	M			
CO2	L	M	H	H	L	H	H
CO3		L	M	M	L	H	H
CO4	L	M	H	H			
CO5	L			L	H	H	M
CO6	L	H	H	M			

LABORATORY COURSES

BOMP6026: MYCOLOGY AND PHYCOLOGY LAB (3 CREDITS-90 HOURS) (L-T-P: 0-0-3)

Course Outcomes

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

- **CO1:** Learn about the vegetative and reproductive structures of some important classes of fungi and algae (Understanding)
- **CO2:** Acquire knowledge and importance of mycorrhizae and lichens (Understanding)
- **CO3:** Learn the techniques of isolation of fungi and algae (Applying)
- **CO4:** 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

COs	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-90 HOURS) (L-T-P: 0-0-3)

Course Outcomes

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

- **CO1:** Interpret the concepts of classification system and identification of few important bryophytes (Understanding)
- **CO2:** Infer the concepts of classification system and identification of few important pteridophytes (Understanding)
- **CO3:** Summarize the concepts of classification system and identification of few important gymnosperms (Understanding)
- **CO4:** Collect, prepare and document herbarium specimens through non-destructive field collection method so as to get acquainted with herbarium technique (Applying)
- **CO5:** Differentiate between monocots and dicots (Understanding)
- **CO6:** 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

COs	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-90 HOURS) (L-T-P: 0-0-3)

Course Outcomes

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

- **CO1:** Get acquainted with tools and techniques of molecular biology (Remembering)
- **CO2:** Perform DNA isolation of genomic DNA and understand how to calculate recombination frequencies (Understanding)
- **CO3:** Learn and understand the underlying principle behind respiration, transpiration and photosynthesis. (Understanding)
- **CO4:** Analyze the concept of diffusion pressure deficit and impact of organic solvent in membrane permeability (Analyzing)
- **CO5:** Identify analytical instruments to carry out experiments (Applying)
- **CO6:** Analyze 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 CO_2 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

COs	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				
CO6							H	

COs	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**
CO6		**H**	**H**	**H**	**H**	**H**	

BOPP6029: PLANT MICROBIOLOGY AND PLANT PATHOLOGY LAB (3 CREDITS-90 HOURS) (L-T-P: 0-0-3)

Course Outcomes

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

- **CO1:** Prepare different media used in microorganism isolation (Applying)
- **CO2:** Apply various techniques for identifying different microbes (Applying)
- **CO3:** Develop protocols and methods for characterizing microbes (Creating)
- **CO4:** 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

COs	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**

POPE6030: PLANT ECOLOGY LAB (3 CREDITS-90 HOURS) (L-T-P: 0-0-3)

Course Outcomes

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

- **CO1:**Gain knowledge about the population and communities characteristics in a given field
- **CO2:**Gain knowledge about the concepts of analyzing edaphic characteristics
- **CO3:**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 CO_2, Chloride, Nitrate and Phosphate.
- **Expt.9.** Field Study

Mapping of CO's to Syllabus

COs	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**

BOCT6031: CYTOGENETICS, MOLECULAR TECHNIQUES AND TISSUE CULTURE LAB (3 CREDITS-90 HOURS) (L-T-P: 0-0-3)

Course Outcomes

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

- **CO1:** Interpret mitosis, meiosis and chromosomal aberration (Understanding)
- **CO2:** Solve problems based on gene interactions (Applying)
- **CO3:** Show hybridization in self and cross pollinated crops (Applying)
- **CO4:** Interpret the basics of plant tissue culture (Understanding)
- **CO5:** Utilize various chromatographic techniques to separate amino acids and plant pigments (Applying)
- **CO6:** Isolate biomolecules and learn to use a thermal cycler (Applying)
- **CO7:** Design primers using various software and use BLAST to identify sequences of similarity (Applying)
- **CO8:** Develop somatic embryos and artificial seeds (Creating)

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

Part 3: Tissue culture

Expt.11. Preparation of MS nutrient medium and study of the sterilization techniques
Expt.12. Induction of callus from explants
Expt.13. Study of somatic embryogenesis in *Daucus carota*
Expt.14. Study of embryo culture using suitable explants
Expt.15. Preparation of artificial seeds

Mapping of COs to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8
CO1	H	H	H					
CO2				H				
CO3					H			
CO4								
CO5						H		
CO6							H	H
CO7								
CO8								

COs	Expt. 9	Expt. 10	Expt. 11	Expt. 12	Expt. 13	Expt. 14	Expt. 15
CO1							
CO2							
CO3							
CO4			H	H			
CO5							
CO6	H						
CO7		H					
CO8					H	H	H

BODI6032: DISSERTATION PHASE I (4 CREDITS-120 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.

BOER6033: ENVIRONMENTAL MANAGEMENT, RESEARCH METHODOLOGY AND BIOSTATISTICS & BIOCHEMICAL LAB

(2 Credits-60 Hours) (L-T-P: 0-0-2)

Course Outcomes

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

CO1: Apply ideas gained for experimental surveys and writing sound scientific papers (Applying)
CO2: Apply the concepts of statistics for interpreting scientific data (Applying)
CO3: Develop ideas for small scale start-ups (Creating)

Expt.1. Practicals 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 CO's 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
CO1			H								
CO2				H	H	H	H	H	H	H	H
CO3	H	H									

BODI6034: DISSERTATION PHASE II

(12 Credits-360Hours)

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

BOAM6101: ALGAE AND MICROBIOLOGY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

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

CO1: Differentiate between cell shapes and structures of microorganisms (Applying)
CO2: Able to understand reproduction and multiplication processes in microbes (Understanding)
CO3: Utilize and create basic identification techniques for microbes (Creating)

Practical:

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	L	H	M	M	M
CO2		M	L	M	H
CO3		M	L		H

BOBC6102: BIOMOLECULES AND CELL BIOLOGY LAB (2 Credits-60 Hours) (L-T-P: 0-0-2)

Course outcomes

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

CO1: To recall the properties of carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins (Remembering)

CO2: To memorize the common tests of carbohydrates, proteins, nucleic acids and lipids and their classification (Remembering)

CO3: To acquire comprehensive knowledge on the logic behind the cell structure and functions (Understanding)

CO4: 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	H						H			
CO2	H		L							
CO3		H		L		L		H	M	L
CO4			M	H	H	H	L	M	L	H

BOMP6103: MYCOLOGY AND PHYTOPATHOLOGY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

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

CO1: Able to recall the general structure of fungi, allied fungi and lichens and show their reproductive structures (Remembering)

CO2: Able to demonstrate thallus structure of different classes of fungi (Understanding)

CO3: Examine the methods of reproduction in fungi (Analyzing)
CO4: 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)
Expt.11. Phytopathology: Herbarium specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, fungal diseases: Early blight of potato, Black stems rust of wheat and White rust of crucifers

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
CO1	M	H	H	M	L			L	H	H	
CO2	H				L		H			M	
CO3	L	H	M	L		L	M	H			L
CO4						H			L		H

BOAR6104: ARCHEGONIATE LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

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

CO1: Infer the various morphological, anatomical and reproductive features of important bryophytes (Understanding)
CO2: Interpret the various morphological, anatomical and reproductive features of important pteridophytes (Understanding)
CO3: Demonstrate the various morphological, anatomical and reproductive features of important gymnosperms (Understanding)
CO4: Develop the art of preparing slides of various archegoniate specimens and identifying them under the microscope (Applying)
CO5: 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	L	H	H	H	H	H								
CO2							H	H	H	H				
CO3											H	H	H	
CO4	H	M	M		M	M	M	M	M	M	M	M	M	
CO5														H

BOMA6105: MORPHOLOGY AND ANATOMY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

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

CO1: Prepare permanent slides, temporary stain mounts, macerations and museum specimens (Creating)

CO2: Gain the knowledge about apical meristem of root, shoot and vascular system (Understanding)

CO3: Apprehend the ideas of the distribution and types of tissues (Understanding)

CO4: Gain an understanding on secondary growth and wood anatomy in plants (Applying)

CO5: Scrutinize the different aspects of plant adaptations (Analyzing)

CO6: Estimate the importance of plant secretory systems (Evaluating)

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, hydrophytes

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	H											
CO2		H		L		L						
CO3		M	H	H		H	H					M
CO4				L	H	L		H	H			
CO5							L		L	H	H	L
CO6							M					H

BOEB6106: ECONOMIC BOTANY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

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

CO1: Recollect the morphology and anatomy of various economically important plants (Remembering)
CO2: Explain the economic importance of crop plants (Understanding)
CO3: Execute various micro-chemical tests of cereals, legumes, sugars and starches (Applying)
CO4: 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	M	H	M	H	M	M	M	H	H	M	L	H
CO2	H	H	H	M	H	H	H	M	L	H	H	M
CO3	M	M	M			M		L				M
CO4	M	M	M	L	L	L	L			L		H

BOGE6107: 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:

CO1: Experiment with meiosis through slide preparation (Applying)
CO2: Solve problems related to Mendel's laws, probability and chi-square analysis (Applying)
CO3: Examine test cross data for chromosome mapping (Analyzing)
CO4: Analyze pedigree charts (Analyzing)
CO5: Demonstrate incomplete dominance and gene interaction (Evaluating)

CO6: Interpret blood typing and human genetic disorders (Understanding)
CO7: Summarize the various 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	Expt.8	Expt.9
CO1	H								
CO2		H							
CO3			H						
CO4				H					
CO5					H				
CO6						H	H		
CO7								H	H

BOMB6108: MOLECULAR BIOLOGY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

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

CO1: Recall the basic knowledge on DNA as the genetic material (Remembering)
CO2: Grasp the procedure to isolate, purify and estimate DNA and also its various replication mechanisms (Understanding)
CO3: Infer the concepts of prokaryotic and eukaryotic RNA polymerases (Understanding)
CO4: Interpret splicing and spliceosome machinery (Understanding)
CO5: Prepare LB medium for growing bacterial cultures (Creating)

Practical:

Expt.1. Preparation of LB medium and raising *E.Coli*
Expt.2. Isolation of genomic DNA from *E.Coli*
Expt.3. DNA isolation from cauliflower head
Expt.4. DNA estimation by diphenylamine reagent/UV Spectrophotometry
Expt.5. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi discontinuous replication)
Expt.6. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs
Expt.7. 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.8. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing

Mapping of COs to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8
CO1							H	
CO2		H	H	H	H			
CO3						H		
CO4								H
CO5	H							

BOPE6109: PLANT ECOLOGY AND PHYTOGEOGRAPHY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

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

CO1: Recall their basic knowledge on ecology in order to use instruments to measure microclimatic variables (Remembering)
CO2: Perceive the concepts of various physico-chemical properties of soil and water (Understanding)
CO3: Estimate the dissolved oxygen of water samples from polluted and unpolluted sources (Evaluating)
CO4: Utilize their knowledge to demonstrate and calculate the plant communities (Applying)
CO5: Fabricate 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, psychrometer/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
a. Study of morphological adaptations of hydrophytes and xerophytes (four each)
b. Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*) Epiphytes, Predation (Insectivorous plants)
Expt.7. Determination of minimal quadrat size for the study of herbaceous vegetation by species area curve method (species to be listed)
Expt.8. Quantitative analysis of herbaceous vegetation for frequency and comparison with Raunkiaer's frequency distribution law
Expt.9. Quantitative analysis of herbaceous vegetation for density, abundance and IVI
Expt.10. Field visit to familiarize students with ecology of different sites

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	L								
CO2	L	L	H	L	M	L				
CO3						H				
CO4						H	H	H	H	
CO5						L	L	L	L	H

BOPS6110: 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:

CO1: Interpret the vegetative characters and systematic position of various angiospermic plants (Understanding)
CO2: Utilize their knowledge on angiosperms to study the floral characters through slide preparation (Applying)
CO3: Apply the ideas of plant taxonomy and systematics in identifying different plant specimens in their natural habitat (Applying)
CO4: Develop the art of preparing herbarium of plant specimens (Creating)

Practical:

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. Field visit (local) – Subject to grant of funds from the university.
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	H		
CO2	H		
CO3		H	
CO4			H

BOBV6111: BIODIVERSITY (MICROBES, ALGAE, FUNGI AND ARCHEGONIATE) LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

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

CO1: Interpret bacteria and viruses (Understanding)
CO2: Dissect the steps involved in gram staining (Analyzing).
CO3: Illustrate the unique features of algae and fungi (Understanding).
CO4: Compare lichens with mycorrhiza (Understanding).
CO5: Interpret the distinguishing characters of bryophytes, pteridophytes andgymnosperms (Understanding)

Practical:

Expt.1. EMs/Models of viruses –T- Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle
Expt.2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule
Expt.3. Gram staining
Expt.4. Study of vegetative and reproductive structures of Nostoc, Chlamydomonas (electron micrographs), *Oedogonium*, *Vaucheria*, *Fucus** and *Polysiphonia* through temporary preparations and permanent slides (* Fucus - Specimen and permanent slides)
Expt.5. *Rhizopus* and *Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides
Expt.6. *Alternaria*: Specimens/photographs and tease mounts
Expt.7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts
Expt.8. *Agaricus*: Specimens of button stage and full-grown mushroom; Sectioning of gills of *Agaricus*
Expt.9. *Lichens*: Study of growth forms of lichens (crustose, foliose and fruticose)
Expt.10. *Mycorrhiza*: ecto mycorrhiza and endo mycorrhiza (Photographs)
Expt.11. *Marchantia*: Morphology of thallus, Wm rhizoids and scales, vs thallus through gemma cup, Wm. gemmae (all temporary slides), vsantheridiophore, archegoniophore, LS sporophyte (all permanent slides)
Expt.12. *Funaria*: Morphology, Wm leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, LS capsule and protonema
Expt.13. *Selaginella*: Morphology, Wm leaf with ligule, TS stem, Wm strobilus, Wm microsporophyll and megasporophyll (temporary slides), LS strobilus (permanent slide)
Expt.14. *Equisetum:* Morphology, TS internode, LS strobilus, TS strobilus, Wm sporangiophore, Wm spores (wet and dry) (temporary slides); TS rhizome (permanent slide)
Expt.15. *Pteris*: Morphology, TS rachis, vs sporophyll, Wm sporangium, Wm spores (temporary slides), TS rhizome, Wm prothallus with sex organs and young sporophyte (permanent slide)
Expt.16. *Cycas*: Morphology (coralloid roots, bulbil, leaf), TS coralloid root, TS rachis, vs leaflet, vs microsporophyll, Wm spores (temporary slides), LS ovule, TS root (permanent slide)
Expt.17. *Pinus*: Morphology (long and dwarf shoots, Wm dwarf shoot, male and female), Wm dwarf shoot, TS needle, TS stem, LS/TS male cone, Wm microsporophyll, Wm microspores (temporary slides), LS female cone, TS & LS stem (permanent slide)

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8
CO1	H	H	M					
CO2			H					
CO3				H	H	H	H	H

COs	Expt. 9	Expt. 10	Expt. 11	Expt. 12	Expt. 13	Expt. 14	Expt. 15	Expt. 16	Expt. 17
CO4	H	H							
CO5			H	H	H	H	H	H	H

BOPT6112: PLANT ECOLOGY AND TAXONOMY LAB (2CREDITS: 60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

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

CO1: Interpret the working principle of basic equipments used in ecological research (Understanding)
CO2: Infer the physiochemical characteristics of soil and water (Understanding)
CO3: Compare hydrophytes with xerophytes (Understanding)
CO4: Explain ecosystem structure (Understanding)
CO5: Utilize the knowledge of plant systematics to study the vegetative and floral characters of various angiospermic plants (Applying)
CO6: Develop the art of preparing herbarium of plant specimens (Creating)

Practical:

Expt.1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter
Expt.2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test
Expt.3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats
Expt.4. Study of morphological adaptations of hydrophytes and xerophytes (four each).Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*), Epiphytes, Predation (Insectivorous plants)
Expt.5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (Species to be listed)
Expt.6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
Expt.7. 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): Brassicaceae –*Brassica*, *Alyssum* / *Iberis*; Asteraceae- *Sonchus*/*Launaea*, *Vernonia*/*Ageratum*, *Eclipta*/*Tridax*; Solanaceae -*Solanumnigrum*, *Withania*; Lamiaceae -*Salvia*, *Ocimum*, Liliaceae *Asphodelus* / *Lilium* / *Allium*
Expt.8. 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	Expt.4	Expt.5	Expt.	Expt.7	Expt.8
CO1	H							
CO2		H	H					
CO3				H				
CO4					H	H		
CO5							H	
CO6								H

BOEB6113: ENVIRONMENTAL BIOTECHNOLOGY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

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

CO1: Understanding the basic knowledge about DO, salinity, pH, chloride, total hardness, alkalinity, acidity, nitrate, calcium, Magnesium and phosphorus (Remembering)
CO2: Grasp the idea about Gravimetric Analysis-Total solid, dissolved solid, suspended solid in an effluent (Understanding)
CO3: Utilize the concepts of DO, salinity, pH, chloride, total hardness, alkalinity, acidity, nitrate, calcium, Magnesium and phosphorus in analyzing soil and water (Applying)
CO4: Scrutinize the concepts of gravimetric analysis (Analyzing)

Practical:

Expt.1. Water/Soil analysis - DO, salinity, pH, chloride, total hardness, alkalinity, acidity, nitrate, calcium, Magnesium and phosphorus

Expt.2. Gravimetric analysis-Total solid, dissolved solid, suspended solid in an effluent

Expt.3. Microbial assessment of air (open plate and air sample) and water

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3
CO1	H		
CO2		H	
CO3	H		
CO4			H

BOBB6114: ECONOMIC BOTANY AND PLANT BIOTECHNOLOGY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

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

CO1: Recall the basic knowledge about economically important plants and plant tissue culture (Remembering)

CO2: Explain the working principle of plant tissue culture methods and molecular biology equipment (Understanding)

CO3: Apply and build advanced protocols for plant tissue culture and quality test of plant products (Applying)

Practical:

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

Expt.2. Familiarization with basic equipment in tissue culture

Expt.3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micro-propagation

Expt.4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE

Mapping of COs to Syllabus

COs	Expt.1	Expt. 2	Expt. 3	Expt. 4
CO1	H	L	M	
CO2		H	L	M
CO3	L	M		H

BORA6115: REPRODUCTIVE BIOLOGY 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:

CO1: Tell and show various reproductive parts of Angiosperm (Remembering)

CO2: Develop pollen viability test and calculation of germination percentage (Applying)

CO3: Examine various types of ovules, the female gametophyte and intra-ovarian pollination (Evaluating)

CO4: Explain and infer endosperm and embryogenesis (Understanding)

CO5: Dissect developing seeds to determine stages of growth (Analyzing)

CO6: Develop or modify protocols for analysis of seed germination, pollination and embryogenesis (Creating)

Practical:

Expt.1. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bi-celled 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	H	H					
CO2		H					
CO3			H	H	H		
CO4						H	H
CO5						H	
CO6					M	M	H

BOPP6116: PLANT PHYSIOLOGY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

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

CO1: Memorize the basic concept of transpiration and stomata (Remembering)
CO2: Interpret the concepts of osmotic and water potential (Understanding)
CO3: Infer the ideas behind seed germination, amylase activity and the effect of different concentrations of plant growth hormones like IAA. (Understanding)
CO4: Calculate stomatal index and frequency and also area and percentage of stoma using the basic knowledge on stomata (Applying)
CO5: 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. Fruit ripening/Rooting from cuttings (Demonstration)
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 Expt.
CO1			H	L	L				
CO2	H	H							
CO3						H	H	H	
CO4				H	H				
CO5									H

BOAP6117: ANALYTICAL TECHNIQUES IN PLANT SCIENCES LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

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

CO1: Infer the various blotting techniques as well as PCR (Understanding)

CO2: Experiment with ELISA and also utilize paper chromatography and TLC to separate sugars and nitrogenous bases (Applying)

CO3: Make use of centrifugation and chromatographic techniques for chloroplast isolation and separation (Applying)

CO4: Apply various biochemical and molecular techniques for protein estimation and separation (Applying)

CO5: Apply molecular techniques for separation of DNA markers(Applying)

CO6: Compare different microscopic techniques (Applying)

CO7: Construct permanent slides (Creating)

Practical:

Expt.1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs

Expt.2. Demonstration of ELISA

Expt.3. Separation of nitrogenous bases by paper chromatography

Expt.4. Separation of sugars by thin layer chromatography

Expt.5. Isolation of chloroplasts by differential centrifugation

Expt.6. Separation of chloroplast pigments by column chromatography

Expt.7. Estimation of protein concentration through Lowry's methods

Expt.8. Separation of proteins using PAGE

Expt.9. Separation of DNA (marker) using AGE

Expt.10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH)

Expt.11. Preparation of permanent slides (double staining)

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
CO1	H										
CO2		H	H	H							
CO3					H	H					
CO4							H	H			
CO5									H		
CO6										H	
CO7											H

BOBS6118: 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:

CO1: Tell the definitions of various statistical terms (Remembering)

CO2: Make use of statistical calculations for data interpretation (Applying)

CO3: Analyze 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

Mapping of COs to Syllabus:

COs	Expt. 1	Expt. 2	Expt. 3
CO1	H	H	H
CO2	H	H	H
CO3	H	H	H

BOPM6119: PLANT METABOLISM LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

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

CO1: Utilize the knowledge to separate photosynthetic pigments (Applying)
CO2: Demonstrate Hill's reaction (Understanding).
CO3: Interpret the effects of light and carbon dioxide on respiration and compare the rate of CO4: respiration in various plant materials (Understanding)
CO5: Demonstrate nitrate reductase activity (Understanding)
CO6: Infer the activity of lipases (Understanding)
CO7: Demonstrate the fluorescence and absorption spectrum of photosynthetic pigments (Understanding)

Practical:

Expt.1. Chemical separation of photosynthetic pigments
Expt.2. Experimental demonstration of Hill's reaction
Expt.3. Study of the effect of light intensity on the rate of photosynthesis
Expt.4. Effect of carbon dioxide on the rate of photosynthesis
Expt.5. Comparison of the rate of respiration in different parts of a plant
Expt.6. Demonstration of activity of Nitrate Reductase in germinating leaves of different plant sources
Expt.7. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids during germination
Expt.8. Demonstration of fluorescence by isolated chlorophyll pigments
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	H								
CO2		H							
CO3			H	H	H				
CO4						H			
CO5							H		
CO6								H	H

BOPB6120: PLANT BIOTECHNOLOGY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

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

CO1: Study various media used in Plant tissue culture Laboratory (Remembering)
CO2: Explain/demonstrate different molecular biology techniques in tissue culture (Understanding).
CO3: Analyze modern DNA techniques used in plant improvement (Analyzing)
CO4: Evaluate and compare techniques in plant tissue culture (Evaluating)
CO5: Design restriction map of circular and linear DNA (Creating)

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, FlavrSavr 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	H							
CO2					L	H	M	M
CO3					H	M		M
CO4	H	M	L					
CO5				H				

BORM6121: RESEARCH METHODOLOGY FOR BOTANY LAB

(2 Credits-60 Hours)(L-T-P: 0-0-2)

Course outcomes

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

CO1: Utilize concepts to solve common chemical calculations (Applying)
CO2: Interpret various cytological and microtechnique experiments (Understanding)
CO3: Utilize concepts to present posters and write scientific articles (Applying)

Practical:

Expt.1. Experiments based on chemical calculations
Expt.2. Plant microtechnique experiments
Expt.3. The art of imaging of samples through microphotography and field photography
Expt.4. Poster presentation on defined topics
Expt.5. Technical writing on topics assigned

Mapping of COs to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5
CO1	H				
CO2		H	H		
CO3				H	H

BOIE6122: INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY LAB (2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

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

CO1: Tell the principles of laboratory instruments (Remembering)
CO2: Explain different sterilization techniques and culture media preparation (Understanding)
CO3: Apply sterilization techniques in laboratory (Applying)
CO4: 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	H	M
CO2	M	H
CO3	M	H
CO4	L	H

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 empiricalinterpretations 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 – 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 theability 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 – 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. **Development Perspectives:** Delineate the developmental policies designed for developed and developing economics. The course also acquaint 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 emphasises 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 andenvironmental 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.

DETAILED SYLLABUS

THEORY COURSES

ENME0028: Introductory Microeconomics (5-1-0)

COURSE OUTCOMES

CO1 Define basic concepts of microeconomics. (Remembering)
CO2 Classify economics from the perspective of individual decision making as consumers and producers. (Understanding)
CO3 Apply some basic principles of microeconomics. (Applying)
CO4 Draw Inferences from interactions of supply and demand. (Analyzing)
CO5 Interpret the characteristics of perfect and imperfect markets. (Evaluating)
CO6 Discuss the use of microeconomic tools for analysing real time situations. (Creating)

Module I: Exploring the Subject Matter of Economics (10 hours)

Why Study Economics? Scope and Method of Economics; The Economic Problem – Scarcity and Choice, The Question of What to Produce, How to Produce and How to Distribute Output; Science of Economics; The Basic Competitive Model; Prices, Property Rights and Profits; Incentives and Information; Rationing; Opportunity Sets; Economic Systems; Reading and Working with Graphs

Module II: Supply and Demand: How Markets Work, Markets and Welfare (15 hours)

Markets and Competition; Determinants of Individual Demand/Supply; Demand/Supply Schedule and Demand/Supply Curve; Market vs. Individual Demand/Supply; Shifts in the Demand/Supply Curve; Demand and Supply Together; How Prices Allocate Resources; Elasticity and its Application; Controls on Prices; Taxes and the Costs of Taxation; Consumer Surplus; Producer Surplus and the Efficiency of the Markets

Module III: The Households (15 hours)

The Consumption Decision – Budget Constraint, Consumption and Income/Price Changes, Demand for all Other Goods and Price Changes; Description of Preferences (Representing Preferences with Indifference Curves); Properties of Indifference Curves; Consumer's Optimum Choice; Income and Substitution Effects; Labour Supply and Savings Decision – Choice between Leisure and Consumption

Module IV: The Firm and Perfect Market Structure (8 hours)

Behaviour of Profit Maximizing Firms and the Production Process; Short Run Costs and Output Decisions; Costs and Output in the Long Run

Module V: Imperfect Market Structure (12 hours)

Basic forms; Price and Output Determination under Monopoly and Monopolistic Competition; Monopoly and Anti-trust Policy; Excess Capacity under Monopolistic Competition; Government Policies towards Competition

Module VI: Input Markets (15 hours)

Labour and Land Markets – Basic Concepts (Derived Demand, Productivity of an Input, Marginal Productivity of Labour, Marginal Revenue Product); Demand for Labour; Input Demand Curves; Shifts in Input Demand Curves; Competitive Labour Markets; Labour Markets and Public Policy

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 DelhiEdition, 2013.
5) A. Koutsoyinnis, Modern Microeconomics, International Edition, Macmillan Press Ltd.D. Salvator, Principles of Microeconomics, 5th Edition, OUP.
6) R. S. Pindyck, D. N. Rubinfeld & P. L. Meheta, Microeconomics, 7th Edition, Pearson, New Delhi, 2009.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M				
CO2		H	H			
CO3				H	M	
CO4				M		H
CO5					H	
CO6			H			M

ENMT0029: Mathematical Methods for Economics–I (5-1-0)

COURSE OUTCOMES

CO1 Define basic concepts of mathematical tools for economics. (Remembering)
CO2 Classify the mathematical tools for economics. (Understanding)
CO3 Apply some mathematical tools for economics into various theories of Economics. (Applying)
CO4 Draw inferences using the mathematical tools. (Analyzing)
CO5 Interpret the applications wherever optimization techniques are used in decision-making. (Evaluating
)CO6 Discuss the use of mathematical tools for logical rationalization or refuting arguments. (Creating)

Module I: Preliminaries (10 hours)

Logic and Proof Techniques; Variables; Sets and Set Operations; Relations; Functions and their Properties; Limit of aFunction; Number Systems

Module II: Functions of one Real Variable (20 hours)

a) Graphs; Elementary Types of Functions – Quadratic, Polynomial, Power, Exponential, Logarithmic; Sequences and Series – Convergence, Algebraic Properties and Applications; Continuous Functions – Characterizations, Properties with Respect to various Operations and Applications
b) Differentiable Functions – Characterizations, Properties with Respect to various Operations and Applications; Second and Higher Order Derivatives – Properties and Applications

Module III: Single-variable Optimization (15 hours)

Geometric Properties of Functions – Convex Functions, Their Characterizations and Applications; Local and Global Optima – Geometric Characterizations, Characterizations using Calculus and Applications

Module IV: Integration of Functions (15 hours)

Meaning and Significance; Basic Rules of Integration; Indefinite and Definite Integrals; Integration by Parts and PartialFraction

Module V: Difference Equations (15)

Basic forms; Finite Differences; Linear Difference Equations – Homogenous and Non-homogenous; Solution of First Order Difference Equation

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 to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	M	M			
CO2		M			M
CO3	M			H	
CO4			H		M
CO5			H		
CO6			M		

ENIE0028: Introductory Microeconomics (5-1-0)

COURSE OUTCOMES

CO1 Define basic concepts of Micro Economics. (Remembering)
CO2 Classify economics from the perspective of individual decision making as consumers and producers. (Understanding)
CO3 Apply some basic principles of microeconomics. (Applying)
CO4 Draw Inferences from interactions of supply and demand. (Analyzing)
CO5 Interpret the characteristics of perfect and imperfect markets. (Evaluating)
CO6 Discuss the use of Micro-Economic tools for analysing real time situations. (Creating)

Module I: Exploring the Subject Matter of Economics (15 hours)

Why Study Economics? Scope and Method of Economics; The Economic Problem – Scarcity and Choice, The Question of What to Produce, How to Produce and How to Distribute Output; Science of Economics; The Basic Competitive Model; Prices, Property Rights and Profits; Incentives and Information; Rationing; Opportunity Sets

Module II: Supply and Demand: How Markets Work, Markets and Welfare (15 hours)

Markets and Competition; Determinants of Individual Demand/Supply; Demand/Supply Schedule and Demand/Supply Curve; Market vs. Individual Demand/Supply; Shifts in the Demand/Supply Curve; Demand and Supply Together; How Prices Allocate Resources; Elasticity and its Application; Consumer Surplus; Producer Surplus

Module III: The Household Behaviour and Consumer's Choice (12 hours)

The Consumption Decision – Budget Constraint, Consumption and Income/Price Changes, Demand for all Other Goods and Price Changes; Description of Preferences (Representing Preferences with Indifference Curves); Properties of Indifference Curves; Consumer's Optimum Choice; Income and Substitution Effects

Module IV: The Firm and Perfect Market Structure (8 hours)

Behaviour of Profit Maximizing Firms and the Production Process; Short Run Costs and Output Decisions; Costs and Output in the Long Run

Module V: Imperfect Market Structure (12 hours)

Basic forms; Price and Output Determination under Monopoly and Monopolistic Competition; Monopoly and Anti-trust Policy

Module VI: Input Markets (15 hours)

Labour and Land Markets – Basic Concepts (Derived Demand, Productivity of an Input, Marginal Productivity of Labour, Marginal Revenue Product); Demand for Labour; Input Demand Curves; Shifts in Input Demand Curves; Competitive Labour Markets; Labour Markets and Public Policy

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 & Carl E. Walsh, Economics, W.W. Norton & Company, Inc., New York, International Student Edition, 4thEdition, 2007.
4) G.S. Maddala & Ellen Miller, Microeconomics: Theory and Applications, McGraw Hill Education, Tenth Reprint, New DelhiEdition, 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 Syllabus

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

CO5				M	H	
CO6			H			

ENME0030: Introductory Macroeconomics (5-1-0)

COURSE OUTCOMES

- CO1 Define basic concepts of macroeconomics including national income, money and inflation. (Remembering)
- CO2 Understand the relationship among the macroeconomic variables like GDP, money supply, inflation and relatedconcepts of closed economy. (Understanding)
- CO3 Apply basic mathematical formulae to measure national income and its related terms. (Applying)
- CO4 Analyze the quantity theory of money, Keynesian model of income determination, IS-LM model and its application forreal life economic decision making. (Analyzing)
- CO5 Interpret the various role of monetary and fiscal policy in credit control and inflation. (Evaluating)
- CO6 Design and develop macroeconomic models or tools for analyzing real time economic situations. (Creating)

Module I: Introduction to Macroeconomics and National Income Accounting (22 hours)

Basic Issues Studied in Macroeconomics; Measurements of Gross Domestic Product; Income, Expenditure and the CircularFlow; Real vs. Nominal GDP; Price Indices; National Income Accounting for an Open Economy; Balance of Payments – Current and Capital Accounts

Module II: Money (18 hours)

Functions of Money; Quantity Theory of Money – Classical and Modern Approach; Determination of Money Supply and Demand; Credit Creation; Tools of Monetary Policy

Module III: Inflation (15 hours)

Meaning and Types; Demand Pull and Cost Push; Inflationary Gap; Inflation and its Social Costs; Anti-inflationary Measures; Hyperinflation; Deflation – Meaning, Effects; Inflation vs. Deflation

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 and Monetary Multipliers

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 Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2				M
CO3	H	H		
CO4			M	H
CO5			H	
CO6				M

ENMS0031: Mathematical Methods for Economics-II (5-1-0)

COURSE OUTCOMES

- CO1 Define the basic concepts of mathematics like set, function, matrix algebra etc. used in economic analysis.(Remembering)
- CO2 Explain the usage of the basic concepts of mathematics in Economics. (Understanding)
- CO3 Apply the mathematical techniques to elucidate the problems of economic theory. (Applying)
- CO4 Analyse the economic theory and draw inferences in context of mathematical techniques. (Analysing)
- CO5 Explain the need of mathematical techniques in understanding real economic theory. (Evaluating)

CO6 Develop or build mathematical models to solve numerical problems in economic theory. (Creating)

Module I: Differential Equations (15)

Meaning and Types; Homogeneous and Non-homogeneous and their Solutions; Linear and Nonlinear; Solution of Linear Differential Equation; Application to Dynamic Market Model

Module II: Linear Algebra (18 hours)

Vector Spaces – Algebraic and Geometric Properties, Scalar Products, Norms, Orthogonality; Linear Transformations – Properties; Systems of Linear Equations – Properties of their Solution Sets; Matrix Representations and Elementary Operations; Determinants and Properties; Matrix Inversion; Applications

Module III: Functions of Several Real Variables (20 hours)

Geometric Representations - Graphs and level Curves; Differentiable Functions – Characterizations, Properties with Respect to various Operations and Applications; Second Order Derivatives – Properties and Applications; The Implicit Function Theorem, and Application to Comparative Statics Problems; Homogeneous and Homothetic Functions – Characterizations and Applications

Module IV: Multi-variable Optimization (22 hours)

a) Convex Sets; Geometric Properties of Functions – Convex Functions, Their Characterizations, Properties and Applications; Further Geometric Properties of Functions – Quasi Convex Functions, their Characterizations, Properties and Applications; Unconstrained Optimization – Geometric Characterizations, Characterizations using Calculus and Applications
b) Constrained Optimization with Equality Constraints – Geometric Characterizations, Lagrange Characterization using Calculus and 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 to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M			
CO2		M	M	
CO3	H		H	
CO4		H		H
CO5			H	
CO6				H

ENIS0029: Introductory Macroeconomics (5-1-0)

COURSE OUTCOMES

CO1 Define basic concepts of macroeconomics including national income, money and inflation. (Remembering)
CO2 Understand the relationship among the macroeconomic variables like GDP, money supply, inflation and relatedconcepts of closed economy. (Understanding)
CO3 Apply basic mathematical formulae to measure national income and its related terms. (Applying)
CO4 Analyze the quantity theory of money and Keynesian model of income determination for real life economic decisionmaking. (Analyzing)
CO5 Interpret the various role of monetary and fiscal policy in credit control and inflation. (Evaluating)
CO6 Design macroeconomic models or tools for analyzing real time economic situations. (Creating)

Module I: Introduction to Macroeconomics and National Income Accounting (22 hours)

Basic issues studied in Macroeconomics; Measurements of Gross Domestic Product; Income, Expenditure and the Circular Flow; Real vs. Nominal GDP; Price Indices

Module II: Money (18 hours)

Functions of Money; Quantity Theory of Money – Classical and Modern Approach; Determination of Money Supply andDemand; Credit Creation; Tools of Monetary Policy

Module III: Inflation (15 hours)

Meaning and Types; Demand Pull and Cost Push; Inflationary Gap; Inflation and its Social Costs; Anti-inflationaryMeasures; Hyperinflation; Deflation – Meaning, Effects; Inflation vs. Deflation

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 and Monetary Multipliers

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 COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2				
CO3	M	H		L
CO4		M		M
CO5			H	
CO6				H

ENIC0032: Intermediate Microeconomics – I (5-1-0)

COURSE OUTCOMES

CO1 Identify the concepts and terms of microeconomics. (Remembering)
CO2 Classify the role of economic agents and their interdependence. (Understanding)
CO3 Use basic principles of microeconomics. (Applying)
CO4 Illustrate the behaviour of consumer and producer in different situations. (Analyzing)
CO5 Interpret the production techniques under perfect markets. (Evaluating)
CO6 Discuss the use of microeconomic tools for examining real life problems. (Creating)

Module I: Consumer Theory - I (20 hours)

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; Utility Maximisation; Consumers' Equilibrium; Income Effects and Substitution Effects of a Price Change; Slutsky Equation; Price Consumption Curve; Income Consumption Curve; Derivation of Demand Curve from Price Consumption Curve

Module II: Consumer Theory - II (25 hours)

Choice Under Risk and Uncertainty – Uncertainty and Probability Distributions; Expected Value and Expected Utility; Maximising 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; Revealed Preference Approach – Strong and Weak Axioms; Properties of Demand Function

Module III: Production and Costs (18 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 IV: Review of Perfect Competition (12 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

Suggested Readings

1) Hal R. Varian, Intermediate Microeconomics, a Modern Approach, W.W. Norton and Company, Affiliated East-West Press(India), 8th edition, 2010.
2) C. Snyder & W. Nicholson, Fundamentals of Microeconomics, Cengage Learning (India), 2010.
3) B. Douglas Bernheim & Michael D. Whinston, Microeconomics, Tata McGraw-Hill (India), 2009.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3			M	
CO4		H		
CO5			H	
CO6				H

ENIC0033: Intermediate Macroeconomics – I (5-1-0)

COURSE OUTCOMES

CO1 Describe the concepts of macroeconomics and its related terms. (Remembering)
CO2 Identify the aggregate variables and their interdependences in a closed as well as in an open economy.(Understanding)
CO3 Apply aggregate variables and concepts in examining the real-life situation (Applying)
CO4 Evaluate the role of aggregate variables in smooth functioning of an economy. (Analyzing)
CO5 Elucidate the effects of aggregate changes on overall growth and development of an economy. (Evaluating)
CO6 Formulate macroeconomic models for analyzing real-life situations. (Creating)

Module I: Aggregate Demand and Aggregate Supply Curves (20 hours)

Concept of Aggregate Demand and Aggregate Supply; Derivation of Aggregate Demand and Aggregate and Supply Curves;Interaction of Aggregate Demand and Supply; The Theory of Effective Demand; Simple Keynesian Model of Income Determination; Saving and Investment Functions; Investment Multiplier

Module II: Inflation, Unemployment and Expectations (25 hours)

Inflation – Types, Causes, Effects; Measures to Control Inflation; Structural Theories of Inflation; Inflation in Developing Countries; Inflation-unemployment Trade-off – Phillips Curve; Adaptive Expectations; Rational Expectations; Policy Ineffectiveness Debate

Module III: Open Economy Models (30 hours)

Short-run Open Economy Models; Mundell-Fleming Model; Exchange Rate Determination; Purchasing Power Parity; AssetMarket Approach; 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) Steven M. Sheffrin, Rational Expectations, Cambridge University Press, 2nd edition, 1996.
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 Syllabus

	Module I	Module II	Module III
CO1	H	M	
CO2			H
CO3	H		
CO4			M
CO5		M	
CO6			H

ENSM0034: Statistical Methods for Economics (5-1-0)

COURSE OUTCOMES

CO1 Recall basic concepts of Statistics. (Remembering)
CO2 Classify the different types and the methods of analyzing data. (Understanding)CO3 Apply various Statistical Tools analyzing data. (Applying)
CO4 Draw Inferences from data. (Analyzing)
CO5 Interpret the inferences drawn from data. (Evaluating)CO6 Predict the inferences drawn from the data. (Creating)

Module I: Introduction and Overview (10 hours)

Populations and Samples; Population Parameters and Sample Statistics; Measures of Location and Variation to Describe and Summarize Data; Population Moments and their Sample Counterparts

Module II: Elementary 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 III: Random Variables and Probability Distributions (15 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)

Module IV: Random Sampling and Jointly Distributed Random Variables (15 hours)

Density and Distribution Functions for Jointly Distributed Random Variables; Computing Expected Values of Jointly Distributed Random Variables; Covariance and Correlation Coefficients

Module V: Sampling (10 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

Module VI: Point and Interval Estimation (10 hours)

Estimation of Population Parameters using Methods of Moments and Maximum Likelihood Procedures; 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, PHI, 2011.
4) William G. Cochran, Sampling Techniques, John Wiley, 2007.
5) Gupta S.C, Fundamentals of Statistics, Himalaya Publishing House, 2018.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H					
CO2	M		H			
CO3				H	H	
CO4			H			M
CO5				H		
CO6		M				H

ENDP0035: Data Collection and Presentation (2-0-0)

COURSE OUTCOMES

CO1 Define the key terms related to data and its related concepts. (Remembering)
CO2 Understand the principles of sampling techniques and data collection methods. (Understanding)
CO3 Apply the various sampling technique and statistical measures in real life problems with the help of computerapplications. (Applying)
CO4 Analyse the computer-based statistical results for better interpretation of the problem. (Analysing)
CO5 Evaluate the statistical results employing various types of diagrams and charts with the help of computer applications. (Evaluating)
CO6 Design and develop statistical tools or methods for real life applications in economics and other social sciences.(Creating)

Module I: Introduction to Data (5 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

Module II: Sampling Design and Data Collection (5 hours)

Sample and Population; Sampling and Sampling Techniques; Random and Non-Random Sampling; Choice of Sampling Technique; Collections of Primary Data – Questionnaire Method, Use of Schedules, Interview Methods; Collection of Secondary Data – Sources and Advantages; Focus Group Discussion; Sampling Error

Module III: Data Processing and Presentation (10 hours)

Processing of Data- Data Entry, Data Screening, Validation and Cleaning; Data Coding and Classification; Data Organizationand Presentation – Frequency Table, Cross Tabulation; Diagrammatic Presentation of Data; One Dimensional Diagrams– Single Bar, Subdivided Bar, Multiple Bar; Two Dimensional Diagrams – Histogram and Pie Diagram; Three Dimensional Diagrams - Rectangular and Cube Diagrams; Pictograms; Cartograms; XY Scatter Plot; Line Diagram; Radar Diagrams; Significance of Diagrams; Limitations of Diagrams

Module IV: Data Management with Computer Applications (10 hours)

Working with MS Word – Creating, Saving and Opening Documents in MS Word; Editing and Formatting; Previewing and Printing Word Document; Working With MS Excel – Creating, Saving and Opening Worksheets in MS Excel; Editing and Formatting; Using Formulas – Entering Formulas, Auto Sum and Other Common Auto-Formulas, Copying Formulas and Functions, Relative, Absolute, and Mixed Cell References; Previewing and Printing Worksheet; Making Graphs and Charts; Multiple Worksheets-Concepts, Creating and Using, Data Analysis and Display; Working with Presentation - Creating, Saving and Opening Slides; Editing and Formatting; Customizing Slides; Previewing and Presenting

Suggested Readings

1) Gupta S.C., Fundamentals of Statistics, Himalaya Publishing House, 2018.
2) Agarwala, B.L., Basic Statistics, New Age International, 2019.
3) Yamane, T., Statistics: An Introductory Analysis, 2nd Edition, New York: Harper and Row, 1967.
4) Nagar, A. L. & Das, R. K., Basic Statistics, Oxford, 1997.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		M		
CO3	H		H	
CO4			H	
CO5				M
CO6				H

ENIE0036: Indian Economy – I (5-1-0)

COURSE OUTCOMES

CO1 Learn the basic understanding of Indian economy. (Remembering)

CO2 Understand the Indian economy since independence. (Understanding)

CO3 Identify the main issues in Indian Setup. (Applying)
CO4 Evaluate the impact development paradigm in the Indian Scenario. (Analyzing)
CO5 Explain shortcomings of the policy and programme for economic development. (Evaluating).
CO6 To understand the relation between India and the world economy as well as its neighboring countries. (Creating)

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 – Achievements and Failure of Indian Planning; Economic Growth and Development under Different Policy Regimes – Goals, Constraints, Institutions and Policy Framework; Globalization and its Impacts on Indian Economy; NITI Aayog vs. Planning Commission

Module II: Population and Human Development (19 hours)

Demographic Trend and Issues – Meaning and Scope of Demography; Population as a Factor of Economic Development; National Population Policy; Demographic Dividend; Human Development Index; India's Human Development Record in Global Perspective; Education in India – Trends and Issues; Health – Trends and Issues; Malnutrition in India

Module III: Growth and Distribution (20 hours)

Poverty – Concept and Incidence of Poverty in India; Strategy of Poverty Alleviation; Trends and Policies in Poverty; Income Inequality in India – Magnitude and Nature, Causes of Income Inequality, Government Policies and Measures; Unemployment – Nature and Types of Unemployment in India, Magnitude, Causes of Unemployment, Government Policies and Measures

Module IV: International Comparisons (16 hours)

India's Economic Interaction with the World Economy; A Comparative Assessment of India's Development Experience with Singapore, South Korea, China, Pakistan, Bangladesh, Sri Lanka, Nepal, Taiwan and Vietnam

Suggested Readings

1) Dutt Rudder & K.P.M Sunderam, Indian Economy, S Chand & Co. Ltd. New Delhi, 2001.
2) Mishra S.K. & V.K. Puri, Indian Economy and –Its development experience, Himalaya Publishing House, 2001.
3) Jalan, B., India's Economic Policy- Preparing for the Twenty First Century, Viking, New Delhi, 1996.
4) Himanshu, Employment Trends in India: A Re-examination, Economic and Political Weekly, September, 2011.
5) Rama Baru et al, Inequities in Access to Health Services in India: Caste, Class and Region, Economic and Political Weekly, September, 2010.
6) Geeta G. Kingdon, The Progress of School Education in India, Oxford Review of Economic Policy, 2007.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2				
CO3	M	M		
CO4		M		
CO5				H
CO6			H	L

ENMB0037: Money and Banking (5-1-0)

COURSE OUTCOMES

CO1 Assess the components of a financial system with respect to real economy linkages and financial market participants (Remembering)

CO2 Understand the impact of central bank monetary policy on financial systems and the overall economy.(Understanding)

CO3 Appraise the roles of financial intermediaries as both brokers and asset transformers. (Applying)

CO4 Assess the development of financial markets and securities in response to market participant requirements.(Analyzing)

CO5 Evaluate the different financial intermediation and risk management services that financial institutions provide andthe need for governmental regulation. (Evaluating)

CO6 Develop the knowledge of working of the central bank of the country in maintaining the financial target of theeconomy. (Creating)

Module I Money and Functions of Money (12 hours)

Concept of Money; Functions of Money; Theories of Demand for Money; Type of Money – M1, M2, M3, M4 and HTheory of Money Supply

Module II: Financial Institutions, Markets, Instruments and Financial Innovations (18 hours)

Role of Financial Markets and Institutions; Money and Capital Markets; Organization, Structure and Reforms in India;Role of Financial Derivatives Problem of Asymmetric Information – Adverse Selection and Moral Hazard

Module III: Interest Rates (14 hours)

Determination of Interest Rate; Sources of Interest Rate Differentials; Types of Interest Rate – Compound and SimpleInterest Rate; Theories of Term Structure of Interest Rates; Interest Rates in India

Module IV: Banking System in India (16 hours)

Indian Banking System; Changing Role and Structure; Banking Sector Reforms; Credit Creation System of CommercialBank; The Evolution of Commercial Banks, Regional Rural Bank in India; NABARD

Module V: Central Banking and Monetary Policy (12 hours)

Functions; Balance Sheet; Goals of Central Bank, 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 Policyof 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, PearsonEducation, 3rd edition, 2009.

3) L. M. Bhole & J. Mahukud, 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 WorkingGroup, IMF Staff Papers.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	H				
CO3			H		M
CO4		M		H	
CO5				H	
CO6					H

ENEE0038: Environmental Economics (5-1-0)

COURSE OUTCOMES

CO1 Define the basic concepts of environmental economics. (Remembering)
CO2 Understand the environmental issues in relation to the theory of externalities. (Understanding)
CO3 Apply environmental principles concerning the environmental problems and policies. (Applying)
CO4 Analyze environmental problems using economic principles. (Analysing)
CO5 Evaluate the diverse methods of environmental valuation for sustainable development. (Evaluating)
CO6 Develop an approach to examine the contemporary environmental issues from an economists' viewpoint. (Creating)

Module I: Introduction (20 hours)

Key Environmental Issues and Problems, Economic Way of Thinking about these Problems; Basic Concepts fromEconomics; Pareto Optimality and Market Failure in the Presence of Externalities; Property Rights and Other Approaches

Module II: The Design and Implementation of Environmental Policy (20 hours)

Overview; Pigouvian Taxes and Effluent Fees; Tradable Permits; Implementation of Environmental Policies in India and International Experience; Transboundary Environmental Problems; Economics of Climate Change

Module III: Environmental Valuation Methods and Applications (25 hours)

Valuation of Non-market Goods and Services – Theory and Practice; Measurement Methods; Cost-benefit Analysis of Environmental Policies and Regulations

Module IV: Sustainable Development (10 hours)

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, Economics of the Environment: Selected Readings, W.W. Norton, 5th edition, 2005.
3) Roger Perman, Yue Ma, James McGilvray & 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, Volume30:675-740, 1992.
5) Bhattacharya, Rabindra N., Environmental Economics: An Indian Perspective. New Delhi: Oxford University Press, 2002.
6) Shankar, U., Environmental Economics, Oxford University Press, New Delhi, 2001.
7) Robert Solow, An Almost Practical Step toward Sustainability, Resources for the Future 40th anniversary lecture, 1992.
8) Kenneth Arrow et al., Are We Consuming Too Much? Journal of Economic Perspectives, 18(3): 147-172, 2004.
9) IPCC (Intergovernmental Panel on Climate Change), Fifth Assessment Report (forthcoming 2014).

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		H
CO3	M	H		
CO4			H	
CO5			M	
CO6				M

ENMI0039: Intermediate Microeconomics – II (5-1-0)

COURSE OUTCOMES

CO1 Recall the basic concepts of applied microeconomics. (Remembering)
CO2 Understand how the microeconomic concepts work in individual decision making process (Understanding)
CO3 Apply the basic principles of applied microeconomics. (Applying)
CO4 Draw inferences from interactions of rivals in game theory. (Analyzing)
CO5 Interpret the characteristics of imperfect market structures. (Evaluating)
CO6 Discuss the use of applied microeconomic tools in real life. (Creating)

Module I: General Equilibrium, Efficiency and Welfare (20 hours)

Exchange Economy – Basic Concept; Pareto Optimality; Edgeworth Box; Equilibrium under Pure Exchange; Efficiency under Pure Exchange; Pareto Efficiency in Production; The Production Possibility Curve; Social Indifference Curves andAllocation of Resources; Pareto Efficiency and Market Failure; Externality

Module II: Market Structure (20 hours)

Monopoly Equilibrium; Pricing with Market Power; Degree of Monopoly Power; Price Discrimination under Monopoly; Equilibrium of Multi-plant Monopoly; Peak-load Pricing; Two-Part Tariff; Monopolistic Competition – Price and Output Determination; Equilibrium with Perceived and Proportionate Demand Curves; Excess Capacity under Monopolistic Competition; Oligopoly – Basic Structure; Collusive and Non-collusive Oligopoly

Module III: Game Theory (20 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

Module IV: Market Failure (15 hours)

Externalities – A Simple Bilateral Model of Externality; Public Goods; Free Rider Problem; Markets with Asymmetric Information; Markets for Lemon; Moral Hazard

Suggested Readings

1) Hal R. Varian, Intermediate Microeconomics, a Modern Approach, 8th edition, W.W. Norton and Company/Affiliated East-West Press (India), 2010.
2) C. Snyder & W. Nicholson, Fundamentals of Microeconomics, Cengage Learning (India), 2010.

Mapping of COs to Syllabus

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

CO3		M	H	
CO4		H		
CO5			M	
CO6				H

ENMA0040: Intermediate Macroeconomics – II (5-1-0)

COURSE OUTCOMES

CO1 Recall the ideas and concepts of macroeconomics. (Remembering)
CO2 Classify macroeconomics from the perspective of policy making. (Understanding
)CO3 Apply some basic principles of macroeconomics. (Applying)
CO4 Draw Inferences from interactions between macroeconomic thoughts and real life situation. (Analyzing)
CO5 Interpret the characteristics of economic growth. (Evaluating)
CO6 Discuss the use of macroeconomic tools for analysing real time situations. (Creating)

Module I: Economic Growth (20 hours)

Overview of Classical Growth Theory; Harrod-Domar Growth Model; Solow Model; Golden Rule; Convergence Debate: Technological Progress and Elements of New (Endogenous) Growth Theory

Module II: Microeconomic Foundations (30 hours)

a) Consumption: Keynesian Consumption Function; Fisher's Theory of Optimal Intertemporal Choice; Life-cycle andPermanent Income Hypotheses; Rational Expectations and Random-walk of Consumption Expenditure
b) Investment: Determinants of Business Fixed Investment; Residential Investment and Inventory Investment; Marginal Efficiency of Capital and Investment
c) Demand for money: Pre-Keynesian and Post-Keynesian Theories of Demand for Money; Demand for Money and Inflation

Module III: Fiscal and Monetary Policy (15 hours)

Active or Passive; Monetary Policy – Objectives, Targets; Rules vs. Discretion – Time Consistency; Government Budget Constraint; Government Debt and Ricardian Equivalence

Module IV: Schools of Macroeconomic Thoughts (10 hours)

Classical Thoughts; Keynes Criticism; Keynesian Thoughts; New Classicals and New Keynesians

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

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

CO5		M		H
CO6			H	

ENIS0041: Introductory Econometrics (5-1-0)

COURSE OUTCOMES

CO1 Define the basic concepts like definition, scope and nature of econometrics. (Remembering)CO2 Explain the concepts of simple and multiple linear regressions. (Understanding)
CO3 Apply OLS method to estimate regression parameters. (Applying)
CO4 Analyse the results of regression models with hypothesis testing. (Analysing)
CO5 Evaluate the regression models for violations of classical assumptions and specification bias. (Evaluating)CO6 Create and design regression models to test hypothesis of real economic problems. (Creating)

Module I: Nature and Scope of Econometrics (8 hours)

Basics of Econometrics – Meaning and Methodology; Relation with Mathematical Economics and Statistics; Applications of Econometrics; Nature of Econometrics

Module II: Statistical Concepts (12 hours)

Normal Distribution; χ^2, t and F Distributions; Estimation of Parameters; Properties of Estimators; Testing of Hypotheses – Defining Statistical Hypotheses; Distributions of Test Statistics; Testing Hypotheses related to Population Parameters; Type I and Type II Errors; Power of a Test; Tests for Comparing Parameters from Two Samples

Module III: Simple Linear Regression Model - Two Variable Case (15 hours)

Estimation of Model by Method of Ordinary Least Squares; Properties of Estimators; Goodness of Fit; Tests of Hypotheses; Scaling and Units of Measurement; Confidence Intervals; Gauss-Markov Theorem; Forecasting

Module IV: Multiple Linear Regression Model (15 hours)

Estimation of Parameters; Properties of OLS Estimators; Goodness of Fit – R^2 and Adjusted R^2; Partial Regression Coefficients; Testing Hypotheses – Individual and Joint; Functional forms of Regression Models; Qualitative (Dummy) Independent Variables

Module V: Violations of Classical Assumptions - Consequences, Detection and Remedies (15 hours)

Multicollinearity – Consequences, Detection, Remedies; Heteroscedasticity – Consequences, Detection, Remedies; Serial Correlation – Consequences, Detection, Remedies

Module VI: Specification Analysis (10 hours)

Omission of a Relevant Variable; Inclusion of Irrelevant Variable; Tests of Specification Errors

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 to Syllabus

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

CO5			H			
CO6				M		

ENSD0042: Statistical Data Analysis (2-0-0)

COURSE OUTCOMES

CO1 Define the key statistical terms and concepts related to data. (Remembering)

CO2 Understand the principles of statistical measures. (Understanding)

CO3 Apply the various statistical measures and their forecasting techniques in real life problems. (Applying)

CO4 Analyse the various statistical results like hypothesis testing and forecasting in practice. (Analyzing)

CO5 Evaluate the statistical results employing various hypothesis testing tools with various statistical packages like SPSSand STATA. (Evaluating)

CO6 Design and develop statistical tools or methods for real life applications in social sciences. (Creating)

Module I: Basic Statistical Tools (7 hours)

Measures of Central tendency - Arithmetic Mean (Simple and Weighted), Geometric Mean, Harmonic Mean, Median, Mode, Quartiles, Merits and Demerits of Measures of Central Tendency; Measures of Dispersion - Concepts of Measures of Dispersion, Range, Quartile Deviation, Standard Deviation, Variance, Properties of Variance, Coefficient of Variation; Merits and Demerits of Measures of Dispersion

Module II: Statistical Tools for Forecasting (7 hours)

Regression – Simple Linear Regression Line, Interpretation of Regression Coefficients, Properties of Regression Coefficients, Residuals and their Properties; Correlation – Karl Pearson's Correlation Coefficient and its Properties, Spearman Rank Correlation Coefficient; Time Series Analysis – Components of Time Series, Additive and Multiplicative Models, Determination of Trend, Construction of Seasonal Indices and Forecasting

Module III: Statistical Inferences (9 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 Distributions for Statistical Inference – Z (Normal) Distribution, T Distribution, F Distribution and X^2 Distribution and their Practical Uses

Module IV: Introduction to Statistical Packages (7 hours)

Introduction to Statistical Package – SPSS and STATA; Working with SPSS/STATA – Preparing the Data File, Creating Data File and Entering Data, Defining the Variables, Entering Data, Modifying Data File, Import File, Screening and Cleaning Data; Analysis with SPSS/STATA – Frequency and Cross Tabulation, Descriptive/Summary Statistics, Estimating CorrelationCoefficient 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

	Module I	Module II	Module III	Module IV

CO1	M			
CO2	M			
CO3	H	H	M	
CO4		M		H
CO5			H	
CO6				H

ENIE0043: Indian Economy-II (5-1-0)

COURSE OUTCOMES

CO1 Define the Macroeconomic Policies and their Impact Indian Economy. (Remembering)

CO2 Explain the policies and Performance in Agriculture. (Understanding)

CO3 Identify the policies and performance in Industry. (Applying)

CO4 Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Analyzing)

CO5 Explain the trends and performance in service sectors. (Evaluating)

CO6 Discuss their understanding of the usefulness of various development policies. (Creating)

Module I: Macroeconomic Policies and their Impact (20 Hours)

Fiscal Policy – Fiscal Reform Measures in the Context of India's New Economic Policy; Monetary Reforms and its Impact; Black Money and Parallel Economy in India – Consequences and Corrective Government Intervention; Trade and Investment Policy – Export Import Policy, Foreign Trade Policy; Labour Regulation

Module II: Policies and Performance in Agriculture (20 Hours)

Changing Structure of Indian Agriculture; Sustainable Agriculture – Concept and Constraints; Diversification of Agriculture;

Impact of Technology on Agriculture; Green Revolution and its Impact on Agricultural Development; Land Reforms and Agricultural Growth in India; Agricultural Credit – Role and Sources of Credit; Agricultural Marketing and Strategy for Development; Trade – WTO and Agriculture; Agricultural Pricing Policy in India

Module III: Policies and Performance in Industry (20 Hours)

Pattern of Industrialization; Industrial Growth and Productivity in the Post Reform Period; New Industrial Policy and Economic Reforms in India; Disinvestment and Privatization; Development of MSME Sector; Globalization and Competition; Foreign Investment in the Industrial sector

Module IV: Trends and Performance in Services (15 Hours)

Role of the Service Sector in the Indian Economy; Growth in and Composition of the Service Sector; Formal and Informal Enterprises in Service Sector; Trend and Growth of Banking and Insurance; Balance of Payments Position – Pre and Post Reform period; Trade in Services and WTO

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) Pulapre Balakrishnan, 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, AmericanEconomic Review, Papers and Proceedings, May, 2009.
6) Kunal Sen, Trade, Foreign Direct Investment and Industrial Transformation in India, in Premachandra Athukorala, editor,The Rise of Asia, Routledge, 2010.
7) Dipak Mazumdar & Sandeep Sarkar, The Employment Problem in India and the Phenomenon of the Missing Middle, IndianJournal 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

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3	M			H
CO4		M	H	
CO5				H
CO6			H	

ENHI0044: Economic History of India 1857-1947 (5-1-0)

COURSE OUTCOMES

CO1 Understand the economic structure during colonial period. (Remembering)
CO2 Explain the agrarian structure in the post-independence period. (Understanding)
CO3 Identify their texts and link the different positions of macroeconomic trends. (Applying)CO4 Evaluate the contribution of railways and industry. (Analyzing)
CO5 Explain the government and fiscal policies under colonial rule. (Evaluating)
CO6 Discuss the usefulness of railways and industries in the development process of Indian economy. (Creating)

Module I: Introduction: Colonial India: Background and Introduction (15 hours)

An Overview of Economic Structure and Policies of Pre-independence Era; The Laws of Inheritance; Socio-cultural Attitudes and India's Economic Backwardness; Drain Theory; Economic Ideas of Ranade and Gandhi

Module II: Macro Trends (15 hours)

National Income – Trend and Composition; Population – Growth, Age Structure and Sex Composition; Changing Occupational Structure

Module III: Agriculture (15 hours)

Agrarian Structure and Land Relations; Agricultural Markets and Institutions – Credit and Irrigation; Land Systems; Commercialization of Agriculture – Causes and Consequences; Trends in Performance and Productivity; Famines

Module IV: Railways and Industry (15 hours)

Railways; The De-industrialization Debate; Industrial Development during the Imperial Era – Cotton, Jute, Steel, Tea Plantation; Evolution of Entrepreneurial and Industrial Structure; Nature of Industrialisation in the Interwar Period; Constraints to Industrial Breakthrough; Labour Relations

Module V: Economy and State in the Imperial Context (15 hours)

The Imperial Priorities and the Indian Economy; Drain of Wealth; International Trade, Capital Flows and the Colonial Economy – Changes and Continuities; Government and Fiscal Policy

Suggested Readings

1) Lakshmi Subramanian, History of India 1707-1857, Orient Blackswan, 2010.
2) Sumit Guha, Mortality decline in early 20th century India', Indian Economic and Social History Review (IESHR), pp 371-74and 385-87, 1991.
3) Tirthankar Roy, The Economic History of India 1857-1947, Oxford University Press, 3rd edition, 2011.
4) J. Krishnamurty, Occupational Structure, Dharma Kumar (editor), The Cambridge Economic History of India, Vol. II,(henceforth referred to as CEHI), 2005.
5) Irfan Habib, Indian Economy 1858-1914, A People's History of India, Vol.28,
6) Jean Dreze, Famine Prevention in India in Dreze and Sen (eds.) Political Economy of Hunger, WIDER Studies inDevelopment Economics, 1990.
7) John Hurd, Railways, CEHI, Chapter 8, pp.737-761

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M	H		
CO3		M		H	
CO4					M
CO5				H	
CO6					H

ENPF0045: Public Finance (5-1-0)

COURSE OUTCOMES

CO1 Define the main concepts in public finance. (Remembering)
CO2 Explain the analytical grasp of government taxes: direct and indirect taxes, (Understanding)CO3 Identify the main issues in government expenditure. (Applying)
CO4 Evaluate economic concepts of public finances. (Analyzing)
CO5 Explain the diagrammatic analysis to demonstrate and compare the economic welfare effects of various governmentpolicy options. (Evaluating)
CO6 Discuss their understanding of the usefulness and problems related to government revenues and expenditures.(Creating)

Module I: Fiscal Functions (15 hours)

Public Finance; Meaning and Scope, Normative Approach to Public Finance – Allocation, Distribution and Stabilizationfunction of government, coordinating the functions; Pareto Efficiency, Equity vs. Efficiency

Module II: The theory of Public Goods (15 hours)

Public Goods – Meaning and characteristics; Public Goods and Market Failure; Type of public goods-Pure and Impure Public Goods, The Free Rider Problem and Market Failure; Efficient Allocation of Public Goods – The Lindahl Equilibrium

Module III: Externalities (15 hours)

Meaning and Types of Externalities; Externalities vis-a-vis Public Good, Internationalization of Externalities; Correctivetaxes and Subsidies; Assignment of Property Rights – The Coase Theorem

Module IV: Incidence of Taxation and Excess Burden of Tax (15 hours)

Direct and Indirect Tax; Concepts of Taxation; Tax Rate, Buoyancy and Elasticity of a Tax; Proportional, Progressive and Regressive Taxation; Concept of Shifting and Incidence, Forward and Backward Shifting, The Demand and Supply Theoryof Incidence Excess Burden of Tax: Meaning and Types

Module V: Issues from Indian Public Finance (15 hours)

Working of Monetary and Fiscal Policies; Fiscal Policies- Definition and Objectives; Instruments of Fiscal Policy; Adopting Monetary Policy to Complement Fiscal Policy; Reforms in the Indirect Tax Structure- Goods and Service Tax, Budget andDeficits; Types of Deficits and their Significance

Suggested Readings

1) Lakshmi Subramanian, History of India 1707-1857, Orient Blackswan, 2010.
2) Musgrave, R.A. and P.B. Musgrave, Public Finance in Theory and Practice, Mc-Graw Hill, 1989.
3) Agarwal, R.C., Public Finance - Theory and Practice, Lakshmi Narayan Agarwal.
4) Choudhury, R.K., Public Finance and Fiscal Policy, Kalyani Publishers.
5) Mithani, D.M., Modern Public Finance, Himalaya Publishing House.
6) Mahesh Purohit, Value Added Tax: Experience of India and Other Countries, Gayatri Publications, 2007.
7) Kaushik Basu, & A. Maertens (ed.), The Oxford Companion to Economics in India, Oxford University Press, 2007.
8) M. M. Sury, Government Budgeting in India, Commonwealth Publishers, 1990.
9) Shankar Acharya, Thirty years of tax reform in India, Economic and Political Weekly, May 2005.
10) Government of India, Report of the latest Finance Commission.
11) Economic Survey, Government of India (latest).

12) State Finances: A Study of Budgets, Reserve Bank of India (latest).

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	M	H			M
CO3			H		
CO4				H	
CO5					H
CO6				M	

ENIE0021: Indian Economy-I (5-1-0)

COURSE OUTCOMES

CO1 Learn the basic understanding of Indian economy. (Remembering) CO2 Understand the Indian economy since independence. (Understanding)CO3 Identify the main issues in Indian Setup. (Applying)
CO4 Evaluate the impact development paradigm in the Indian Scenario. (Analyzing)
CO5 Explain shortcomings of the policy and programme for economic development. (Evaluating).
CO6 To understand the relation between India and the world economy as well as its neighboring countries. (Creating**)**

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 – Objectives, Achievements and Failure of Indian Planning, Shortcomings of Planning in India; The Post-1991 Globalization Strategies based on Stabilization and Structural Adjustment Packages; Economic Growth and Development under Different Policy Regimes Goals, Constraints, Institutions and Policy Framework; NITI Aayog vs. Planning Commission

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 Indicators; Human Development Index; India's Human Development Recordin Global Perspective; Education in India – Features, Trends, Issues; Health – Trends and Issues; Malnutrition in India

Module III: Growth and 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; Inequality – 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: International Comparisons (17 hours)

India's Economic Interaction with the World Economy; A Comparative Assessment of India's Development Experience with Singapore, South Korea, China, Pakistan, Bangladesh, Sri Lanka, Nepal, Taiwan and Vietnam

Suggested Readings

1) Dutt, Rudder & K.P.M Sunderam, Indian Economy, S Chand & Co. Ltd. New Delhi, 2001.
2) Mishra, S.K & V.K Puri, Indian Economy and –Its development experience, Himalaya Publishing House, 2001.
3) Jalan, B, India's Economic Policy- Preparing for the Twenty First Century, Viking, New Delhi, 1996.
4) Himanshu, Employment Trends in India: A Re-examination, Economic and Political Weekly, September, 2011.
5) Rama, Baru et al, Inequities in Access to Health Services in India: Caste, Class and Region, Economic and Political Weekly, September, 2010.
6) Geeta, G. Kingdon, The Progress of School Education in India, Oxford Review of Economic Policy, 2007.

Mapping of COs to Syllabus

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

CO5				H
CO6				H

ENDE0046: Development Economics-I (5-1-0)

COURSE OUTCOMES

CO1 Define the various concepts of growth and development. (Remembering)
CO2 Compare and explain the difference between growth and development. (Understanding)CO3 Identify the various growth theories. (Applying)
CO4 Analyse the aspects of measuring development. (Analysing)
CO5 Justify the use of HDI over other measures of development. (Evaluating)CO6 Improve the understanding of the development process. (Creating)

Module I: Conceptions of Development (20 hours)

Development – Meaning and Definition; Difference between Growth and Development; Objectives of Development; Three Core Values of Development; Shortcomings of use of Per Capital Income as Index of Economic Development; Modern view of Economic Development – Human Development Index, Basic Needs Approach, Sen's Capabilities Approach; Top-down Development; Inclusive Development and Sustainable Development

Module II: Growth Models and Empirics (18 hours)

Growth Models and their Relevance to the UDCs; Harrod and Domar's Model of Economic Growth; The Knife Edge Problem; Solow's Neoclassical Model; Endogenous Growth Model; Kaldor's Model

Module III: Poverty and Inequality: Definitions, Measures and Mechanisms (20 hours)

Understanding Poverty – Concept and Definition; Measuring Poverty, Poverty Line, Head Count Ratio, Poverty Gap Ratio, Squared Poverty Gap Ratio, Multidimensional Poverty Index, Human Poverty Index; Measurement of Income Inequality
– Economic Growth and Income Inequality, Kuznets Hypothesis, Lorenz Curve, Gini Coefficient

Module IV: Political Institutions and the Functioning of the State (17 hours)

The Determinants of Democracy; Alternative Institutional Trajectories and their Relationship with Economic Performance;Within-country Differences in the Functioning of State Institutions; State Ownership and Regulation; Government Failuresand Corruption

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 & Dilip Mookerjee, Understanding Poverty, Oxford University Press, 2006.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2		H		
CO3			M	
CO4	M			M
CO5			H	
CO6				M

ENHE0047: Economics of Health and Education (5-1-0)

COURSE OUTCOMES

CO1 Learn the key importance of health and education in development process (Remembering)CO2 Understanding the micro economics concept in relation to health sector (Understanding
CO3 Evaluating the health care programme and policy to provide decision concerning the allocation of resources.(Applying)
CO4 Explain the health system in the context of Indian scenario. (Analyzing)
CO5 Evaluate the importance of investment in education to increase human capital. It also gives lights on direct andindirect benefits of education in development of society. (Evaluating)
CO6 Develop the knowledge of educational financing from the point of view of Economics (Creating)

Module I: Role of Health and Education in Human Development (10 hours)

Health and Education Outcomes and their Relationship with Economic Development; Investing in Health and Education – Physical Capital vs. Human Capital; Education & Health as Joint Investments for Development; Importance of Health & Education in Poverty Alleviation

Module II: Microeconomic Foundations of Health Economics (15 hours)

Demand for Health – Production Function of Health, Grossman's Model of Demand for Health; Determinants of Demand for Health & Health Care; Supply of Health Care – Health Care Delivery System; Health Insurance Market; Difference between Private and Social Health Insurance; Causes of Market Failure in the Provision of Health Services – Moral Hazard,Adverse Selection, Supplier-induced Demand, Externalities; Rationale for Government Intervention in the Health Sector; Issues of Equity and Inequality

Module III: Evaluation of Health Programs (10 hours)

Economic Evaluation of Health Care - Cost Minimization Analysis, Cost Effectiveness Analysis, Cost Benefit Analysis, Cost Utility Analysis; Burden of Disease – HALE, QALYs and DALYs

Module IV: Health Sector in India: An Overview (12 hours)

Overview of Health Care in India; Health System of India; Health Outcomes – Indicators of Health Outcomes, Socio- economic Determinants of Health; Health Financing Concept and Scope in India; Policies for Achieving Health for All

Module V: Education: Investment in Human Capital (14 hours)

Rate of Return to Education; Private and Social; Quality of Education; Education and Economic Growth; Cost of Education – Expenditure on Education; Signaling or Human Capital; Theories of Discrimination

Module VI: Education Sector in India: An Overview (14 hours)

Literacy Rates; School Participation; School Quality Measures; Gender and Caste Discrimination in India; The Approaches of Education Planning – Social Demand Approach, Social Justice Approach, Rate of Returns Approach, Man PowerPlanning Approach; Educational Planning in Developing Countries with Special Reference to India

Suggested Readings

1) William, Jack. Principles of Health Economics for Developing Countries, World Bank Institute Development Studies, 1999.
2) World Development Report, Investing in Health, The World Bank, 1993.
3) Henderson, J. W. Health Economics & Policy, (3e), Thomson South-Western, Latest Edition, 2007.
4) David, Wonderling, Reinhold Gruen & Nick Black, Introduction to Health Economics, Open University Press, 2005.
5) Sherman Folland, Allen Goodman & Miron Stano, Economics of Health and Health Care, Routledge; 8th edition, 2017.
6) Blaug, M. Introduction to Economics of Education, Latest Edition, 1972.
7) Cohen, E. & T. Gaske, Economics of Education, Latest Edition, 1989.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H			H		
CO2						M
CO3		H	L			H
CO4				H		
CO5			H			
CO6					H	

ENAE0048: Applied Econometrics (5-1-0)

COURSE OUTCOMES

CO1 Define the advanced topics like empirical research, regression diagnostics, dynamic econometric models and paneldata models. (Remembering)

CO2 Explain the dynamic econometric models and panel data models with diagnostics. (Understanding) CO3 Apply estimation methods to determine parameters of dynamic and panel data models. (Applying) CO4 Analyse the results of dynamic and panel data models along with regression diagnostics. (Analysing)CO5 Evaluate the dynamic regression models and panel data models with software package. (Evaluating)

CO6 Create and design dynamic regression models and panel data models to test hypothesis of real economic problems.(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 (10 hours)

Misspecification; Functional Forms; Model Selection

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

Module V: Introduction to Econometric Software Package (10 hours)

GRETL; E-VIEWS; STATA (any one)

Suggested Readings

1) Jeffrey M. Wooldridge, Econometrics, CENGAGE learning, India Edition, 2009.
2) Dimitrios Asteriou & 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 to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3	H		M		M
CO4				H	
CO5		M		H	
CO6					H

ENHI0044: Economic History of India (1857-1947) (5-1-0)

COURSE OUTCOMES

CO1 Understand the economic structure during colonial period. (Remembering)
CO2 Explain the agrarian structure in the post-independence period. (Understanding)
CO3 Identify their texts and link the different positions of macroeconomic trends. (Applying)CO4 Evaluate the contribution of railways and industry. (Analyzing)
CO5 Explain the government and fiscal policies under colonial rule. (Evaluating)
CO6 Discuss the usefulness of railways and industries in the development process of Indian economy. (Creating)

Module I: Introduction: Colonial India: Background and Introduction (15 hours)

An Overview of Economic Structure and Policies of Pre-independence Era, The Laws of Inheritance; Socio-cultural Attitudes and India's Economic Backwardness; Drain Theory; Economic Ideas of Ranade and Gandhi

Module II: Macro Trends (15 hours)

National Income – Trend and Composition; Population – Growth, Age Structure and Sex Composition; Changing Occupational Structure; Urbanization; Poverty

Module III: Agriculture (15 hours)

Agrarian Structure and Land Relations; Agricultural Markets and Institutions – Credit and Irrigation; Land Systems; Commercialization of Agriculture - Causes and Consequences; Trends in Performance and Productivity; Problem of Rural Indebtedness; Emergence of Agricultural Labour as Category; Famines

Module IV: Railways and Industry (15 hours)

Railways; The De-industrialization Debate; Industrial Development during the Imperial Era – Cotton, Jute, Steel, Tea Plantation; Evolution of Entrepreneurial and Industrial Structure; Nature of Industrialisation in the Interwar Period; Constraints to Industrial Breakthrough; Labor Relations

Module V: Economy and State in the Imperial Context (15 hours)

The Imperial Priorities and the Indian Economy; Drain of Wealth; International Trade, Capital Flows and the Colonial Economy – Changes and Continuities; Government and Fiscal Policy

Suggested Readings

1) William, Jack. Principles of Health Economics for Developing Countries, World Bank Institute Development Studies, 1999.
2) Lakshmi Subramanian, History of India 1707-1857, Orient Blackswan, 2010
3) SumitGuha, Mortality decline in early 20th century India', Indian Economic and Social History Review (IESHR), pp 371-74and 385-87, 1991.
4) Tirthankar Roy, The Economic History of India 1857-1947, Oxford University Press, 3rd edition, 2011.
5) J. Krishnamurty, Occupational Structure, Dharma Kumar (editor), The Cambridge Economic History of India, Vol. II,(henceforth referred to as CEHI), 2005.
6) Irfan Habib, Indian Economy 1858-1914, A People's History of India, Vol. 28

7) Ira Klein, When Rains Fail: Famine relief and mortality in British India, 1984
8) Jean Dreze, Famine Prevention in India inDreze and Sen (eds.) Political Economy of Hunger, WIDER Studies in Development Economics, 1990, pp.13-35.
9) John Hurd, Railways, CEHI, Chapter 8, pp.737-761
10) Rajat Ray (ed.), Entrepreneurship and Industry in India, 1994.
11) AK Bagchi, Deindustrialization in India in the nineteenth century: Some theoretical implications, Journal of Development Studies, 1976.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M	H		
CO3			M	H	
CO4					M
CO5				H	
CO6					H

ENTM0049: Topics in Microeconomics – I (5-1-0)

COURSE OUTCOMES

CO1 Identify the body of basic game theory concepts that enables economic analysis. (Remembering)CO2 Explicate the uses and the concepts of basic game theory. (Understanding)
CO3 Apply game techniques to elucidate economic problems. (Applying)
CO4 Assess the role of game theory in context of mathematical techniques. (Analyzing)
CO5 Explain the solution concepts for game theory with a variety of economic applications. (Evaluating)CO6 Develop basic game tools to analyze real economic problems. (Creating)

Module I: Normal form Games – I (20 hours)

The Normal form – Basic Ideas; Dominant and Dominated Strategies; Iterated Elimination of Strictly Dominated Strategies; Iterated Elimination of Weakly Dominated Strategies; Dominance Solvability; Pure and Mixed Strategies; Nash Equilibrium

Module II: Normal form Games – II (20 hours)

Symmetric Games – Player-symmetry, Strategy-symmetry, Symmetry Principle; Symmetric Single Population Games;Symmetric Equilibrium; Applications of Normal form Games

Module III: Extensive form Games with Perfect Information – I (15 hours)

Formalizing Perfect Information Extensive form Games – The Game Tree; Perfect Information Extensive form Strategies

Module IV: Extensive form Games with Perfect Information – II (20 hours)

Sub-game Perfection; Sub-game Perfect Nash Equilibrium in Finite Games; Backward Induction in Finite Games; Generalized Backward Induction Procedure; Commitment; Bargaining; Other Applications

Suggested Reading:

1) Martin J. Osborne, An Introduction to Game Theory, Oxford University Press, New Delhi, 2004.
2) Hugh Gravelle and Ray Rees, Microeconomics, Pearson Education, 2nd edition, 1992.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H		M	
CO2	M	H		
CO3			H	
CO4				M
CO5		M		
CO6				H

ENPO0050: Political Economy – I (5-1-0)

COURSE OUTCOMES

CO1 Provide students with basic conceptual tools and frameworks for analyzing economic development issues.(Remembering)
CO2 Give students a basic understanding of the economic development process in several regions of the world(Understanding)
CO3 The students understand the practical applicability of the economics theories to complex economic issues. (Applying)CO4 Develop the ability to evaluate the determinants of economic growth including institutions, human capital, international trade, and financial development. (Analyzing)
CO5 Examine various strategies that governments could employ to promote growth, such as poverty relief programs,public investment in education, intellectual property right protection, and industrial policies. (Evaluating)
CO6 Enable to examine the working of various institutional frameworks and their evolution in different phase ofEconomics reforms. (Creating)

Module I: Introduction and Historical Overview (15 hours)

Perspective on Political Economy with a Historical Overview; Capitalist Development in the Pre-second World war Period; Golden Age – Factors Contributing to Golden Age; Review of Economic Growth of Asian Countries during Golden Age

Module II: Changing Dynamics of Capitalist Production, Organizational Form. (15 hours)

Fordist and Post-Fordist Production; Inclusive vs. Extractive Institutions; Obstacles to Institutional Change; Changing Dynamics of Organization; Production, Markets and Labour Process, The Changing Nature of Job Security and Labour Rights

Module III: The State in the Era of Globalization (12 hours)

Different Views on Globalization; Welfare Development and Autonomy; Globalization and the Limits of the Welfare State;Traditional Trade Share to GDP; Job Creation; Foreign Direct Investment; Development and State Autonomy

Module IV: The Changing Role of Finance and social Dimension (15 hours)

The Changing Role of Finance in Capital Accumulation and Corporate Structure; Finance and Globalization – Financialization, Financial Liberalization – Inflow and Outflow of Capital and Financial Crisis; Globalization and Uneven Development – Growth, Inequality and Exclusion

Module V: New Perspectives of Political economy (15 hours)

Gender in Work; Gender and Wage Discrimination; Accumulation and Globalization; Issues in Environment and Sustainability; GHG Emission, Climate Change, Energy Use, Property Rights Protection; Decision Tree; Contract Enforcement and the Hold-Up Problem; Solutions to Contract Failure

Suggested Readings

1) Michel Beaud, A History of Capitalism, 1500-2000, trans. by Tom Dickman and Anny Lefebvre, New York: Monthly ReviewPress, 2001.
2) Ash Amin (ed.), Post-Fordism: A Reader, Blackwell, 1994.

3) Fran Tonkiss, Contemporary Economic Sociology: Globalisation, Production, Inequality, Chapter 4 (Fordism and After), Routledge India 2008 reprint, 2006.
4) S. Hymer, The Multinational Corporation and the Law of Uneven Development, in H. Radice (ed.) International Firms andModern Imperialism, Penguin Books, 1975.
5) David Harvey, A Brief History of Neoliberalism, OUP, 2005.
6) Andrew Glyn, Challenges to Capital, in Capitalism Unleashed: Finance, Globalization and Welfare, Oxford: Oxford University Press, (Ch. One, pp. 1-24), 2006.
7) G Dumenil & D Levy, The Crisis of Neoliberalism, Harvard University Press, 2011.
8) K.S. Jomo (ed.), The Long Twentieth Century: The Great Divergence: Hegemony, Uneven Development and GlobalInequality, OUP, 2006.
9) Marilyn Power, 2004, Social Provisioning as a Starting Point for Feminist Economics, Feminist Economics, Volume 10: 3-19.
10) John Bellamy Foster, Ecology against Capitalism, Monthly Review Press, 2002.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1		M	M		
CO2	H				
CO3	M	H		M	
CO4			H		H
CO5				H	
CO6					M

ENFM0051: Money and Financial Markets (5-1-0)

COURSE OUTCOMES

CO1 Assess the components of a financial system with respect to real economy linkages and financial market participants (Remembering)
CO2 Understand the impact of central bank monetary policy on financial systems and the overall economy.(Understanding)
CO3 Appraise the roles of financial intermediaries as both brokers and asset transformers. (Applying)
CO4 Assess the development of financial markets and securities in response to market participant requirements.(Analyzing)
CO5 Evaluate the different financial intermediation and risk management services that financial institutions provide andthe need for governmental regulation. (Evaluating)
CO6 Develop the knowledge of working of the central bank of the country in maintaining the financial target of theeconomy. (Creating)

Module I: Money and functions of money (12 hours)

Concept of Money; Functions of Money; Medium of Exchange, Unit of Account, Store of Value; Theories of Demand forMoney; Type of Money – M1, M2, M3, M4 and H Theory of Money Supply

Module II: Financial Institutions, Markets, Instruments and Financial Innovations (18 hours)

Role of Financial Markets and Institutions; Problem of Asymmetric Information – Adverse Selection and Moral Hazard;Money and Capital Markets: Organization, Structure and Reforms in India; Role of Financial Derivatives

Module III: Interest Rates (14 hours)

Determination of Rate of Interest; Importance of Interest; Sources of Interest Rate Differentials; Compound and SimpleInterest Rate; Theories of Term Structure of Interest Rates; Interest Rates in India

Module IV: Banking System in India (16 hours)

Indian Banking System – Changing Role and Structure; Banking Sector Reforms; The Evolution of Commercial Banks,Credit Creation System of Commercial Bank; Regional Rural Bank in India; Non-Performing Asset

Module V: Central Banking and Monetary Policy (12 hours)

Functions, Balance Sheet; Goals of Central Bank, Instruments of Monetary Control; Qualitative and Quantitative Measuresof Credit Control; 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) M. R. Baye & D. W. Jansen, Money, Banking and Financial Markets, AITBS, 1996.
4) Rakesh Mohan, Growth with Financial Stability- Central Banking in an Emerging Market, Oxford University Press, 2011.
5) L. M. Bhole & J. Mahukud, Financial Institutions and Markets, Tata McGraw Hill, 5th edition, 2011.
6) M. Y. Khan, Indian Financial System, Tata McGraw Hill, 7th edition, 2011.
7) N. Jadhav, Monetary Policy, Financial Stability and Central Banking in India, Macmillan, 2006.
8) R.B.I., Report of the Working Group: Money Supply Analytics and Methodology of Compilation, 1998.
9) R.B.I. Bulletin, Annual Report and Report on Currency and Finance (latest).

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H	M		
CO3		M			
CO4					H
CO5				H	
CO6					H

ENPF0020: Public Economics (5-1-0)

COURSE OUTCOMES

CO1 Define the main concepts in public economic policies. (Remembering)
CO2 Explain the concepts of public goods, public expenditures and taxation. (Understanding)
CO3 Identify the main issues of budgeting and fiscal policies. (Applying)
CO4 Evaluate economic concepts of income redistribution. (Analyzing)
CO5 Explain the evaluation of budget deficit and public debt. (Evaluating)
CO6 Discuss the working principle of fiscal federalism in India. (Creating)

Module I: Public Economic Theory (38 hours)

a) Fiscal Functions: An Overview; Meaning and Scope of Public Economics; Need for Public Sector; Allocation, Distribution and Stabilization Functions of Government; Co-ordination and Conflict of Functions
b) Public Goods: Meaning and Characteristics; Pure and Impure Public Goods; The Free Rider Problem; EfficientAllocation of Public Goods – The Lindahl Equilibrium and Samuelson‘s Theory of Public Expenditure
c) Externalities: Meaning and Type of Externalities; Market Failure and Externalities; Internalization of Externalities – Corrective Taxes and Subsidies; Assignment of Property Rights – The Coase Theorem
d) Taxation: Its Economic Effects; Dead Weight Loss and Distortion; Efficiency and Equity Considerations; Tax Incidence; Optimal Taxation

Module II: Indian Public Finances (37 hours)

a) Tax System – Main Features of India's Tax System; Changing Tax Structure of India; Major Tax Reforms since 1991

b) Budget; Deficits and Public Debt – Stages of Budget Preparation; Revenue and Capital Budget; Concept of Deficits – Budgetary Deficit, Revenue Deficit, Fiscal Deficit, Primary Deficit; Budgetary Trend in India; Study of Latest Union Budget; Necessity of Public Debt; Characteristics of India's Public Debt; India's Internal and External Debt Liabilities;
Problems of Public Debt Policy

c) Fiscal Federalism in India: Meaning; Inter Governmental Resource Transfer – Trend and Techniques; Role of Finance Commission; Critical Evaluation of Finance Commission's Awards; Recommendations of the Latest Finance Commission

Suggested Readings

1) J. Hindriks, & G. D. Myles, Intermediate Public Economics, MIT Press, 2006.
2) H. Rosen, & T. Gayer, Public Finance, 9th ed., McGraw-Hill/Irwin, 2009.
3) Joseph E. Stiglitz, Economics of the Public Sector, W.W. Norton & Company, 3rd edition, 2000.
4) R.A. Musgrave & P.B. Musgrave, Public Finance in Theory & Practice, McGraw Hill Publications, 5th edition, 1989.
5) John Cullis & Philip Jones, Public Finance and Public Choice, Oxford University Press, 1st edition, 1998.
6) Harvey Rosen, Public Finance, McGraw Hill Publications, 7th edition, 2005.
7) Mahesh Purohit, Value Added Tax: Experiences of India and Other Countries, 2007.
8) KaushikBasu & A. Maertens (ed.), The New Oxford Companion to Economics in India, Oxford University Press, 2013.
9) M.M. Sury, Government Budgeting in India, 1990.
10) M. Govinda Rao, Changing Contours of Federal Fiscal Arrangements in India, AmareshBagchi (ed.), Readings in PublicFinance, Oxford University Press, 2005.
11) Paul Samuelson, Diagrammatic Exposition of a theory of Public Expenditure, Review of Economics and Statistics, Volume37, 1955

Mapping of COs to Syllabus

	Module I	Module II
CO1	M	
CO2		M
CO3	H	
CO4		H
CO5	M	
CO6	M	H

ENIY0025: Indian Economy-II (5-1-0)

COURSE OUTCOMES

CO1 Define the Macroeconomic Policies and their Impact Indian Economy. (Remembering)

CO2 Explain the policies and Performance in Agriculture. (Understanding)
CO3 Identify the policies and performance in Industry. (Applying)
CO4 Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Analyzing)
CO5 Explain the trends and performance in service sectors. (Evaluating)
CO6 Discuss their understanding of the usefulness of various development policies. (Creating)

Module I: Macroeconomic Policies and their Impact (20 hours)

Fiscal Policy – Fiscal Reform Measures in the Context of India's New Economic Policy, Fiscal Responsibility and Budget Management (FRBM) Act; Monetary Reforms and its Impact; Black Money and Parallel Economy in India – Consequences and Corrective Government Intervention; Trade and Investment Policy – Export Import Policy, Foreign Trade Policy;Current and Capital Account Convertibility; Labour Regulation

Module II: Policies and Performance in Agriculture (20 hours)

Changing Structure of Indian Agriculture; Sustainable Agriculture – Concept and Constraints; Diversification of Agriculture;Agrarian Structure and Technology; Green Revolution and its Impact on Agricultural Development; Land Reforms and Agricultural Growth in India; Role of Rural Credit in Agrarian Sector; Agricultural Marketing and Strategy for Development;Trade – WTO and Agriculture; Agricultural Pricing Policy in India; Pricing and Procurement of Agricultural Products

Module III: Policies and Performance in Industry (20 hours)

Pattern of Industrialization; Industrial Growth and Productivity in the Post Reform Period; Diversification of Industries; New Industrial Policy and Economic Reforms in India; Disinvestment and Privatization; Development of MSME Sector; Globalization and Competition; Foreign Investment in the Industrial Sector

Module IV: Trends and Performance in Services (15 hours)

Role of the Service Sector in the Indian Economy, Growth and Composition of the Service Sector; Formal and Informal Enterprises in Service Sector; Trend and Growth of Banking and Insurance; Balance of Payments Position – Pre and Post Reform Period; Trade in Services and WTO

Suggested Readings

1) Shankar Acharya, Macroeconomic Performance and Policies 2000-08, 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) Pulapre Balakrishnan, Ramesh Golait & Pankaj Kumar, Agricultural Growth in India Since 1991, RBI DEAP Study no. 27,2008.
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, rade Liberalisation and New Imported Inputs, American EconomicReview, Papers and Proceedings, May, 2009.
6) Kunal Sen, Trade, Foreign Direct Investment and Industrial Transformation in India, in Premachandra Athukorala (Editor),The Rise of Asia, Routledge, 2010.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3	M		H	
CO4			M	
CO5				H
CO6				H

ENDE0052: Development Economics-II (5-1-0)

COURSE OUTCOMES

CO1 Define the key concept of demography (Remembering)
CO2 Explain the concept of land, labour, and credit market in order to understand the problem faced by developingcountries. (Understanding)
CO3 Identify the sustainable development issues for sustainable growth. (Applying)
CO4 Analyze the role of globalization in the process of development. (Analyzing)
CO5 Explain the governance of communities and organizations in developing countries. (Evaluating)
CO6 Discuss various aspects of process of development. (Creating)

Module I: Demography and Development (20 hours)

Meaning and Scope of Demography; Demographic Concepts – Birth and Death Rates, Age Structure, Fertility and Mortality, Life Expectancy at Birth, Sex Ratio; The Theory of Demographic Transition – Demographic Transitions During the Process of Development; Gender Bias in Preferences and Outcomes and Evidence on Unequal Treatment Within Households; Connections between Income, Mortality, Fertility Choices and Human Capital Accumulation; Migration

Module II: Land, Labour and Credit Markets (18 hours)

The Distribution of Land Ownership; Land Reform and its Effects on Productivity; Contractual Relationships between Tenants and Landlords; Land Acquisition; Nutrition and Labour Productivity; Informational Problems and Credit Contracts; Microfinance; Interlinkages between Rural Factor Markets

Module III: Individuals, Communities and Collective Outcomes (15 hours)

Individual Behaviour in Social Environments; Multiple Social Equilibria; Governance in Organizations and in Communities; Individual Responses to Organizational Inefficiency

Module IV: Environment and Sustainable Development (12 hours)

Defining Sustainability for Renewable Resources; Brief History of Environmental Change; Common-Pool Resources; Environmental Externalities and State Regulation of the Environment; Economic Activity and Climate Change

Module V: Globalization (10 hours)

Concept of Globalization; Globalization in Historical Perspective; Economics and Politics of Multilateral Agreements; Trade; Production Patterns and World Inequality; Trade and Development Strategies – Import Substitution vs. Export Promotion; Financial Instability in a Globalized World

Suggested Readings

1) A. Banerjee, R. Benabou, D. Mookerjee (eds.), Understanding Poverty, Oxford University Press, 2006.
2) P. Dasgupta, Economics: A Very Short Introduction, Oxford University Press 2007.
3) C. Kolstad, Intermediate Environmental Economics, Oxford University Press, 2012.
4) G. Meier, J. Rauch, Leading Issues in Economic Development, Oxford University Press, 2005.
5) W. Nordhaus, The Climate Casino, Yale University Press, 2013.
6) R. Rajan, Fault Lines, How Hidden Fractures Still Threaten the World Economy, 2010.
7) D. Ray, Development Economics, Princeton University Press, 1998.
8) D. Rodrik, The Globalization Paradox: Why

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2	H				H
CO3		M	M		
CO4				H	M
CO5			H		
CO6				H	

ENPC0053: Political Economy – II (5-1-0)

COURSE OUTCOMES

CO1 The students get the idea of the origin of Capitalism thoughts (Remembering)
CO2 Develop the knowledge of the relation between the capitalist economics and monopolist capitalism working.(Understanding)
CO3 Realization of working of the state in a capitalist economy (Applying)
CO4 Development the idea of the origin of economics in Indian context of Chanakya's Arthashastra. (Analyzing)
CO5 Evaluating the various conflicts of economics and political thoughts over the various phase of time. (Evaluating)
CO6 Develop the knowledge of various class conflicts in India during the colonial period. (Creating)

Module I: Analyzing Social Change in Historical Perspective (18 hours)

The Method of Historical Materialism; Transition from Feudalism to Capitalism – Factors Responsible for Transition of Feudalism to Capitalism; Capitalism as a Historical Process – Characteristic of Capitalism, Industrial Revolution and Capitalism; Alternative Perspectives

Module II: Capitalism as an Evolving Economic System (17 hours)

Basic Features; Accumulation and Crisis; Modern Corporation; Monopoly Capitalism – Process of Concentration andCentralization of Capital, Competitive Process, Capitalist Relation

Module III: The State in Capitalism (17 hours)

The State and the Economy; Contestation and Mutual Interdependence; The State as an Arena of Conflict;Imperialism – The Basic Foundations

Module IV: Class relationship in India (20 hours)

Early Indian Economic Thought – Chanakya's Arthashastra; Colonial Economic Policies; Class Politics and Indian States – Class Politics, Minority Politics, Types of Politics and Economic Performance; Demand Polity and Command Polity

Suggested Readings

1) J. Gurley, The Materialist Conception of History, Ch.2.1 in R. Edwards, M. Reich and T. Weisskopf (ed.), The Capitalist System, 2nd edition, 1978.
2) O. Lange, Political Economy, Vol. 1, 1963.
3) E.K. Hunt, History of Economic Thought, M.E. Sharpe, Indian edition, Shilpi Publications, 2004.
4) Irfan Habib, Capitalism in History, Social Scientist, Vol. 23:15-31, 1995.
5) R.L. Heilbroner, Capitalism, in The New Palgrave Dictionary of Modern Economics, Macmillan, Also reprinted as Chapter 2in Behind the Veil of Economics by R.L. Heilbroner, W.W. Norton, 1988.
6) P. Sweezy, The Theoryof Capitalist Development, Monthly Review Press, 1942.
7) J. Schumpeter, Capitalism, Socialism and Democracy**,** George Allen and Unwin 1976.
8) P. Baran (1957), The Political Economy of Growth, Chapter 3, Pelican edition, 1973.
9) R. Heilbroner, The Role of the State, in The Nature and Logic of Capitalism, 1985.
10) M. Kalecki, Political Aspects of Full Employment, in E.K. Hunt and J. G. Schwarz (eds.), A Critique of Economic Theory,Penguin Books, 1972.
11) Prabhat Patnaik, Lenin's Theory of Imperialism Today in K. S. Jomo (ed.) The Long Twentieth Century: The Great Divergence: Hegemony, Uneven Development and Global Inequality, OUP.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2	H	M		
CO3		H		
CO4				H
CO5			H	M
CO6		H		

ENCC0054: Comparative Economic Development (1850-1950) (5-1-0)

COURSE OUTCOMES

CO1 Learn the key importance of comparative economic development issues (Remembering).CO2 Develop the understanding of key comparative economic (Understanding)
CO3 Show a clear awareness of the historical underpinning of economic development in Britain, Japan and China.(Applying)
CO4 Describe and analyze the main sectors and institutions in each of these contemporary economies.(Analyzing)CO5 Evaluate the key factors of the agricultural revolution experienced by Great Britain and the rise of Industries.
(Evaluating)
CO6 Improve the understanding of the industrial working class and their growth. (Creating)

Module I: Introduction and Perspectives on Comparative Economic Development (10)

Introduction to Comparative World Economic History; Perspectives on World Economic History; Why Study Comparative World Economic History?

Module II: An Overview of Economic Development of the countries selected for case studies (20)

Britain – Pre requisites for Industrial Revolution and the Socio-economic Climate in Britain that was Conducive to its Industrial Growth; CHINA – Ming and Qing Dynasty; An Overview of the Agricultural Sector; JAPAN – Imperial Rule Paving way for Samurai Governance; Rise of EDO Governance – An Overview of the Agricultural Sector

Module III: Agriculture (10)

Agrarian Surplus and the Role of the Peasantry in Economic Development; Agricultural Revolution

Module IV: Industry (10)

The Industrial Revolution in Britain; Spread of Industrial Revolution Worldwide; Movement towards Industrial Growth; Industrialization in Late Industrializers

Module V: The Factory System and Making of the Industrial Working Class (15)

Division of Labour; Structure of Industrial Authority; Organisation of Work and Industrial Production; Relationship between Workers and Managers

Module VI: The Role of the State in Industrial and Developmental Transition (10 hours)

Market Failures and Importance of State Intervention; Role of the State in Developmental Transition Especially in Agricultural and Industrial Sectors; State and Corruption; Role of the State in India for Economic Development – Development Plans and Policy Choices, Allocation of Resources in Industry and Agriculture

Suggested Readings

1) J. Gurley, The Materialist Conception of History, in R. Edwards, M. Reich and T. Weisskopf (ed.), The Capitalist System, 2nd edition, 1978.
2) E.J. Hobsbawm, World of Labour: Further studies in the history of labour, London Weidenfeld & Nicholson, 1984.
3) E.J. Hobsbawm, Industry and Empire: An Economic History of Britain since 1750, Weidenfeld & Nicholson, 1968.
4) Peter Mathias, The First Industrial Nation, An Economic History of Britain, 1700-1914. 2nd edition Methuen, 1983.
5) T. Nakamura, Economic Growth in Pre-War Japan, Tr. by Robert A Feldman, Yale University Press, 1983.
6) Okochi, Karsh & Levine, Workers and Employees in Japan, The Japanese Employment Relations System, University ofTokyo, 1965.
7) Y. Hayami, A Century of Agricultural Growth in Pre-War Japan: Its Relevance to Asian Development, University ofMinnesota Press, 1975.
8) Chalmers Johnson, MITI and the Japanese Miracle: The Growth of Industrial Policy 1925-1975, Stanford UniversityPress, 1982.
9) W.W. Lockwood, Economic Development of Japan, Expanded edition, Princeton University Press, 1966.
10) Dobb M., Soviet Economic Development since 1917, Universal Book Stall, New Delhi, 1995.
11) Paul R. Gregory & Robert C. Stuart, Soviet Economic Structure and Performance, Harper & Row, 3rd edition, 1986.
12) Hughes & Cain, American Economic History, HarperCollins College Publishers, 4th edition, 1994.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	M					
CO2		M	M			
CO3					H	
CO4				H		M
CO5			M		H	
CO6				H		H

ENFI0055: Financial Economics (5-1-0)

COURSE OUTCOMES

CO1 Define the various components of Financial System. (Remembering)
CO2 Explain the various concepts related to the investment theory. (Understanding)CO3 Identify the capital asset pricing models. (Applying)
CO4 Compare the various concepts of options and derivatives. (Analysing)
CO5 Explain the importance corporate finance and related concepts. (Evaluating)CO6 Discuss pattern and working principles of corporate finance.

Module I: Investment Theory and Structure of Interest rates: Deterministic cash-flow streams (15 hours)

Basic theory of Interest; Discounting and Present Value; Internal Rate of Return; Evaluation Criteria; Fixed-Income Securities; Bond Prices and Yields; Interest Rate Sensitivity and Duration; Immunisation; The Term Structure of InterestRates; Yield Curves; Spot Rates and Forward Rates

Module II: Models of Single-period random cash flows (15 hours)

Random Asset Returns; Portfolios of Assets; Portfolio Mean and Variance; Feasible Combinations of Mean and Variance; Mean-Variance Portfolio Analysis – The Markowitz Model, The Two-Fund Theorem; Risk-Free Assets and The One-Fund Theorem

Module III: Capital Asset Pricing Model (12 hours)

The Capital Market Line; The Capital Asset Pricing Model; The Beta of an Asset and of a Portfolio; Security Market Line;Use of The CAPM Model in Investment Analysis and as a Pricing Formula

Module IV: Options and Derivatives (18 hours)

Introduction to Derivatives and Options; Forward and Futures Contracts; Options; Other Derivatives; Forward and Future Prices; Stock Index Futures; Interest Rate Futures; The Use of Futures for Hedging; Duration-Based Hedging Strategies; Option Markets; Call and Put Options; Factors Affecting Option Prices; Put-Call Parity; Option Trading Strategies: Spreads; Straddles; Strips and Straps; Strangles; The Principle of Arbitrage; Discrete Processes and The Binomial Tree Model; Risk- Neutral Valuation

Module V: Corporate Finance (15 hours)

Patterns of Corporate Financing – Common Stock, Debt, Preferences, Convertibles; Capital Structure and the Cost of Capital; Corporate Debt and Dividend Policy; The Modigliani- Miller Theorem

Suggested Readings

1) J. Gurley, The Materialist Conception of History, in R. Edwards, M. Reich and T. Weisskopf (ed.), The Capitalist System, 2nd edition, 1978.
2) David G. Luenberger, Investment Science, Oxford University Press, USA, 1997
3) Hull, John C., Options, Futures and Other Derivatives, Pearson Education, 6th edition, 2005.
4) Thomas E. Copeland, J. Fred Weston & Kuldeep Shastri**,** Financial Theory and Corporate Policy, Prentice Hall, 4thedition, 2003.
5) Richard A. Brealey & Stewart C. Myers, Principles of Corporate Finance, McGraw-Hill, 7th edition, 2002.

6) Stephen A. Ross, Randolph W. Westerfield & Bradford D. Jordan, Fundamentals of Corporate Finance. McGraw-Hill,7th edition, 2005.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1		M			
CO2	M		H		
CO3		M		H	
CO4			H		
CO5				H	
CO6					H

ENTM0056: Topics in Microeconomics – II (5-1-0)

COURSE OUTCOMES

CO1 Identify the body of game theory concepts that enables economic analysis. (Remembering)CO2 Explicate the uses and the concepts of game theory. (Understanding)
CO3 Apply Bayesian game techniques to elucidate economic problems. (Applying)CO4 Assess the role of information in formulating game theory. (Analyzing)
CO5 Explain the solution concepts for game theory with a variety of economic applications. (Evaluating)CO6 Develop game techniques to analyze real economic problems. (Creating)

Module I: Repeated Games (25 hours)

The Basic Idea; Finitely Repeated Games vs. Infinitely Repeated Games; Finitely Repeated Games and Backward Induction;Infinitely Repeated Games; History Dependent Strategies; One-step Deviation Property; The Repeated Prisoners' Dilemma; Idea of Folk Theorem – Nash Folk Theorem

Module II: Simultaneous-move Games with Incomplete Information (Bayesian Games) (16 hours)

Strategies; Solving Bayesian Games; Information and Bayesian game; Bayesian Nash Equilibrium; Public Good Provisions; Auctions; Other Applications of Bayesian Games

Module III: Extensive form Games with Imperfect Information (22 hours)

Strategies; Principles for the Equivalence of Extensive Games; Mixed and Behavioral Strategies; Sequential Equilibrium – Strategies and Beliefs; Games with Observable Actions; Applications

Module IV: Information Economics (12 hours)

Adverse Selection – Consequences, Solutions, Numerical Example with Private Information; Moral Hazard – Consequences, Solutions; Signaling Games

Suggested Readings

1) Martin J. Osborne, An Introduction to Game Theory, Oxford University Press, New Delhi, 2004.
2) Hugh Gravelle & Ray Rees, Microeconomics, Pearson Education, 2nd edition, 1992.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2	M		H	
CO3				H
CO4	H			
CO5		H		
CO6			M	H

ENEE0026: Environmental Economics (5-1-0)

COURSE OUTCOMES

CO1 Define the basic concepts of environmental economics. (Remembering)
CO2 Understand the environmental issues in relation to the theory of externalities. (Understanding)CO3 Apply principles concerning the environmental problems and policies. (Applying)
CO4 Analyze environmental problems using economic principles. (Analysing)
CO5 Evaluate the diverse methods of environmental valuation for sustainable development. (Evaluating)
CO6 Develop an approach to examine the contemporary environmental issues from an economists' viewpoint. (Creating)

Module I: Introduction (10 hours)

Environmental Economics – Meaning, Nature, Scope; Interlinkage between Economy and Environment; Population and Environment; Poverty and Environment

Module II: The Theory of Externalities (10 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 (15 hours)

Overview; Pigouvian Taxes and Effluent Fees; Tradable Permits; Choice between Taxes and Quotas under Uncertainty; Implementation of Environmental Policy

Module IV: International Environmental Problems (10 hours)

Trans-Boundary Environmental Problems; Economics of Climate Change; Trade and Environment

Module V: Measuring the Benefits of Environmental Improvements (20 hours)

Non-Market Values – Use Value, Option Value, Bequest Value; Measurement Methods – Willingness to Pay andWillingness to Accept Compensation; Risk Assessment and Perception

Module VI: Sustainable Development (10 hours)

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

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H			M		
CO2		H		H		M
CO3	M		H			H
CO4		H				
CO5			M		H	
CO6						

ENIE0024: International Economics (5-1-0)

COURSE OUTCOMES

CO1 Know the key principles of international economics. (Remembering)
CO2 Understand the main theories of international economics. (Understanding)
CO3 Apply the theories and models of international trade for economic growth and global welfare. (Applying)
CO4 Analyse the links between trade, international finance, economic growth and globalization, with a particular emphasison the experiences of developing countries. (Analysing)
CO5 Evaluate international trade policies regarding increase in exports, international debt, and international institutions tosolve domestic economic problems. (Evaluating)
CO6 Design and develop economists' arguments concerning international trade and policies. (Creating)

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 Flow of Goods, Services, and Capital; Current International Economic Problems and Challenges

Module II: Theories of International Trade (25 hours)

The Ricardian Theory of Trade; Specific Factor Model of Trade; Heckscher-Ohlin Models; New Trade Theories; TheInternational 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; 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 (15 hours)

Balance of Payments – Current and Capital Account; Exchange Rates – Fixed vs. Flexible Exchange Rates, Spot and Forward Exchange Rates; Foreign Exchange Risks – Hedging, Speculation, Interest Arbitrage; International Monetary Systems; 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 Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		H
CO3	M	H		
CO4			H	
CO5				H
CO6			M	

ENDI6001: Dissertation/Project

Course Description:

The UG 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.

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 students will also learn how to apply the statistical and econometric tools in their own research.

The Structure of the Course:

In Dissertation, the students have to independently think of a research idea and, by the end of the semester, have to defend a research proposal based on the idea i.e. need to present the Synopsis by the end of the sixth 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 submitthe 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

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, Collection of data.
4.	Validation of data, data entry and preliminary analysis of data (drawing graphs, trend lines, etc)
5.	Main data analysis
6.	Dissertation writing and Proof reading
7.	Submission and Viva Voce

Mapping of Courses to POs/PSOs – BA (Honours)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
1.1	M							H					
1.2							M	L	H	M			
1.3	M							H					
2.1							M	H			M		
2.2							M	L	H	M			
2.3							M	H			M		
3.1	M							H		L	L	L	
3.2							M	H			M		
3.3	H						L		H				
3.4													
3.5			L	M			L				L		H
3.6							M	L			M		M
3.7	M					H	M				M	H	L
4.1	M							H	L				
4.2							M	H			M		
4.3	M									H			
4.4	H	M					M		H	H	M		
4.5			L	M			L				L		H
4.6			L	H			M				M		H
4.7	M			M			M	M			M		M
5.1			L	M			L				L		H
5.2	L						H				H		L
5.3	M		M		H		M				M		
5.4													
5.5			L	H			M				M		H
5.6	M						L		M	M	L	M	M
5.7		H	M	M				L			M		M
5.8				L			M	L	L	L	L	M	M
5.9		M	H	M	M		L	L			M		M
6.1			L	M		L	L				L		H
6.2	L				L		H	M			H	L	L
6.3		L	L	L	H			L			H		H
6.4	M		M	L		M	M				M	M	M
6.5	M			L			L	M	L	L	L	H	M
6.6	M							H		L			
6.7	M					H	M				M	H	L
6.8		L	M	M		L	M		L	L	M	M	
6.9	M	M	H	M			M		M	M			M

MASTER OF ARTS - MA ECONOMICS

(w.e.f. *2021 Batch*)

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 theability 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 policymaking. 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 governingtrade and relations across countries.

PSO 5. **Perspective of Sectoral Knowledge:** To equip with the knowledge of sectoral behaviour, sector specific theories andpolicies.

PSO 6. **Population and Behavioural Studies:** To understand the principles of population and human decision makingbehaviour guided by cognitive skills.

DETAILED SYLLABUSTHEORY COURSES

ENML0046: Microeconomic Analysis (4-0-0)

COURSE OUTCOMES

CO1 Describe the detail concepts of microeconomics (Remembering)

CO2 Illustrate the behaviour of economic agents as well as the behaviour of the firms (Understanding)CO3 Apply microeconomic concepts and theories to analyse real-life situations (Applying)

CO4 Illustrate the interactions of Microeconomics with other branches of Economics (Analyzing)

CO5 Elucidate the effects of economic policies on microeconomic behaviour and thus on the overall economic activities(Evaluating)

CO6 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

	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

CO1 Describe the detail concepts of macroeconomics and its related terms. (Remembering)
CO2 Identify the behaviour of macroeconomic variables and their interdependences in a closed as well as in an openeconomy. (Understanding)
CO3 Apply macroeconomic variables and concepts in examining the real-life situation (Applying)
CO4 Evaluate the role of macroeconomic variables in smooth functioning of an economy and its dynamics. (Analyzing)
CO5 Elucidate the effects of macroeconomic changes and policies on overall growth and development of an economy.(Evaluating)
CO6 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 BusinessCycles – 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; Inflationand 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

	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

CO1 Identify the body of basic mathematics that enables economic analysis (Remembering) CO2 Explicate the usage of the concepts of mathematics in Economics (Understanding)
CO3 Apply mathematical techniques to elucidate economic problems (Applying)
CO4 Assess the role of economic theory and draw inference in context of mathematical techniques (Analysing) CO5 Explain the solution concepts for economic problems with a variety of economic applications (Evaluating) CO6 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

	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

CO1 Define the key aspects of economic development. (Remembering)
CO2 Explain the role of various measurement of economic development. (Understanding)CO3 Identify the various theories and approaches to economic development. (Applying) CO4 Analyse the uses of various development theories of growth. (Analyzing)
CO5 Explain the importance of development theories. (Evaluating)
CO6 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

	Module I	Module II	Module III	Module IV
CO1		M		
CO2	M	H		
CO3				H
CO4			H	
CO5				H
CO6			H	

Department Electives

ENMB0050: Money and Banking (3-0-0)

COURSE OUTCOMES

CO1 Learn basic ideas of monetary theory and the effects of monetary variables on the macroeconomic system.(Remembering)
CO2 Understand the working of non-banking financial institution and international financial institutions. (Understanding)
CO3 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)
CO4 Understand the working of Indian baking system and the inter connectivity of the banks. (Analyzing)CO5 Enable to evaluate the trend of financial reform in the field of financial inclusion. (Evaluating)
CO6 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

	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

CO1 Learn the key issues related to the Indian economy. (Remembering)
CO2 Understand the economic reforms and its impact on Indian economy. (Understanding)CO3 Identify the policies and performance in different sector (Applying)
CO4 Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Analyzing)CO5 Explain the economic reform and its impact in Indian economy. (Evaluating)
CO6 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, India's Economy: Performances and Challenges: Development and Participation, Oxford University Press, 2010.
3) Pulapre Balakrishnan, The Recovery of India: Economic Growth in the Nehru Era, Economic and Political Weekly,November, 2007.
4) Pulapre Balakrishnan, Ramesh Golait & Pankaj Kumar, Agricultural Growth in India Since 1991, RBI DEAP Study No. 27,2008.

5) 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.
6) 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

	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

CO1 Explain in detail the measures and approaches of various statistical tools and techniques (Remembering) CO2 Express the notion of pre-specified ideas about statistical parameters and methods for hypothesis testing. (Understanding)
CO3 Explicate the idea statistical estimation and analytical techniques (Applying)
CO4 Gain computational skills to put into practice various statistical inferential approaches (Analysing)CO5 Evaluate the underlying assumptions of various analysis tools and techniques (Evaluating)
CO6 Analyze the results and suggest recommendations to the decision making processes (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; Moment Generating Functions; Conditional Expectation and Distribution; Conditional Variance; Applications; Characteristic Function of a Random Variable

Module III: Sampling Techniques (15 hours)

A Brief Review of Random Sampling and Estimates of a Population Mean; Ratio Method Estimation – Concept, Bias; Ratio Estimators in Simple Random Sampling and Stratified Random Sampling; Regression Method of Estimation – Concept, Bias; Regression Estimators in Simple Random Sampling and Stratified Random Sampling; Cluster Sampling – Estimation with Equal and Unequal Clusters; Sub Sampling (Two-Stage only)

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

	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2	M		H	
CO3		M		H
CO4			H	
CO5			M	
CO6				H

ENEM0053: Econometric Methods (4-0-0)

COURSE OUTCOMES

CO1 Define the basic concepts of econometrics and statistics. (Remembering)
CO2 Explain the concepts of simple linear regression and its associated topics. (Understanding)CO3 Apply the regression models estimating regression parameters using OLS. (Applying)
CO4 Analyse the results of regression models with hypothesis testing and different statistical tests. (Analysing)CO5 Evaluate the regression models along with diagnostics and model specification. (Evaluating)
CO6 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 TobitProbability 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

	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

CO1 Define the main concepts in public economic policies. (Remembering)
CO2 Explain the concepts of public goods, public expenditures and taxation. (Understanding)CO3 Identify the main issues of budgeting and fiscal policies. (Applying)
CO4 Evaluate economic concepts of income redistribution. (Analyzing)
CO5 Explain the evaluation of public investment projects and decision making in the public sector. (Evaluating)
CO6 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

	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

CO1 Understand the recent economic reforms in Indian economy since 1991. (Remembering)
CO2 Explain the sector wise reform ranging from agriculture to service sector and foreign trade as well. (Understanding)CO3 Identify the main issues of reform and policy debate and its performance in Indian Economy. (Applying)
CO4 Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Analyzing)CO5 Explain the trends and performance in service sectors. (Evaluating)
CO6 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), Oxford University Press, New Delhi, 1999.

Mapping of COs to Syllabus

	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

CO1 Know about Indian tax system and its type and reforms over the years (Remembering)
CO2 Discuss the various types of grants available and the mechanism of availing those grants (understanding)
CO3 Develops analytical framework that facilitates the evaluation of public policy and subsequently inform the publicdebate. (Applying)
CO4 Evaluate the process of budget allocation and discuss the trend of government expenditure (Analyzing)
CO5 Examining the working of various international financial institution in the context of globalization (Evaluating)CO6 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 ofGrants – 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

	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

CO1 Describe the different types of research and the needs of research in Economics (Remembering)

CO2 Identify the essential conditions helpful for the formulation of research hypothesis (Understanding)

CO3 Evaluate the various tools and techniques of sampling to collect data (Applying)
CO4 Gain knowledge of statistical software for analysing data (Analysing)
CO5 Assess the relative importance of various analytical tools and techniques (Evaluating)
CO6 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

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

	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		M		H	
CO3	H				H
CO4			M		
CO5		H		M	
CO6			H		H

ENES0058: Environmental Economics and Sustainability (4-0-0)

COURSE OUTCOMES

CO1 Define the basic concepts of environmental economics, including its key principles and methods. (Remembering)CO2 Understand the environmental issues in relation to the theory of externalities, public goods, and welfare. (Understanding)

CO3 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)

CO4 Analyze environmental problems using various economic techniques and to assess various environmental policies andissues. (Analysing)

CO5 Evaluate and examine the methods developed for valuing environmental goods and services for sustainabledevelopment. (Evaluating)

CO6 Develop and design various approaches to examine issues in the contemporary environmental discourse from an 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

	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

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.	a) Synopsis Presentation b) 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)	

ENEG0059: Agriculture Economics – Issues and Management (4-0-0)

COURSE OUTCOMES

CO1 Draw distinctive features of agriculture which can influence the whole economy (Remembering)
CO2 Recognize limited resources available in the economy and realize the need of their efficient allocations throughimproved production techniques (Understanding)
CO3 Identify the new investment opportunities in agriculture to challenge economic problems like unemployment,inequality etc. (Applying)
CO4 Assess the role of agricultural policies to achieve harmonious development (Analysing)
CO5 Explain the trade-off between agriculture and non-agriculture to achieve sustainable agricultural development and in sensitizing overall development (Evaluating)
CO6 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)

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 Creditand Rural Indebtedness; Need for State Intervention

Module IV: Farm Management (12 hours)

Farm Management Analysis – Production Function Approach, Farm-budgeting Approach; Farm Efficiency Measurements; Farm Efficiency Indicators; Productivity and Farm Size Debate; Crop Protection – Weed Control, Pest and Disease Control

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

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3	M			H
CO4				
CO5		H	M	
CO6		H		M

ENED0060: Economics of Education (4-0-0)

COURSE OUTCOMES

CO1 Know Understand the concept of welfare economics and its applicability in education sector (Remembering)
CO2 Understand the educational financing from the point of view of Economics (Understanding)
CO3 Gain policy level understanding for improvement of health sector from economics prospective. (Applying)
CO4 Explore approaches of economic theory to health sector. (Analyzing)
CO5 The students can evaluate the investment pattern in education and also understand the direct and indirect benefits of education in development of society. (Evaluating)
CO6 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

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4		H		
CO5			H	M
CO6				H

EVHE0061: Health Economics (4-0-0)

COURSE OUTCOMES

CO1 Learn the detail concepts of health economics and application of economic concept in the health sector.(Remembering)
CO2 Develop ideas and critical understanding on the health system in the context of Indian scenario. (Understanding)CO3 Identify the demand and supply gap in healthcare system to suggest healthcare professionals and policymakers. (Applying)
CO4 Assess the role of government in health care delivery system and identifying the scope of health financing. (Analyzing)CO5 Evaluate the health care programmes and policy to provide decisions concerning the allocation of resources. (Evaluating)
CO6 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 forReconstruction 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

	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

CO1 Recall the concepts of micro economics concepts of price, market type, business motives (Remembering)
CO2 Understand basic models of the behaviour of firms and industrial organization and how they can be applied to policyissues (Understanding)
CO3 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)
CO4 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)
CO5 Discuss the need of competitive environment and the degree competition for a healthy functioning of a market.(Evaluating)
CO6 Develop the ability to calculate market concentration with different index and understand the relation betweencompetition 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 ScaleIndustries; 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

	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

CO1 Know the key concepts and practical applications of international economics including international trade andinternational finance. (Remembering)
CO2 Understand the key principles and models of international economics and know the country's position regardinginternational trade, terms of trade, international debt and balance of payments and foreign exchange. (Understanding)
CO3 Apply the theories and models of international trade for economic growth and global welfare and critically commenton international economic policy. (Applying)
CO4 Analyse the links between trade, international finance, economic growth and globalization, with a particular emphasison the experiences of developing countries. (Analysing)
CO5 Evaluate international trade policies regarding increase in exports, international debt, and international institutions tosolve domestic problems like inflation, unemployment and value of currency etc. (Evaluating)
CO6 Design and develop economists' arguments and models concerning international trade policies and its analysis for various issues of the day surrounding globalization. (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 – Exchange Rate and the Balance of Payments, 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; Portfolio Balance Model and Exchange Rates; Exchange Rate Dynamics

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, Cambridge University 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

	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

CO1 Highlight various policies on population control measures (Remembering)
CO2 Develop the knowledge of the different models, theories about the relationship between population growth anddevelopment (Understanding)
CO3 Develop the ability to relate the changes in social and political economy due to demographical changes. (Applying)
CO4 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 offertility and mortality. (Analyzing)
CO5 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)
CO6 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 India's Prospects, Princeton University Press, Princeton, 1958.
9) John, R. W., Population: An Introduction to Concepts and Issues, (7th ed.), New York: Wadsworth Publishing Company,2002.
10) King, M. & M.A. Hill (eds.), Women's Education in Developing Countries: Barriers, Benefits and Politics, John Hopkins, Baltimore, 1993.
11) Shryock, H. S. et. al., The Methods and Materials of Demography, New York: Academic Press, 1976.
12) Srinivasan, K., Basic Demographic Techniques and Applications, New Delhi: Sage Publications, 1998.
13) Thompson, W. S. & Lewis, D. T., Population Problems, New Delhi: Tata McGraw Hills Publishing Co., 1976.

Mapping of COs to Syllabus

CO/Mapping	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3	H			
CO4		M		M
CO5			H	L
CO6				H

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

ENOR0065: Operations Research (4-0-0)

COURSE OUTCOMES

CO1 Familiar with basic ideas, characteristics and different phases of Operations Research (Remembering)
CO2 Describe the basic concepts of convex sets and linear programming method (Understanding)
CO3 Identify situations where linear and non-linear programming problem can be applied (Applying)
CO4 Perform sensitivity analysis to assess the magnitude of change of a linear programming (Analysing)
CO5 Develop strong analytical skills and logical argument to work on with complex issues (Evaluating)
CO6 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

	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

CO1 Relate the demography concepts to understand the demography of female population (Remembering)
CO2 Articulate connections between global, regional and local issues and their relation to women's experiences and to human rights. (Understanding)
CO3 Examine the various gender indices to understand the framework of policy relating to gender issues. (Applying)CO4 Explore the factors responsible for gender discrimination in India (Analyzing)
CO5 Evaluate the role of technology and institutions in addressing the problem of gender inequalities. (Evaluating)
CO6 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 – GenderBudgeting, 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

	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

CO1 Learn the key concepts of financial economics. (Remembering)
CO2 Understand the fundamental concept and application of financial field. (Understanding)
CO3 Identifying the current financial issues and problems to provide better decision-making to investors. (Applying)CO4 Illustrate the trading in the stocks market and analyze the complexities of the derivative market. (Analyzing) CO5 Evaluate the financial policy and programme to provide financial advice to policymakers. (Evaluating)
CO6 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 Structureof 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

	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3			H	
CO4		H		M
CO5			M	
CO6				H

ENRE0068: Rural Economy and Development (4-0-0)

COURSE OUTCOMES

CO1 Draw distinctive features of rural economy which can influence the economy of rural sector. (Remembering)CO2 Understand the prevailing problems of rural economy and identify the scope for development of rural areas. (Understanding)

CO3 Elucidate the Agricultural Finance and rural credits system and marketing system. (Analyzing)CO4 Identify the new development strategies for development of rural economy. (Applying)

CO5 Assess the various policy and programmes of rural development. (Evaluating) CO6 Use of economic prospective for the development of rural economy. (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 RuralPopulation; 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; Polices 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 RuralDevelopment

Suggested Readings

1) A N Agarwal & Kundana Lal, 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

	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2	M			
CO3		M	M	
CO4				H
CO5			H	
CO6				H

ENLE0069: Labour Economics (4-0-0)

COURSE OUTCOMES

CO1 Define the main concepts related to labour economics. (Remembering)

CO2 Explain the analytical grasp of labour demand and supply. (Understanding

)CO3 Identify the main issues of wage determination. (Applying)
CO4 Analyse the theoretical issues in labour economics. (Analyzing)
CO5 Explain the practical applicability of theories related to labour productivity and labour mobility. (Evaluating)
CO6 Discuss the key issues of Indian labour market and measures to solve the problems in labour market. (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 – Job Search and Job Matching, Imperfect Information in Labour Market; Labour Flexibility

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.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	M				
CO3		M			
CO4				H	M
CO5			M	H	
CO6			H		H

ENBE0070: Behavioural Economics (4-0-0)

COURSE OUTCOMES

CO1 Learn the principles and methods of Behavioural Economics (Remembering)
CO2 Identify the systematic departures of economic behaviour from the prediction of the neoclassical model(Understanding)
CO3 Get the idea of how behavioural principles have been applied to economic problems (Applying)
CO4 Understand the principles behind the behavioural approach for the development of analytical tools in Economics(Analysing)
CO5 Incorporate psychologically motivated assumptions into economic models (Evaluating)
CO6 Interpret how behavioural models change the predictions for equilibrium behaviour and their implications for optimalpolicy (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

	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

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

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.

BA (Honours) IN EDUCATION

BA (Honours) Education programme at Assam Don Bosco University combines ideas and research from Education, Psychology, Sociology, Philosophy, and History. It introduces them to all important elements of Education including the foundations, theories and principles of Education, and an exposure to the latest developments in pedagogy and educational technology. Students will become familiar with scientific methodologies in curriculum development, measurement, and evaluation in Education. The course has been designed for students who have academic interests in Education or aspirations to work with children and young people in a variety of fields, helping them develop their critical thinking and character.

PROGRAM OUTCOMES – BA EDUCATION

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.

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.

Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

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.

Ethics: Recognize different value systems including your own, understand the moral dimensions ofyour decisions, and accept responsibility for them.

Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

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.

All Round Development: A sound graduate in Education with high cognitive, affective and psychomotor abilities

PROGRAM SPECIFIC OUTCOMES – BA EDUCATION

Course wise by looking into the nature of each module of each course of studies, PSOs have been determined in view of Bloom's Taxonomy of cognitive objectives:

Basics of Education: To enable the students to understand the different aspects of education.

Social Responsibility: To create a sense of social responsibility among the students by way of discussion, demonstration.

Cognitive and Affective Competencies: To make the students sound in their cognitive abilities andvalue system in relation to education.

Skill Based Competencies: Students are to possess basics of teaching and teaching skills, testing skills and some life skills along with the skill of educational management.

MA IN EDUCATION

MA Post Graduate Programme is designed for those who aspire to innovate roles in the world of Education. A masterful blend of theory and practice, the programme will assist the candidate to obtain a Master Degree in Education with specialization in the areas of Educational Leadership and Educational Psychology where there is demand for trained personnel.

PROGRAM OUTCOME - MA EDUCATION

PO1- **Critical Thinking:** To inculcate critical thinking among the students.

PO2**-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.

PO3**-Scientific Temper:** To inculcate scientific temper among the students to be judicious and logical in their thinking and presentation.

PO4-**Effective Citizenship:** To enable the students to possess the qualities of a good citizen and prove to be a productive member of the society.

PO5- **Ethics:** To create ethical values among the students to be a righteous individual.

PO6- **Environment and Sustainability:** To create environmental awareness among the students lashing with the sense of sustainability.

PO7- **Gender Sensitization and social commitment:** To sensitize the students about the gender variability and its utility in harmonious ways of life.

PO8-**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 who are to contribute in environmental sustainability and social development.

Courses offered in BA Education (Honours)

CC1- EDFE0124: FOUNDATIONS OF EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Describe the concept, process and functions of education. (Understanding)CO2 State individual, social and national aims. (Remembering)
CO3 Identify the forms and bases of education. (Application)
CO4 Analyze the curriculum and use the curriculum in practice. (Analysis)
CO5 Apply different methods for teaching and creating learning among the students.(Application)
CO6 Evaluate the practices of child-centrism in education. (Evaluation)

Module I: Meaning, Aims and Objective of Education (20 lectures)

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 (20 lectures)

Forms of Education: Formal education, Informal education and non-formal Education – Meaning,concepts, nature and importance.

Bases of Education: philosophical, psychological, sociological and biological.

Module III: Dimensions of Education (18 lectures)

The learner, the teacher-qualities and responsibilities; curriculum and co-curricular activities-meaning and modern concept, need and importance; Educational Institutions – school, family andsocial institutions, religious institutions, state, etc. – their roles in education.

Module IV: Child-Centrism in Education and Educational Methods (17 lectures)

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: AtlanticPublisher.(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 EducationPress. (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: Theworld press Pvt. Ltd (1990)
10) Saxena, N.R. S. Philosophical and sociological foundations of education. Meerut: VinayRakheja (2014)

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M			
CO 3		H	M	H
CO 4			H	M
CO 5			M	H
CO 6			M	H

CC2- EDTE0125: THEORIES AND PRINCIPLES OF EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Explain the concept, process, functions of education and various factors influencing itsfunctions. (Understanding)
CO2 Identify the individual differences among the students and teach accordingly. (Applying)CO3 State the various aspects and dimensions of education. (Remembering)
CO4 Explain the factors of conscious learning and the issues in formal discipline.(Understanding)
CO5 Evaluate the current trends in education. (Evaluation)
CO6 Apply the basics of environmental education, value education and human rightseducation. (Applying)

Module I: Understanding 'Education' (20 lectures)

Divergent description of Education; education as a process; functions of education (context of individual and social aim, factors influencing functions); education and schooling; education and indoctrination; heredity and educational attainment; individual differences in education.

Module II: Facets of Education (20 lectures)

a) Aspects of education - explanation, interpretation, application, perspective, empathy, self-knowledge.

b) Ducasse's dimensions of education - intellectual education, physical education, vocational education, education in social dexterity, education of the will, aesthetic education, moral and religious education, liberal education.

Module III: Conscious Learning and Formal Discipline (18 lectures)

a) Conscious Learning-factors in conscious learning, the evolution of judgment, the evolution of ideas.

b) Formal Discipline-rise of the concept of formal discipline, criticism by psychologists, positive discipline as formal discipline.

Module IV: Current trends in Education (17 lectures)

a) Indian constitution and education, globalization and education, privatization in education, modernization of Indian education.

b) Developing trends in environmental education, value education, human rights education etc.

Suggested Readings

1) Moore, T.W. Punishment and Education. Proceedings of the Philosophy of Education Societyof Great Britain. (1967). https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467- 9752.1967.tb00101.x
2) Newman, J.H. Discourses on the Scope and Nature of University Education. Dent. (1852). http://www.ajdrake.com/etexts/texts/Newman/Works/disc_1852.pdf
3) Peters, R.S. Essays on Educators. Allen & Unwin. (1981)
4) 4.Piaget, J. The Moral Judgment of the Child. Routledge & Kegan Paul. (1999) https://www.burmalibrary.org/docs20/Piaget-moral_judgment_of_the_child-en-ocr- tu.pdf? cf_chl_jschl_tk =pmd_7036138c2a9a7e22bb6d77d6823cc80344f638f1- 1629096814-0-gqNtZGzNAg2jcnBszQb6
5) Plato. The Republic. Penguin. (1941). http://faculty.smcm.edu/jwschroeder/Web/ETHR1002/Global_Jutice_Readings_files/3.Plato Repblic.pdf
6) Rousseau, J.J. Emile. Dent. (1889). https://brittlebooks.library.illinois.edu/brittlebooks_open/Books2009-08/rousje0001emile/rousje0001emile.pdf
7) Ryle, G. The Concept of Mind. (2009) https://antilogicalism.com/wp-content/uploads/2018/04/concept-of-mind.pdf

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		H
CO 3			H	
CO 4			H	
CO 5				H

CO 6	M			H

GEC 1- EDGC0128: GUIDANCE AND COUNSELLING (5-1-0)

COURSE OUTCOMES

CO1 Illustrate the concept, nature, and scope of guidance and counseling and its significancein the field of education. (Understanding)
CO2 State the qualities of a teacher as a guidance worker. (Remembering)CO3 Apply the bases of guidance in guidance service. (Applying)
CO4 Identify the characteristics of diverse learners and Perform the guidance activitiesaccordingly. (Applying)
CO5 Apply the different skills and techniques of counselling. (Applying)
CO6 Discuss the different tools and techniques used in guidance and counselling.(Understanding)

Module I: Introduction to Guidance (18 lectures)

Meaning; Definition and Nature of Guidance; Historical background of the guidance in India; Needand Principles of Guidance; Bases of guidance; Teacher as a guide.

Module II: Types of Guidance (17 lectures)

Educational Guidance; Vocational Guidance; Personal Guidance.

Module III: Concept of Counselling (20 lectures)

Meaning; Definition and Nature of Counselling; Need for Counselling to 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 (20 lectures)

Testing Technique to measure the different constructs of an individual: Intelligence, Creativity, Interest, Aptitude and Personality traits; Non-testing Techniques: Observation, Interview, Scales, Cumulative records, Organisation of guidance and Counselling services.

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 BookDepot 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 PvtLimited (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, S. K. 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: SterlingPublishing Pvt.Ltd (1984).
11) Kochhar, S. K. Educational & Vocational Guidance in Secondary Schools. N. Delhi: SterlingPublishers (1987).
12) Madhukar, I. 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: TataMcGrawHill (1991).
15) Singh, R. 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 Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M	H	M
CO 2	H	H	M	M
CO 3	H	H	M	H
CO 4	M	H	H	H
CO 5		H	H	
CO 6	M	H	M	H

CC3- EDPF0126: PHILOSOPHICAL FOUNDATIONS OF EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Explain the theoretical bases of education and incorporate the application of differentphilosophies in education. (Understanding)
CO2 Describe the different philosophical ideologies of western and Indian thinkers.(Remembering)
CO3 Identify the link between educational philosophy and national values. (Applying)
CO4 Analyze the Indian and Western philosophy in terms of curriculum, method of teaching,discipline, role and place of students (Analyzing)
CO5 Explain the basics of philosophy of knowledge and value as a part of education.(Understanding)
CO6 Identify and classify the values and apply the different values in real life situations.(Applying)

Module I: Philosophy and Education (17 lectures)

Introduction to the historical and philosophical traditions in education - Socrates andphilosophical ideals; relationship and influence of philosophy on education.

Module II: Western and Indian Philosophical ideologies (18 lectures)

Comparative analysis of Western and Indian Philosophical ideologies:

a) Indian: Swami Vivekananda, Rabindranath Tagore, Mahatma Gandhi, Aurobindo Ghosh, Krishnamurti.

b) Western: Plato, Jean Jacques Rousseau, Friedrich Froebel, John Dewey, Paulo Freire.

Module III: Schools of Philosophy and National Values (20 lectures)

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.

c) Inculcation of core national values as enshrined in the Constitution of India.

Module IV: Education and Epistemology (10 lectures)

Knowledge - Nature, role of knowledge, scientific inquiry, senses and feelings, experience(empiricism), reasoning and logic - inductive and deductive.

Module V: Education and Axiology (10 lectures)

Values - conceptual basis, need and importance, role of education, morality and actions,aesthetics, ethics - Kantian ethics, responsibility and freedom.

Suggested Readings

1. Ayer, A. J. The Problem of Knowledge. Penguin. (1956)

2. Dewey, J. Democracy and Education. Macmillan, New York. (1916)

3. Dewey, J. Experience and Education. Macmillan, New York. (1938)

4. Durkheim, E., Education and Sociology. Free Press, Chicago. (1922)

5. Froebel, F. The Education of Man. Fairfield, Kelley, New Jersey. (1903)

6. Hirst, P. H. Knowledge and the Curriculum. Routledge and Kegan Paul. (1975)

7. Hirst, P. H. and Peters, The Logic of Education. Routledge and Kegan Paul. (1970)

8. Hobbes, T., Leviathan. Collier-Macmillan. (1909) http://files.libertyfund.org/files/869/0161_Bk.pdf

9. Hume, D. An Enquiry Concerning Human Understanding. La Salle. (1748)

10. Kant, I. Critique of Pure Reason. Dent. (1998). http://strangebeautiful.com/other- texts/kant-first-critique-cambridge.pdf

11. Moore, T.W. Educational Theory: An Introduction. Routledge and Kegan Paul (1974)

12. Peters, R. S. Ethics and Education. Allen and Unwin (1966)

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M	H	M	M	
CO 3	M	M	H		H
CO 4			H		
CO 5				H	H
CO 6			M		H

CC4- EDES0127: EDUCATION AND SOCIETY (5-1-0)

COURSE OUTCOMES

CO1 Discuss the concept of sociology of education and relationship between society andeducation. (Understanding)
CO2 Describe the existence of social groups, social institutions and agencies of education andthe process of socialization. (Understanding)
CO3 State the role played by education in bringing about social change. (Remembering)CO4 Identify the process of transmission and preservation of culture. (Applying)
CO5 Analyze the importance of social change, national integration, internationalunderstanding and democracy in a diverse social context. (Analyzing)
CO6 Evaluate the role of education in solving social problems. (Evaluation)

Module I: Sociology and Education and Agencies of Education (20 lectures)

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 (20 lectures)

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 society.

Module III: Education and Society (20 lectures)

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 lectures)

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: Twentyfirst 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 BookHouse (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 Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	H		H	
CO 3	H	H	H	H
CO 4		H		
CO 5			H	
CO 6				H

GEC 2- EDGE0129: GENDER EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Describe the concept, need and scope of gender education and understand genderstudies as an academic discipline. (Understanding)

CO2 Identify the difference between sex and gender and to explain the social constructiontheories of identity. (Application)

CO3 Analyze the status of girl's education in schools and how gender influences the issues in the education system. (Analysis)

CO4 Find out the status of gender disparities in India and the presence of gender biases inschool curriculum. (Application)
CO5 State the status of women's education. (Remembering)
CO6 Evaluate women's movement in India and the policies and programmes adopted toimprove the status of women education in India. (Evaluation)

Module I: Gender studies (13 lectures)

Concept, Need, Scope; Gender studies as an academic discipline; Gender and Economy and WorkParticipation; Gender and globalization; Gender and education.

Module II: Identification of structures of domination and control (15 lectures)

Society, Family and school in India; Issues in school education-Problems of access, enrolment,retention, stagnation, drop-out and push out; Higher Education and Professional Spaces.

Module III: Gender and Education (14 lectures)

Gender as the Basis of Inequality-Issue of patriarchy, hierarchy, power, dominance, subjugation;gender disparity in Education– gender bias in school curriculum.

Module IV: Issues of Indian women (15 lectures)

Family, caste, class, culture, religion related issues; Women's education; Coeducation-its educational implications; Literacy and Non-formal education for women's development; Education of Girl child in India: present status and challenges ahead.

Module V: Women's Movements and routes towards change (18 lectures)

Pre-independent, post Independent and current women's movements; National committees and commissions for women; governmental and non-governmental organizations for women and childdevelopment; Community participation for education of the girl child; Constitutional provisions, policies, programmes for women.

Suggested Readings

1. Apple, Michael W. & Smith, Christian L. (ed.) The Politics of the Textbook, Routledge, NewYork.(1991)
2. Bhasin, Kamla. What is Patriarchy? Kali for Women,New Delhi. (1993)
3. Bhog, Dipta. Gender andCurriculum, Review of Women Studies, Economic and PoliticalWeekly,37(17):1638-1642.
4. Chakravarti, Uma. Rewriting History; The Life and Times of Pandita Ramabai. OUP;Delhi. (2013)
5. Geetha, V. Gender: Stree; Kolkata. (2002)
6. Giroux, H . Ideology, Culture and the Process of Schooling. Falmer Press, London. (1981)
7. Kumar, Krishna. What is Worth Teaching, Orient Blackswan, Delhi. (2004)
8. MHRD-Ramamurty Committee Report -Towards enlightened and humane society, Delhi. (1990)
9. Narasaiah. M. L. Women, Children and Poverty. New Delhi: Discover Publishing House. (2001)
10. NCERT-National Curriculum Framework 2005, N.C.E.R.T. New Delhi
11. NCERT-National Curriculum Framework2005PositionPaperno. 3.1 by National Focus Group on

Problems of Scheduled Caste and Scheduled Tribe Children, N.C.E.R.T. New Delhi

12. NCERT-National CurriculumFramework2005PositionPaperno.3.2 by National Focus Group onGender issues in Education, N.C.E.R.T. New Delhi

13. NCERT-National Curriculum Framework for School Education2000, N.C.E.R.T. New Delhi

14. Parvin, M.R. Empowerment of Women: Strategies and Systems for Gender Justice. New Delhi:Dominant Publishers. (2005).

15. Rao, D. B. Education for Women. New Delhi: Discover Publishing House. (2011).

16. Rao, D.B. International Encyclopedia of Women. New Delhi: Discover Publishing House. (2011).

17. Sindhuja, P. Economic Empowerment of Women through Self-Help Groups. New Delhi:Discover Publishing House. (2011)

18. Skelton, C. The SAGE Handbook of Gender and Education. New Delhi: Sage. (2006).

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	H		M		
CO 3		H			
CO 4			H	M	M
CO 5				H	H
CO 6					H

CC5- EDPB0130 PSYCHOLOGICAL BASES OF EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Describe the concept psychology as- Science of behaviour, Growth and Development.(Remembering)
CO2 Explain various theories related to human development and learning. (Understanding)CO3 Elaborate the theories related to intelligence and personality. (Application)
CO4 Assess the intelligence and personality of individuals. (Analysis)

Syllabus

Module I: Psychology as a science of behaviour (15 Lectures)

Meaning of Psychology; Nature and fields of psychology; Educational Psychology-its meaning,nature and scope; Relationship between Education and psychology.

Module II: Psychology of growth and development (15 Lectures)

Introduction to growth and development; principles and factors of development; stages ofdevelopment; Theories of development: Erickson's theory of Psycho-social development.

Module III: Learning and theories of learning (15 Lectures)

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 Learning; Individual differences and its educational implications.

Module IV: Intelligence and its theories (15 Lectures)

Intelligence: Definition, Nature and Theories: Two Factor Theory of Intelligence, Guildford structure of Intellect; Intelligent Quotient (IQ); Emotional Intelligence; Assessment of Intelligence.

Module V: Personality and its theories (15 Lectures)

Meaning and Nature; Theories of personality: Type and Trait Theory, Determinants of personality, Assessment of personality: projective techniques.

Suggested Readings

1. Chauhan, S. S. (2004). Advanced Educational Psychology, Vikas Publishing House Pvt. Ltd, NewDelhi.
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: UniversityPublications
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.

Mapping of COs to syllabus

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

CC6- EDDE0131 DISTANCE EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Understand the Concept, Scope, objectives of Distance Education. (Remembering)CO2 Review the Historical Development and its Growth in India. (Understanding)
CO3 Identify the types of Distance Education Institutions. (Application)
CO4 Illustrate the advantages and challenges in Distance Education and its Relevance to theChanging Society. (Evaluation)

Module I: Introduction to Distance Education (15 Lectures)

Concept of Distance Education: Meaning, Characteristics, Scope Types of Distance Education;

Merits and Demerits of Distance Education; Objectives of Distance Education; Difference betweenOpen Learning and Distance learning Relevance of Distance Education to the Changing society likeIndia.

Module II: Historical Development of Distance Education (25 Lectures)

Historical development of Distance education; The University Grants Commission (UGC); Planning Commission; Central Advisory Board on Education; University of Delhi's School of CorrespondenceCourses and Continuing Education; Education Commission (1964-66); Directorates of Distance Education/Centres of Distance Education; Open University system; Ministry of Human Resource Development; Indira Gandhi National Open University (IGNOU); Distance Education Council of India.

Module III: Types of Distance Education Institutions (20 Lectures)

National Open University; State Open Universities; Distance Education Institutions (DEIs) at: Institutions of National Importance, Central Universities, State Universities, Deemed to be Universities, State Private Universities; DEIs at Stand-alone Institutions: Professional Associations, Government Institutions, Private Institutions.

Module IV: Issues, Challenges of Distance Education (15 Lectures)

Issues and challenges of Distance Education: Network, Internet, Online courses, Webinars, Google meet, Google Classroom/Drive, SWAYAM Courses, NPTEL Courses; Adaptations of methods of Teaching-Learning: E-Seminars, Online-Workshops, Online Conferences, Video-Audio mode of presentations, Online Assessments.

Suggested Readings

1) Anderson, T. (2008). *Theory and Practice of Online Education* (2nd ed) ISBN 9781897425084.
2) Anderson, T., &Dron, J. (2010). Three generations of distance education pedagogy. *TheInternational Review of Research in Open and Distance Learning*, 12(3), 80–97.
3) Bates, T. (2005). Technology, e-learning and distance education: Routledge Falmer.
4) Garrison, D.R. (2011, 20 May). E-Learning in the 21st Century: A Framework for Research and Practice. New York: Taylor & Francis. ISBN 0-203-83876-9.
5) *Honeyman, M; Miller, G (December 1993).* "Agriculture distance education: A validalternative for higher education?
6) Kaplan, A. M. & Haenlein, M. (2016). *"Higher education and the digital revolution: About MOOCs, SPOCs, social media, and the Cookie Monster". Business Horizons.* ***59*** *(4): 441–50.*
7) Moore, M. G. & Greg K. (2005). *Distance Education: A Systems View (2nd ed.). Belmont, CA: Wadsworth.* ISBN 0-534-50688-7.
8) Taylor, J. C. (2001). Fifth generation distance education. *e-Journal of Instructional Science andTechnology* (e-JIST), 4(1), 1-14.
9) Terry Evans, M. H., David Murphy (Ed.). (2008). *International Handbook of Distance Education*. Bingley: Emerald Group Publishing Limited.
10) Vaughan, N. D. (2010). *"Blended Learning". In Cleveland-Innes, MF; Garrison, DR (eds.).* An Introduction to Distance Education: Understanding Teaching and Learning in a New Era*. Taylor & Francis. p. 165.* ISBN 978-0-415-99598-6*.*
11) Walsh, T. (2011). Unlocking the Gates: How and Why Leading Universities Are Opening Up Access to Their Courses (Princeton University Press.

Mapping of COs to syllabus

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

CC7- EDDI0132 DEVELOPMENT OF EDUCATION IN INDIA (5-1-0)

COURSE OUTCOMES

CO1 Review the Ancient and Medieval system of Education in India. (Remembering)
CO2 Know about the different educational policies adopted by British Rule. (Understanding)CO3 Understand the development of education during the British rule in India. (Application)CO4 Analysis the development of Education in Independent India and Assam. (Analysis) CO5 Understand various initiatives of the Government of India like SSA, Mid-Day Meal, etc.
(Evaluation)
CO6 Evaluate the contemporary concerns and issues of Indian Education. (Creation)

Module I: Education in Ancient India (20 Lectures)

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 Lectures)

A brief introduction to the Educational Activities of East India Company and Christian Missionaryin 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.

Module III: Education in Post-Independence (20 Lectures)

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: Vocationalization of Education (10 Lectures)

Concept, Scope and need of Vocational Education; Objectives of Vocational education in +2stage; Vocationalization and National Development, NPE-1986 and POA-1992 with reference to Vocational Education.

Module V: Issues and Challenges in Indian Education at School Stage (10 Lectures)

Concept of UEE and its problems: Physical, Social and Quality access in relation to UEE; Operation

Blackboard (OBB); District Primary Education Programme (DPEP); Sarva Shiksha Abhiyan (SSA) and RTE-Act2009; Quality of Education at Secondary School Stage and Rashtriya Madhyamik Shiksha Abhiyan (RMSA); 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 syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3		H			
CO 4			H	M	M
CO 5				H	
CO 6					H

SEC-1- EDSE0133 LIFE SKILLS EDUCATION (2-0-0)

COURSE OUTCOMES

CO1 Understand the concept of life skill and life skill education and its importance.(Understanding)
CO2 Understand the meaning of emotion, empathy, etc. (Understanding)
CO3 Employ various skills in life such as social skills, cognitive skills, communication skills,coping skills, creative thinking skills, decision making skills, etc. (Application)
CO4 Construct the meaning of self. (Application)

Module I: Understanding of Life Skills (8 Lectures)

Skills and life skills; Origin and development of Life skills; Understanding life skills; Significance of life skills; Introduction to 10 core skills: Social, thinking and coping skills.

Module II: Social skills (8 Lectures)

Understanding self, self-concept, self-esteem, self-control, self-realization, self-awareness; Communication types, styles, barriers, skills of effective communication; Interpersonal relationships- healthy relationship, Empathy: altruism, empathy and volunteerism.

Module III: Cognitive skills (7 Lectures)

Cognitive skills-nature, elements, types; Critical thinking- nature, Stages; Creative thinking-nature, stages; Problem solving: factors, steps; Decision making - process, need, consequences.

Module IV: Coping Skills (7 Lectures)

Coping with emotion: definition, characteristics, types, classification-wheel model, two- dimensional approach, coping strategies; coping with stress: stressors, sources of stress; General adaptive syndrome model of stress coping strategies.

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. Bundes ministerium fur Bildung, Wissenschaft, Forschung und Technologie.

Mapping of COs to syllabus

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

GEC 3: POPULATION EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Understand the trend of population in the world, India and North East India.(Remembering)
CO2 Understand the importance of quality life and population education. (Understanding)CO3 Analyze the effects of over population and various plans. (Analyzing)
CO4 Evaluate various ways and means of controlling the growing population. (Evaluating)

Module I: Indian Population (20 Lectures)

Trend of Indian Population since 1901; Population scenario in North East of India; Population explosion, optimum population, under population and overpopulation, population scenario in the world; Quality of life.

Module II: Introduction to Population Education (20 Lectures)

Definition, nature, objectives and scope of population education; Curriculum of population education for school stages; Approaches for teaching population education and preparation of teachers.

Module III: Population Education Policies and Programme in India (20 Lectures)

Population Education and Five Year Plans of India; Population Education Policies and programmes in India with special reference to Family Planning; Mass media And Population Education; Nature and need of family life education.

Module IV: Evaluation in Population Education (15 Lectures)

Concepts of evaluation and measurement; Schemes of Evaluation: Formative and summative; Evaluation in Population education; Evaluation of students and population education programmes.

Suggested Readings

1) Aggarwal, J.C (2003): Population Education, Delhi: Shipra Publications

2) Dubey, S.N (2001): Population of India, 2001, Delhi: Authors Press, Laxminagar.

3) Gupta, P.K (2005): Population Education: Meerut, R. Lall Book Depot

4) Kapoor, K.C &Kapoor, A. (2013): Population Education, Guwahati, EBH, Publications

5) Kapoor, K.C.(2005): Effectiveness of training Modalities in Population Education for Secondary School Teachers of Arunachal Pradesh and their Attitude towards PopulationEducation, (Unpublished Report)

6) Mehta,T. S.s and Chandra, R.(1972): Population Education(Selected Readings).New Delhi: NCERT

Mapping of COs

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

CC8- EDET0135 EDUCATIONAL THINKERS (5-1-0)

COURSE OUTCOMES

CO1 Know the different educational thinkers of the world and India. (Remembering) CO2 Analysis the contribution of educational thinkers of the world. (Understanding) CO3 Analysis the contribution of educational thinks in India. (Application)

CO4 Understand the different philosophies of some eminent educational philosophers.(Analyse)

CO5 Evaluate the role of teachers and various methods of teaching in the field of education.(Evaluate)

Module I: A-Indian Thinkers (20 Lectures)

Swami Dayanand (1825- 1883): Philosophy, Aims of Education and values; Swami Vivekananda (1863-1902): Philosophy Principles, Character Building, Discipline and values; Rabindranath Tagore(1861-1914): Tagore's Philosophy and its features, basic contributions in the field of Education.

Module II: B-Indian Thinkers (19 Lectures)

M. K. Gandhi (1869-1948): Features of Gandhian Educational Philosophy, Objectives of Education and Gandhiji's view on Education, Concept of Basic Education and its relevance in 21stcentury; Sri Aurobindo (1872-1950): Life Sketch, Philosophy of life, Views on Education, Teachers and teaching, Concept of Ashram School, International Centre of Education.

Module III: A-Western Thinkers (18 Lectures)

Jean Jacques Rousseau: Life Sketch, Philosophy of Education, Self-Education, Rousseau Idolizes Nature, Naturalism, Negative Education, The Emile-its importance, Basic Ideas of Rousseau's Philosophy; John Dewey: Life Sketch, Philosophy of Life, Laboratory School, Methods of teaching.

Module IV: B-Western Thinkers (18 Lectures)

Friedrich August Froebel (1782-1852): Philosophy and Principles, Concept of Kindergarten and its features and relevance in present context; Maria Montessori (1870-1952): Life sketch, EducationalPhilosophy and Principles, Role of Teacher, Concept of Children's House.

Suggested Readings

1) Aggarwal, J. C. (2002). Psychological, Philosophical and Sociological Foundations ofEducation, *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*, DaryaGanj, New Delhi
4) Rai, B. C. (2000). Principles of Education, *Prakashan Kendra*, Lucknow
5) Safaya, S. (2010). Modern Theory and Principles of Education, *Dhanpat Rai PublishingCompany PvtLtd*, New Delhi
6) Singh, Y. K. (2013). Philosophical Foundations of Education, *APH Publishing Corporation*, NewDelhi
7) Sur Roy, T. (2013) Educational Thinker: Oriental and Occidental, *Ashok Publications*,Guwahati
8) Taneja, V. R. (2009). Educational Thought and Practice, *Sterling Publishers Pvt Ltd*, New Delhi

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV
CO 1	H		H	
CO 2			H	H
CO 3	H	H		
CO 4		H	H	H
CO 5			H	H

CC9- EDTC0136 EDUCATIONAL TECHNOLOGY (5-1-0)

COURSE OUTCOMES

CO1 Understand the conceptual framework of educational technology.(Remembering) CO2 Explain the concept of teaching, its nature, phases etc. (Understanding)
CO3 Describe the nature of instructional technology and process of communication.(Application)
CO4 Classify different approaches in educational technology. (Analysis)
CO5 Apply various innovations in the field of education for qualitative improvements using technology (Evaluation)

Module I: Introduction to Educational Technology (13 Lectures)

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: Teaching-Learning Process (17 Lectures)

Nature of Teaching-learning process; variables and functions of teaching: levels and phases of teaching; Instructional objectives relating to cognitive; affective and psycho-motor domains; writing of instructional objectives in behavioural forms.

Module III: Communication and Instruction (15 Lectures)

Concept and need of communication; Forms of communication; Model of communication process; Classroom communication: Verbal and Non-verbal; Instructional Technology: Programmed Instruction (PI), Personalized system of Instruction (PSI), Computer Assisted Instruction (CAI), Modular Instruction (MI).

Module IV: Behavioural Technology (15 Lectures)

Need and Nature of behavioural technology; Features of teaching behaviour; 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 V: Emerging Trends of Educational Technology (15 Lectures)

Nature of Information Technology (IT); Mass Media in Education: Radio, TV, Internet and E-Learning; Multimedia Approach: EDUSAT, Blended Learning, MOOCs; Research in Educational Technology.

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, NewDelhi

6) Sharma, R. A (1988) : Technology of Teaching, Loyal Book Depot, Meerut

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		
CO 4	M	M		H	
CO5					H

CC 10: EDFC0137 FOUNDATIONS OF CURRICULUM DEVELOPMENT (5-1-0)

COURSE OUTCOMES

CO1 Recall the conceptual framework of curriculum. (Remembering)
CO2 Explain/ classify the different bases and approaches of curriculum designing.(Understanding)
CO3 Evaluate the role of the teacher in the construction of the curriculum. (Application)CO4 Analyze the developmental process and evaluation of the curriculum. (Analysis) **CO5** Use the different strategies for curriculum implementation. (Evaluation)

Module I: Nature of Curriculum (18 Lectures)

Defining curriculum; Components of curriculum; Principles of curriculum; Goals and objectives forcurriculum development; Characteristics of a good curriculum.

Module II: Bases of curriculum construction (20 Lectures)

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 (20 Lectures)

Major approaches: subject-centered, broad fields/ life-centered, learner-centered approaches;

Models of curriculum development: Technical/Scientific model- Tyler Model and Taba Model, Non- technical/ non-scientific model – Open class model, Wienstien and Fantini's Model.

Module IV: Process of curriculum development and the role of teachers in curriculum development (17 Lectures)

Process of curriculum development: Assessment of educational needs, Formulation of objectives Selection and organization of content, Selection and organization 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: Allynand 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: HimalayaPublishing 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 ChicagoPress.
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

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

SEC- 2: EDTS0138 TEACHING SKILLS AND TEACHING PRACTICE (1-1-1)

COURSE OUTCOMES

CO1 Recall the concept of teaching, teaching profession teaching practice. (Remembering)CO2 Explain and identify the different teaching skills and its sources. (Understanding)
CO3 Formulate lesson plans. (Application)

CO4 Delivering the lesson plan in the class. (Analysis)
CO5 Appraise teacher's behaviour in the class. (Evaluation)

Module I: Introduction to Teaching and Teaching Skills (8 Lectures)

Meaning, definition, and nature of teaching; Teaching as profession; Teaching skills and sources ofteaching skills; Approaches of teaching.

Module II: Teaching Practice (10 Lectures)

Concept of teaching practice; Objective of teaching practice; Concept of Lesson Plan; Significanceof Lesson Plan; Development of Lesson Plan.

Practicum (12 Lectures)

Preparing Lesson Plans (10 numbers)Delivering Lesson Plans (5

numbers)

One Lesson Plan for Final Teaching Practice Examination and Viva Voce

Scheme of Evaluation

Stock of Lesson Plans	:	` 20 Marks
Teaching Aids	:	10 Marks
Final Lesson Plan Presentation & Viva Voce:		20 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) Singh, L.C. (ed)(1987): The International Encyclopedia of Teaching and Teacher Education,Pergamon Press, Oxford.
4) Kapoor, KC, (Ed) (2008): Teacher Education in 21st Century, the Associate Publishers, AmbalaCantt.

Mapping of COs to syllabus

	Module I	Module II
CO1	H	H
CO2	H	
CO3		H
CO4		H
CO5	H	M
CO6	H	M

GEC 4: EARLY CHILDHOOD CARE AND EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 State the concept, need and significance, philosophies, policies and interventions ofECCE. (Remembering)
CO2 Explain and elaborate the underlying philosophies on ECCE in India. (Understanding)CO3 Utilize the information to create a safe and secure environment for children.
(Application)
CO4 Compare and contrast between the different philosophical ideas, policies andinterventions (Analysis)
CO5 Evaluate the accuracy and relevance of the ECCE policies and interventions. (Evaluating)
CO6 Predict ways and means of implementing the ECCE policies and interventions. (Creating)

Module I: Nature of ECCE (20 Lectures)

Meaning, Definitions and Significance of ECCE in the context of Universalization of ElementaryEducation Objectives and scope of ECCE; ECCE and Human Resource Development.

Module II: Philosophies on ECCE (15 Lectures)

John Dewey; Maria Montessori; Friedrich Froebel; Rabindranath Tagore and Tarabai Modak.

Module III: Policies and Programmes on ECCE (20 Lectures)

ECCE before independence and after independence of India; National Children's Policy 1974; NPE-1986 and POA-1992; Convention on Rights of child, 1989.

Module IV: Initiatives and Interventions (20 Lectures)

Government, Private and NGO's; ICDS and SSA; Preschool Education and training programmes;
ECCE and National Curriculum Framework.

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 extentof Utilization by Community, New Delhi, NCERT

9) Viruru, R. (2001): Early Childhood Education, New Delhi, Sage Publications

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2		H		
CO3				H
CO4		H	H	H
CO5			H	H
CO6			M	H

CC11- EDME0140 MEASUREMENT AND EVALUATION IN EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 To recall the basics of educational measurement and evaluation. (Remembering)
CO2 To explain/ illustrate the different types of techniques of measurement and evaluation.(Understanding)
CO3 To prepare a good test/scale (Creation).
CO4 To administer the tools and interpret the scores. (Application)

Module I: Nature of Measurement and Evaluation (15 Lectures)

Concept of Measurement; Types of Measurement: Psychological and physical; Concept of educational measurement; Functions of educational measurement; Concept of assessment and evaluation; Principles and steps of Evaluation; Relationship between educational measurement and evaluation.

Module II: Testing and Non-Testing Techniques in Educational Measurement and Evaluation (15 Lectures)

Testing Technique: Achievement Test aptitude Test, Intelligence Test; Non-Testing technique: Interview, Observation, Questionnaire, Rating Scales, Check list attitude scale, cumulative record.

Module III: Concept of Reliability and Validity (30 Lectures)

Meaning and Nature of reliability of the test scores; Methods of Computing Co efficient of reliability: test-retest, parallel form, split half, KR-20, 21; Factors influencing reliability of test scores; Meaning and nature of Validity of the test scores; Types of Validity: face, content, construct, concurrent, predictive; Relationship between validity and reliability; Factors affecting validity.

Module IV: Test Items (15 Lectures)

Concept and types of test items; Guidelines for writing objective types test items; Guidelines for writing essay type test items; Guidelines for interpretive exercises; Construction and standardization of test and attitude scale; Concept and types of norms.

Suggested Readings

1) Annastasi, A. (1976): Psychological Testing, McMillan Publication Co. New York

2) Edwards, A. L. (1966) : Techniques of Attitude Scale Construction, New York

3) Frank, S. Freeman (1990) : Theory and Practice of Psychological Testing, IH Publishing Co.Bombay

4) Granlund, N.E (1976): Measurement and Evaluation in Teaching, McMillan Publishing Co.New York

5) Linn, R. L. & Miller, M. D. (2008) : Measurement and Assessment in Teaching, DarlingKindersley, Pvt.Ltd

6) Sharma, R. A. (1998) : Essentials of Measurement in education and Psychology, R. Lall BookDepot, Meerut

Mapping of COs to syllabus

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

CC12- EDIE0141 INCLUSIVE EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Recall the concept of inclusive education and its associated variables. (Remembering)CO2 Explain the evolution and significance of inclusive education. (Understanding)
CO3 Use inclusive pedagogy in creating an inclusive classroom. (Application) CO4 Analyze the prevailing legal provisions and policies of inclusion. (Analysis)
CO5 Identify Teacher's role and competencies, and assistive and adaptive technologiesavailable for inclusive classroom. (Analysis)
CO6 Choose the relevant pedagogy and appropriate technology for inclusion. (Evaluation)CO7 Create strategies to overcome barriers to inclusion. (Creation)

Module I: Introduction to the concept of Inclusive Education and its evolution (20 Lectures)

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 (19 Lectures)

Policies and Legislations for Inclusive Education; National Policy of Education 1986; Programme of Action 1992; Persons with Disabilities Act 1995; National Policies of Disabilities 2006; National Curriculum Framework 2005; Concession and facilities to Diverse learners: Academic and Financial(Rehabilitation Council of India Act 1992); Inclusive Education Under SSA; Features of United Nations Convention on the Rights of Persons with Disabilities.

Module III: Planning and management of Inclusive Classrooms (19 Lectures)

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 (17 Lectures)

Attitude**;** Labeling**;** Peer Rejection**;** Accountability**;** Traditional Oriented Teaching etc.**;** Interventions: Environmental Intervention**,** Social Intervention, Academic Intervention.

Suggested Readings

1) Basha, Sayed Hayath. (2017). *Inclusive Education: Policies and practices*. New DelhiPublishers: 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 ofSpecial 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. NewDelhi.

8) Dash, N. (2006). *Inclusive Education for Children with special Needs*. Atlantic publishers andDistributers Pvt. Ltd.: New Delhi.

Mapping of COs to syllabus

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

CO5	M	M	H	H
CO6			H	H
CO7			H	H

DSE 1: EDHR0142 HUMAN RIGHTS EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Recognize the origin, meaning, concept, objectives provisions of human rights, humanrights education, and value. (Remembering)
CO2 Understand various constitutional provisions and conventions of rights of child andwomen along with others human rights. (Understanding)
CO3 Apply the Knowledge of Human Rights in life. (Application)
CO4 Analyze the functions of various national and international human rights bodies.(Analysis)
CO5 Evaluate the human rights curriculum and approaches to teach human rights at differentladders of school education. (Evaluation)
CO6 Prepare the Curriculum of Human Rights Education. (Creation)Module I: Introduction to

Human Rights Education (20 Lectures)

Origin and historical account of Human Rights; Description of UN Charter and UDHR; Meaning ofHuman Rights and Human Right Education; Constitutional Provisions for Human Rights.

Module II: International Covenants, Convention and Gender Equity (17 Lectures)

International Covenants on Economics, Social and Cultural Rights; Convention of Rights of Childand role of ILO; Right to Education Act -2009.

Module III: Human Rights and Duties (20 Lectures)

Human Right Protection Act and role of NHRC, SHRCs, UN, UNESCO; Curriculum framework ofHuman Rights Education; Approaches of Teaching for Human Rights Education.

Module IV: Value Education (18 Lectures)

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: AsianInstitute 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

	Module I	Module II	Module III	Module IV
CO 1	H			H
CO 2	H	H	H	
CO 3	H	H	H	M
CO 4			H	
CO5		M	H	
CO6			H	

DSE-2: EDES0143 ELEMENTARY STATISTICS IN EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 State the concept of, nature, and utility of statistics. (Remembering)CO2 Understand the nature and organization of data. (Understanding) CO3 Developing the skill of presenting data graphically. (Application)
CO4 Analyze the data by using measures of central tendency and variability. (Analyzing)CO5 Synthesizing the data. (Synthesis)
CO6 Evaluating the computed results indicating the relationship in two sets of data.(Evaluation)

Module I: Introduction to Statistics (20 Lectures)

Meaning, definition and functions of Statistics Need of Statistics in Education; Concept of data, methods of organizing data; Graphical representation of data: Frequency Polygon, Histogram, Cumulative Frequency curve, Cumulative Frequency Percentage curve or ogives.

Module II: Measures of Central Tendency (18 Lectures)

Meaning and significance of Measures of Central Tendency; Computation of Mean from Ungrouped and Grouped data; Computation of Median from Grouped and Ungrouped data;Computation of Mode from Grouped and Ungrouped data.

Module III: Measures of Variability (17 Lectures)

Meaning and significance of Measures of Variability Concepts; Uses and Computation of Range, AD, SD and QD Percentile and Percentile Ranks.

Module IV: Linear Correlation (20 Lectures)

Meaning of Correlation; Degrees of Correlationship; Computation of Correlation by using –ProductMoment Method and rank Difference Method; Interpretations of Computed Co-efficient of Correlation.

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,NewYork(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,NewDelhi(2009)

5) Mangal, S.K.: Statistics in Psychology and Education, PHI Pvt. Ltd, Delhi (2018)

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2	H	H	H	H
CO 3	H			
CO 4		H	H	
CO 5	H	H	H	H
CO 6	H	H	H	H

DSE- 3: EDAE0144 ADULT EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Understanding about the nature, scope, and relevance of adult education among thestudents. (Understanding)
CO2 Identify different methods and skills for effective transaction of the adult educationcurriculum. (Application)
CO3 Understand different forms of adult education. (Understanding)
CO4 Dealing with different adult education agencies and making use of those agencies forthe growth and development of adult education in India. (Application)
CO5 Creating some critical thinking and values among the adults. (Analyzing)
CO6 Establishing effective and productive adult education centres and ensuring desiredfunctioning of the centres. (Application)

Module I: Concepts of Adult Education (20 Lectures)

Concept of adult education, objectives of adult education, importance of adult education for economic, social and political development of India; Concept of non-formal education, general characteristics of non-formal education, factors which necessitated non-formal education, difference between informal, non-formal and formal education

Module II: Methods of Adult Education (20 Lectures)

Methods of Adult Education: Campaign method, centre method, individual method, residential method and mass communication method. Meaning, scope and importance of adult literacy: Difference between literacy and functional literacy, methods of imparting literacy; Follow up programmes: Types, need and importance.

Module III: Forms of Adult Education (18 Lectures)

Forms of Adult Education: Remedial, continuing, workers and mass media; Methods of adult education: Teacher dominated method, co-operative method and mass media methods;Administrative structure of adult education, organization of adult education programmes at the field level training of adult education functionaries.

Module IV: Agencies of Adult Education (17 Lectures)

Agencies of adult education—Government and non-government; Current status of adulteducation in India with special reference to Punjab, National Literacy Mission, Adult education as conceived in the National Policy of Education 1986.

Suggested Readings

1. Bhola, H.S. Evaluating Functional Literacy, Bucks, Hulton Educational Publication.

2. Bordia, Anil, Kidd, J.R. (1977). Adult Education: A Book of Readings, New and Draper, J. Delhi,Indian Adult Education Association.

3. Chopra, R. (1998). Adult and Non-Formal Education. New Delhi. International Book House,

4. Moshini, S. R.(1989). History of Adult Education in India. New Delhi. Anmol Publication.

5. Prasad, P.S. (1989). Adult Education. New Delhi. Asian Publishing House.

6. Sharma, R.P. (2002). Non-Formal Education for Development. Agra. Bhargava Book House.

7. Smith, R. M. (1970). Handbook of Adult Education. New York. McMillan Publication.

8. Styler, W. E. (1966). Adult Education in India. New York. Oxford University Press

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	H	
CO 3			H	
CO 4				H
CO 5	M	H	H	H
CO 6				H

DSE-4: EDSP0145 SPECIAL EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Understand the meaning of Special education. (Remembering)
CO2 Explain the characteristics, trends and issues in special education. (Understanding)
CO3 Discuss the nature, types, characteristics and educational implications of children withdisabilities. (Understanding)

CO4 Examine the nature, scope and issues in career education and rehabilitation of personswith disabilities. (Evaluation)
CO5 Recognize and describe role of family, school and community in childrenperformance.(Remembering)
CO6 Analyse the various policies and acts of government. (Analysis)

Module I: Introduction to Special Education (18 Lectures)

Special Education: Definition and History, Scope and nature of Special Education, Need and importance of Special education, Changing Trends and Issues in Special Education.

Module II: Types and Educational needs of children with special abilities (20 Lectures)

Concept, Definitions and Characteristics of special ability; Definition and types: HearingImpairment, Visual Impairment, Mental Retardation, Neuro–muscular, Autism; Dyslexia; ADHD; Down Syndrome; Epilepsy; Cerebral Palsy; Slow Learners and ASD; Approaches in teaching children with special educational needs.

Module III: School, Community and Children with special abilities (20 Lectures)

Family and their impact on the child with special needs; Parental reaction and attitudes to the child with disabilities; Need and importance: School and Community; Role of special teachers; Types of programmes for community awareness and participation; Role of community in prevention, identification, and intervention of disabilities, Role of NGOs , Role of Mass media for community awareness.

Module IV: Career Education and Rehabilitation (17 Lectures)

Rehabilitation: Concept, Objective and Function , International Legislation for Special Education; Role of UN; Persons with Disabilities Act, 1995; Rights of Persons with Disabilities Act, 2016; Vocational training and job opportunities.

Practicum:

Visit at least two institutes for disabilities and observe children with disabilities learning, andsubmit a report of observation.

Making learning materials for students with disabilities.

Suggested Readings

1) Kumari, Meena: Education for Children with Special Needs, New Delhi, Centrum Press: 2009
2) Mani, M.N.G., Techniques of teaching blind children, New Delhi Sterling Publishers, 1992.
3) Panda, KC (1997) Education and Exceptional Children, Vikas Publishing House, New Delhi.
4) S.S. Chauhan (2002) Education of Exceptional Children
5) Status of Disability (2012). Rehabilitation Council of India, New Delhi

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			

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

DSE-5: EDEE0146 ECONOMICS OF EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Understand the conceptual framework of economics and its relationship with education(Understanding)
CO2 Understand education as an industry in terms of investment (inputs), process, andoutput (Understanding)
CO3 Finding out the cost effectiveness of education system (Application)
CO4 Analyzing the cost of education system and making it low-cost effectiveness (Analysis)CO5 Explain the financing system at different stages (Understanding)
CO6 Evaluate the financing system of educational institution (Evaluation)

Module I: Education in Economic Context (20 Lectures)

Meaning of economics and its relation with education: Concept, Need and Scope of Economics of Education; Education as Public good and Private Good; Education as investment and consumption at individual and societal levels; Education as an industry.

Module II: Cost, Pricing and Financing of Education (18 Lectures)

Concept of Cost of Education at different stages; Types of costing-direct and indirect, private and social cost; Pricing of Education at different stages: micro and macro perspectives; Financing of education at different stages Sources of financing: private and public, endowments, grants and grants in –aid.

Module III: Economics and Development (17 Lectures)

Contribution of education towards Economic Development; Education as a process of Human Capital formation; Education equity and income distribution; Economic conceptualisation of Innovation, Knowledge and Technology; Effect of Migration of knowledge workers and Brain- drain.

Module IV: Economics of Educational Institutions (20 Lectures)

Schools and financing- government and private schools: aided and non-aided - How these different modes of financing get reflected in the admission policy, fee-structure, teaching-learningprocess and teacher recruitment, New economic policy and school education, Understanding the demand for and supply of higher education, Education quality and job-market: developments in Information and Communication Technology (ICT) and Artificial, Intelligence (AI)- implications for job market and education policy.

Suggested Readings

1) Education and Development in India- Critical Issues in Public Policy and Development, Jandhyala B G Tilak
2) Higher Education, Public Good and Markets, Jandhyala B G Tilak,Routledge
3) Investment in Education and Social Choice, Tapas Majumdar
4) The Economics of Inequality in Education, J.B.G. Tilak
5) Education and Economics: Disciplinary Evolution and Policy Discourse, Saumen Chattopadhyay
6) Handbook of the Economics of Education ;Eric A Hanushek Stephen Machin LudgerWoessmann
7) The Economics of Education, Samuel Akinyemi
8) Resources, Values and Development; Amartya Sen
9) An introduction to the Economics of Education, Mark Blaug
10) Economic value of education, Theodore W. Schultz
11) Economics of Education selected readings Vol1 and Vol.2, Mark Blaug (Ed)

Journal Articles

1) Chattopadhyay, S. (2013): An Economic Conceptualisation of Education: Disciplinary Evolution and Policy Discourse, Journal of Educational Planning and Administration,, XXVII (1), 51-70
2) Chattopadhyay, S. (2009): The Market in Higher Education: Concern for Equity and Quality, Economic and Political Weekly, XLIV(29), 53-61
3) Dequiedt, V. and Y. Zenou (2013). International migration, imperfect information, and brain drain, Journal of Development Economics, 102, 62-78.
4) Schultz, T.W. (1961): Investment in Human Capital, The American Economic Review, 51(1), 1- 17.
5) Winston, G.C. (1999): "Subsidies, Hierarchy and Peers: The Awkward Economics of Higher Education", Journal of Economic Perspectives, 13 (.1), 13-36.
6) Woodhall, M. (1967): The Economics of Education, Review of Educational Research, 37(4), 387-398.

E-resources

1) Video Lectures on Economics of Education produced by Krishna Kanta Handiqui State Open University, Guwahati, available at https://www.youtube.com/watch?v=KwGiuiI1UuY
2) MIT Open Courseware available at https://ocw.mit.edu/courses/urban-studies-and- planning/11-126j-economics-of-education-spring-2007/index.htm

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H	H	H	
CO 3		H	H	
CO 4		H	H	H
CO 5		H		
CO 6				H

DSE 6- EDHG0147 HUMAN GROWTH AND DEVELOPMENT (5-1-0)

COURSE OUTCOMES

CO1 Recall the concept of Growth and Development and its associated variables and issues(Remembering)
CO2 Explain the concepts of maturation and individual differences, their effect on humangrowth and development (Understanding)
CO3 Use the knowledge of the various theories of growth and development and itsassociated variables in addressing the diversity of the classroom (Application)
CO4 Critically analyze the theories of development and their Educational Implications(Analysis)
CO5 Explain childhood and adolescence as stages of development along with their developmental characteristics and role of the teacher in addressing their needs(Understanding)

Module I: Introduction to Growth and Development (20 Lectures)

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**;** Havighursts' Developmental Tasks throughout one's lifespan: Concept of Developmental tasks**,** Characteristics of Developmental tasks**,** Sources of Developmental tasks**,** Developmental tasks from babyhood to old age**,** Educational Implications of Developmental tasks**;** Stages of Human growth and development (characteristic features): Prenatal Development, Post- natal Development.

Module II: Maturation and Individual Differences (18 Lectures)

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: Theories of Development and their Educational Implications (20 Lectures)

Cognitive Theory: Piaget Psycho-sexual Theory, Freud Psycho-social Theory, Erickson Bio- ecological Theory, Bronfrenbrenner Kohlberg's theory of Moral Development; Chomsky's theory of Language Development.

Module IV: Childhood and Adolescence (17 Lectures)

Childhood: Concept, Developmental Characteristics and role of teacher in addressing their needs; Adolescence: Concept, Developmental characteristics, problems encountered by adolescents, roleof the teacher in addressing adolescent problems.

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 HillEducation 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, NewYork.

11) Chauhan, S. S. (2004). *Advanced Educational Psychology.* Vikash Publishing House Pvt. Ltd.New Delhi.

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2		H		
CO3		H	H	
CO4		H		
CO5				H

CC13: EDTL0148 TEACHING LEARNING METHODS AND PEDAGOGY (5-1-0)

COURSE OUTCOMES

CO1 To recall the several components of the teaching-learning process. (Remembering)CO2 To explain/ illustrate the theories and principles of teaching. (Understanding)

CO3 To use the theories, methods, principles and maxims of teaching. (Application) CO4 To choose the appropriate method, skills, approaches while teaching. (Evaluation)CO5 To create effective lesson plans. (Creation)

Module I: Concepts of teaching and learning (18 Lectures)

Meaning and definitions of the term teaching; Teaching from a descriptive point of view; Teachingfrom a success point of view. Variables and functions of teaching, levels and phases of teaching.

Module II: Theories and Principles of Teaching (19 Lectures)

Nature of theory of teaching; Significance of theory of teaching; Formal, descriptive andnormative theories of learning; Teaching skills and Microteaching; Techno-Pedagogy.

Module III: Instructional Objectives and Approaches of Teaching (20 Lectures)

Concept of instructional objectives and learning outcomes; Taxonomy of instructional objectives with special reference to cognitive objectives; Methods of teaching: Lecture method, Discussion method, Demonstrative method; Approaches of teaching: Inquiry approach, Modular approach, Computer assisted instruction and Keller's plan.

Module IV: Lesson Plan and Process of Evaluation (18 Lectures)

Meaning and significance of lesson plan; Approaches of lesson plan; Preparation of lesson plan; Concepts of measurement and evaluation in education; Principles of evaluation in education; Preparing a balanced question paper with its blue print.

Suggested Readings

1) Aggarwal, J.C. Essentials of Educational Technology, Innovation in Teaching-Learning, VikasPublishing House Pvt. Ltd. New Delhi (2014)
2) Bloom, B.S : Taxonomy of Educational Objectives, New York (1956).
3) Freeberg, M.J & Drescoli, A. Universal Teaching Strategies, Boston: Allyan and Bacon (1992)
4) Gage, N.S. "Theories of Teaching" in theories of learning and instruction, Chicago UniversityPress(1968).
5) Jangira, N.K. & Ajit Singh Core Teaching Skills: The Microteaching Approach, NCERT, NewDelhi (1983).
6) Kapoor, K.C et. al. Teacher Education in the 21st Century, The Associated Publishers, Ambalacantt (2008):.
7) Mangal, S.K & Mangal, U. Essentials of Educational Technology, PHI Learning Pvt. Ltd, Delhi.Mudranalaya(2014)
8) Passi, B.K. Becoming Better Teacher: Microteaching Approach, Ahmedabad: Sahitaya (1976).
9) Stone, Edgar & Morris, Sidney. Teaching Practice: Problems and Perspectives, London(1972)

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H	H	H

CO2		H	H	
CO3		H	H	H
CO4		H	H	H
CO5	H	M	M	M

CC 14- EDEM0149 EDUCATIONAL MANAGEMENT AND ADMINISTRATION (5-1-0)

COURSE OUTCOMES

CO1 State the meaning, definition, nature, scope and objectives of educationaladministration. (Remembering)
CO2 Explain the types, elements, characteristics, functions and factors influencingeducational administration. (Understanding)
CO3 Understand the concept of school and school management and types of administration.(Understanding)
CO4 Analyze the qualities and role of school personnel and their professional ethics.(Analysis)
CO5 Identify the different steps and approaches of institutional planning. (Application) CO6 Apply the principles of supervision in educational management and administration. (Application)

Module I: Introduction to Educational Administration (20 Lectures)

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.

Module II: School Management (18 Lectures)

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 and attitude of the teachers, Autocratic and Democratic administration.

Module III: Institutional planning (17 Lectures)

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: Supervision (20 Lectures)

Meaning and Nature of Supervision; Concept of Inspection; Difference between Inspection and Supervision; Aims, Types, Scope of Supervision; Supervision Procedures; Principles of Supervision; Problems in Supervision; Suggestions for developing supervision; Effective supervision; Functional basis of supervision; Difference between supervision and administration.

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. Advances in Educational Administration, Volume 10, 1–4. Elsevier Ltd.
5) English, F. (ed.). Encyclopedia Educational leadership and Administration (Vol. 1). SagePublication: Thousand Oaks.
6) Stanley, A. G. &Samier, E. A.Political Approaches to Educational Administration andLeadership. Routledge: New York.
7) 7. Starratt, R. Centering Educational Administration: Cultivating Meaning,Community, and Responsibility. Lawrence Erlbaum Associates, Publishers: New Jersey.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H	M		
CO 3		H		
CO 4		H		
CO 5			H	
CO 6				H

GROUP-II

DSE 1- EDTE0150 TEACHER EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Know the concept of Teacher Education programmes. (Remembering)
CO2 Understand the structure and curriculum of the Teacher education Programme.(Understanding)
CO3 Understand the concepts of Pre-service & In-service Teacher Education Programmes.(Understanding)
CO4 Analyze the current trends in the field of Teacher Education. (Application)CO5 Apply process of research in the field of Teacher Education. (Application)

Module - I: Introduction to Teacher Education (20 Lectures)

Meaning, nature and scope of Teacher Education; Historical background of Teacher Education inIndia; Objectives of Teacher Education; Paradigm shifts in education and preparation of teachers.

Module – II: Structure and Curriculum of Teacher Education (17 Lectures)

Salient Features of the Teacher Education Curriculum; Structure of Teacher Education curriculum at Pre-primary and Primary level; Structure of Teacher Education curriculum at Secondary stage; Curriculum for Teacher Educators.

Module-III: Pre-service and In-service Teacher Education (18 Lectures)

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 Programsas per NCTE; Modes of Transaction; Micro Teaching and SSST; Team Teaching.

Module-IV: Current Trends and Research in Teacher Education (20 Lectures)

Practice Teaching and Internship; Flander's Interaction Analysis Category System (FIACS);

Integrated Teacher Education Programme; Research in Teacher Education; Process of Action Research; Technology in Teacher Education.

Suggested Readings

1) Aggarwal.J.C (2010): Teacher Education, Theory and Practices, New Delhi, Daoba Home
2) Harvilas, S. and Naik, J.P (2016): A History of Education in India, Bombay, McMillan & Co.
3) Jangaiah, C(2016): Teacher Education, APH Publishing Corporation
4) Jangira, N.K (2002): Teacher Training and Teacher Effectiveness –An experience in Teaching,New Delhi, National Publishing House
5) Kumar, T.P (2010): Teacher Education, APH Publishing Corporation
6) NCERT (1968): The Third Indian Year Book on Education, New Delhi, NCERT
7) NCTE (1978): Teacher Education Curriculum-A Framework, New Delhi, NCERT
8) Mohanty,R.K (2012) : Teacher Education,R.Lal Book Depot, Raj Printers
9) Shirmali, K.L: Better Teacher Education, New Delhi, Ministry of Education, Govt. of India

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3	M	M	H	
CO 4	M	M	M	H
CO 5				H

DSE 2: EDEE0151 ENVIRONMENTAL EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Learning about the concepts of environmental education. (Remembering)
CO2 Understanding the relationship between man and environment. (Understanding)

CO3 Identification and classifying the natural resources and measures for conserving theseresources. (Application)
CO4 Developing a sound curriculum of environmental education and creating critical thinkingthrough its transaction. (Analysis)
CO5 Assessing the environment and its impact on the quality of life. (Evaluation)
CO6 Providing approaches and skills to transact the curriculum efficiently and productively.(Creation)

Module-I: Introduction to Environment and Environmental Education (20 Lectures)

Meaning, components and nature of environment; Relationship between man and his environment; Determinism and Possibilism; Nature, objectives and scope of environmental education.

Module-II: Natural Resources (18 Lectures)

Land, Water, and Air resources; Mineral resources; Plant life and animal life as resources; Depletion of resources and conservation of resources; Use of resources and sustainable development; Climate change.

Module-III: Environmental Pollution (20 Lectures)

Meaning of environmental pollution; Causes, effects, and control of pollution of air, water, land, soil, noise etc.; Global warming; Solid waste management; Radioactive waste management; Concept of 3R's (Reduce, Reuse, Recycle); Environmental hazards-Floods, earthquakes, cyclones etc.; Environmental Disaster and Disaster Management.

Module-IV: Curriculum of Environmental Education and some Issues (17 lectures)

Process of curriculum development of environmental education; Transaction of the curriculum of environmental education; evaluation of students in environmental education; Growth ofpopulation and its effects on environment; Values and ethics of life.

Suggested Readings

1) Saini, L. D. (2004). Environmental education. Kalyani Publishers, New Delhi
2) UGC. (2005). Textbook of environmental studies, universities Press, New Delhi
3) Mayr, E. (1999): This is biology: The science of living world universities Press, New Delhi
4) Diwan, P & Diwan, P. (1998). Environmental management law and administration. Vanity book International, New Delhi
5) Agarwal, S.K. (1997). Environmental issues and themes. APH Publishing corporation, New Delhi
6) Kapoor, K. C. (2000). Environmental awareness and attitude towards environmental education in relation to SES of students and teachers of 10+2 schools of Arunachal Pradesh. Aresearch project report: Unpublished (ICSSR)
7) Fedoror, E. (1980). Man and nature. Progress publishers, Moscow
8) Gerasimor, I. P. (1993). Geography and ecology. Progress publishers, Bombay.

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV

CO 1	H	M		
CO 2	H	H	H	
CO 3		H		H
CO 4				H
CO5			M	H
CO6				H

DSC -3 EDPN0152 PHYSICAL EDUCATION (5-1-0)

COURSE OUTCOME

CO1 Describe physical and health education and develop the skills in organizing the physicaleducation programmes in schools. (Application)
CO2 Explain the health and safety education and understand the nature of injuries and toprovide first aid. (Understanding)
CO3 Illustrate knowledge about yoga and physical exercises, about recreation, health andsafety education. (Application)
CO4 Identify common communicable diseases with the nature of injuries and to provide firstaid. (Analysis)
CO5 Display knowledge about yoga and physical exercises. (Application)
CO6 Discuss diet modification in the treatment of under-weight and obesity. (Application)

Module I: Introduction to Physical Education (18 Lectures)

Meaning, Definition, Aims, Scope and Importance of Physical Education; Physical Fitness- Meaning, Definition, Components and Benefits; Origin and Development of Ancient and Modern Olympics-Olympic torch, Olympic Flag, Marathon Race, Difference between Ancient and Modern Olympic Games - Recreational activities; First Aid: on Road, Water, Fire accidents and Snake bite; Common sports injuries: Strain, Sprain, Contusion, Laceration, Fractures and Dislocation; Safety Education**:** Importance with reference to Schools, Play fields, Road, School and Home.

Module II: Causes and Prevention of Diseases (18 Lectures)

Lifestyle disorders: Heart diseases, Cancer, HIV/AIDS, Reproductive Helpless Health, Osteoporosis, Depression, Intentional & Unintentional Injuries, Diabetes and Obesity; Back Pain: Causes, Symptoms and Prevention; Addiction: Alcoholism, Smoking and Drugs; Impact of Pollution on Human health; Communicable diseases: Malaria, Swine flu, Chikungunya, Typhoid, Cholera, Smallpox, Tuberculosis and Dengue: Causes, Symptoms and Prevention.

Module III: Yoga and Physical Exercises (19 Lectures)

Meaning, Definition and Uses of Yoga - Essentials of Yogic Practices, Methods and Benefits of selected Asanas and Pranayama - Physical Exercises, Types: Aerobic, Anaerobic; Effects of Physical Exercises on various systems - Circulatory, Muscular, Digestive and Respiratory systems; Difference between Physical Exercises and Yoga - Fitness components and its importance - Effect of Physical Exercises on human body systems.

Module IV: Concept of Health Education (20 Lectures)

Meaning, Definition, Objectives and Importance of Health Education; Nutrition - Malnutrition - Personal Hygiene - Health Education in Schools - Health Instruction, Health Services; Food and Nutrition: Meaning of Food, Classification, Constituents of Food, Vitamins and Deficiency Diseases, Meaning of Nutrition, Malnutrition – Causes of Malnutrition - Balanced Diet and Diet for Obesity and Underweight.

Suggested Readings

1) Agarwal, Satya, P. (1998), The social role of the Gita: How and why, Motilal Banarsidass.
2) Goel Devraj & Goel Chhaya (2013) Universe of Swami Vivekananda & Complete Wholistic.
3) Cocial Development, CASE Publication under UGC SAP, M.S University of Baroda, Vadodara.
4) Porter, Noah. (2003) Falung Gong in the United States: An Ethnographic Study, Master Thesis, Department of Anthropology, College of Arts and Sciences, University of South Florida.
5) Dhanajoy, S., & Seema, K. (2007). Lesson planning: Teaching methods and class management in physical education. New Delhi: Khal Sahitya Kendra.
6) Nash T.N. (2006). Health and physical education. Hyderabad: Nilkamal Publishers.
7) Prasad, Y. V. (2006). Method of teaching physical education. New Delhi: Discovery Publishinghouse.
8) Sachdeva, M. S. (2006). School organisation, administration and management. Ludhiana: ·Dandon Publication.
9) Chandra, S., Sothi, & Krishnan. P. (2005). Health education and physical education. Delhi:Surject Publications.
10) Mangal, S. K. (2005). Health and physical education. Ludhiana: Tandon Publication bookmarket.
11) Ajmer, S. (2003). Essentials of physical education. New Delhi: Kalyani Publishers. ·
12) Tiwari, O. P. (2002). Asana : Why and how. India: Kanalyadhama.
13) Hedge, (1997). How to maintain good health. New Delhi: UBPSD Publishers.
14) Kanele., B. S., & Kumar, C. P. (1996). Text book on health and physical education. Ludhiana:Kalyana Publishers.
15) Reema, K. (1996). Physical fitness. New Delhi: Khel Sahitya Sports Publication.
16) Dambrosa, D., & Robert, D. (1993). Prevention and treatment and running injuries. NewJersey: Slack Incorpor Road.
17) Krishna, G. (1993). The purpose of yoga. New Delhi: UBS Publishers Ltd. ·
18) Ramachandran, L.T., & Dharmalingam. (1993). Health education. A new approach. New Delhi:Vikas Publishers Ltd.
19) Charles, B. A. (1992). Foundation of physical education and sport. New Delhi: B1 Publication.
20) Eriksson, O. B. (1990). Sports medicine, health and medication. Enfield: Guinness.Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H

CO 2	M	H	M	H
CO 3	H	H	H	H
CO 4	H	H	H	H
CO5	H	H	H	H
CO6	H	H	H	H

DSE-4 EDPE0153 PEACE EDUCATION (5-1-0)

COURSE OUTCOMES

CO1 Recall the different elements related to peace education. (Remembering)
CO2 Explain the development and importance of peace education both at the national andinternational level. (Understanding)
CO3 Critically analyze the stage wise curriculum of education for peace. (Analysis) CO4 Put into classroom practice the pedagogy of education for peace. (Application)
CO5 Assess the present relevance of the ideology of eminent thinkers on peace education.(Evaluation)

Module I: Peace Education (18 Lectures)

Meaning - Definition - Aims of Peace Education; Different Levels of Education; Gandhian concept of peace; Different approaches to peace; Historical Development of Peace Education; Peace Education in India and its development; Gandhiji's contributions to peace movement; Creation of United Nations; Creation of UNESCO, UNICEF, UNO-UNDP, UNEP, UNHRC; Amnesty International, International Committee of Red Cross and NGOs.

Module II: Education for Peace and Peace Culture (20 Lectures)

Concept and meaning of Education for peace; Curriculum Development of Education for peace; Stage specific approach: Early childhood, Elementary stage, Secondary stage, Higher Education stage, Adult Education stage; Fostering Culture of Peace, Role of home in Peace cultivation, Participatory Communication, Democratic Participation and Gender equality, Sustainable Economic and social development, Non- violence, International Peace and Security.

Module III: Pedagogy of Education of Peace (17 Lectures)

Introduction- Enquiry method; Value clarification; Jurisprudential Model of Teaching; Role playing;Dramatics; Literacy Activities; Yoga and Meditation; Sports and Games; Teacher Education for Peace.

Module IV: Peace Thinkers (20 Lectures)

(Study of relevant extracts from the writings of) John Dewey ; Paulo of Freire; Montessori ('Peace and Education') ; Dalai Lama ('Universal Responsibility); Krishnamurti, J. ('Education and World Peace') ; Gandhi ('Brute Force' and 'Passive Resistance' in Hind Swaraj); Sri Aurobindo ('The Ideal of Human Unity').

Suggested Readings

1) Barash, P. David (2000). Approaches to Peace, oxford university press, New York. 2.

2) Galtung, I (1996). Peace by peaceful means: Peace and conflict, Development and civilization,PRIO – International peace research institute of Oslo and sage publications.

3) Gandhi, M.K., (1959) An Autobiography of The story of my experiments with Truth,Ahmadabad : Navajivan Trust.

4) Hicks, David, (1988), Education for Peace. New York : Routledge.

5) Barash. P.David (2000). Approaches to peace, Oxford University Press, New York. 2. NCERT National curriculum Framework (2005), position paper, National Focus Group on Education for peace, NCERT, New Delhi (2006).

6) Barash, P David (2000). Approaches to peace, Oxford University Press, New York 2. Gandhi, M.K., (1944). Non-violence in peace and war, navajivan publishing House, Ahmedabad

7) Burns, Robin Joan and Robert Aspeslagh (1996). Three Decades of peace education Around the world, New Jersey : Garland Publication, INC.

8) Hicks, David, Edi, (1988), Education for Peace, New York: Routledge.

9) Timpson, William M (2002), Teaching and Learning Peace, Madison, Wisconsin, Atwood Publishing.

10) Sofia Stril-Rever (2016). New Reality: Peace and Universal Responsibility, according to the Dalai Lama. Excerpt from the Charter of Universal Responsibility .Retrievedfromhttps://www.qscience.com/docserver/fulltext/rels/2016/2/rels.2016.peace.12.pdf?expires=1587409759&id=id&accname=guest&checksum=7507CBB527E69E367228AB1 AE9D5424B

11) Duckworth, C.(2010). Maria Montessori's Contribution to Peace Education. Teachers Center. ColumbiaUniversity,!2008.Retrievedfromhttp://www.tc.edu/centers/epe/PDF%20articles/Du ckworth_ch4_22feb08.pdf

12) Howlett, C. F. (2008). John Dewey and Peace Education. Teachers College. ColumbiaUniversity.Retrievedfromhttp://www.tc.edu/centers/epe/.../Howlett_ch3_22feb08. pdf

13) Krishnamurti, J. (2008). Education and Significance of life. Retrieved from https://www.holybooks.com/wp-content/uploads/J-Krishnamurti-Education-and-the- Significance-of-life.pdf

14) Gandhi, M.K. (1938). Hind Swaraj or Indian Home Rule. Ahemadabad: Navajivan PublishingHouse. **ISBN:** 81-7229-070-5.

15) Gupta, M. (2017). An Education for the Future: A Dream Vision of Sri Aurobindo and theMother. The New Learn Vol. 3, No 27-28.

Mapping of COs to syllabus

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

CO5				H

DSE-5: EDIT0154 INSTRUCTIONAL TECHNOLOGY (5-1-0)

COURSE OUTCOMES

CO1 Describe the nature of Educational Technology. (Application)
CO2 Distinguish about the meaning and nature of Instructional Technology. (Analysis)CO3 Explain the Structure of Teaching-learning Process. (Application)
CO4 Create and generate skills for designing Instructional materials. (Application)CO5 Illustrate the modern approaches of imparting instruction in the classroom.
(Application)

Module I: Nature of Educational Technology (18 Lectures)

Contributions of Science and Technology in Human Life; Concept and nature of Educational Technology; Technology in Education and Technology of Education; Types/Forms of Educational Technology: ET: I, ET: II, ET: III; Objectives of Educational Technology; Scope of Educational Technology.

Module II: Concept of Instructional Technology (18 Lectures)

Meaning and Nature of Instructional Technology; Need of Instructional Technology; Difference between Teaching and Instruction; Assumptions of Instructional Technology; Basic features of Instructional Technology; Instructional Designs.

Module III: Instructional Objectives (19 Lectures)

Meaning of Instructional Objectives; Relationship of Instructional Objectives with General aimsand objectives of Education; Taxonomy of Instructional Objectives: Cognitive, Affective and Psychomotor Instructional Objectives; Writing Instructional Objectives in behavioural Forms.

Module IV: Modern Approaches to Instructions (20 Lectures)

Programmed Instructions: Meaning, Principles, Features; Styles of Programming: Linear Programming, Branching Programming and Mathetics Programming; Development of Programmed Instructional Material; Personalized Systems of Instruction, Computer Assisted Instruction; Bloom's Mastery Learning Approach to instruction.

Suggested Reading:

1) Bloom, B. S. (ed.) (1956): *Taxonomy of Educational Objectives.* David Mc Kay, New York.
2) Bruner, J. S. (1966): *Towards a Theory of Instruction.* Harvard University Press,Massachusetts.
3) Chauhan, S. S. (1979). *Innovations in Teaching learning process.* Pvt. Ltd., New Delhi.
4) Dececco, J. P. (1970): *The Psychology of Learning and Instructional Technology.* Prentice Hallof India, New Delhi.
5) Leith, G. O. et.al. (1966): *A Handbook of Programmed Learning.* Birmingham.
6) Mager, R. P. (1962): *Preparing Instructional Objectives.* Palo Alto, California.
7) Mangal, S.K. & Mangal, U. (2009). *Essentials of Educational Technology.* PHI Learning Pvt Ltd.Delhi.
8) Mitra, S. K. (1968): Proceedings of symposium on Educational Technology, IPAL, NCERT. New

Delhi.

9) Sharma, R. A. (1988): *Technology of Teaching,* Loyal Book Depot, Meerut.

10) Unwin, D. (Ed). (1969): Media and methods: Instructional technology in Higher Education.

Mapping of COs to syllabus

	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
CO5	H	H	H	H
CO6	H	H	H	H

DSE 6- EDER0155 ELEMENTS OF RESEARCH (5-1-0)

COURSE OUTCOMES

CO1 Understand the conceptual framework of research. (Remembering)CO2 Apply the process of research. (Application)
CO3 Create different tools of research. (Creation)
CO4 Use of tools and collecting desired data. (Application)
CO5 Understand statistical techniques to analyze the collected research data.(Understanding)

Module I: Introduction to Research in Education (17 Lectures)

Meaning and Nature of research, Relationship between research and philosophy, Types of Research: Fundamental, Applied and Action Research, Principles of research, Qualities of a good researcher, Scope of research in education.

Module II: Methods of Research (18 Lectures)

Meaning and nature of research designs, Historical method of research, Descriptive cum normative survey method of research, Experimental method of research, Case study method.

Module III: Process and tools of research (20 Lectures)

Process of research, General steps of research, Review of related literature, Variable and their types, Meaning, significance, and types of hypotheses, Sample and sampling, Tools of research: Tests, scales, questionnaire, interview, observation, features of a good tool of research, Preparation of research proposal.

Module IV: Statistics in Research (20 Lectures)

Meaning, significance, and limitations of statistics**,** Concept of data and its graphical representation: Frequency polygon, Histogram, Ogive, Pie diagram, Measures of CentralTendency, Variability, and coefficient of correlation: Product Moment Method and Rank

Difference Method, Hypotheses testing: Z-test, t-test and chi-square test.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		M	H	
CO 3			H	
CO 4			M	H
CO 5				H

Suggested Reading:

1) Best, John W & James V. Kahn. (2002): Research in Education. Prentice Hall, Pvt. Ltd. NewDelhi.
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, NewYork.
5) Koul, L. (2009): Methodology of Educational Research. Vikas Publishing House Pvt. Ltd. NewDelhi.
6) Mangal, S. K. & Mangal, S. (2013): Research Methodology in Behavioural Sciences. PHILearning Pvt. Ltd., Delhi.
7) Mangal, S. K. (2018): Statistics in Psychology and Education. PHI Learning Pvt. Ltd. New Delhi.

EDME0113: EDME0024 MEASUREMENT AND EVALUATION IN EDUCATION (4-0-0)

COURSE OUTCOMES

CO1 State the meaning and functions of measurement, assessment and evaluation.(Remembering)
CO2 Describe the tools, testing and non-testing techniques of educational measurement andevaluation. (Understanding)
CO3 Synthesize the features of the concept of reliability. (Creation)CO4 Find out the content Validity of a text. (Application)
CO5 State the steps for construction and standardization of the test. (Remembering)CO6 Evaluate the final draft of the test. (Evaluation)

Module I: Nature of Measurement And Evaluation (12 Lectures)

Concept of Measurement; Types of Measurement: Psychological and physical; Concept of educational measurement; Functions of educational measurement; Concept of assessment and evaluation; Principles and steps of Evaluation; Relationship between educational measurement and evaluation.

Module II: Testing And Non-testing Techniques In Educational Measurement And EvaluatioN (12Lectures)

Testing Technique: Achievement Test, aptitude Test, Intelligence Test; Non-Testing technique: Interview, Observation, Questionnaire, Rating Scales, Check list, attitude scale, cumulative record.

Module III: Concept of Reliability (10 Lectures)

Meaning and Nature of reliability of the test scores; Methods of Computing Coefficient of reliability: test- retest, parallel form, split half, KR-20, 21; Factors influencing reliability of test scores.

Module IV: Concept of Validity (12 Lectures)

Meaning and nature of Validity of the test scores; Types of Validity: face, content, construct, concurrent, predictive; Relationship between validity and reliability; Factors affecting validity.

Module V: Test Items (14 Lectures)

Concept and types of test items; Guidelines for writing objective types test items; Guidelines for writing essay type test items; Guidelines for interpretive exercises; Construction and standardization of test and attitude scale; Concept and types of norms.

Suggested Readings

1) Annastasi, A (1976): Psychological Testing, McMillan Publication Co. New York

2) Edwards, A. L. (1966) : Techniques of Attitude Scale Construction, New York

3) Frank, S. Freeman (1990) : Theory and Practice of Psychological Testing, IH Publishing Co.Bombay

4) Granlund, N.E. (1976): Measurement and Evaluation in Teaching, McMillan Publishing Co.New York

5) Linn, R.L. & Miller, M.D. Measurement and Assessment in Teaching, Dorling Kindersley Pvt.Ltd (2008)

6) Sharma, R.A. Essentials of Measurement in education and Psychology, R. Lall Book Depot,Meerut(1998)

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	M	M	M
CO2		H		M	H

CO3			H	M	
CO4			M	H	
CO5					H
CO6	M	M	M	M	H

EDTY0114: EDET0015 EDUCATIONAL TECHNOLOGY (4-0-0)

COURSE OUTCOMES

CO1 State the emergence, basic features and scope of Educational technology andinstructional technology. (Remembering)
CO2 Apply educational technology for achieving quality education. (Application)
CO3 Explain the taxonomies of cognitive, affective and psychomotor educational objectives.(Understanding)
CO4 Analyse the interactive phase of the T-L process. (Analysis)
CO5 Explain the concept and steps of programmed instruction and evaluate the facilitatorsand barriers of the process of communication. (Evaluation)
CO6 Identify the features of Behavioural technology and use the multimedia approach in theclassroom for the purpose of teaching. (Application)

Module I: Introduction To Educational Technology (13 Lectures)

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: Teaching-learning Process (12 Lectures)

Nature of Teaching-learning process; Variables and functions of teaching; Levels and phases of teaching; Instructional objectives relating to cognitive, affective and psycho-motor domains; Writing of instructional objectives in behavioral forms.

Module III: Communication And Instruction (12 Lectures)

Concept and need of communication; Forms of communication; Model of communication process; Classroom communication: Verbal and Non-verbal; Instructional Technology: Programmed Instruction (PI), Personalized system of Instruction (PSI), Computer Assisted Instruction (CAI), Modular Instruction (MI).

Module IV: Behavioural Technology (13 Lectures)

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 V: Emerging Trends Of Educational Technology (10 Lectures)

Nature of Information Technology (IT); Mass Media in Education: Radio, TV, Internet and E-Learning; Multimedia Approach; EDUSAT, Blended Learning, MOOCs; Research in EducationalTechnology.

Suggested Readings

1) Aggarwal, J.C. Essentials of Educational Technology, Vikas Publishing House Pvt. Ltd., NewDelhi (2014)

2) Bruner, J. S. Toward a Theory of instruction, New York(1966)

3) Flanders, Ned A : Analyzing Teacher Behaviour,California, Addison Wesley (1972)

4) Mangal,S. K & Mangal, U. Essentials of Educational Technology PHI Learning Pvt.Ltd,Delhi(2014)

5) Mitra, S. K. Proceedings of symposium on educational Technology,IPAL, NCERT, New Delhi(1968)

6) Sharma, R.A. Technology of Teaching, Loyal Book Depot, Meerut (1988)

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	M		M	H
CO2	M	H		M	H
CO3			H	M	
CO4			M	H	
CO5			H		
CO6				H	H

EDFC0115: FOUNDATIONS OF CURRICULUM DEVELOPMENT (4-0-0)

COURSE OUTCOMES

CO1 Enumerate the components, principles, goals and objectives of curriculumdevelopment. (Understanding)
CO2 Demonstrate the different viewpoints of existentialism, idealism, realism, pragmatismon the curriculum development. (Application)
CO3 Discuss about the different dimensions and approaches of curriculum designing.(Remembering)
CO4 Analyze the role of teachers in bringing about changes and modification in thecurriculum. (Analysis)
CO5 Assess the methods and process of curriculum development and examine the relevanceof the existing curriculum. (Evaluation)

Module I: Nature of Curriculum (12 Lectures)

Defining curriculum; Components of curriculum; Principles of curriculum; Goals and objectives forcurriculum development; Characteristics of a good curriculum.

Module II: Bases of Curriculum Construction (15 Lectures)

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 (18 Lectures)

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 Lectures)

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. (1986). Curriculum Planning and Development.London: Allyn and Bacon.

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: HimalayaPublishing 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 ChicagoPress.

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

	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2		H		

CO3			H	H
CO4	M			H
CO5			H	H

EDGC0116: EDGC0128 GUIDANCE AND COUNSELLING IN EDUCATION (4-0-0)

COURSE OUTCOMES

CO1 Explain the term guidance along with its philosophical, sociological and psychologicalbases. (Understanding)
CO2 Analyze the components of educational guidance, vocational guidance and personalguidance. (Analysis)
CO3 Differentiate the different types of counselling and find out the qualities of an effectivecounselor. (Application)
CO4 Describe the features of testing technique in guidance and counselling. (Understanding)CO5 Evaluate the guidance and counselling services. (Evaluation)

Module I: Introduction to Guidance (16 Lectures)

Meaning and Definition; Nature of Guidance; Historical background of the guidance in India; Needand Principles of Guidance; Bases of guidance; Teacher as a guide.

Module II: Types of Guidance (13 Lectures)

Educational Guidance, Vocational Guidance, Personal Guidance.

Module III: Concept of Counselling (14 Lectures)

Meaning and Definition; Nature of Counselling; Need for Counselling to 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 Lectures)

Testing Technique to measure the different constructs of an individual: Intelligence, Creativity, Interest, Aptitude and Personality traits; Non-testing Techniques: Observation, Interview, Scales, Cumulative records; Organisation of guidance and Counselling services.

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 DepotEducational 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: Sterlingpublishers(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: SterlingPublishing Pvt. Ltd (1984).

11) Kochhar, S. K. Educational & Vocational Guidance in Secondary Schools. N. Delhi: SterlingPublishers (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:TataMcGrawHill (1991).

15) Raj, Singh. . Educational & Vocational Guidance, N. Delhi: Commonwealth Publications(1994).

16) Sharma, N. R. Educational and Vocational Guidance. Agra: Vinod PustakMandir (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 syllabus

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

EDSI0117: SPECIAL AND INCLUSIVE EDUCATION (4-0-0)

COURSE OUTCOMES

CO1 Explain the nature, scope, objectives and principles of Special Education.(Understanding)
CO2 Use and apply new approaches of teaching children with special needs. (Application)

CO3 Discuss the causes of visual, speech and hearing impairment. (Remembering)CO4 Enumerate the policies and legislations in favour of persons with disabilities. (Understanding)

CO5 Analyze the causes of mental retardation and learning disabilities like Autism andsuggest preventive measures. (Analysis)

CO6 State the etiological factors affecting learning of students and state the medicalinterventions for the same. (Understanding)

Module I: Introduction to Special Education (10 Lectures)

Historical background of Special Education-Meaning and Definition; Nature, objectives and scopeof special education; Principles of special education.

Module II: Introduction to Inclusive Education (10 Lectures)

Concept and nature of Inclusive Education; Objectives and scope of Inclusive Education; Childrenwith special needs (CWSN); Identification of disabilities; Types of disabilities.

Module III: Impairments (15 Lectures)

Visual Impairment- blindness and low vision; Methods of teaching visually impaired students; Hearing Impairment- Definition, Causes and Preventions, Methods of teaching; Speech Impairment- definition and method of teaching.

Module IV: Policies and Legislations (10 Lectures)

International Legislation for Special Education; Role of UN; Persons with Disabilities Act, 1995; Rights of Persons with Disabilities Act, 2016; Rehabilitation Council of India- Acts, Objectives and functions.

Module V: Mental Retardation and Learning Disability (15 Lectures)

Mental retardation- Definition and Identification of Mental Retardation and Mental Illness; Causesand Prevention of mental retardation; Characteristics -Mild, Moderate, Severe, Profound; Types and Classification of Mental Retardation and Mental Illness; Intervention and Educational Programmes; Learning Disability- Concept, characteristics, and Types: Etiological Factors affecting learning, Issues and needs of children with Learning Disabilities; Autism- characteristics, medical intervention and role of education.

Suggested Readings

1) Evans, P and Verma, V. (Eds.) Special Education. Past, Present and Future. The Faimer Press(1990).

2) Hearty and Alur,Mithu: Education for Children with Special Needs(From segregation toInclusion) New Delhi, Sage Publication: 2009

3) Jangira, N.K., & Mani, M.N.G., Integrated Education of the Visually Handicapped,Management Perspectives. Gurgaon Academic Press, 1991.

4) Judith, I(2008).Learners, Learning and Educational Activity, London: Routledge

5) Kumari, Meena: Education for Children with Special Needs, New Delhi, Centrum Press: 2009

6) Mani, M.N.G., Techniques of teaching blind children, New Delhi Sterling Publishers, 1992

7) Myreddi, V. & Narayan, J. Educating Children, Secunderabad, NIMH

8) Narayan, & Kutty, A.T.T. Handbook for Trainers of the Mentally Retarded persons. Pre-primary level. NIMH, Secunderabad (1989).

9) Overton, T. Assessment in Special Education An Applied Approach. New York McMillan(1992).

10) Panda, K.C. Education of Exceptional Children. New Delhi Vikas Publications (1997).

11) Report to UNESCO ,Education for All-2000 Bulletin No.32,1998

12) Smith, R: Children with Mental Retardation : A parent's Guide Edited by Romanye Smith,Bethesda, USA, Woodbine House,1993

13) Subba Rao, T.A. Manual on Developing Communication Skills in Mentally Retarded Persons,NIMH, Secunderabad (1992).

14) Zeki, S: The Visual images in Mind and Brain, Scientific American, 1992

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	H	H	
CO2		H	H		
CO3			H		H
CO4				H	
CO5	M	M	M	M	H
CO6			H		H

EDTL0118: TEACHING LEARNING METHODS AND PEDAGOGY (4-0-0)

COURSE OUTCOMES

CO1 Recognize the meaning, definitions, and functions of teaching, evaluation, and measurement and recall the meaning of instructional objectives and lesson plan(Remembering)

CO2 Illustrate the theories of teaching and explain approaches of teaching (Understanding)CO3 Develop and use the lesson plan in classroom for the purpose of teaching a lesson,
differentiate between principles and maxims of teaching, and apply various micro-teaching skills (Application)

CO4 Analyze the concept of teaching and taxonomy of instructional objectives with specialreference to cognitive objectives (Analysis)

CO5 Develop the ability to evaluate lesson plans (Evaluation)

CO6 Formulate the learning outcomes in accordance with the different categories of formulated instructional objectives and prepare balanced question papers with blueprint (Creation)

Module I: Concepts of Teaching and Learning (12 Lectures)

Meaning and definitions of the term teaching; Teaching from a descriptive point of view; Teaching from a success point of view; Variables and functions of teaching; Levels and phases of teaching.

Module II: Theories and Principles of Teaching (15 Lectures)

Nature of theory of teaching; Significance of theory of teaching; Formal, descriptive and normative theories of learning; Teaching skills and Microteaching.

Module III: Instructional Objectives and Approaches of Teaching (18 Lectures)

Concept of instructional objectives and learning outcomes; Taxonomy of instructional objectives with special reference to cognitive objectives; Methods of teaching: Lecture method, Discussion method, Demonstrative method; Approaches of teaching: Inquiry approach, Modular approach, Computer assisted instruction and Keller's plan.

Module IV: Lesson Plan and Process of Evaluation (15 Lectures)

Meaning and significance of lesson plan; Approaches of lesson plan; Preparation of lesson plan; Concepts of measurement and evaluation in education; Principles of evaluation in education; Preparing a balanced question paper with its blue print.

Suggested Readings

1) Aggarwal, J.C. Essentials of Educational Technology, Innovation in Teaching-Learning, VikasPublishing House Pvt. Ltd. New Delhi (2014)

2) Bloom, B.S : Taxonomy of Educational Objectives, New York (1956).

3) Freeberg, M.J & Drescoli, Amy,Universal Teaching Strategies, Boston: Allyan and Bacon(1992)

4) Gage, N.S. "Theories of Teaching" in theories of learning and instruction, Chicago University Press(1968).

5) Jangira, N.K. & Ajit Singh Core Teaching Skills: The Microteaching Approach, NCERT, NewDelhi (1983).

6) Kapoor, K.C et. al. Teacher Education in the 21st Century, The Associated Publishers, Ambalacantt (2008):.

7) Mangal, S.K & Mangal, U. Essentials of Educational Technology, PHI Learning Pvt.Ltd, Delhi. Mudranalaya(2014)

8) Passi, B.K. Becoming Better Teacher: Microteaching Approach, Ahmedabad: Sahitya (1976).

9) Stone, Edgar & Morris, Sidney. Teaching Practice: Problems and Perspectives, London(1972)

Mapping of COs to syllabus

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

CO4	H		H	
CO5			M	H
CO6			H	H

EDEM0119: EDUCATIONAL MANAGEMENT AND ADMINISTRATION (4-0-0)

COURSE OUTCOMES

CO1 Recognize the meaning, concept, nature, types and significance of EducationalAdministration, School Management, Institutional planning, and Supervision. (Remembering)
CO2 Explain the factors influencing EA and professional ethics and attitude of the teachers;understand the role of teachers in school management, planning and supervision. (Understanding)
CO3 Apply the concept of Time Management and principles of Supervision. (Application)
CO4 Analyze the qualities of a Headmaster/Principal and problems in supervision; compareand contrast autocratic and democratic administration. (Analysis)
CO5 Evaluate the functions of educational administration, school management, institutionalplanning, and supervision along with evaluating the qualities of teachers. (Evaluation)
CO6 Create innovative institution plans and provide suggestions for supervision ininstitutions. (Creation)

Module I: Introduction To Educational Administration (12 Lectures)

Meaning and 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.

Module II: School Management (12 Lectures)

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 and attitude of the teachers; Autocratic and Democratic administration.

Module III: Institutional Planning (12 Lectures)

Meaning of Planning; Concept of Institutional Planning; Importance of Institutional Planning; Aimsof Institutional Planning, Steps and Preparation of Institutional planning; Approaches of Educational Planning – Man Power and Rate of return approach.

Module IV: Supervision (14 Lectures)

Meaning and Nature of Supervision; Concept of Inspection; Difference between Inspection and Supervision; Aims, Types, Scope of Supervision; Supervision Procedures; Principles of Supervision; Problems in Supervision; Suggestions for developing supervision; Effective supervision; Functional basis of supervision; Difference between supervision and administration.

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 & Ducky,F.G. Basic Principles of supervision.

4) 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.

5) English, F. (ed.). Encyclopedia Educational leadership and Administration (Vol. 1). Sage Publication: Thousand Oaks.

6) Stanley, A. G. & Samier, E. A.Political Approaches to Educational Administration and Leadership. Routledge: New York.

7) Starratt, R. CenteringEducational Administration: Cultivating Meaning, Community, and Responsibility. Lawrence Erlbaum Associates, Publishers:
New Jersey.

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2	H	H	M	M
CO3			H	H
CO4		H		M
CO5	H	H	H	H
CO6			H	H

EDCI0120: SCIENTIFIC METHODOLOGY (4-0-0)

COURSE OUTCOMES

CO1 State the meaning, aims and functions of Science. (Remembering)
CO2 Assess the influence of science and technology in the field of education and in thedevelopment of a society. (Evaluation)
CO3 Analyze the contribution of various scientists towards education. (Analysis)
CO4 Describe the various approaches and methods of teaching science. (Understanding) CO5 Use action research for solving the problem faced by students in class. (Application) CO6 Explain the steps of the scientific method of research. (Understanding)

Module I: Introduction to the Nature of Science (15 lectures)

Meaning and definition of science, Functions of science, Aims of science, Science and technologyin societal development, Qualities of a good science teacher.

Module II: Contributions of Eminent Scientists (10 lectures)

Sir J. C. Bose (1858-1937), Acharya Prafulla Chandra Ray (1861-1944), S. Ramanujan (1887-1920),

Marie Curie (1867-1934), Louis Pasteur (1822-1895), Charles Darwin (1809-1882).

Module III: Scientific Methods and Approaches (20 lectures)

Methods of teaching science: Lecture, Observation, Demonstration, Discussion, Project method, Laboratory method, Inductive-Deductive method; Constructivist approach; Approaches: Problem-solving approach, Inquiry Approach, Constructivist Approach including 5E learning model; Scientific equipment and other teaching aids.

Module IV: Research In Science (15 lectures)

Concept of research; Types of research- Fundamental, Applied & Action research; Scientific method of research; Process of research; Action research for science teachers.

Suggested Readings

1) Pedagogy of Science- Physical Science, Part I & II Textbook for B. Ed., NCERT; ISBN 978-93-5007-224-0 & 978-93-5007-225-7 respectively (2013).

2) Soni, A. Teaching of Science. Tandon Publications.

3) Rajasekar, S. Methods of Teaching Physical Science. Neelkamal Publications Pvt. Ltd. ISBN 81-8316-031- X(2011).

4) Shankat, T. Methods of Teaching Life Science, Crescent Publishing Corporation. ISBN 81-8342-062- 1(2018).

5) Malhotra, V. Methods of Teaching Physics. Crescent Publishing Corporation. ISBN 81-8342-025- 7(2018).

6) Vanaja, M .Methods of Teaching Physical Science. Neelkamal Publications Pvt. Ltd. ISBN 978-81-8316- 329-3 (2012).

7) Mohan, R.. Innovative Science Teaching- for Physical Science teachers. PHI Learning Pvt. Ltd.ISBN 978- 81-203-3157-0 (2013).

8) Malhotra, V. Methods of Teaching Mathematics. Crescent Publishing Corporation. ISBN 81-8342-029-X (2018).

9) Llewellyn, D. Teaching High School Science through Inquiry: A case study approach. SAGEPublications India Pvt. Ltd. ISBN 978-81-321-1601-1 (PB)(2005).

10) Koul, L. Methodology of Educational Research, Vikas Publishing House Pvt. Ltd. ISBN 978-81-259-2796- 9(2009).

11) Kerlinger, F. N. Foundations of Behavioral Research. Surjeet Publications (2004).

Mapping of COs to syllabus

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

CO4			H	M
CO5				H
CO6			M	H

EDTE0121: EDTE0023 TEACHER EDUCATION (3-0-0)

COURSE OUTCOMES

CO1 Recognize the meaning, nature, features and scope of teacher education, curriculum,types of teacher education programmes, and practice teaching. (Remembering)
CO2 Illustrate the salient features of teacher education curriculum and explain FlandersInteraction Analysis Category System (FIACS), and action research. (Understanding)
CO3 Apply curriculum for effective teaching learning and steps of micro teaching inclassroom setting. (Application)
CO4 Analyze the historical background of teacher education in India, need of curriculum at secondary stage, components of Pre-service and In-service Teacher education, behaviorof the teachers by using FIACS, etc. (Analysis)
CO5 Evaluate the current trends in the field of Teacher Education. (Evaluation)
CO6 Create the structure of teacher education curriculum at primary level and steps ofaction research. (Creation)

Module I: Introduction to Teacher Education (10 Lectures)

Meaning, nature and scope of Teacher Education; Historical background of Teacher Education inIndia; Objectives of Teacher Education; Paradigm shifts in education and preparation of teachers.

Module II: Structure and Curriculum of Teacher Education (12 Lectures)

Salient Features of the Teacher Education Curriculum; Structure of Teacher Education curriculum at Pre- primary and Primary level; Structure of Teacher Education curriculum at Secondary stage; Curriculum for Teacher Educators.

Module III: Pre-service and in-service Teacher Education (12 Lectures)

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 Programsas per NCTE; Modes of Transaction; Micro Teaching and SSST Team Teaching.

Module IV: Current Trends and Research in Teacher Education (11 Lectures)

Practice Teaching and Internship; Flanders Interaction Analysis Category System (FIACS) Integrated Teacher Education Programme Research in Teacher Education Process of Action Research Technology 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

	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2		H		H
CO3	M	H	H	
CO4	H	H		
CO5	H	H	H	H
CO6		H		H

EDDA0122: DISTANCE AND ADULT EDUCATION (3-0-0)

COURSE OUTCOMES

CO1 Recognize the meaning, definition, nature, objectives, characteristics, scope,characteristics of adult learners and of distance education. (Remembering)

CO2 Understand various aspects of theory and practice of Distance education and adulteducation. (Understanding)

CO3 Apply policy initiatives with regard to adult education and distance education and utilizemodels of distance education. (Application)

CO4 Critically analyze, appreciate and promote the role of distance and adult education inthe emerging social, political, cultural, economic, developmental, environmental andeducational situations for effecting transformation at the national and international levels. (Analysis)

CO5 Evaluate schemes, policies, functions of universities and other Government agencieswith regard to adult and distance education. (Evaluation)

CO6 Create futuristic models of adult and distance education. (Creation)

Module I: Understanding Adult Education (10 Lectures)

Adult Education- Meaning, definition, nature, objectives, characteristics, scope, target group,characteristics of adult learners, importance of adult education in India.

Module II: Trends In Adult Education (13 Lectures)

National Literacy Mission (NLM) - Objectives, Management Structure, role and function; Supporting agencies for adult education programmes and bodies such as State Resource Centre, Directorate of Adult Education. Total Literacy Campaigns (TLC), Post – Literacy Campaigns (PLC), Teaching methods for adults, Role of NGOs, Universities and other Government agencies in support of the NLM UNESCO's efforts; Hamburg Declaration on Adult Education, 1997.

Module III: Understanding Distance Education (12 Lectures)

Distance Education- Meaning, nature, scope, characteristics, significance, merits and demerits; Types of interaction in distance learning; Use of technology in distance learning; Historical Context; Distance Education in India; Models of Distance Education- Systems Model, TransactionalModel.

Module IV: Commissions And Agencies Of Distance Education (10 Lectures)

Report of Indian Commissions and Committees on Distance Education- NPE, 1986; Open University- Concept, Status in India; IGNOU; Commonwealth of Learning; International Council for Distance Education (ICDE); Asian Association of Open University (AAOU).

Suggested Readings

1) Mohanty. S. Adult and Non-Formal Education, Second Edition, Deep & Deep Publications Pvt.Ltd (2002).

2) Reddy. V. Adult and Lifelong Education, APH Publishing Corporation, Darya Ganj, New Delhi(2012).

3) Mohanty. S. Lifelong Education and Adult, APH Publishing Corporation, Darya Ganj, NewDelhi (2012).

4) Attri. A. Adult Education, APH Publishing Corporation, Darya Ganj, New Delhi (2012).

5) Singh. M. Adult Education in India: Some Reflections, Kanishka Publishers, New Delhi (2012).

6) Reddy, P. A. Post-Literacy & Continuing Education. Discovery Publishing House. ISBN 81-7141-433-8 (2007).

7) Kumar, P. J. & Rao, D. B. Effectiveness of Distance Education System. Discovery PublishingHouse. ISBN 81-7141-437-0 (2011).

8) Ramanujam, P. R. Globalisation, Education and Open Distance Learning. Shipra Publications.ISBN 987- 81-7541-273-6 (2009).

Mapping of COs to syllabus

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

CO5		H	H	H
CO6			H	

EDES0123: ELEMENTARY STATISTICS IN EDUCATION (3-0-0)

COURSE OUTCOMES

CO1 State the meaning, concept, types, and significance of statistics, measures of centraltendencies, variability, and correlation. (Remembering)
CO2 Understand the concept of statistics, measures of central tendencies, variability,correlation, and nature of data and its organization. (Understanding)
CO3 Apply statistical techniques and measures in educational research. (Application) CO4 Analyze and interpret data, Central tendency and variability of the collected data. (Analysis)
CO5 Evaluate measures of central tendencies, variability, and correlation. (Evaluation)CO6 Create data and compute the correlation value of variables. (Creation)

Module I: Introduction to Statistics (10 Lectures)

Meaning, definition and functions of Statistics; Need of Statistics in Education; Concept of data, methods of organizing data; Graphical representation of data: Frequency Polygon, Histogram, Cumulative Frequency curve, Cumulative Frequency Percentage curve or ogives.

Module II: Measures of Central Tendency (10 Lectures)

Meaning and significance of Measures of Central Tendency; Computation of Mean from Ungrouped and Grouped data; Computation of Median from Grouped and Ungrouped data;Computation of Mode from Grouped and Ungrouped data.

Module III: Measures of Variability (13 Lectures)

Meaning and significance of Measures of Variability; Concepts, Uses and Computation of Range, AD, SD and QD Percentile and Percentile Ranks.

Module IV: Linear Correlation (12 Lectures)

Meaning of Correlation; Degrees of Correlation ship; Computation of Correlation by using – Product Moment Method and rank Difference Method; Interpretations of Computed Coefficient of Correlation.

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, NewYork(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, NewDelhi(2009).

5) Mangal, S.K. Statistics in Psychology and Education, PHI Pvt. Ltd, Delhi (2018).

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2	H	H	H	H
CO3	H	H	H	H
CO4	H	H	H	H
CO5	H	H	H	H
CO6	H	H	H	H

EDPT6101: PSYCHOLOGICAL TESTING (1-0-2)

COURSE OUTCOMES

CO1 Recall the steps of various psychological tests. (Remembering)
CO2 Understand the importance of psychological tests and explain the procedures ofconducting the same. (Understanding)
CO3 Applying the steps and procedures for administering a psychological tests correlate it toreal life situations. (Application)
CO4 Analyze the procedures of psychological testing. (Analysis)
CO5 Evaluate the psychological experiments with the help of apparatuses. (Evaluate)CO6 Develop the ability to create self-prepared tests. (Creation)

Psychological Experiment with apparatus: Any two from the following:Maze Learning

Bilateral Transfer -Mirror learning Division of Attention

(Tachistoscope)Reaction Time

Test Administration : Any two from the followingAdjustment Inventory by V.

K. Mittal

Rorschach Inkblot test

Thematic Apperception Test (TAT)Differential Aptitude Test (DAT)

Scheme of Evaluation:

Psychological Experiment with apparatus: 30 marks

Psychological Experiment without apparatus:	20 Marks
Practical book:	10 Marks
Viva Voce:	40 Marks
Total	**100 Marks**

Mapping of COs to syllabus

	Exp 1	Exp 2	Exp 3	Exp 4
CO1	H	H	H	H
CO2	H	H	H	H
CO3	H	H	H	H
CO4	H	H	H	H
CO5	H	H	H	H
CO6	H	H	H	H

EDPW6102: PROJECT WORK (EDUCATIONAL TOUR) (0-0-3)

COURSE OUTCOMES

CO1 Identify the goals of institutions. (Remembering)
CO2 Analyze the overall functions of institutions. (Analysis)
CO3 Evaluate the academic performance of final year class/classes and assess the physicalinfrastructure. (Evaluation)
CO4 Explain the plans and policies of the institutions. (Understanding)CO5 Create project report. (Creation)

Educational Tour as a project for UG 6th semester students aims at providing some practical experience about an eminent educational institution/institutions. This educational tour will be of two /three day's duration.

On the basis of all the observations, the students need to prepare the complete report of the project stepwise. Each student needs to make the presentation of this project report indicating their experiences. The constituted group of members will assess the project report presented by the students.

Evaluation:

Internal Assessment = 40 % (Presentation) External Assessment = 60 %

(Report + Viva)**Mapping of COs to syllabus**

CO1	H

CO2	H
CO3	H
CO4	H
CO5	H

MA IN EDUCATION (EDUCATIONAL LEADERSHIP/EDUCATIONAL PSYCHOLOGY)

EDLR0007: LEADERSHIP AND SOCIAL RESPONSIBILITY (3-0-0)

COURSE OUTCOMES

CO1 State the meaning of leadership and the qualities of a true leader. (Remembering)
CO2 Discuss the concept of leadership and management and the different theories and stylesof leadership. (Understanding)
CO3 Analyze the role of individual social responsibility and the social responsibility ofeducators. (Analysis)
CO4 Identify the role of leadership in the decision making process and find out thetechniques that improves decision making process. (Application)
CO5 Discuss the role of leadership in policy formulation and find out the effect of leadershipin 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

	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

EDFE0011: PHILOSOPHICAL FOUNDATIONS OF EDUCATION (4-0-0)

COURSE OUTCOMES

CO1 Recall/ identify/ state the philosophical foundation of education. (Remembering)
CO2 Explain/compare and contrast the contributions of different schools of philosophy andphilosophers to the field of education. (Understanding)
CO3 Apply philosophical implications in designing and developing the curriculum.(Application)
CO4 Using Indian and Western philosophical thoughts in practice. (Application)CO5 Analyze the aims, function and agencies of education. (Analysis)
CO6 Create one's own philosophy to address the different educational problems one maycome across. (Creativity)

Module I: Nature and Scope of Education (10 Lectures)

Education as a science and Education as a social process; Nature of Knowledge; Role of Philosophyin Education; Aims of education – individual, social, vocational and democratic; Formal, informal, and non-formal agencies of education; Relation between school and society. Functions of education: Individual development, Transmission of cultural heritage, Acquisition of skills, Acquisition and generation of human values, Social cohesion; A practical approach to philosophy of education.

Module II: Indian Schools of Thought (17 Lectures)

Astika and Nastika; Sankhya, yoga, Nyaya, Vaisheshika, Mimamsa, and Vedanta; Buddhism, Jainism, Carvaka.

Module III: Western Philosophical Thought (20 Lectures)

Some major schools: Naturalism, Idealism, Rationalism, Pragmatism, Realism, Logical positivism, Empiricism, Existentialism, Marxism and Postmodernism - Their educational implications with special reference to epistemology, axiology and the process of education.

Module IV: Modern Indian Thinkers (13 Lectures)

Vivekananda, Tagore, Gandhi, Aurobindo, J. Krishnamurti, Radhakrishnan; Nature of Knowledge and theories of knowledge; Social Philosophy of Education – Freedom, Equality, Democracy and Responsibility; Indigenous philosophy with special reference to northeast India.

Suggested Readings

1) Bailin, S. and Siegel, H. Critical thinking. The Blackwell guide to the philosophy of education,181-193. (2003).

2) Barrow, Robin. (Chapter 1: the concept of education. Ch 2: knowledge and curriculum. Anintroduction to Philosophy of Education1988), London: Routledge. 5812.2008.00422.x.

3) Biesta, G. 'This is My Truth, Tell Me Yours'. Deconstructive pragmatism as a philosophy for education. Educational Philosophy and Theory, (2010) 42(7), 710-727. doi:10.1111/j.1469.

4) Bredo, E. Mead's Philosophy of Education. Curriculum Inquiry,(2010) 40(2), 317-334.doi:10.1111/j.1467-873X.2010.00484.x.

5) Brown, L.M. Aims of Education, New York: Teachers College Press (1970).

6) Brubacher, John. . Modern Philosophies of Education, New Delhi: TATA McGraw-Hillpublishing company Ltd (1970).

7) Carr. Brian and Mahalingam. Indira.. Part II and III, Companion Encyclopedia of AsianPhilosophy. London and New York: Routledge (1998).

8) Cohen, B. (1983).Means and Ends in Education, London: George Allen and Unwin.

9) Dewey, J. (1966). Democracy and Education and Introduction into Philosophy of Education,New York: The Free Press.

10) Freire, P. (1971). Pedagogy of the oppressed. New York: Herder And Herder.

11) Hamm C. M. (1989). Chapter 3, An Analysis of the Concept of Education. 31-40. RoutledgeFalmer London and New York.

12) Hamm, C.M. (1989). Philosophical issues in education: An introduction, Chapter 1, The natureof philosophical inquiry into educational discourse. 1-14.

13) Kamii, Constance. (1984). Autonomy: the aim of education as envisioned by Piaget. The PhiDelta Kappan, Vol. 65, No. 6, 410-415.

14) Kazepides, T. (1979). Human nature in its educational dimensions. Journal of philosophyof Education, Vol.13, 55-63.

15) Lal. B.K. Contemporary Indian Philosophy. Delhi: Motilal Banarsidass (1973).

16) Lipman, M. Thinking in education. Cambridge University Press(2003).

17) Morris, V. Existentialism in Education, New York: Harper and Row.(1966).

18) Peters, R. S. (Ed.). The concept of education (international library of the philosophy ofeducation volume 17). Routledge (2010).

19) Radhakrishnan. S. Indian Philosophy. Vol. 1. 2nd edn. USA: Oxford University Press (2008).

20) Radhakrishnan. S. Indian Philosophy. Vol. 2. 2nd edn. USA: Oxford University Press (2008).

21) Saksena. Kishore. Essays in Indian Philosophy. Honolulu: Universities of Hawaii Press (1970).

22) Sidorkin, A. M. On the Essence of Education. Studies In Philosophy and Education(2011).,30(5), 521-527. doi:10.1007/s11217-011-9258-3.

23) Smith, Philip. Philosophy of Education, New York: Harper and Row(1965).

24) White, J. Elusive rivalry? Conceptions of the philosophy of education. Ethics andEducation,(2010). 5(2), 135-145. doi:10.1080/17449642.2010.516134.

25) Winch, C. and Gingell, J. Key concepts in the philosophy of education. PsychologyPress(1999).

Mapping of COs to syllabus

	Module I	Module II	Module III	Module IV
CO1	M	H	H	H
CO2		H	H	H
CO3		H	H	H
CO4		H	H	H
CO5	H	M	M	M
CO6		H	H	H

EDEP0012: FUNDAMENTALS OF EDUCATIONAL PSYCHOLOGY (4-0-0)

COURSE OUTCOMES

CO1 Recall the contribution of psychology to the varied aspects of education. (Remembering)CO2 Extrapolate the educational implications of psychological concepts. (Understanding)

CO3 Apply the different strategies of the theories of learning, memory, motivation, thinkingand problem solving age appropriately for the development of students. (Application)

CO4 Apply the psychological testing to improve the teaching-learning situations.(Application)

CO5 Critically analyze the psychological theories to identify their gaps and relevance.(Analysis)

CO6 Justify the implications of the different theories of development, learning, memory,motivation, thinking and problem solving. (Evaluation)

CO7 Predict human behaviour. (Creation)
CO8 Design classroom environment that promote student learning. (Creation)

Module I: Foundations of Psychology (12 Lectures)

Definitions of psychology; Historical antecedents of psychology and trends in 21st Century; Psychology: Its meaning, nature, methods and scope; Educational Psychology: concept concerns and scope, and functions of educational psychology.

Module II: Human growth and Development (14 Lectures)

Human Development and growth: Concept, principle; Factors influencing development and their relative role; Stages of human development: General characteristics and problems of each stage; Stage specific developmental tasks; Adolescence in Indian context – Characteristics and problems of adolescents, their needs; Theories of growth and development; Piaget, Bruner, Erickson and Kohlberg –and their educational implications. Individual Difference: Concept of intra and inter differences.

Module III: Learning and Memory (12 Lectures)

Learning: Concept, kinds, levels of learning, laws of learning and various viewpoints on learning; Theories of Learning: trial and error, classical conditioning, operant conditioning, Gagne's theory of learning, Carl Rogers theory of learning and field theory of learning; cognitive view point and information processing; Educational implications of the viewpoints on learning; Memory: Encoding and remembering, different forms of memory, theories of forgetting.

Module IV: Motivation, Thinking and Problem Solving (22 Lectures)

Motivation: Meaning; Motives: Types; Theories: McDougall's, Freud's and Maslow's Self Actualization Theory; Thinking: Definition and concept, nature, Theories, Tools, Types, Training, Development of thinking; Problem Solving: Meaning and Definition, Steps in Problem Solving, Factors affecting Problem Solving, and Strategies for Problem Solving.

Suggested Readings

1) Atkinson, J.W. and Feather, N.T. A Theory of Achievement Motivation, New York: WileyPublishers (1960).
2) Bhatnagar, S. Advanced Educational Psychology, Agra: Bhargava Book House (2002).
3) Chand, T. Educational Psychology, Agra: Bhargava Book House (2002).
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: Psychologypress (2010).
8) Forsyth, D. R. Group Dynamics. Fifth Edition. USA: Wadsworth, Cengage Learning (2006).
9) Gagne, R.M. The Conditions of Learning (2nd edition), New York: Rinehart and Winston(1976).
10) Guilford, J.P. The Nature of Human Intelligence, New York: McGraw Hill (1967).

11) Hulac, D. M., and Benson, N. . Getting Students to Work Smarter and Harder: Decreasing Off- Task Behavior through Interpersonal Techniques. School Psychology Forum,5(1), 29- 36(2011).

12) Judd, C.H. Educational Psychology, Guwahati: Nivedita DK Distributions (2002).

13) Kuppuswamy, B. Advanced Educational Psychology, Jalandhar: Jalandhar University Publications (1963).

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Mapping of COs to syllabus

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

CO4			H	H
CO5		H	H	H
CO6		H	H	H
CO7		H	H	M
CO8		M	H	M

EDTE0013: EMERGING TRENDS IN EDUCATION (3-0-0)

COURSE OUTCOMES

CO1 Recall contemporary issues, techniques in education. (Remembering)
CO2 Explain/ identify/ classify the contemporary issues and techniques in education.(Understanding)
CO3 Use the new techniques of teaching in practice. (Application)
CO4 Appraise the present educational institutions regarding the challenges and hurdlesfaced. (Evaluation)
CO5 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).

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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

	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

CO1 Recall the characteristic features of education in ancient India, Pre- Independent Indiaand post- Independent India. (Remembering)
CO2 Explain, compare and draw generalizations about the various educational commissionsand policies. (Understanding)
CO3 Justify the relevance of different educational features from ancient to post-independent India in present day educational system. (Application)
CO4 Critically analyze the various policies and commissions in terms of their relevance andimplementation. (Analysis)
CO5 Trace the contribution of each period to the shaping of the present education system.(Evaluation)
CO6 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; Relevanceof 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'sMinutes 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, EducationCommission 1964-66, National Policy on Education 1986, Ramamurthy Review Committee 1990, National Commission on Teacher 1999, National house Committee 2004; problems of Indian Education- Wastage and Stagnation, Examination Reform, Inclusive Education and Education ofthe Marginalized.

Module IV: Current Government Policies (10 Lectures)

Unni Krishnan commission; DPEP; National policy on ICT; National Commission Report; Panchayat Raj Act; Rashtriya Madhyamik Shiksha Abhiyan; Rashtriya Uchchatar Shiksha Abhiyan; SSA; RTE; Right to Information Act; Total Literacy Campaign; NAEP; National Knowledge Commission; Education for all; NAS; SPQEM; etc.

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, NewDelhi, Govt. of India (1948).
8) M.H.R.D. Challenges of Education (1985). A policy perspective, Ministry of Education, NewDelhi, Govt. of India (1985).
9) M.H.R.D. Report of the Secondary Education Commission (1952). Ministry of Education, NewDelhi, Govt. of India (1952).
10) Mookerji, R. K. Ancient Indian Education: Brahmanical and Buddhist, Delhi, MotilalBanarsidass 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.

Mapping of COs to syllabus

	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

CO1 State the nature, scope and approaches of Educational Technology. (Remembering)CO2 Describe the teaching models and explain the concept of instructional design. (Understanding)

CO3 Analyze the different instructional approaches in the process of teaching and learning.(Analysis)

CO4 Discuss the nature of the process of communication and the application of ICT in theteaching learning process. (Application)

CO5 Identify the various software and hardware and state its use both in face to face andvirtual 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, KanishkaPub. 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).
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10) Joyce, and B Weil, Models of Teaching, Prentice Hall, New Jersey.
11) Mangal S.K. Foundations of Educational Technology, Prakash Brothers Ludhiana.
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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

	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

EDPC0016: PEACE EDUCATION AND CONFLICT MANAGEMENT (3-0-0)

COURSE OUTCOMES

CO1 Describe the importance and relevance of peace education (Application)
CO2 Explain the concept of peace as held by different thinkers and other religious beliefs.(Analysis)
CO3 Discuss the awareness of the modes and methods for conflict management.(Application)
CO4 Compare the global issues and peace movements. (Evaluation) CO5 Narrate the various methods of conflict Management. (Application)CO6 Describe the theories of Peace. (Analysis)

Module I: Understanding peace as a dynamic social reality (10 lectures)

Peace – meaning, nature; theories of peace – democratic peace and active peace; religious beliefs and peace – Buddhism, Islam, Hinduism and Christianity.

Module II: Philosophy of peace and peace education (15 lectures)

Montessori, Freire, the Dalai Lama, Gandhi, Krishna murthy, Aurobindo and Tagore; Concept and scope of peace education; peace teacher, peace method and other enabling practices for a cultureof peace in an educational setting.

Module III: Conflict management and its methods and modes (10 lectures)

Meaning, types, levels and reasons for conflict; approaches to the study of conflict; methods and modes of conflict resolution - mediation, negotiation, diplomacy, coercive methods; creativepeace building, cross cultural methods.

Module IV: Global issues and peace movements (10 lectures)

Human rights, preservation of ecology, population control, economic exploitation, deprivation, equitable economic world order; non-alignment movement, campaign for nuclear disarmament and role of world organizations in promoting peace.

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: ERICClearinghouse on Teaching and Teacher Education (1995).

8) Hopper, B. Peace education and years 1to 10 studies of society and environment key learningArea. 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 fromhttp://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: NationalCouncil of Educational Research and Training (2014).

16) Salomon, G., & Nevo, B. Peace Education: The Concept, Principles, and Practices around theWorld. 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

EDSF0017: SOCIOLOGICAL FOUNDATIONS OF EDUCATION (4-0-0)

COURSE OUTCOMES

CO1 Explain the meaning and scope of sociology and the relationship between sociology andeducation. (Remembering)
CO2 Summarize the contributions of different theoretical perspectives on betterunderstanding of the society. (Understanding)
CO3 Assess the influence and impact of classroom climate on student's learning. (Evaluation)
CO4 Propose method for securing healthy cooperation between the home and school in theteaching-learning process. (Application)
CO5 Identify and suggest ways and means to make the community an effective agency ofeducation. (Application)
CO6 Discuss sociology of education in National perspectives and identify the merits anddemerits of state control on education. (Analysis)
CO7 Describe schooling in the context of Globalization and National policies. (Understanding)

Module I: Concept and Approaches (10 Lectures)

Education from a sociological point of view – functionalism, structuralism, system approaches to education and a critical evaluation of these approaches; transition from pre-capitalist to capitalist social formations and its impact on educational structure and function; education and social groups, education in a multi-cultural context.

Module II: Theoretical Perspective of Educational Sociology (15 Lectures)

Theoretical approaches to educational sociology and their relevance in present day scenario - standpoint theory, theory of social learning by Bandura, social realism, critical theory, rational choice theory, human capital theory, conflict theory.

Module III: School as a Social Institution (15 Lectures)

School as a social institution, school as an organization; hierarchy of authority and their functions in school, unpacking schools` social contexts - contexts and factors shaping differences in schooling and schooling outcomes, schools as sites for social development, school choice, social mobility by means of education; organisational climate types, classroom climate and its impact.

Module IV: Cross-National Perspectives on the Sociology of Education (10 Lectures)

a) Culture - conceptual understanding of culture, developing intercultural competencythrough education, culture and personality, education for cross-national understanding;

b) Education beyond geographical barriers - distance education, online certification courses, student and faculty exchange programmes, curriculum goals for creating globally competentstudents.

Module V: Schooling in the Context of Globalization and National Policies (10 Lectures)

Central policies of education, privatization of education, sanskritisation and westernization of society and role of education, conceptualizing modernization from educational point of view, present education system and sociological issues - primary level, secondary level, higher educational level

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) Bills . Sociology of Education reviewer awards. Sociology of Education, 86(4).(2013)

3) Binder, A. J. Sociology of Education's Cultural, Organizational, and Societal Turn. Sociology ofEducation, 86(4), 282-283. (2013).

4) Bose, S. . A Contextual Analysis of Gender Disparity in Education in India: Women's Status and Community. Sociological Perspectives, 55(1), 67-91.(2012).

5) Brown, F.J. Educational Sociology, Prentice Hall of India, New Delhi.

6) Clinard, M. B., & Elder, J. W. Sociology in India: A Study in the Sociology of Knowledge. American Sociological Review, 30(4), 581-587. (1965).

7) Damle, Y. B. Sociology in India: its teaching and status. International Social Science Journal, 26(2), 343-348.(1974).

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9) 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).

10) 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)

11) MacIver and Page- Society: An Introductory Analysis, Macmillan.

12) 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).

13) Sharma, C. L. Crisis of Character in India: The Need for Moral Education. Education & Society, 8(1), 64-73.(1990).

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15) 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).

16) 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	Module V
CO 1	H		H		H
CO 2		H			M

CO 3			H		M
CO 4			H		
CO 5	M			H	
CO6				H	
CO7					H

EDTK0018: KNOWLEDGE AND CURRICULUM (3-0-0)

COURSE OUTCOMES

CO1 Describe the fundamental knowledge on knowledge and create awareness about thedifference between knowledge, assumptions, belief, information. (Creation)
CO2 Equip the students with the process of knowledge construction. (Application)CO3 Differentiate between Teaching and Training.(Analysis)
CO4 Evaluate the curriculum framework and the process of curriculum development.(Evaluation)
CO5 Analyze and interpret the approaches to curriculum development. (Application)

Module I: Introduction to knowledge and Understanding (12 Lectures)

Knowledge: Concept, Characteristics, Nature, Types, Sources; Difference in Belief, Assumptions, Information, Knowledge, and skills; Knowledge as true justified belief.

Module II: knowledge construction (11 Lectures)

Nature, process of construction, Essentials of Knowledge construction, Role of teacher and Learner in Knowledge Construction; Difference in Teaching and Training, Pedagogy, Andragogy, Aesthetics.

Module III: Understanding Curriculum (10 Lectures)

Curriculum Framework, curriculum: Nature, Perspectives, and Objectives - Syllabus: Nature, Functions and Elements, Process of curriculum development; principles & Criteria for the selectionof the content.

Module IV: Approaches to Curriculum Development (12 Lectures)

Meaning, Importance, Components of curriculum development; Foundations to Curriculum; Curriculum Development Approaches: Subject-centered, Activity- centered, Learner-centered, Society-centered.

Suggested Readings

1) Laxmi, Vijay and Kaur, Jasdeep . Knowledge and Curriculum. Ludhiana:TandonPublications.(2017).

2) Dhankar, Rohit. Aims of Education to classroom – mapping the field of curriculum.

3) Hirst, P.H., Realms of meaning and forms of knowledge in 'Knowledge and Curriculum' A

collection of philosophical papers, Routledge and Kegan Paul, 1974.

4) Kumar, Krishna. What is worth teaching? Orient Blackswan. (1992).

5) Nambissan, Geetha. B. . 'Identity, Exclusion and the Education of Tribal Communities'. In Rekha Wazir (Ed.) The Gender Gap in Basic Education: NGOs as Change Agents. New Delhi: Sage(2000).

6) NCERT . Position papers on Science, Language, Social Science, Mathematics, Assessment.NCERT, New Delhi(2006)

7) Noah, Lemos. . An Introduction to the Theory of Knowledge.Cambridge.(2007).

8) Sarangpani, Padma. Constructing school knowledge. 8. Saxena, Sadhana . 'Education of the Masses in India: A Critical Enquiry'. In Krishna Kumar and Joachim Oesterheld (Eds.) Education and Social Change in South Asia. New Delhi: Orient Longman.(2007).

9) Batra, P. . The Contested Terrain of School Social Science.Learning Curve. Bangalore: Azim Premji Foundation.(2010).

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11) Carr, D., 'The logic of knowing how and ability', Mind, vol. 88, 1979, pp. 394–409.

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15) Mukherjee, A. The Nature of mathematics and its relation to school education. Learning Curve XIV, pp. 16-22.(2010).

16) Mukherjee, A. . Methods of enquiry in science, Proceedings of the International Seminar on Science Education. VidyaBhawan Education Resource Centre, Udaipur.(2005).

17) Winch, P., The Idea of a Social Science and Its Relation to Philosophy, London, Routledge and Kegan Paul, 1958.

18) Young, M.F.D. (ed.), Knowledge and Control, London, Collier-MacMillan, 1971.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		
CO 3		H		
CO 4			H	H
CO 5			M	H

SPECIALISATION: EDUCATIONAL LEADERSHIP

EDEL0019: DEVELOPING EDUCATIONAL LEADERSHIP (3-0-0)

COURSE OUTCOMES

CO1 Explain the importance of education and describe the educational system andinstitutions (Understanding)
CO2 Appraise the nature of collaboration and role played by stakeholders in the field ofeducation. (Evaluation)
CO3 Critically analyze the curriculum content and pedagogy existing in schools. (Analysis)CO4 Illustrate the role of leadership in the process of inclusion. (Application)
CO5 Describe the various features of good leadership in the field of education.(Remembering)

Module I: Education system and Institutions (15 Lectures)

1) Education as an ideal (What is education?; Aims of education); Education as a system; School as a social institution.

2) 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.

3) 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.

R*eflecting 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.

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

	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

CO1 Explain the nature of child and childhood education. (Understanding)
CO2 Characterize the nature of human growth, maturation and development. (Application)CO3 Appraise the nature and theories of development. (Evaluation)
CO4 Describe an understanding about adjustment mechanism in social context.(Remembering)
CO5 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 (10 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; concept of tools; zone of proximaldevelopment, Piaget and Vygotsky debate.

Developing a personal narrative of experiences of adolescence

Module III: Enabling learning (10 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.

Students analyze views of parents on parenting and child care practices. Quality frameworks.

Module IV: Psychology of Adjustment and Adjustment Mechanisms (6 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.

Module V: Differently-abled persons and learning (9 Lectures)

Understanding differently abled persons; educational implications: ADHD, autism, dyslexia. juvenile delinquency.

Develop a detailed discussion paper on various kinds of learning difficulties

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

Wadsworth Cengage Learning Publications. (2010).

3) 3. Bronfenbrenner,Urie. 'The ecology of human development'. Harvard University Press Cambridge. (1979).

4) Crow & Crow. 'Understanding Our Behavior '. N.Y. Alfred A Knoff Publications(1956).

5) Erickson, H.Erik. 'Childhood and Society'. W.W. Norton Publication.(1993).

6) Erickson, H.Erik. 'Stages of Psychosocial Development '. Green Verlag, Gmbtt(2005) .

7) Freud S. 'Psychopathology of Everyday Life-The Basic Writings of Sigmund Freud.' New York, Modern Library.(1938).

8) Kostelnik, J.M., Gregory,M.K., Soderman. K.A., & Whiren, P.A. 'Guiding children's socialdevelopment and learning '. Wadsworth Cengage Learning Publications(2012).

9) Kozulin A.,Gindis, B., Ageyev.,S.V & Miller, M.S. 'Vygotsky's Educational Theory in Cultural context '. Cambridge University Press.(2003).

10) Lahner, George. ' The Dynamics of Personal Adjustment '. New Jersey: Prentice –Hall. (1964).

11) Lerner, J. 'Learning Disabilities-Diagnosis and Teaching Strategies'. Boston HoughtonMifflin.(1985).

12) Lock, A & Strong, T. 'Social Constructionism – Sources and Stirrings in Theory and Practice'. Cambridge University Press (2010).

13) Mangal, S.K. 'Educating Exceptional Children-An Introduction to Special Education' .PHI Learning Private Limited,Delhi(2010).

14) Mangal, S.K. Abnormal Psychology ' N.D-Sterling Publications (revised edition)(1987). '

15) Mangal, S.K. 'Advanced Educational Psychology '. PHI Learning Private Limited,Delhi,(2002).

16) McLounghlin, J.A and Netick, A. . 'Defining Learning Disabilities- A new and co-operative direction '.Journal of Learning disabilities.(1983).

17) Newman,M.B & Newman, R.P. 'Development through Life-A psycho-social approach'.12th edition, Cengage Learning Stamford.(2006).

18) Sinha, AKP, Singh, R.P. 'Manual for Adjustment, Inventory for College Students'. Agra, National Psychology Corporation. (1971).

19) Telford, C.W & Sawrey, J.M. ' The Exceptional Individuals' .New Jersey,Prentice-Hall. (1967).

Mapping of COs to Syllabus

	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

EDCI0021: CURRICULUM DEVELOPMENT AND INSTRUCTION (3-0-0)

COURSE OUTCOMES

CO1 Explain the nature of curriculum. (Application)
CO2 Describe the basis of curriculum development. (Analysis)
CO3 Distinguish the approaches of curriculum development. (Evaluation)CO4 Mention the process of curriculum development. (Application)
CO5 Frame about the assessment of curriculum. (Remembering)
CO6 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 inthe 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 SchoolCurriculum, (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 University4:1, pp 5-21.

6) Kumar, Krishna. Origins of India's 'Textbook Culture from Comparative Education Review32(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 Achievementin 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 EducationalTheories 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 andIdeology in Education, Oxford University Press.

13) Hoare. Q and Smith G. N. On Education in Selection from The Prison Notebook of AntonioGramsci (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 review42(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

	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

EDTP0022: PRINCIPLES & TECHNIQUES OF TEACHING AND PEDAGOGY (3-0-0)

COURSE OUTCOMES

CO1 Explain the nature of teaching. (Understanding)
CO2 Mention the theories of teaching and different models of teaching. (Analysis)CO3 Distinguish the different methods of teaching. (Application)
CO4 Narrate the concept of pedagogy in the process of teaching and learning. (Evaluation)CO5 Communicate the various Recent Developments in Pedagogy. (Application)
CO6 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 inStudent 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

	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

CO1 Describe the concept of teacher education. (Understanding)CO2 Explain teaching as a profession. (Application)
CO3 Identify the structure of teacher education programmes. (Application)CO4 Illustrate the recent trends of teacher education. (Remembering)
CO5 Prepare the course structure of Teacher Education with integrated Teacher EducationProgrammes. (Analysis)
CO6 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 inclusiveclassrooms; 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

	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

CO1 Describe the conceptual framework of educational measurement andevaluation.(Applying)
CO2 Mention different dimensions of educational measurement and evaluation.(Remembering)
CO3 Explain the concepts of reliability and validity of test scores. (Remembering)
CO4 Identify the tools and techniques to be used in the process of educational measurementand evaluation (Analyzing)
CO5 Apply the process of construction and standardization of tools. (Applying)CO6 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 andpractice. 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

	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

EDPL0025: EDUCATIONAL LAW AND GOVERNMENT POLICY (3-0-0)

COURSE OUTCOMES

CO1 Describe Educational Law and Government Policy. (Analysis)
CO2 Identify the various legal, ethical, and policy dimensions of education. (Remembering)CO3 Illustrate government policy issues, commission reports. (Application)
CO4 Discuss the constitutional provisions related to education and minority issues whileunderstanding RTE. (Evaluation)
CO5 Explain RTI and other relevant laws and ordinances. (Understanding)CO6 Narrate and explain the North-Eastern education code. (Application)

Module I: Criminal and civil laws pertaining to education (10 Lectures)

Jurisprudence, Provisions of criminal and civil laws pertaining to educational institutions; FIR;Arrest; Bail; Detention; Search.

Module II: Indian constitution and Education (10 Lectures)

Relevant provisions from the constitution of India relating to education; Minority institution Act; Fundamental Rights (Article 13, 15, 21A, 28 & 30); Fundamental Duties 51A; Directive Principles ofState Policy (37); Fifth and sixth schedule provisions.

Module III: Landmarks Judgments (5 Lectures)

Landmark judgments related to education.

Module IV: Government policies (10 Lectures)

Government policies, commissions and recommendations; The Panchayats Act (243B, G); TheMunicipalities Act (243Q , W); Fifth and sixth schedule provisions.

Module V: RTE Act and RTI (10 Lectures)

The Right of Children to Free and Compulsory Education (RTE) Act, 2009; Right to Information(RTI) Act 2005; North-Eastern education code.

Suggested Readings

1) Citizen's charter.
2) Jain, M. P. Indian Constitutional Law. Jain Book house. Delhi.
3) National Policy on Education 1986.
4) Pandey, J.N. Constitutional Law. Jain Book house. Delhi.
5) Report to the People on Education 2010-11 (MHRD).
6) Sadgopal, A. Right to education vs. right to education act. Social Scientist, 38(9/12), 17-50.http://eoc.du.ac.in/RTE%20-%20 notified.pdf.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M	H	
CO 2	M	M		H
CO 3	H	M	H	
CO 4	H			H
CO 5	M	H	M	
CO 6	H		H	H

EDFM0026: FINANCIAL MANAGEMENT AND ACCOUNTING (3-0-0)

COURSE OUTCOMES

CO1 Describe accounts and finance in relation to education. (Application)
CO2 Illustrate the various processes of taxation regulations related to education. (Evaluation)CO3Work out the double entry accounting. (Analysis)
CO4 Illustrate the process of budgetary control and Auditing. (Application)
CO5 Identify the Process of Deduction of Tax and computation of Tax at source.(Remembering)
CO6 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

	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

CO1 Recognize the meaning, concept, process, nature, and scope of life, development, lifespan development, and emotions of an individual. (Remembering)
CO2 Understand the biological bases and anatomical structures controlling human development along with understanding emotional development and its associatedcomponents. (Understanding)
CO3 Analyze theories of development M1 and issues of human development at variousstages. (Analysis)
CO4 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)
CO5 Evaluate the influence of socialization on the development process of an individual.(Evaluation)
CO6 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

	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

CO1 Recognize the concept, nature, process, laws, types, and methods of learning.(remembering)
CO2 Understand the relationship of learning with interest, motivation, maturation, andindividual difference. (Understanding)
CO3 Analyse various factors influencing learning. (Analysis)

CO4 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)
CO5 Evaluate the educational implications of learning and effectiveness of learning styles.(Evaluation)
CO6 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

	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

CO1 Understand the concept, scope, importance, process, types, advantages, and barriers ofcommunication in an organization. (Understanding)

CO2 Apply skills of presentation utilizing visual aids, implement decision making techniquesfor effective communication. (Application)

CO3 Analyse the communicative dimensions of team work and violation of professionalboundaries. (Analysis)

CO4 Create and draft business letters and design and develop conflict managementstrategies. (Creation)

CO5 Understand the concept, need, significance, and execution of administrative feedback inorganizational communication. (Understanding)

CO6 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 inunderstanding 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 internalcommunication, 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 ina 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

	Module I	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

CO1 Recognize the nature, scope, objectives, significance, and elements of educationaladministration. (Remembering)
CO2 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)
CO3 Apply democratic educational administration in practical situations and the principles ofevaluation in supervisory works. (Application)
CO4 Analyse the duties of educational administrators/school managers including headmasterand teachers. (Analysis)
CO5 Evaluate democratic administration, functional basis of supervision, and roles ofeducational administrators. (Evaluation)
CO6 Utilize creative ways towards infrastructural resource management and supervisoryprogrammes. (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

	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

CO1 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)
CO2 Understand the theoretical perspectives of ethics and social responsibility, relationshipof educational ethics with gender and leadership, and significance of teaching profession. (Understanding)
CO3 Evaluate the strategies of social responsibility and role of ethics in a workplace.(Evaluation)
CO4 Apply the criteria of profession and UGC's code of conduct for teachers. (Application)
CO5 Analyze the influence of globalization on ethics and developmental activities andimportance of code of conduct. (Analysis)
CO6 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 ofethics; types of values, morals.

Module II: Theoretical Perspectives of ethics (12 Lectures)

Ethical theories: Utilitarianism, Kantian ethics, Natural rights theories; religious ethics; virtueethics; 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 xlv no 21).

5) Sreekumar, N. Ethics, profession and developmental concerns, Economic and Political.Weekly June 26.

Mapping of COs to Syllabus

	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

CO1 State the meaning, nature, objectives, scope, process, types, and approaches ofcounseling. (Remembering)
CO2 Explain various theories of counseling and understand the concept, need, and skills ofeducational psychologists. (Understanding)
CO3 Apply the theories and tools and techniques of counseling. (Application)
CO4 Assess the skills of counseling and role of teacher as a counselor. (Evaluation)CO5 Analyze the theories of counseling and various types of guidance. (Analysis)
CO6 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

	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

CO1 Recognize the historical background of mental health, objectives, scope, and need ofmental health, factors affecting mental health of children and adolescents, and the characteristics of a mentally healthy person. (Remembering)

CO2 Explain the factors affecting mental health in childhood, the features of adolescents,and the role of parents and teachers in these regards. (Understanding)
CO3 Apply solutions to various problems pertaining to mental health of child andadolescents. (Application)
CO4 Evaluate problem behaviours among children and adolescents. (Evaluation)
CO5 Analyze the status of mental health of school going children and adolescents and thebest practices in mental health care. (Analysis)
CO6 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 todevelopmental 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

	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

CO1 Describe the conceptual framework of Research process. (Understanding)CO2 Explain the methods and designs in Educational Research. (Analysis)
CO3 Apply and interpret the tools and techniques of research. (Application)CO4 Examine the organization and analysis of data. (Remembering)
CO5 Analyze the application of statistics in Educational research. (Application)CO6 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

	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

DC-PRACTICUM EDJG6002: JOURNALING - A TECHNIQUE FOR PERSONAL ANDACADEMIC GROWTH (1-0-2)

COURSE OUTCOMES

CO1 Recall one's life experiences. (Remembering)
CO2 Explain clearly and specifically one's life experiences. (Understanding)

CO3 Develop the skill of writing. (Application)
CO4 Analyze life experiences at a conscious level and enhance reflective thinking. (Analysis)CO5 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 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 to Syllabus

	M1
CO1	H
CO2	H
CO3	H
CO4	H
CO5	H

EDES6003: EDUCATIONAL SEMINAR I (0-0-2) – Practicum

COURSE OUTCOMES

CO1 Develop higher cognitive abilities to respond to new knowledge, critical thinking, andkeen observation of research conducted. (Understanding & Evaluation)
CO2 Develop the abilities to seek clarification, defend the ideas of others, and presenteffectively. (Application & Creation)
CO3 Develop the feeling of tolerance, co-operation, and respect of the ideas and feelings ofothers. (Understanding)
CO4 Acquire good manners of putting questions and answering the questions of otherseffectively 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

PRACTICUM: EDSV6004-SCHOOL VISIT (0-0-2)

COURSE OUTCOMES

CO1 Aware of the school environment and its functioning. (Remembering)
CO2 Understand the dimensions of use of lands, different amenities and different equipmentavailable in the schools. (Understanding)
CO3 Analyze the role of teachers and their code of ethics. (Analysis) CO4 Apply measures to improve the outputs of the school. (Application)
CO5 Assist the principal/teachers in the smooth functioning of schools. (Application)

Report to be Prepared:

Report on Inputs:

- Human Resources

- Non-Human ResourceReport on Processing:
- Teaching-Learning Process
- Analysis of Curriculum
- Analysis of Time table
- Use of Hardwares
- Use of Softwares
- Modes of Transactions
- Identifying the problems faced by teachers
- Classroom Management etc

iii. Report on Outputs:

- Subject wise Performance
- Causes of poor and high Performance

iv. Attitude of Teachers and Students towards SchoolMapping of COs to Syllabus

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

EDDI6005: DISSERTATION PHASE-I (0-0-2)

COURSE OUTCOMES

CO1 Develop the skill to prepare the Research Proposal. (Application)CO2 Apply the skill in collection of data in the field. (Application)
CO3 Develop the ability to analyze the data. (Analysis)
CO4 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

	Phase-I
CO 1	H
CO 2	H
CO 3	H
CO 4	H

EDDI6007: DISSERTATION PHASE-II (0-0-4)

COURSE OUTCOMES

CO1 Develop the skill to prepare the Research Proposal. (Application)CO2 Apply the skill in collection of data in the field. (Application)
CO3 Develop the ability to analyze the data. (Analyzing)
CO4 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:

A. 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)

B. 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

C. 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 outin the 3rd semester where the students will work on research proposal, literature review and thefirst 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

	Phase-II
CO 1	H
CO 2	H

CO 3	H
CO 4	H

EDIN6008: INTERNSHIP (0-0-3)

COURSE OUTCOMES

CO1 To acquaint the students with the total environment of the school.(Remembering)CO2 To learn about the functioning of the school.(Understanding)
CO3 To observe the administrative and managerial activities.(Remembering)
CO4 To observe the morning assembly and teaching work in the classroom for having an ideaof teaching work.(Analysis)
CO5 To prepare lesson plans and teaching aids for conducting classes.(Application)
CO6 To observe and participate in the co-curricular activities and extracurricular activities.(Application)
CO7 To organize the co-curricular and extracurricular activities. (Creation)
CO8 To understand the behaviour of teachers, students, principal, headmaster and othersupporting staff. (understanding)

Activities to be performed:

I. Organization/ observation of morning assembly.

Classes to be taught during the day by preparing lesson plans.

Unplanned classes to be taken during the day if some teachers are on leave.Observing the class of an effective/

good teacher.

Participating/ organizing co-curricular activities. Participating/ organizing

extracurricular activities.Any other specific events of the day.

II. Undertaking action research or case study.

III. 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

CO1 Develop higher cognitive abilities to respond to new knowledge, critical thinking, andkeen observation of research conducted. (Understanding & Evaluation)
CO2 Develop the abilities to seek clarification, defend the ideas of others, and presenteffectively. (Application & Creation)
CO3 Develop the feeling of tolerance, co-operation, and respect of the ideas and feelings ofothers. (Understanding)
CO4 Acquire good manners of putting questions and answering the questions of otherseffectively 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)

COURSE OUTCOMES

CO1 Understand the concept and purpose of teaching practice (Understanding)CO2 Develop skill of preparing lesson plan (Creating)

CO3 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:

1. Internal Assessment : 40 Marks (Based on Test)
2. 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

	M1	M2
CO 1	H	
CO 2		H
CO 3		H

SWCA6010: COMPUTER APPLICATION FOR SOCIAL SCIENCES (1-0-1)

COURSE OUTCOMES

CO1 Describe the application of the basics of Word Processin**g**. (Applying)CO2 Illustrate the basics of Excel Worksheet. (Applying)
CO3 Explain the basics of PowerPoint Presentation tools. (Analyzing)
CO4 Work out data analysis in research using Statistical Analysis Packages. (Applying) CO5 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, creatingdocument, 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, SagePublication, 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

	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 ENGAGEMENTPROGRAMME)

(1-0-1)

COURSE OUTCOMES

CO1 Learn the concept of service learning and community engagement. (Remembering)
CO2 Understand the importance of service learning and community engagement fordeveloping the skills of addressing real life issues in one's own community. (Understanding)
CO3 Develop the ethics of civic participation. (Applying)
CO4 Develop an understanding of the importance of communication skills in interacting withcommunity members. (Understanding)
CO5 Be exposed to and empathize with people who are less fortunate than they are,economically, socially, academically, medically etc. (Applying)
CO6 Organize awareness programmes, rallies, campaigns, social service etc. (Analysing)CO7 Develop the skills of problem solving and reflective thinking. (Analysing)
CO8 Realize one's potentiality to make a difference in the life of their community members.(Evaluating)
CO9 Understand and experience the system of inequality that exists in the Educationalsystem. (Evaluating)
CO10 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 training in developing one's life skills.

5. Providing teachers training in pedagogy.

6. Providing training to school teachers in the use of ICT for enhancing students' learning.

7. Providing training to teachers in the preparation of teaching aids by using availablecommunity resources.

8. Creating awareness on Mental Health and strategies for its sustenance.

9. Creating awareness on the importance of Physical health and ways of maintaining one's health.

10. Creating awareness on the importance of education and ways of creating a conduciveenvironment for proper learning.

11. Creating awareness on AIDS.

12. Creating awareness on Population explosion- its effects and ways of population control.

13. 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 fromhttps://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 InclusiveEducation. 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

	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 COURSE

EDES6011 EDUCATION FOR SUSTAINABLE DEVELOPMENT (For UG) (1-0-1)

COURSE OUTCOMES

CO1 To create awareness about the concept of Sustainable Development. (Remembering) CO2 To create skill among the students to find out the sustainability of any economic activity. (Understanding)

CO3 To create awareness among students about the concept of Education for SustainableDevelopment. (Applying)

CO4 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 realizationof 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 fromhttp://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%2 0Education%20for%20Sustainable%20Development.pdf.

Mapping of COs to Syllabus

	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 (For PG) (1-0-1)

COURSE OUTCOMES

CO1 To create awareness among the students about conceptual framework of teaching skills.(Remembering)
CO2 To make the students well aware of the sources of teaching skills. (Understanding)CO3 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 microteaching 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

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

List of Courses

CBCS- I to VI Semester

Course-1st Semester
1.1 Foundations of Education
1.2 Theories and Principles of Education
1.3 Guidance and Counselling
Course-2nd Semester
2.1 Philosophical Foundations of Education
2.2 Education and Society
2.3 Gender Education
Course-3rd Semester
3.1 Psychological Bases of Education
3.2 Distance Education
3.3 Development of Education in India
3.4 Life Skills Education
3.5 Population Education
Course-4th Semester
4.1 Educational Thinkers
4.2 Educational Technology
4.3 Foundations of Curriculum Development

4.4 Teaching skills & Teaching Practice
4.5 Early Childhood Care and Education
Course-5th Semester
5.1 Measurement and Evaluation in Education
5.2 Inclusive Education
5.3 Human Rights Education
5.4 Elementary Statistics in Education
5.5 Adult Education
5.6 Special Education
5.7 Economics of Education
5.8 Human Growth and Development
Course-6th Semester
6.1 Teaching Learning Methods and Pedagogy
6.2 Educational Administration and Management
6.3 Teacher Education
6.4 Environmental Education
6.5 Physical Education
6.6 Peace Education
6.7 Instructional Technology
6.8 Elements of Research

MA Course List

1st Semester
1.1 Philosophical Foundations of Education
1.2 Fundamentals of Educational Psychology
1.3 Emerging Trends in Education
1.4 History and Development of Education in India
Elective Group I
1.5 Educational Technology
Elective Group II
1.6 Leadership and Social Responsibility
1.7 Journaling – a Technique for Personal and Academic Growth

2nd Semester
2.1 Sociological Foundations of Education
2.2 Research Methodology in Education
2.3 Knowledge and Curriculum
Specialisation Courses: One area of Concentration to be opted
Educational Leadership
2.4 Developing Educational Leadership
Educational Psychology
2.5 Human Development and Learning
Elective Group II
2.6 Peace Education and Conflict Management
2.7 Educational Seminar I
2.8 Computer Applications for Social Sciences (Lab)
2.9 School Visits

3rd Semester
3.1 Curriculum Development and Instruction

3.2 Principles and Techniques of Teaching and Pedagogy
3..3 Teacher Education
3.4 Measurement and Evaluation in Education
Specialization Courses:
Educational Leadership
3.5 Educational Law and Government Policy
3.6 Financial Management and Accounting
Educational Psychology
3.7 Life Span Development and Education
3.8 Learning and Individual Differences
3.9 Dissertation Phase I
3.10 Educational Seminar II
3.11 Teaching Practice

4th Semester
4.1 Organisational Communication
Specialization Courses:
Educational Leadership
4.2 Educational Administration
4.3 Ethics and Social Responsibility in Education
Educational Psychology
4.4 Counselling Skills for Educational Psychologists
4.5 Child and Adolescent Mental Health
4.6 Dissertation Phase II
4.7 Internship

		BA 1ST SEMESTER											
Course	**Code**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**

1.1 Foundations of Education	EDFE0124	H	M	M	H	M	L	H	H	H	H	H	L
1.2 Theories and Principles of Education	EDTE0125	H	H	H	M	H	H	H	H	H	H	M	M
1.3 Guidance and Counselling	EDGC0128	M	H	H	L	H	L	H	H	H	H	H	M
		BA 2ND SEMESTER											
Course	**Code**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
2.1 Philosophical Foundations of Education	EDPF0126	H	M	M	H	H	L	H	M	H	H	H	H
2.2 Education and Society	EDES0127	M	H	H	H	H	H	H	H	H	H	H	L
2.3 Gender Education	EDGE0129	H	H	H	H	H	H	H	H	H	H	H	M
		BA 3RD SEMESTER											
Course	**Code**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
3.1 Psychological Bases of Education		H	H	H	M	M	M	H	H	H	H	H	H
3.2 Distance Education		H	H	H	M	H	H	H	H	H	H	H	M
3.3 Development of Education in India		H	H	H	M	H	H	H	H	H	H	H	M
3.4 Life Skills Education		H	H	H	H	H	H	H	H	H	H	H	M

3.5 Population Education		M	M	M	H	M	M	M	H	H	H	H	H
		BA 4TH SEMESTER											
Course	**Code**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
4.1 Educational Thinkers		H	M	M	H	H	M	H	H	H	H	H	H
4.2 Educational Technology		H	H	H	M	H	H	H	H	H	H	H	H
4.3 Foundations of Curriculum Development		H	M	M	M	M	M	H	H	H	H	H	H
4.4 Teaching skills & Teaching Practice		H	H	H	H	H	H	H	H	H	H	H	H
4.5 Early Childhood Care and Education		H	H	H	M	H	H	H	H	H	H	M	M
Course	**Code**	**BA 5TH SEMESTER**											
		PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
5.1 Measurement and Evaluation in Education		H	H	H	M	H	H	H	H	H	H	H	H
5.2 Inclusive Education		H	M	M	M	H	M	H	M	H	H	H	H
5.3 Human Rights Education		H	H	H	H	H	H	H	H	H	H	H	M
5.4 Elementary		H	M	M	L	H	M	H	H	H	L	M	H

Statistics in Education													
5.5 Adult Education		M	H	H	H	H	M	H	H	H	H	M	M
5.6 Special Education		H	H	M	M	L	M	H	H	M	H	H	M
5.7 Economics of Education		H	H	H	M	M	M	H	H	H	M	H	H
5.8 Human Growth and Development		M	H	H	M	M	H	H	H	H	M	H	M
Course	**Code**	**BA 6TH SEMESTER**											
		PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
6.1 Teaching Learning Methods and Pedagogy		H	H	H	H	H	M	H	H	H	H	H	H
6.2 Educational Administration and Management		H	H	H	H	H	M	M	H	H	H	H	H
6.3 Teacher Education		H	H	H	H	H	H	H	H	H	H	H	H
6.4 Environmental Education		H	H	H	H	H	H	H	H	H	H	H	H
6.5 Physical Education		M	M	M	H	H	L	H	H	L	M	H	M
6.6 Peace Education		H	H	H	H	H	M	H	H	H	H	M	M
6.7 Instructional Technology		H	H	M	L	H	M	H	H	H	H	H	H
6.8 Elements of Research		H	H	M	M	H	H	H	H	H	H	H	H
Course	**Code**	**BA 5TH SEMESTER**											

		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4
5.1 Scientific Methodology	EDCI0120	H	H	H	M	H	H	H	H	H	H	H	H
5.2Environmental Studies	CHES0002	H	M	M	M	H	M	H	M	H	H	H	H
5.3 Measurement and Evaluation in Education	EDME0113	H	H	H	H	H	H	H	H	H	H	H	M
5.4 Educational Technology	EDTY0114	H	M	M	L	H	M	H	H	H	L	M	H
5.5 Foundations of Curriculum Development	EDFC0115	M	H	H	H	H	M	H	H	H	H	M	M
5.6 Guidance and Counselling in Education	EDGC0116	H	H	H	M	M	M	H	H	H	M	H	H
5.7 Special and Inclusive Education	EDSI0117	M	H	H	M	M	H	H	H	H	M	H	M
Course	**Code**	**BA 6TH SEMESTER**											
		PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
6.1 Teaching Learning Methods and Pedagogy	EDTL0018	H	H	H	H	H	M	H	H	H	H	H	H
6.2 Educational Management and Administration	EDEM0119	H	H	H	H	H	M	M	H	H	H	H	H
6.3 Psychological	EDPT6101	H	H	H	H	H	H	H	H	H	H	H	H

Testing													
6.4 Project Work	EDPW6102	H	H	H	H	H	H	H	H	H	H	H	H
6.5 Teacher Education	EDTE0121	H	H	H	H	H	M	H	H	H	H	M	M
6.6 Distance and Adult Education	EDDA0122	H	H	M	L	H	M	H	H	H	H	H	H
6.7 Elementary Statistics in Education	EDES0123	H	H	M	M	H	H	H	H	H	H	H	H

MA 1st SEMESTER													
Course	**Course code**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
1.1 Philosophical foundations of Education	EDFE0011	H	H	H	L	M	M	M	H	H	H	H	H
1.2Fundamentals of Educational Psychology	EDEP0012	H	H	H	M	L	M	L	H	H	H	H	H
1.3 Emerging Trends in Education	EDTE0013	H	M	H	M	M	M	M	H	H	H	H	M
1.4 History and Development of Education in India	EDDE0014	H	M	M	M	L	L	M	H	H	H	H	H
1.5 Educational	EDET0015	H	M	H	M	H	H	M	H	H	H	H	H

Technology													
1.6 Leadership and Social Responsibility	EDLR0007	H	H	H	H	H	H	H	H	H	H	H	H
1.7 Journaling	EDJG6002	H	H	M	M	H	L	H	H	H	H	H	H
MA 2ND SEMESTER													
Course	**Course code**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO4**
2.1 Sociological Foundations of Education	EDSF0017	H	L	H	H	M	M	H	H	H	H	H	M
2.2 Research Methodology and Statistics in Social Science	EDRM0034	H	H	H	H	H	M	H	H	M	H	M	H
2.3 Knowledge and Curriculum	EDTK0018	H	L	M	M	M	L	M	H	M	H	H	H
2.4 Developing Educational Leadership	EDEL0019	M	H	M	H	H	M	H	H	H	H	H	H
2.5 Human Development and Learning	EDDL0020	M	H	M	M	M	M	H	H	M	H	H	H
2.6 Peace Education and Conflict Managemen	EDPC0016	M	H	H	H	H	H	M	H	H	H	H	M

t													
2.7 Educational Seminar-I	EDES6003	H	H	H	M	H	M	H	H	H	H	H	H
2.8 Computer Application for Social Sciences (Lab)	SWCA6010	H	H	H	M	H	H	L	H	H	H	H	H
2.9 School Visit	EDSV6004	M	H	M	H	H	H	H	H	H	H	H	H
MA 3RD SEMESTER													
Course	**Course code**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PS O2**	**PSO 3**	**PSO 4**
3.1 Curriculum Development and Instruction	EDCI0021	M	M	H	M	M	L	L	H	H	H	H	H
3.2 Principles and Techniques of Teaching and Pedagogy	EDTP0022	H	H	H	H	H	H	H	H	H	H	H	H
3.3 Teacher Education	EDTE0023	H	H	H	H	H	M	H	H	H	H	H	H
3.4 Measurement and Evaluation in Education	EDME0024	H	M	H	M	H	M	H	H	M	H	H	H
3.5 Educational Law and Government Policy	EDPL0025	M	L	M	H	H	M	M	H	H	H	H	H
3.6 Financial Management	EDFM0026	M	L	L	L	H	L	M	H	L	H	L	H

and Accounting													
3.7 Life Span Development and Education	EDLE0027	H	L	H	H	M	M	H	H	H	H	H	H
3.8 Learning and Individual Differences	EDLI0028	H	H	H	M	M	H	H	H	M	H	H	H
3.9 Dissertation Phase-I	EDDI6005	H	H	H	H	H	M	H	H	H	H	H	H
3.10 Educational Seminar-II	EDES6009	H	H	H	M	H	M	H	H	H	H	H	H
3.11 Teaching Practice	EDTP6010	H	H	H	H	M	L	H	H	H	H	H	H
MA 4TH SEMESTER													
Course	**Course code**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
4.1 Organisational Communication	EDOC0029	M	H	M	M	M	L	M	H	H	H	H	H
4.2 Educational Administration	EDEA0030	M	M	M	H	L	L	M	H	H	H	H	H
4.3 Ethics and Social Responsibility in Education	EDSR0031	M	H	M	H	H	H	H	H	H	H	H	M
4.4 Counselling	EDSP0032	M	H	M	H	L	L	M	H	M	H	H	H

Skills for Educational Psychologists													
4.5 Child and Adolescent Mental Health	EDCA0033	H	H	M	H	H	M	M	H	H	H	H	M
4.6 Dissertation Phase-II	EDDI6007	H	H	H	H	H	M	H	H	H	H	H	H
4.7 Internship	EDIN6008	H	H	H	H	M	M	H	H	H	H	H	H

1.1 THEORIES OF PERSONALITY(4 Credits- 60 hours)

COURSE/LEARNING OUTCOMES

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

CO1 Define personality. (Remembering)
CO2 Explain the rationale behind the theories of personality. (Understanding)
CO3 Identify the impact of environment and genetics in development of personality.(Applying)
CO4 Analyse modifications of self in perceiving environment. (Analysing)CO5 Assess the relation between cultural and personality. (Evaluating) CO6Compare 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 ofpersonality: 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

Atkinson, R. L., Atkinson, R. C., Smith, E. E., Bem, D. J. and Hilgard, E. R. (1990).Introduction to Psychology.

New York: H. B. J. Inc.

Sternberg, R. J. (2010). Cognitive Psychology. New York: Cengage Learning

Passer, M.W. and Smith, R.E.(2010). Psychology: The Science of Mind and Behavior. New Delhi: Tata McGraw-Hill.

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

2	H	H	H	M
3		M	M	
4	M	H	H	H
5	M	H		M
6			M	H

1.2 CONCEPTS OF MENTAL HEALTH AND ILLNESS-I

(4 Credits - 60 hours)

COURSE OUTCOMES

CO1 Define mental health and illnesses and list categories of mental illness as specified inDSM and ICD (Remembering)
CO2 Classify and categorise mood disorders, obsessive compulsive and related disorders,anxiety disorders (Understanding)
CO3 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)
CO4 Analyse the distinction between normality and abnormality. Distinguish clinical featuresof different mental illnesses. (Analysing)
CO5 Evaluate Bio Psycho Social models and other models of mental health and illness.(Evaluate)
CO6 Create a management plan for patients on the basis of clinical features, diagnosiscriteria and therapist competence. (Creating)

Syllabus

Module I: Introduction (10 hours)

Definition of mental illness and mental health. Historical review and changes in the concept ofmental 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-StressModel

Module III: Mood Disorders (Symptoms, Etiology and Treatment (15 hours)

Unipolar Depressive Disorders in different population. Bipolar and Related Disorders in differentpopulation.

Module IV: Anxiety and Related Disorders (Symptoms, Etiology and Treatment) (10 hours)

Phobias in different population: specific phobia and social phobia. Generalised Anxiety Disordersin 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, DissociativeDisorder: Dissociative Identity Disorder, Depersonalisation Disorder, Derealisation Disorder

Suggested Readings

1) Diagnostic and Statistical Manual of Mental Disorders (DSM-5), 2013 American PsychiatricAssociation.
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 MaladaptiveBehaviour. 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 ofclinicalPsychology 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. 2ndEdition. Los Angeles: Sage, (2008).
9) Korchin, Sheldon, J., Modern Clinical Psychology, Principles of Intervention in the Clinic andCommunity. 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 DevelopingCountries. NGO Innovations in India. New Delhi: Sage, (2003).

Mapping of COs to Syllabus

	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

1.3 RESEARCH METHODOLOGY AND STATISTICS IN SOCIAL SCIENCE

(4 Credits- 60 hours) COURSE/LEARNING OUTCOMES

CO1 Define the basic concepts of research and recognize the philosophical foundations ofresearch. (Remembering)
CO2 Understand the steps in conducting research and the major research designs.(Understanding)
CO3 Analyse the collected data in research using different statistical measures. (Analysing)
CO4 Apply research design, tools and statistical measures to carry out research in socialsciences. (Applying)
CO5 Compare natural and social sciences as well as the different approaches and researchdesigns most commonly used in social sciences research. (Evaluating)
CO6 To create a research proposal using indicating appropriate research design method ofdata 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 andANOVA.

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), NewDelhi: 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 forpractitioners,* New Delhi: Sage.
11) Sarantakos, S. (2005). Social Research, New York: Palgrave Macmillan.

Mapping of COs to Syllabus

	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

1.4 COGNITIVE PSYCHOLOGY

(4 Credits-60 Hours)

COURSE OUTCOMES

CO1 Define the basic concepts of cognitive psychology, identify major theoretical foundations and recognize the historical background of cognitive psychology.(Remembering)
CO2 To understand the relationship between mind, brain and behaviour. (Understanding)CO3 To analyse the scope and application of cognitive psychology. (Analysing)
CO4 To use measures of cognitive psychology in research and practice. (Applying)
CO5 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)

Syllabus

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 exploringcognition (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 andHierarchical 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 andAttention.

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: FourthDimension, 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

Galotti, K.M. (2013). Cognitive Psychology In and Out of the Laboratory (5th ed.). Sage Publications Inc.

Kellogg, R.T. (2007). Fundamentals of Cognitive Psychology. Sage Publication.Matlin, M. W. (2006).

Cognition. John Wiley & Sons, Inc.

Riegler, G.L.R. (2008). Cognitive Psychology: Applying the Science of the Mind. Pearson Education.Jahnke, J.C., & Nowaczyk, R.H.

(1998). Cognitive Psychology. Prentice Hall.

Matlin, M. W. (1995). Cognition. Prism Book.

Reed, K.S. (2000). Cognition: Theory and Applications. Wadsworth.

Mapping of COs to Syllabus

	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

1.5 EASTERN APPROACHES TO PSYCHOLOGY AND COUNSELLING

(3 Credits-45 Hours)

COURSE OUTCOMES

CO1 Define the basic terms related to the different eastern approaches of psychology.(Remembering)
CO2 Classify among Indian/Chinese/Japanese approaches to psychology. (Understanding)
CO3 Make use of the appropriate Indian/Chinese/Japanese approaches to psychology inapplied settings. (Applying)
CO4 Examine ancient and contemporary eastern approaches of psychology. (Analysing)CO5 Recommend the suitable approach in applied settings. (Evaluating)
CO6 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 ofthought.

Module IV: Indian and other Eastern Approaches to Health and Wellbeing (8 hours)

Yoga, Ayurveda, goals of life-concept of purusharthas, personality development-concept ofAshramas

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

	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			

1.6 GENERAL PSYCHOLOGY(3 credits – 45 hours)

Course/Learning Outcomes

CO1 Define psychology, name the different fields of psychology, list the different areas inwhich psychology is applicable. (Remembering)
CO2 Understand how the visual and auditory systems work. (Understanding)
CO3 Apply the theories of learning to modify behavior and application of different strategiesfor memory improvement. (Applying)
CO4 Analyse the strengths and weaknesses of the important theories of psychology.(Analysing)
CO5 Evaluate the contribution of psychology in different fields. (Evaluating)
CO6 Create a basic idea of personality and the important theories of personality. (Creating)Syllabus

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), andHumanistic 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

	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

1.7 PRACTICUM - I

(2 credits – 60 hours) Course/Learning Outcomes

CO1 Define the important concepts of psychology research, and assessment techniques.(Remembering)
CO2 Understand the importance and steps associated with planning and conducting anexperiment. (Understanding)
CO3 Apply the basic concepts of research and assessment techniques in measuring important psychological constructs associated with positive psychology. (Applying)
CO4 Categorize different types of intelligence assessment techniques. (Analyzing)
CO5 Evaluate the importance of different types of assessment techniques and measurementtools. (Evaluating)
CO6 Design and conduct an experiment. (Creating)Syllabus

Module I: Introduction to Practicum (9 hours)

Primary modes of psychological enquiry: Experimental method, Observation, Survey, andInterview

Psychometric 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): Basicconcepts, 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, andIssues*. 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

	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			

1.8 PERSONAL GROWTH I(P/NP)

(2 Credits - Workshop and assignment mode)

COURSE OUTCOMES

CO1 Understand the basic principles of psychology (Remembering)
CO2 Understand personality traits, values, skills and interests. (Understanding)CO3 Gain self-awareness and emotional awareness (Applying)
CO4 Set specific, achievable short- and long-term goals (Analysing)Syllabus

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

1) Psychology of Success: Finding Meaning in Work and Life, 5th Edition, Denis Waitley, 2010,McGraw-Hill

Mapping of COs to Syllabus

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

Masters in Science – Psychology 2nd Semester

2.1 CONCEPTS OF MENTAL HEALTH AND ILLNESS-II(4 Credits – 60 Hours)

COURSE OUTCOMES

CO1 Define mental illnesses. (Remembering)
CO2 Classify and categorise developmental disorders, schizophrenia, personality disorders,substance related disorders, eating disorders and neurocognitive disorders. (Understanding)
CO3 Apply diagnostic criteria categorise developmental disorders, schizophrenia, personality disorders, substance related disorders, eating disorders and neurocognitive disorders todiagnose individuals with mental illnesses. (Applying)
CO4 Analyse the distinction between normality and abnormality. Distinguish clinical features of different mental illnesses. (Analysing)
CO5 Explain the causal factors of mental health and illnesses. (Evaluating)

CO6 Create a management plan for patients on the basis of clinical features, diagnosiscriteria and therapist competence. (Creating)

Syllabus

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) (10hours)

Substance Related DisordersEating 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 MaladaptiveBehaviour. 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 ofclinicalPsychology 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. 2ndEdition. Los Angeles: Sage, (2008).

13) Korchin, Sheldon, J., Modern Clinical Psychology, Principles of Intervention in the Clinic andCommunity. 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 DevelopingCountries. NGO Innovations in India. New Delhi: Sage, (2003).

Mapping of COs to Syllabus

	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

2.2 BIO-PSYCHOLOGY(3 Credits- 45 hours) **COURSE**

OUTCOMES

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

CO1 Identifying biological bases of behavior. (Remembering)
CO2 Associating the role of the nervous system with behavior and emotions. (Understanding)
CO3 Examining the impact of bio chemicals in behavior and mental health at a conceptuallevel. (Applying)

CO4 Mapping the biological markers of individual difference. (Analyzing)
CO5 Reflecting on genetic and chromosomal bases of psychopathology. (Evaluating)CO6Develop 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 ofneuron.

Genetic bases of behavior: Structure of a gene, DNA and Chromosomes, Types and Functions ofGenes, 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.andSmith,R.E.(2010).Psychology:TheScienceofMindandBehaviour.NewDelhi: TataMcGraw-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.

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

6	H		M	

2.3 PSYCHOLOGICAL TESTING(4 Credits - 60 hours)

COURSE OUTCOMES

CO1 Define the basic concepts of psychological testing. (Remembering)
CO2 Classify the group and individual techniques of psychological testing. (Understanding)CO3 Make use of different statistical concepts in data analysis. (Applying)
CO4 Examine the results of the statistical data analysis. (Analysing)
CO5 Recommend the suitable tool for data collection/interview in applied settings.(Evaluating)
CO6 Test the psychometric properties of a tool and develop a psychological tool usingappropriate norms of tool construction. (Creating)

Syllabus

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,Typesof 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

	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			

2.4 HEALTH PSYCHOLOGY

(3 Credits 45 hours)

COURSE/LEARNING OUTCOMES

CO1 At the end of this course students will be able to:
CO2 Define the basic terms related to the field of health psychology. (Remembering)CO3 Learn the approaches to changes in health behavior(Understanding)
CO4 Make use of psychological research methods, theories, and principles to enhance biopsychosocial approaches for health promotion and illness prevention. (Applying)
CO5 Examine the stressors and its impact on the etiology and course of many health relatedproblems. (Analyzing)
CO6 Estimate the management of various health related disorders. (Evaluating)
CO7 Devise policies of health care delivery system beneficial to the public. (Creating)
CO8 Develop awareness about the stressful impact of disabling/life-threatening illness on thepatient and their family members as well as the health care providers. (Creating)

Syllabus

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 BehaviorChange

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: DorlingKindersley (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

	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

2.5 INTRODUCTION TO SOCIAL PSYCHOLOGY(3 Credits – 45 hours)

COURSE OUTCOMES

CO1 Define the basic concepts of social psychology in different contexts. (Remembering)
CO2 Explain different concepts of social processes, social influence, group dynamics andgroup influence. (Understanding)
CO3 Apply the theoretical concepts of social psychology into real life settings. (Applying)
CO4 Analyze the difference between social perception and social cognition as well asprejudice, stereotype, discrimination. (Analyzing)
CO5 Compare different types of groups and their functional systems. (Evaluating)
CO6 Discuss various social problems in light of the theoretical concepts of social psychology.(Creating)

Syllabus

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 andCompany (1997).

4) Dalal, Ajit K., A. Misra, Girishwar (Eds)., New Directions in Indian Psychology, SocialPsychology, New Delhi: Sage (2001).

5) Eckes, Thomas and Trautner, Hanns M. (Eds.) , The Developmental Social Psychology ofGender, Mahwah: Lawrence Erlbaum Associates, Publishers (2000).

6) Hogg, Michael A. and Cooper, Joel (Eds), The Sage Handbook of Social Psychology, ConciseStudent 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 socialproblems

Mapping of COs to Syllabus

	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			

2.6 PRACTICUM-II

(2 Credits, 60 Hours)

COURSE OUTCOMES

CO1 Define the basic terms related to aptitude, personality, projective techniques, positiveemotions, posttraumatic growth and clinical rating scales.
CO2 Classify the various types of psychological tests on the basis of their use.(Understanding)
CO3 Make interpretations and draw conclusions based on the norms given in the manual.(Applying)
CO4 Examine the details of the rating scale/ test, the aim, applications, procedure ofadministration and results. (Analysing)
CO5 Estimate the purpose and importance of each of these tests. (Evaluating)
CO6 Test the administrator's decision-making process to select a particular test forassessment of a given psychological condition. (Creating)

Syllabus

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-BuildTheory), 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, psychometricproperties 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,24th reprint.New Delhi:TataMcGraw-Hill.

3) Gregory, R.J. (2006). Psychological Testing: History, Principles, and Applications (4 thEd.).New Delhi: Pearson Education.

4) Baron, Robert A. and Byrne, D. (2001) .Social Psychology 8 th Edition (Reprint).New Delhi :Prentice-Hall of India Pvt Ltd.

5) Carson,R.C., Butcher,J.N and Mineka,S.(2004). Abnormal psychology. 13th Edition. NewDelhi: Pearson Education

Mapping of COs to Syllabus

	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

2.7 FIELD WORK(2 Credits)

COURSE OUTCOMES

CO1 Define counselling and mental illnesses (Remembering)CO2 Understand the value of supervision (Understanding)
CO3 Apply the theoretical principles to individuals at various setups (Applying)CO4 Distinguish clinical features of different mental illnesses. (Analysing)
CO5 Evaluate the models of mental health and illness. (Evaluate)
CO6 Create a management plan for patients on the basis of clinical features, diagnosiscriteria and therapist competence. (Creating)

Syllabus

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. Thefieldwork 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

	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

2.8 Psychological First Aid (P/NP)

(2 Credits - Workshop and assignment mode)

COURSE OUTCOMES

CO1 Remember the basic concepts of psychological first aid. (Remembering)CO2 Understand the steps of psychological first aid. (Understanding)
CO3 Gain self-awareness and awareness about emergency care. (Applying)CO4 Plan specific, achievable remedial measures (Analysing)

Syllabus

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

1) Psychology of Success: Finding Meaning in Work and Life, 5th Edition, Denis Waitley, 2010,McGraw-Hill.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			

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

Masters in Science-(Counselling Psychology) 3rd Semester

3.1 FOUNDATIONS OF COUNSELLING PSYCHOLOGY(4 Credits, 60 Hours)

COURSE OUTCOMES

CO1 Define the basic concepts of counselling psychology, identify major theoretical foundations and recognize the historical background of counselling psychology.(Remembering)
CO2 To understand the professional therapist-client relationship in a therapeutic setting.(Understanding)
CO3 To analyse the scope and application of counselling psychology. (Analysing) CO4 To use the therapeutic skills of counselling psychology in practice. (Applying)
CO5 To evaluate different counselling models, therapeutic skills and their appropriateapplicability. (Evaluation)
CO6 To develop an understanding of counselling skills, therapies and ethical guidelines ofcounselling practice. (Creating)

Syllabus

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 aswell as parents, Adoption, Marriage & Pre-marital Counselling.

Counselling diverse population: Gender, counselling for geriatric clients, the ethnic minorities, andthe 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

	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

3.2 CHILD AND YOUTH COUNSELLING(4 Credits- 60 hours)

Course/Learning Outcomes

CO1 Define the basic concepts and goals of child counseling (Remembering)
CO2 Understand the specific issues faced by children and youth, especially pertaining toeducation, and career. (Understanding)
CO3 Apply the skills and techniques of counselling in child and youth-counselor relationship(Applying)
CO4 Compare and contrast among the major learning styles models and theories incounseling (Analyzing)
CO5 Appraise the significance of the child-counsellor relationship, and major theories in thecounseling process. (Evaluating)
CO6 Build on the traditional views of learning styles models and improve counselling skills.(Creating)

Syllabus

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 aboutcounselling

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, timemanagement

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 anddrawing, drama, metaphor, storytelling)

Module IV: Counselling Children with specific problem (12 Hours)

Children and trauma: child abuse (physical, sexual, emotional), HIV/ AIDS, specific issues ineducational settings

Techniques 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 careerpreparation, career decision making, career exploration techniques

Career development theories: Holland, Ginzberg, and Super

Career counselling with diverse population: children, adolescents, college students, women andadults.

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, DelmarPublishers Inc.
3) Butler, G., and Hope, T. (1997). Managing your mind: The mental fitness guide. OxfordUniversity Press.
4) Cohen, L. G., and Spenciner, L. J., (2003). Assessment of Children and Youth with SpecialNeeds. Boston: Allyn and Bacon.
5) Mangal S. K. (2008). Essentials of Educational Psychology, New Delhi, Prentice Hall of India Pvtltd.
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

	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

3.3 DISABILITY STUDIES AND REHABILITATION PSYCHOLOGY(4 Credits - 60 hours)

COURSE OUTCOMES

CO1 Define the concept of rehabilitation and list the methods of assessment andinterventions for various disabilities (Remembering)
CO2 Illustrate the scope of rehabilitation psychology (Understanding)
CO3 Plan assessments and interventions for various learning, intellectual and physicaldisabilities and apply the models of rehabilitation in practice (Applying)
CO4 Analyse the general functions of rehabilitation psychology (Analysing)
CO5 Compare and conclude on the prevention and early intervention for various disability(Evaluating)
CO6 Modify the flaws in the successful implementation of various acts related to disability(Creating)

Syllabus

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, BlackwellPublisher (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 orvisually impaired, American foundation for the blind, U.S (1997)
5) James K. Luiselli, Dennis C. Russo, Walter P. Christian, Effective Practice for children withAutism: Educational and Behavioural support Intervention that work (2008)
6) KimEtheringon, rehabilitation counselling in physical and mental health, Jessica Kingsleypublication
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: AshishPublishing (1988).

Mapping of COs to Syllabus

	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

Masters in Science-(Clinical Psychology) 3rd Semester

3.1 FOUNDATION OF CLINICAL PSYCHOLOGY(4 Credits-60 hrs.)

COURSE OUTCOMES

CO1 Definition of clinical psychology, acquire knowledge and understanding the philosophical roots and historical events that have shaped the field of clinicalpsychology (Remembering)
CO2 Explore the underlying philosophical assumptions, individual contributors, and variousforces that served to shape the emerging field of clinical psychology (Understanding)
CO3 Demonstrate familiarity with scientific, ethical, legal, and practice-oriented issues in thefield (Applying)
CO4 Acquire a basic understanding of western (and, to an extent, Indian) philosophical thought, to articulate a philosophy of their own, and apply that philosophy to theirprofessional work in field of clinical Psychology (Applying)
CO5 Think critically about the science of psychology, analyse psychological theory, research,and practice in a historical context, and develop ideas, critiques, and conclusions of their own (Analysis)
CO6 Adapt and develop a basic understanding about assessment and interventions in thecontext 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)

Competencies in Clinical Psychology (18 hours)

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
6) Delhi: Sage publication
7) Gregory, R. J. (2000). Psychological testing: History, principles, and applications (3rd Ed.).Boston: Allyn & Bacon.
8) Wolman, B.B. (1965). Handbook of clinical psychology. N.Y: McGraw Hill INC
9) Groth-Marnat, G. (1999). Handbook of psychological assessment, 3rded. New York: JohnWiley & Sons, Inc.

COURSE OUTCOMES (COs) Mapping

	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

3.2 PSYCHODIAGNOSTICS(4 Credits: 60 hours) **COURSE**

OUTCOMES

CO1 Define the concept of assessment (Remembering)
CO2 Gather the significance and scope of psychological assessment in diagnosis andintervention (Understanding)
CO3 Apply various approaches of assessment in practice (Applying)
CO4 Estimate the appropriate assessments for different population as per the diagnoses.(Analysing)

CO5 Assess the socio-cultural factors in various assessments aiding in the diagnoses.(Evaluating)
CO6 Design psychopathology formulation which will impede the process of effectivetherapeutic sessions. (Creating)

Syllabus

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. DiagnosticInterviewing. 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, andethics (Low Price Edition). Delhi: Pearson Education.

2) Pomerantz, A.M. (2008). Clinical Psychology: Science, practice, and culture. SagePublications: New Delhi

3) Trull,T.J., & Phares,E.J. (2001). Clinical psychology: Concepts, methods, and profession (6thed.). 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 (IIIrdEdition) Vol. 1.2. William and wilkins, Batrmore, London, 1989.

6) Anastasi, A., & Urbina, S. (2005). Psychological Testing. 7th ed. Pearson Education: NewDelhi, India.

7) Barlow, D.H. & Durand, V.M. (2005). Abnormal psychology: An Integrative Approach (4thed.). Wadsworth/Thompsons. Belmont CA.

8) Butcher J.N; Mineka Susan; and Hooley Jill M. (2014) Abnormal Psychology (15th Ed.) DorlingKindersley 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

	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

3.3 FORENSIC PSYCHOLOGY(3 credits – 45hours) **COURSE**

OUTCOMES

CO1 Define forensic psychology and the role of a Forensic Psychologist. (Remembering)CO2 Illustrate on the nature of crime. (Understanding)
CO3 Examine the social, psychological theories of crime. (Analysing)
CO4 Apply the methods of forensic psychological investigation. (Applying)
CO5 Explain the concept of Juvenile delinquency, sexual offenders and serial offenders.(Evaluating)
CO6 Create an idea about the importance of Forensic psychological assessment into practice.(Creating)

Syllabus

Module I: Introduction (11 hours)

Meaning, nature and definition of Forensic Psychology, Historical background, training of aForensic 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 UKltd 1663 Liberty Drive. Bloomington, IN 47403. USA

2) Horton N.A., Heritage.C.L.(2010). Handbook of forensic Neuropsychology. SpringerPublishing company. New York

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

3.4 PRACTICUM-III

(2 credits – 60 hours) Course/Learning Outcomes

CO1 Define the basic concepts of disability, intelligence and personality assessment.(Remembering)
CO2 Extend the theoretical knowledge of disability, personality and intelligence theories andassessment techniques into practice. (Understanding)
CO3 Make use of the important measurement tools to learn administration and scoring.(Applying)
CO4 Examining test scores and interpretation of results. (Analyzing)
CO5 Evaluate the importance of personality, intelligence and disability assessment.(Evaluating)
CO6 Construct conclusion from the results of psychological assessment. (Creating)Syllabus

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/PearsonEducation.

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, andIssues*. Australia: Thomson Wadsworth.

Mapping of COs to Syllabus

	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

3.5 RESEARCH PROJECT PHASE I (4 Credits)

COURSE OUTCOMES

CO1 Knowledge of the major theoretical approaches and findings in psychology.(Remembering)
CO2 Demonstrate knowledge about the research methods used in psychology,.(Understanding)
CO3 Apply the knowledge for preparing research design, and data analysis. (Applying)
CO4 Critically analyse information related to the study of behaviour and mental processes,and use the critical assessment in forming conclusions and arguments. (Analysing)
CO5 Present and defend opinions by making judgments about information, validity of ideas,or quality of work based on a set of criteria. (Evaluating)
CO6 Develop the understanding of how to prepare a research proposal. (Creating)Syllabus

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

	RESEARCH PROJECT PHASE I
CO 1	H
CO 2	M
CO 3	H
CO 4	H
CO 5	M
CO 6	H

3.6 SUPERVISED INTERNSHIP I(4 Credits)

COURSE OUTCOMES

CO1 Remembering the personal integrity, accountability, professional deportment andconcern for the welfare of others. (Remembering)
CO2 Understanding of Psychological disorders, empathy, reflective practice, and self-care.(Understanding)
CO3 Applying scientific, theoretical, contextual approach to the discipline (Applying)CO4 Analyse the symptom severity and clinical features of disorders. (Analysing) CO5 Determine ethical and Legal guidelines of practice (Evaluating)
CO6 Develop effective work skills, including cognitive and expressive skills, self-directedlearning & continuing education. (Creating)

Syllabus

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

	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

3.7 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 howcommunity 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

CO1 Define the clinical features of psychological disorders. (Remembering)
CO2 Demonstrate fundamental knowledge and comprehension of the major concepts,theoretical perspectives, historical trends, and empirical findings in psychology. (Understanding)
CO3 Develop Scientific reasoning and critical thinking, including effective research methodology in solving problems related to behavior and mental processes. (Applying)
CO4 Analyse ethically and socially responsible behaviors for professional and personal settings, including development of values that build diverse communities. (Analysing)
CO5 Determine their basic area of interest to work further/specialize in clinical setting.(Evaluating)
CO6 Develop the competence in writing case studies, and interpersonal communicationskills. (Creating)

Syllabus

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 howcommunity organizations work and expand their clinical and interpersonal skills. The summer internship enriches the students' academic experience while making a valuable contribution tothe community and utilizing the vacation optimally.

Mapping of COs to Syllabus

	SUMMER INTERNSHIP (P/NP)
CO 1	H
CO 2	H
CO 3	M
CO 4	H
CO 5	H
CO 6	M

3.8 STUDY TOUR (Pass/Non-Pass)

COURSE OUTCOMES

CO1 Define mental illnesses and rehabilitation. (Remembering) CO2To understand counselling in real life setting. (Understanding)
CO3 To apply theoretical principles in order to understand the functioning of various mentalhealth settings (Applying)
CO4 Distinguish clinical features of different mental illnesses. (Analysing)
CO5 Explain the importance of different models of mental health and illnesses in assessment.(Evaluating)
CO6 Develop practical knowledge about different psychological practice and rehabilitationsetting. (Creating)

Syllabus

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

	Module 1	Module 2
CO1	H	H
CO 2	H	
CO 3		H
CO 4	H	
CO 5	H	M
CO 6	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:

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.

B.A. (Honours) MASS COMMUNICATION

The B.A Mass Communication programme of Assam Don Bosco University is a three-year (six semesters) programme consisting of theory and practical components, taught and learned through a combination of lectures, hands-on training and project execution.

PROGRAMME OUTCOMES – BA MASS COMMUNICATION

PO1 **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.

PO2 **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.

PO3 **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4 **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.

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**: Understand the issues of environmental contexts and sustainable development.

PO7 **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 – BA MASS COMMUNICATION

PSO1 **Knowledge of Communication**: An ability to define and identify the various fields of mass communication.

PSO2 **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.

PSO3 **Developing Technical Skills:** An ability to apply media technology skills as well hone written and spoken communication skills essential for various media platforms.

PSO4 **Enhancing Professional Skills:** An ability to analyse and assess responsibilities as professionals in the field of media.

PSO5 **Creating Multimedia Content:** An ability to create media programmes for varied media audience needs.

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

PO1 **Critical Thinking**: Gain conceptual and theoretical knowledge and learn to critically think and analyze the dynamics and contemporary phenomenon of mass communication.

PO2 **Scientific Temper:** Develop logical and creative thinking for the solutions in Print media, electronic media and Communication for development.

PO3 **Effective Communication**: Develop the communication skills, theoretical and practical knowledge among the students in print, digital and development communication.

PO4 **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO5 **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6 **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.

PO7 **Environment and Sustainability**: Understand the environment issues and promote sustainable development goals.

PO8 **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

PSO1 **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.

PSO2 **Application of Knowledge**: Apply communication skills and practices in context of social and cultural milieu of the North-eastern region.

PSO3 **Developing Critical Aptitude:** An ability to test and analyze research findings by demonstrating critical thinking and problem-solving skills.

PSO4 **Enhancing Professional Skills:** An ability to develop professional skills and use in the field of print media, electronic media and development communication.

PSO5 **Creating Multimedia Content:** An ability to create media programmes for varied media audience needs.

DETAILED SYLLABUS

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 Raj Melkote, 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

	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

CO1 Define the concept, meaning and characteristics of the media industry (Remembering)
CO2 Explain the functions of communication (Understanding)

CO3 Choose appropriate media channels for effective communication (Applying
CO4 Distinguish different types of media (Analysing)
CO5 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

	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

CO1 Demonstrate an understanding of the history of media and the evolution of the mediated environment (Understanding)
CO2 Organize a historical survey of media and diachronic analysis of a variety of mediated forms especially in the context of India (Applying)
CO3 Identify the rich folk heritage of India and its role in grass-root communication (Applying)
CO4 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, Harper Collins.
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

	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

	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

CO1 Define the concept of semiotic theory and practice (Remembering)
CO2 Explain the intersection between communication, in its many forms, and society and culture (Understanding)
CO3 Apply communication theories and models in communication programmes and research (Applying)
CO4 Analyse the link between major theoretical understandings of communication and the socio-cultural setting they have developed in (Analysing)
CO5 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, Marshall McLuhan, 2008, Routledge

Mapping of COs to Syllabus

	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

CO1 Define the concept, meaning and function of journalism (Remembering)
CO2 Explain the role and responsibilities of a journalist. (Understanding)
CO3 Apply the concepts and techniques of journalism in news reporting (Applying)
CO4 Analyse the role of news media in society (Analysing)
CO5 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 of news 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

	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

CO1 Define the meaning and concept of investigative and data journalism (Remembering)
CO2 Demonstrate how to conduct news investigation (Understanding)
CO3 Plan and execute investigative news reporting methodically and ethically (Applying)
CO4 Analyse different sets of data and information (Analysing)
CO5 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 investigative reporting.

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, AK Peters/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

	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

CO1 Define the basic terms related to development & development communication (Remembering)
CO2 Explain different models and approaches of development (Understanding)
CO3 Develop communication strategy for development (Applying)

CO4 Examine role of media in socio-economic development and social change (Analysing)
CO5 Assess situation for communication intervention (Evaluating)
CO6 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 planning models: 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

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

MCRM0034: COMMUNICATION RESEARCH METHODOLOGY (4-0-0)

COURSE OBJECTIVES

CO1 Define meaning, scope, objectives and significance of media research (Remembering)
CO2 Demonstrate appropriate methods for collecting and analysing research data (Understanding)

CO3 Apply research methods related to the disciplinary areas of communication and media (Applying)
CO4 Assess and appraise relevant literature (Evaluating)
CO5 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

	Module 1	Module 2	Module 3
CO1	H		
CO2		H	
CO3			H
CO4		H	
CO5	H		

MCDM0035: DIGITAL MEDIA (3-0-0)

COURSE OBJECTIVES

CO1 Define new media and information society (Remembering)

CO2 List the characteristics of new media (Remembering)
CO3 Show their ability to engage in contemporary debates on the implications of digital culture (Understanding)
CO4 Demonstrate the ability to deal critically with social analysis of popular media (Understanding)
CO5 Analyse key issues emerging from recent development into digital culture (Analysing)

Module 1: Digital Communication (12 Lectures)

New Media and Information Society, The Characteristics of New Media, Hyper-textuality and Hyper- Mediacy, New Media and Visual Culture, Interactivity, Mobile journalism (MOJO).

Module 2: The Internet and the Public Sphere (10 Lectures)

Online News; Digital Economics, Access and the Digital Divide, Economics and Networked Media Culture, The social form of New Media, Globalisation; neo-liberalism and the Internet.

Module 3: Media, Culture, Technology and Society (13 Lectures)

Relationship between Space and Identity, Ideological Connotation of the new Cyber and Participatory Culture, Intensity of Change; Intensifying Process of Globalization, Cyber-Culture, Fragmentation and Convergence.

Module 4: Online Media Praxis (10 Lectures)

Challenges and Opportunities for Journalists - Readers as Publishers, New Media Journalism; Online Edition of Newspapers-Management and Economics, Security Issues in Using Digital Technology (Malware, Phishing, Identity Thefts), social media and Citizen Journalism, E-governance, Internet and Live Streaming.

Suggested Readings

1) A Networked Self: Identity, Community and Culture in social Networking Sites, Papacharissi, Z. (Ed.,), 2011, Routledge
2) Critique, social media and the Information Society, Christian Fuchs and Marisol Sandoval (Eds.,), 2006, Routledge
3) Digital Cultures: Understanding New Media, Glen Creeber, and Royston Martin (Eds.,), 2009, Open University Press
4) Handbook of New Media, Leah Lievrouw and S. Livingstone, 2006, London: Sage
5) New Media Language, J. Aitchison, 2003, Routledge
6) New Media: A Critical Introduction, J. Dovey, 2009, Routledge
7) New Philosophy for New Media, Mark B. N. Hansen, Mark B. N., 2004, MIT Press.
8) New Media: A Critical Introduction, Martin Lister, Jon D., Seth Giddings, Iain Grant, Kieran K, 2009, Routledge,
9) The New Media Handbook, Andrew Dewdney, Andrew and Peter Ride, 2006, Routledge
10) The New Media Book, Dan Harries Dan, 2002, Palgrave MacMillan

Mapping of COs to Syllabus

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

Service Learning

MCLS0100: COMMUNITY MEDIA (2-0-0)

COURSE OUTCOMES

CO1 Define and explain service learning and participatory approach to social development (Remembering)
CO2 Classify the different types of community media (Understand)
CO3 Utilise community media for social change and development (Applying)
CO4 Analyse storytelling formats and content about development issues (Analyzing)
CO5 Identify opportunities for discussing development issues using community media (Evaluating)
CO6 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

	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

Generic Elective - IV

MCMC0131: MOBILE COMMUNICATION (5-1-0)

COURSE OUTCOMES

CO1 Define mobile communication (Remembering)
CO2 Trace the evolution of wireless and mobile communication technology (Understanding)
CO3 Apply the key technologies used in development and distributing content for the mobile platform (Applying)
CO4 Create media contents for social media (Creating)

Module 1: Introduction to Mobile Communication (25 Lectures)

Wireless Communication Technology, Evolution of mobile communication, basic components of mobile communication system, mobile phones as a tool for development communication.

Module 2: Mobile Communication and Convergence (25 Lectures)

Interactive content development, mobile convergence: visual, text, images and video, blogging, podcasting and live streaming, Television, Radio and Internet content creation through mobile phones.

Module 3: Mobile Journalism (25 Lectures)

Concept and meaning, advantages of mobile journalism, Mastering mobile journalism, Skills and workflow, Technology and equipment – MOJO Apps, hardware, Mobile Camera Techniques, Case study.

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

Mapping of COs to Syllabus

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

Core Course - 2

MCIJ0132: INTRODUCTION TO JOURNALISM (5-1-0)

COURSE OUTCOMES

CO1 DEFINE THE concepts, meanings and functions of news (Remembering)
CO2 Classify different types of news media (Understanding)
CO3 Apply the concepts and techniques of journalism in news reporting (Apply)
CO4 Analyse ethical issues in journalism (Analyse)
CO5 Explain the roles and responsibilities of media persons (Evaluate)
CO6 Produce and edit new stories (Create)

Module 1: Understanding News (15 Lectures)

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

Module 2: Different Forms of Print: A historical Perspective (15 Lectures)

Yellow journalism, penny press, tabloid press, language of news- Robert Gunning: Principles of clear writing, Rudolf Flesch formula- skills to write news.

Module 3: Understanding the structure and construction of news (20 Lectures)

Organising a news story, 5W's and 1H, Inverted pyramid, Criteria for newsworthiness, principles of news selection, use of archives, sources of news, use of the Internet.

Module 4: Different Mediums-a comparison (15 Lectures)

Language and principles of writing: Basic differences between the print, electronic and online journalism, data and investigative journalism, citizen journalism.

Module 5: Role of Media in Democracy (10 Lectures)

Responsibility to Society, Press and Democracy, Contemporary debates and issues relating to media, ethics in journalism.

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
8) Writing Tools: 50 Essential Strategies for every writer, Roy Peter Clark, 2006, Little Brown

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	M			
CO2		H		H	
CO3			H		
CO4				H	M
CO5	M				M
CO6	H	H	H		

Core Course - 3

MCHM0133: HISTORY OF THE MEDIA (5-1-0)

COURSE OUTCOMES

CO1 Discuss the history of print media and its role in Indian freedom movement (Remembering)
CO2 Understand history and development of television industry (Understanding)
CO3 Analyse the emerging trends in the media and information industry (Analyse)
CO4 Evaluate the development of the media and information industry (Evaluate)

Module 1: History of Print Media (20 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 (17 lectures)

Emergency and Post Emergency Era, Changing Readership, Print Cultures, Language Press.

Module 3: Sound Media (20 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 3: Visual Media (18 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

Core Course - 4

MCVC0134: VISUAL COMMUNICATION (4-0-0)

COURSE OUTCOMES

CO1 Define and analyse the concepts and theories of visual communication (Remembering)
CO2 Illustrate the fundamentals of design (Understanding)
CO3 Apply the knowledge of the elements and principles of design to solve real world design problems (Applying)
CO4 Analyse the various design requirements for various purposes (Analyse)
CO5 Evaluate how specific visual arts and design convey meaning (Evaluating)
CO6 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, Digital tablet, 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

General Elective Course - 1

MCPC0135: PROFESSIONAL COMMUNICATION (5-1-0)

COURSE OUTCOMES

CO1 Define the meaning and concept of communication (Remembering)
CO2 Demonstrate a holistic understanding of the principles of professional communication (Understanding)
CO3 Demonstrate presentation skills using a range of materials including text, visual, sounds and technology (Understanding)
CO4 Develop professional writing skills in business letters, email, press release, articles (Applying)

CO5 Explain the nature and importance of body language and listening skills in acts of communicative intention (Evaluating)
CO6 Build the essential skills to effectively work in various professional contexts (Creating)

Module 1: Theories & Language of Communication (20 Lectures)

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 (20 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 (15 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 (15 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			
CO 3		H			H
CO 4				H	H
CO 5		H	H	H	H

General Elective Course - 2

MCBJ0136: BASICS OF COMMUNICATION AND JOURNALISM (5-1-0)

COURSE OUTCOMES

CO1 Define the concept, meaning and functions of communication and news (Remembering)
CO2 Classify different types of news media (Understanding)
CO3 Apply the concepts and techniques of journalism in news reporting (Applying)
CO4 Analyse ethical issues in journalism (Analysing)
CO5 Explain the roles and responsibilities of media persons (Evaluating)
CO6 Elaborate, produce and edit new stories (Creating)

Module 1: Introduction to Communication (20 Lectures)

Definition of Communication, nature and process of human communication, functions of communication, Forms of Communication, Levels of Communication, Mass Communication and its Process, Normative Theories of the Press, Media and the Public Sphere.

Module 2: Understanding News (20 Lectures)

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 Lectures)

Organising a news story, 5W's and 1H, Inverted pyramid, Criteria for newsworthiness, principles of news selection, use of archives, sources of news, use of internet, Language and principles of writing: Robert Gunning: Principles of clear writing, Rudolf Flesch formula- skills to write news, Basic differences between the print, electronic and online journalism, data and investigative journalism, citizen journalism.

Module 4: Role of Media in a Democracy (15 Lectures)

Responsibility to Society, Press and Democracy, Contemporary debates and issues relating to media, media ethics.

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	

Core Course - 1

MCMC0137: INTRODUCTION TO MEDIA AND COMMUNICATION (5-1-0)

COURSE OUTCOMES

CO1 Define the basic terms related to Communication (Remembering)
CO2 Classify different types & models communication (Understanding)
CO3 Analysis of the communication and its effect (Evaluating)
CO4 Analyse the emerging trends in communication industry (Analyse)
CO5 Apply theories and models in communication planning (Creating)

Module 1: Media and Everyday Life (12 Lectures)

Television, Print, Radio, Advertisement, Digital media, The internet – discussion around media and everyday life, Discussions around mediated and non-mediated communication.

Module 2: Communication and Mass Communication (13 Lectures)

Forms of communication, Levels of communication, Mass communication and its process, Normative theories of the Press, Media and the public sphere.

Module 3: Mass Communication and Effects Paradigm (20 Lectures)

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, Critique of the effect's paradigm and emergence of alternative paradigm.

Module 4: Four Models of Communication (15 Lectures)

Transmission models, Ritual or Expressive models, Publicity model, Reception model.

Module 5: Suggestive Student Projects/Presentations (30 Lectures)

Presentations on everyday engagement with the media environment. Presentations on the forms and stages of communication in the contemporary context and its relevance in the current media ecology.

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	Module 5
CO1	M	M			
CO2		H			
CO3			H	H	
CO4	M	M			
CO5			H	H	H

MCTP6015: TECHNIQUES OF PHOTOGRAPHY AND IMAGE EDITING (0-0-2)

COURSE OUTCOMES

CO1 Show working knowledge of digital SLR cameras (Remembering)
CO2 Demonstrate an understanding of composition and image design process (Understanding)
CO3 Apply image editing and output techniques (Applying)
CO4 Analyse and critique one's own artistic output (Analysing)
CO5 Determine safe and responsible work practices (Evaluating)
CO6 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

CO1 Demonstrate the ability to explore different options for handling daily experiences (Understanding)
CO2 Develop self-awareness, self-learning and communication skills (Applying)
CO3 Apply contextual and experiential learning in their everyday lives (Applying)
CO4 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, Number 1, 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 State University 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 Press Pvt. 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

CO1 Show awareness of safe and responsible work practices (Remembering)
CO2 Demonstrate an understanding of the audio-video production process (Understanding)
CO3 Experiment with different types of audio and video production tools (Applying)
CO4 Develop competency in editing and output techniques (Creating)
CO5 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.

Core Course - 5

MCGD6103: GRAPHIC DESIGN (0-0-2)

COURSE OBJECTIVES

1. Gain skills in the development of print and on-line publications (Remembering)
2. Demonstrate competency in image editing (Understanding)
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

Core Course - 5

MCIB0141 INTRODUCTION TO BROADCAST MEDIA (4-0-0)

COURSE OUTCOMES

CO1 Define the meaning and concept of broadcast media (Remembering)
CO2 Understand the principles and techniques of broadcast media (Understanding)
CO3 Demonstrate competency in shooting and editing video (Applying)
CO4 Critique the issues and debates in news broadcasting and production (Analysing)
CO5 Produce content for broadcast media (Creating)

Module 1: Basics of Visual Images (10 Lectures)

What is an image, electronic image, television image - Digital image, Edited Image (politics of an image) What is a visual? (Still to moving) - Visual Culture - Changing ecology of images today - 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 Design- Its Meaning with examples from different forms - 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- Basic Soft-wares and Techniques.

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

MCTP0142 TELEVISION PRODUCTION (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, Short films and documentaries.

Core course - 6

MCNM0143 INTRODUCTION TO NEW MEDIA (5-1-0)

COURSE OUTCOMES

CO1 Define new media (Remembering)
CO2 Understanding the concept and meaning of new media (Understanding)
CO3 Analyse the emerging trends in the new media (Analysing)
CO4 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)

Linear and Non-linear writing, Contextualized Journalism, Writing Techniques, Linking, Multimedia, Storytelling structures, 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

Core Course - 7

MCSC0144 MEDIA, CULTURE AND SOCIETY (5-1-0)

COURSE OUTCOMES

CO1 Define the key terms related to media, culture and society (Remembering)
CO2 Understand the linkage between media, culture and society (Understanding)
CO3 Analyse the ways in which media, culture and society influence each other (Analysing)
CO4 Critique the ideological structures in society and their propagation by the media (Evaluating)

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 (15 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	M	H	M	H	H
CO4	M	H	H	M	M
CO5					

Skill Enhancement Course (SEC) - 1

MCRP6104 RADIO PRODUCTION (0-0-2)

COURSE OUTCOMES

CO1 Understand the skills and techniques of radio production (Understanding)
CO2 Identify the radio technologies for audio recording and broadcasting (Applying)
CO3 Discover the skills required for developing content for radio (Analysing)
CO4 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

Skill Enhancement Course (SEC) - 1

MCIC0145 INTRODUCTION TO COMPUTER APPLICATIONS (0-0-2)

COURSE OUTCOMES

CO1 Demonstrate an understanding on Computer operating system and different software (Understanding)
CO2 Use Computer applications and Internet efficiently (Applying)

CO3 Excel in creating and editing on word documents, spreadsheets and point presentation (Creating)

Module 1: Word Processing Software (8 lectures)

Getting Started with Microsoft Office, creating, editing, saving and printing text documents, Fonts and paragraph formatting, simple character formatting, inserting tables, smart art, page breaks, using lists and styles, working with images, using spelling and Grammar check, understanding document properties.

Module 2: Spreadsheet (8 lectures)

Spreadsheet basics, creating, editing, saving and printing spreadsheets, working with functions & formulas, modifying worksheets with colour & auto formats, graphically representing data: Charts & Graphs, speeding data entry: using data forms, analysing data: data Menu, subtotal, filtering data, formatting worksheets, securing & Protecting spreadsheets.

Module 3: Presentation software (8 lectures)

Opening, viewing, creating, and printing slides, applying auto layouts, adding custom animation, using slide transitions, graphically representing data: Charts and Graphs, creating professional slides for presentation.

Module 4: Internet and the World Wide Web (8 lectures)

Understanding search engines, types of websites, understanding E-mails, VPN, Bookmarking and going to a specific website, Search engine extensions, adding hypertext in word file and emails, understanding user-generated content, understanding social media platforms.

Suggested Readings:

1) Excel Formulas and Functions for Dummies, Ken Bluttman and Peter G. Aitken, 2010, John Wiley & Sons publications
2) Excel 2019 Bible, John Walkenbach, Michael Alexander and Richard Kusleika, Wiley Publications
3) Internet Effectively: A Beginner's Guide to the World Wide Web Paperback, Tyrone Adams Sharon Scollard, 2005, Pearson Publications
4) Microsoft Office 2019 Step by Step, Curtis Frye and Joan Preppernau, Microsoft Press
5) Office 2019 All-in-One for Dummies, Peter Weverka, 2018,
6) PowerPoint 2019 For Dummies, Doug Lowe, 30 November 2018, For Dummies publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	H
CO2			L	H
CO3	H	H	H	
CO4				

Generic Elective - III

MCBP0139 BASICS OF PHOTOGRAPHY (4-0-0)

COURSE OUTCOMES

CO1 Demonstrate an understanding of composition and image design process (Understanding)
CO2 Show working knowledge of digital SLR cameras (Applying)
CO3 Analyse and critique one's own artistic output (Analysing)
CO4 Determine safe and responsible work practices (Evaluating)
CO5 Plan ways to promote one's work on the internet (Creating)

Module 1: Digital Camera Basics (15 lectures)

Camera Principles, Working of DSLR camera, Essential components of DSLR camera, Digital Image sensor, Basic features of DSLR camera – aperture; shutter speed; ISO, Exposure meter, Shooting modes.

Module 2: Photographic Lens (10 lectures)

Basic components of camera lens – lens barrel; lens elements; bayonet; zoom ring; focus ring; aperture blades, Types of

lenses, Focal length, Angle of view, Depth of field, Lens filters, Lens accessories.

Module 3: Photographic Composition (15 lectures)

Elements of composition – lines; shape; texture; pattern, arranging visual elements – foreground; background; middle-ground; rule of thirds; space, Understanding Perspective.

Module 4: Photographic Lighting (10 lectures)

Characteristics of light, Basic optics – wavelength and colour; shadows; reflection and refraction, Light sources, Relationship between light source and subject, Three-point lighting, White Balance, Basic lighting equipment.

Module 5: Digital Image Formats, Storage and Presentation (10 lectures)

Image capturing formats – RAW; JPEG; TIFF, Storage devices – SD card; CF card etc. Camera kits and accessories, getting one's work noticed – world wide web; building own website; getting connected; stock photography.

Suggested Readings:

1) Basics of Digital Images, Jonathan Sachs, 1996, Digital Light & Color, PDF.
2) Fundamentals of Photo Composition, Paul R. Comon, 2012, Sterling Publications.
3) Langford's Basic Photography, Michael Langford, Anna Fox and Richard Smith Sawdon, 2015, Focal Press
4) Mastering Digital Cameras, Al Judge, 2014, Createspace Independent Pub.
5) The DSLR Cinematography Guide, R. Kono, 2010, Creative Commons, e-book.
6) Understanding Exposure, Bryan Peterson, 2016, Amphoto Books.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1			H		
CO2	H	H			
CO3					H
CO4				H	
CO5					H

Generic Elective - III

MCPY0140 PHOTOGRAPHY (0-0-2)

Description

Students will acquire introductory skills and knowledge about the art of digital photography. Students will learn to comfortably handle DSLR cameras, understand the concepts of exposure triangle; and apply composition techniques from finding effective backgrounds to rule of the thirds. At the end of the course, students will prepare a photo portfolio which will be submitted as a requirement for the completion of the course.

Suggested Assignments

Street photography, Landscape photography, Studio portrait, Food photography, Product photography, Photo story. Students will maintain documentation for all the photo assignments during the semester.

Suggested Readings:

1) Basics of Digital Images, Jonathan Sachs, 1996, Digital Light & Color, PDF.
2) Fundamentals of Photo Composition, Paul R. Comon, 2012, Sterling Publications.
3) Langford's Basic Photography, Michael Langford, Anna Fox and Richard Smith Sawdon, 2015, Focal Press
4) Mastering Digital Cameras, Al Judge, 2014, Createspace Independent Pub.
5) The DSLR Cinematography Guide, R. Kono, 2010, Creative Commons, e-book.
6) Understanding Exposure, Bryan Peterson, 2016, Amphoto Books.

Core Course - 8

MCPR0146 ADVERTISING AND PUBLIC RELATIONS (5-1-0)

COURSE OUTCOMES

CO1 Trace the evolution of advertisement and public relations (Remembering)
CO2 Discuss the concept and tools of advertising and public relations (Understanding)
CO3 Apply the concepts, principles and tools of advertising and public relations (Applying)
CO4 Analyse the role and importance of advertising in society (Analysing)
CO5 Critique the different aspects of brand building and its importance for an organisation (Evaluating)
CO6 Develop and demonstrate strategic plans and planning methods in advertising and public relations (Creating)

Module 1: Introduction to Advertising (15 lectures)

Meaning and history Advertising, Functions, Role of Advertising in Marketing mix, PR), Advertising Theories and Models-AIDA model, DAGMAR Model, Maslow's Hierarchy Model, communication theories applied to advertising, Types of advertising and new trends, Economic, Cultural, Psychological and Social aspects of advertising, Ethical & Regulatory Aspects of Advertising-Apex Bodies in Advertising-AAAI, ASCI and their codes.

Module 2: Advertising through Print, electronic and online media (15 lectures)

Types of Media for advertising, Advertising Objectives, Segmentation, Positioning and Targeting, Media selection, Planning, Scheduling, Marketing Strategy and Research and Branding Advertising department vs. Agency-Structure, and Functions, Advertising Budget, Campaign Planning, Creation and Production.

Module 3: 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 4: PR-Publics and campaigns (15 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 5: Social Media Marketing (15 lectures)

Social Media Technologies and Management, Integrated Marketing Communication, Developing Social Networks, Social Media Strategies, Tactics and Ethics, Social Media Tools, Measurement Strategies and ROI.

Suggested Readings

1) Advertising Made Simple, 5th Edition, Frank Jefkins, 1992, Made Simple
2) Advertising Theory and Practice, S. A. Chunawalla, 2015, Himalaya Publishing House
3) Effective Public Relations and Media Strategy, 3rd Edition, Reddi C.V. N, 2013, PHI Learning Pvt Ltd
4) Facebook Advertising For Dummies 1st Edition, Paul Dunay, Richard Krueger, Joel Elad, 2010, Kindle Edition
5) Fundamentals of Digital Marketing, 2nd Edition, Puneet Bhatia, 2019, Pearson Education
6) Handbook of Public Relations, Heath Robert L, 2000, Sage Publications.
7) Ogilvy on Advertising, 1st Edition, David Ogilvy, 1985, RHUS
8) Ogilvy on Advertising in the Digital Age, Miles Young, 2018, Carlton Books
9) Public Relation Techniques, Jefkins Frank, 1994, Heinmann Ltd
10) Public Relations Strategies & Tactics, Wilcox, 2009, Pearson Education

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H		H		
CO2	H	H	H	H	
CO3		H		H	H
CO4					

CO5		H	H	H	
CO6		H	H	H	

Core Course - 9

MCDC0147 DEVELOPMENT COMMUNICATION (5-1-0)

COURSE OUTCOMES

CO1 Identify the linkages between development, media, and communication (Remembering)
CO2 Understand the concepts and theories of development and social change (Remembering)
CO3 Analyse the role of the media in socio-economic development and social change (Analyse)
CO4 Assess communication channels for development (Evaluating)
CO5 Create media programmes for development interventions (Creating)

Module 1: Development: Concept, Concerns, Paradigms (20 Lectures)

Concept of development Measurement of development, Development versus growth Human development, Development as freedom, Models of development, Basic Needs Model, Nehruvian model, Gandhian Model, Panchayati Raj, Developing countries versus developed countries, UN Millennium Development Goals.

Module 2: Development Communication (20 Lectures)

Concept and approaches, Paradigms of development, Dominant paradigm: dependency, alternative paradigm, Dev communication approaches – diffusion of innovation, empathy, magic multiplier, Alternative Dev communication approaches: Sustainable Development Participatory Development Inclusive Development, Gender and development, Development support communication– definition, genesis, area woods triangle, Social and Behaviour Change Communication (SBCC).

Module 3: Role of Media in Development (20 Lectures)

Mass Media as a tool for development, Role, performance record of each medium- print, radio, tv, video, traditional media, Role of development agencies and NGOs in development communication, Critical appraisal of dev communication programmes and govt. schemes: SITE, Krishi Darshan, Kheda, Jhabua, MNREGA; Cyber media and development: E-governance, e-chaupal, national knowledge network, ICT for dev narrowcasting, Development support communication in India in the areas of: agriculture, health & family welfare, population, women empowerment, poverty, unemployment, energy and environment, literacy, consumer awareness, Right to Information (RTI).

Module 4: Practising Development Communication (15 Lectures)

Strategies for designing messages for print, Community radio, Television programmes for rural India, New media technologies for development, Development Journalism and rural reporting in India, Information needs in rural areas; Use of traditional media for development in rural areas; Rural newspapers; Critical appraisal of mainstream media's reportage on rural problems and issues.

Suggested Readings:

1) Communication and Development - Critical Perspective, Everett M Rogers, 2000, Sage, New Delhi
2) Communication for Development in The Third World, 3rd Edition, Srinivas R. Melkote & H. Leslie Steeves, 2001, Sage Publications.
3) Development Journalism, What Next? D V R Murthy, 2007, Kanishka Publication, New Delhi.
4) Mass Media and Development Issues, Anil Kumar, 2007, Bharti Prakashan, Upadhyay Varanasi.
5) Mass Media and National Development- the role of information in developing countries, Wilbur Schramm, 1964, UNESCO/Stanford University Press
6) Panchayat System in India, Ghosh & Pramanik, 2007, Kanishka Publication, New Delhi.
7) Technology Communication Behaviour, C.A. Belmont, 2001, Wordsworth Publication, New Delhi.
8) UNDP: Human Development Report (published every year), Oxford University Press, New Delhi.
9) World Bank: World Development Report (published every year), Oxford University Press, New Delhi.

Mapping of COs to Syllabus

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

CO4				H
CO5				H

Core course – 10

MCLE0148 MEDIA LAWS AND ETHICS (5-1-0)

COURSE OUTCOMES

CO1 Discuss media laws and ethics in India and global context (Remembering)
CO2 List the salient features of the Indian Constitution in relation to the media (Understanding)
CO3 Demonstrate an understanding of the nature of ethics and morality in journalism (Applying)
CO4 Critique the ethical issues of the media (Analysing)

Module 1: Introduction to Indian Constitution (15 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 (15 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 (15 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					

Skill Enhancement Course (SEC) – II

MCNA6105 NEWS READING AND ANCHORING (0-0-2)

COURSE OUTCOMES

CO1 Identify the various skills necessary to be a professional news anchor (Remembering)
CO2 Understand the roles and responsibilities of a news presenter (Understanding)
CO3 Apply news reading and anchoring skills to develop programmes for cross-media platforms (Applying)
CO4 Articulate the art of anchoring, news reading and reporting (Analysing)
CO5 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
CO5		

Skill Enhancement Course (SEC) – 2

MCFM0149 FOLK MEDIA (0-0-2)

COURSE OUTCOMES

CO1 Identify the major forms of folk media in India (Remembering)
CO2 Explain the role of folk media as an alternative media (Understanding)
CO3 Discover the skills required for performing street play and puppetry (Analysing)
CO4 Critique the role of folk media in fostering social change (Evaluating)
CO5 Plan and organise folk media performance for varied audiences (Creating)

Module 1: Meaning and Nature of Folk Media (12 lectures)

Definition; nature and types of folk media, Strengths and Advantages, Challenges faced by folk media, Major forms of folk media in India, Difference Between folk media and electronic media, Status of folk media in India today, Participatory communication and folk media, Folk media and its role in social change; Uses in different fields – DFP, Song and Drama Division, NGOs, Social Action Groups.

Module 2: Folk Media of Northeast India (8 lectures)

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 3: Street Play and Puppetry (10 hours)

Influence of folk theatre on street theatre, Role of street theatre in the Indian freedom struggle, Street theatre as agitational propaganda and social education, Origin of puppets, Traditional and contemporary forms of puppets, Window on the world puppets, Use of puppets – entertainment; education; social education.

Suggested Assignments:

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) Assam, Its Heritage and Culture, Chandra Bhushan, Kalpaz Publications.
2) Folk Culture of Assam: A Brief History of Ancient Assam, Julfikar Hussain, 2019, Notion Press.
3) Folk and Folklore of Assam, Julfikar Hussain, 2020, Notion Press.
4) Folk Media and Political Movement: A Case Study on the Bodos of North East India, Dr Faguna Barmahalia, August 2018, Volume 5, Issue 8, www.jetri.org,
5) Examining the Role of Traditional Folk Media in Rural Development, Coleman Essien, 2017, LAP LAMBERT Academic Publishing
6) Puppets in India and Abroad, Sampa Ghosh and Utpal K. Banerjee, 2014, National Book Trust.
7) Role of Traditional Folk Arts as Media of Mass Communication, Sathish Kumar, 2013, Lambert Academic Publishing.
8) Traditional Folk Media in India, Shyam Parmar, 1975, Gekha Books.
9) Traditional Folk Media In India : Practice & Relevance, 1st Edition, Raghavendra Mishra, 2016, Bharati Prakashan

Mapping of COs to Syllabus

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

CO5			H

Core Course – 11

MCIR0150 INTRODUCTION TO RESEARCH (5-1-0)

COURSE OUTCOMES

CO1 Define the meaning of communication research (Remembering)
CO2 Understand the methods of communication research (Understanding)
CO3 Apply the methods of media research (Applying)
CO4 Assess the needs for communication in various fields (Assessing)
CO5 Assess and appraise relevant literature (Evaluating)
CO6 Design and conduct communication research projects (Creating)

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 (20 Lectures)

Understanding media and communication research, Qualitative-Quantitative Technique, Content Analysis, Survey Method, Observation Methods, Experimental Studies, Case Studies, Historical Research, Ethnography, Netnography.

Module 3: Sampling Techniques (20 Lectures)

Sampling Methods, Sampling Error, Tools of data collection: Primary and Secondary Data-Questionnaire, Focus Groups, Telephone, Surveys, Online Polls, Published work.

Module 4: Data Analysis and Report Writing (20 Lectures)

Data Analysis Techniques; Coding and Tabulation, Non-Statistical Methods (Descriptive and Historical) Working with Archives; Library Research; Working with Internet as a source; Writing Citations, Bibliography Writing the research report, Readership and Audience Surveys, Various scaling techniques, textual analysis, discourse analysis, Ethical perspectives of mass media research.

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
6) Research Methods: The Basics, Nicholas Walliman, 2011, Routledge
7) Qualitative Inquiry and Research Design: Choosing among Five Traditions, John W. Crewell, 1997, Sage Publications
8) Writing your thesis, Paul Oliver, 2008, Sage Publications

Mapping of COs to Syllabus

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

Core Course - 12

MCAB0151 ADVANCED BROADCAST MEDIA (5-1-0)

COURSE OUTCOMES

CO1 Demonstrate an understanding on different broadcast formats (Understanding)
CO2 Apply the techniques of programme production for broadcast media (Applying)
CO3 Analyse the emerging trends in broadcast media (Analysing)
CO4 Create television programmes by mixing genres (Creating)

Module 1: Broadcast Genres (15 lectures)

Why am I the 'Idiot Box'? – Debates; issues and concerns of the television genre, Various evolving contemporary television genres – Drama; soap opera; comedy; reality television; children's television, animation; prime time and day time.

Module 2: Public Service Broadcasting (20 lectures)

Public service model in India - policy and laws, Global overview of public service broadcasting, Community radio, Community video, Participatory communication, Campus radio.

Module 3: Private Broadcasting (20 lectures)

Private broadcasting model in India - policy and laws, Structure; functions and working of a broadcast channel, Public and Private partnership in television and radio programming (India and Britain case studies).

Module 4: Advanced Broadcast Production (20 lectures)

Writing and producing for radio, Public Service Advertisements, Jingles, Radio Magazine shows, mixing genres in television production – Music Video for social comment/as documentary, Mixing ENG and EFP, Reconstruction in News based programming.

Suggestive Projects:

- Script writing
- Presentation of experimental genre in Radio/TV
- Presentation about PSBT and such organizations.
- Script on Music Presentation
- Presentation of Commercial Channel functions.
- Presentation on global broadcasting models & Indian Broadcasting Models

Suggested Readings:

1) Advanced Broadcast Media Technologies Market Developments and Impacts in the 90's and beyond, Marcia L. De Sonne, 1992, Lawrence Erlbaum Assoc Inc.

2) Broadcast News: Writing Reporting & Producing, Ted White and Frank Barnas, 2012, Focal Press

3) Other Voices: The Struggle for Community Radio in India, Vinod Pavarala, Kanchan K Malik, 2007, Sage Publications.

4) Radio in New Avatar: AM to FM, Dr. Ambrish Saxena, 2011, Kanishka Publisher.

5) Radio Production, Robert McLeish, 2015, Taylor & Francis.

6) The Television Genre Book, Glen Creeber, 2015, Palgrave Macmillan.

7) Television Production Handbook, Herbert Zettl, 2010, Wadsworth Publishing Co Inc.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4

CO1	H			
CO2				
CO3			M	H
CO4	H			H

Group – I: Discipline Specific Elective (DSE)

MCME0152 MEDIA MANAGEMENT AND ENTREPRENEURSHIP (5-1-0)

COURSE OBJECTIVES:

CO1 Identify the various principles of media management (Remembering)
CO2 Understand the concept of media management and entrepreneurship (Understanding)
CO3 Apply the knowledge and principles of media management (Applying)
CO4 Evaluate the scenario of media entrepreneurship (Analysing)

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
CO3	H			

CO4				H

Group – I: Discipline Specific Elective (DSE)

MCPH0153 ART AND PRACTICE OF DIGITAL PHOTOGRAPHY (4-0-0)

COURSE OUTCOMES

CO1 Show working knowledge of digital SLR cameras (Remembering)
CO2 Demonstrate an understanding of composition and image design process (Understand)
CO3 Analyse and critique one's own artistic output (Analysing)
CO4 Determine safe and responsible work practices (Evaluating)
CO5 Develop photography portfolio and projects (Creating)

Module 1: History of Photography (10 lectures)

Origin of photography – pinhole camera and camera obscura, early technological advancement, Pioneers of photography, George Eastman and Kodak, Evolution of camera – from film to digital era.

Module 2: Digital Camera and Photography Lens (15 lectures)

Human eye and camera, Essential components of digital camera, Digital camera sensors, Digital image capture and file formats, Exposure triangle, Exposure meter, Camera kits and accessories, Components of camera lens, Types of lenses, Lens aberration, Focal length, Angle of view, Depth of field, Lens filters, Lens accessories.

Module 3: Photographic Lighting (15 lectures)

Lighting basics – nature of light; properties of light (direction, intensity, colour); wavelength and colour; reflection and refraction, Outdoor lighting, Studio lighting, Three-point lighting, Lighting ratio, soft light, hard light, Portrait lighting – split lighting; rembrandt lighting, butterfly lighting, loop lighting, Lighting accessories.

Module 4: Photographic Composition (10 lectures)

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 5: Digital Image: Post-production and Presentation (10 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) Fundamentals of Photo Composition, Paul R. Comon, 2012, Sterling Publications
2) Langford's Basic Photography, Michael Langford, Anna Fox and Richard Smith Sawdon, 2015, Focal Press
3) Mastering Digital Cameras, Al Judge, 2014, Createspace Independent Pub
4) Photography, Barbara London, John Upton, 2013, Pearson
5) Photography: A Very Short Introduction, Steve Edwards, 2006, Oxford University Press.
6) The Advanced Digital Photographer's Handbook, Yvonee V. Butler, 2005, Focal Press.
7) Understanding Exposure, Bryan Peterson, 2016, Amphoto Books.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1		H	H		

CO2			H	H	
CO3					H
CO4			H		
CO5					H

MCPH6106 PHOTOGRAPHY (0-0-2)

Description

Students will acquire skills and knowledge about the art of digital photography. Using a combination of lecture, demonstration, and hands-on exercises, this course will explore the basic photographic techniques and artistic concerns involved in making photographs. These include camera handling, composition, effective use of light, file management, digital image manipulation and developing a photographic vision. At the end of the course, students will create a portfolio of unique photographs which will be submitted as a requirement for the completion of the course.

Suggested Assignments:

Nature Photography, Street Photography, Portrait Photography, Fashion Photography, Food photography, Photo story production in groups of three, Maintain individual photography portfolio.

Suggested Readings:

1) Basics of Digital Images, Jonathan Sachs, 1996, Digital Light & Color, PDF
2) Fundamentals of Photo Composition, Paul R. Comon, 2012, Sterling Publications
3) Langford's Basic Photography, Michael Langford, Anna Fox and Richard Smith Sawdon, 2015, Focal Press
4) Mastering Digital Cameras, Al Judge, 2014, Createspace Independent Pub
5) The DSLR Cinematography Guide, R. Kono, 2010, Creative Commons, e-book
6) Understanding Exposure, Bryan Peterson, 2016, Amphoto Books

Group – II: Discipline Specific Elective (DSE)

MCDM0154 COMMUNICATION AND DISASTER MANAGEMENT (5-1-0)

COURSE OBJECTIVES

CO1 Understand approaches of disaster management (Understanding)
CO2 Analyse media's role in disaster management (Analysing)
CO3 Design disaster communication (Applying)
CO4 Produce media contents on disasters and disaster prevention (Creating)

Module 1: Introduction to Disaster Management (25 Lectures)

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 Lectures)

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 Lectures)

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
CO3		H	
CO4			H

Group-II: Discipline Specific Elective (DSE)

MCVF0155 INTRODUCTION TO ANIMATION AND VFX (4-0-0)

COURSE OUTCOMES

CO1 Identify the tools and techniques for animation and VFX (Remembering)
CO2 Understand and apply various techniques of animation and VFX (Understanding)
CO3 Demonstrate progress in basic animation and VFX skills (Evaluating)
CO4 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.

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

MCVF6107 ANIMATION AND VFX (0-0-2)

Description

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.

- Design and create a short 2D Animation with sound
- Design and create a short 3D Animation with sound using After Effects

Project Evaluation Criteria

- Evaluation of the final project: 70%
- Viva-voce: 30%

Last date of project submission

- To be notified by the department
- Portfolio Submission and Presentation: To be notified by the department

MCIN6108 INTERNSHIP

(Non-credited Compulsory Course)

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

Core Course - 13

NCGM0156 GLOBAL MEDIA AND POLITICS (5-1-0)

COURSE OUTCOMES

CO1 Identify the inter-relation between local, global, international and intercultural issues and trends (Remembering)
CO2 Understand the relationship between media and political actors (Understanding)
CO3 Demonstrate understanding of the role and the position of media institutions in the wider context of socio-political relations and conflict (Applying)
CO4 Critically evaluate media-related issues to contemporary debates in global politics (Analysing)
CO5 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

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			H
CO3			H		
CO4				H	H
CO5				M	M

Core Course - 14

MCIF0157 INTRODUCTION TO FILM STUDIES (4-0-0)

COURSE OUTCOMES

CO1 Identify the historical background of moving images (Remembering)
CO2 Discuss the major film movements (Understanding)
CO3 Interpret the role of cinema in popular culture (Applying)
CO4 Critique cinema from around the world (Analysing)

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.

Module 4: Film and Popular Culture (15 lectures)

Melodrama, Stardom, Film Authorship with a special focus on Satyajit Ray/Akira Kurosawa, Introduction to feminist film theory.

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			

MCDP6109 DOCUMENTARY PRODUCTION (0-0-2)

COURSE OUTCOMES

CO1 Discuss the types of documentaries and production techniques (Remembering)
CO2 Understand ethical issues related to documentary production (Understanding)
CO3 Reflect upon and analyse the documentary form (Analysing)
CO4 Critically evaluate documentary forms and production techniques (Evaluating)
CO5 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

1) 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:

2) A New History of Documentary Film, Jack EC Ellis, 2005, Continuum Intl Pub Group,
3) "Documentary" in Geoffrey Nowell Smith ed The Oxford History of World Cinema, Charles Musser, 1996, Oxford University Press
4) Directing the Documentary, Michal Rabigerl, 2004, Focal Press
5) How to Write a Documentary Double Take by PSBT, Trisha Das
6) Indian Film, Erik Barnow and Krishnaswamy, 1980, Oxford University Press
7) The Open Frame Reader: Unreeling the documentary Film Ed. by PSBT, Rajiv Mehrotra, 2006, Rupa Publications
8) 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
9) The Techniques of Documentary Film Production, W.Hugh Badley, 1969, Focal Press,
10) 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

Group-III: Discipline Specific Elective (DSE)

MCNE0158 MEDIA IN NORTHEAST INDIA (5-1-0)

COURSE OBJECTIVES

CO1 Describe the important socio-political and development realities of Northeast India (Remembering)
CO2 Trace the growth of media organisations in Northeast India (Understanding)
CO3 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, Significant 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, Noted Journalist 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, Future 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

Group-III: Discipline Specific Elective (DSE)

MCHR0159 HUMAN RIGHTS AND CONFLICT REPORTING (5-1-0)

COURSE OUTCOMES

CO1 Examine the theoretical, methodical and critical analysis of the relationship between media and conflicts (Remembering)

CO2 Develop skills and attitudes to empower people with principles of human rights (Understanding)
CO3 Analyse the role of media, communication and information in the discipline of human rights (Analysing)
CO4 Create awareness on issues of human rights violations (Creating)

Module 1: Introduction to Human Rights (20 Lectures)

Meaning, nature and development of human rights, right to life, equality, civil rights, political rights, cultural rights & economic rights, UN charter and UDHR, specific Articles of the Universal Declaration of Human Rights, Organisations working on Human Rights issues – national and global, Red Cross, Amnesty, Human rights watch.

Module 2: Issues and Challenges of Human Rights (15 Lectures)

Rights of women and children, Developmental rights and rights of indigenous people, social and political movement, Ethnic conflict, Armed conflicts and human Rights violation in North-eastern region, case studies.

Module 3: Approaches to Understanding Conflict and Conflict Management (20 Lectures)

The context of defining conflict, Nature and types of conflicts, Conflict situation, Root causes of conflict, Conflict theories, Conflict management, Conflict transformation, Third party Mediation, Gandhian approach to conflict resolution, Case studies

Module 4: Human Rights and Conflict Reporting (20 Lectures)

Understanding conflict reporting, media in conflict situation, Journalist's survival guide, physical safety, Legal safeguards, reporting on victims of conflict: women, children, Trauma reporting, Reporting Human Rights violations, genocide and crimes against humanity, Understanding the nuances: ignoring, silencing or misrepresenting human rights issues around the world, Conflict Reporting in North-eastern India, ethical issues in conflict reporting, case studies.

Suggested Readings:

1) Conflict Theory and the Conflict in Northern Ireland, Cunningham Jr William G.
2) Gandhi's way: A Handbook of Conflict Resolution, Juergensmeyer Mark, 2005, University of California Press
3) Peace by Peaceful Means, International Peace Research Institute, Galtung Johan, 1996, Oslo
4) Peace-Building: Theoretical and Concrete perspectives, Gawerc Michelle I, 2006, Peace & Change Wiley online library
5) Peace Journalism, Jake Lynch and Annabel McGoldrick, 2005, Hawthorn Press, Stroud
6) Press in Assam - Origin and Development, Sunil Pawan Baruah, 1999, Published by Shri K.N Dutta Baruah
7) Reporting Human Rights (Global Crisis and the Media Book 20), 1st Edition, Susana Sampaio - Dias, 2016, International Academic Publishers
8) The mediation process practical strategies for resolving Conflict, Moore Christopher (1998-2005), Research Consortium Book Summary

Mapping of COs to Syllabus

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

Group -IV: Discipline Specific Elective (DSE)

MCMP6110 MEDIA PROJECT (0-0-6)

Project Description

Students will create a video production project which will be an application of the skills gained by them during the duration of their study. As part of the project work students will apply their theoretical knowledge and understanding in the practical realm and work together in a group. The video production project can be in a fictional format, documentary format or animated format. The subject, topic, content of the project will be of 20 minutes duration. After approval of the idea from the teacher in- charge and the script selection committee, students will execute the project within the given time frame. Students should have

sponsors for their project which shall cover some percentage of their approved budget. The video production project will be publicly screened in the university followed by discussion with the groups.

The final evaluation will be on the basis of the following criteria:

a) Video Production Project – 50%
b) Screening and Discussion – 20%
c) Viva-Voce – 20%
d) Pre-screening Publicity and Marketing – 10%

Project Submission Date: To be notified by the department

Screening Date: To be notified by the department

Viva-voce: To be notified by the department

Group -IV: Discipline Specific Elective (DSE)

DISSERTATION (0-0-6)

Dissertation Description

As part of the course students will undertake a research study in the field of media and communication. Students will complete data collection, analysis, 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.

Suggested Readings

1) Methodology of Research in Social Sciences, O.R. Krishnaswamy and M. Ranganatham, 2016, Himalaya Publishing House
2) Mass Media Research: An Introduction, Roger D. Wimmer and Dominick R. Joseph, 2005, Wadsworth Publishing Co. Inc
3) Research Methodology: Methods and Techniques, 4th Edition C.R. Kothari and Gaurav Garg, 2019, New Age International Publishers
4) Research Methods in Mass Communication, III Stempel, Guido H. and Bruce H. Westley, 1988, Prentice-Hall
5) Writing Your Thesis, Paul Oliver, 2014, Sage Publications, New Delhi
6) Writing Successful Reports and Dissertations (Student Success) 1st Edition, Lucinda Becker, 2014, Sage Publications

MCML0037 MEDIA LAWS, ETHICS AND SOCIAL RESPONSIBILITY (3-0-0)

COURSE OUTCOMES

CO1 Define the salient features of media laws and ethics (Remembering)
CO2 Explain the essential features of the Indian Constitution in the context of press freedom (Understanding)
CO3 Examine the purpose and role of media professionals in society (Applying)
CO4 Analyse the legal issues pertaining to the media (Analysing)
CO5 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

	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

CO1 Define the key terms related to advertising, public relations and corporate communication (Remembering)
CO2 Explain the different models and approaches of advertising, public relations and corporate communication (Understanding)
CO3 Develop public relations and corporate communication strategies for public & private enterprises (Applying)

CO4 Plan and execute ethically sound and socially responsible advertising strategies and public relations campaigns (Evaluating)
CO5 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, Amanda Coleman, 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

	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H	H	H
CO3		H	H
CO4	H	H	
CO5			H

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 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.

Suggested Readings:

1) Research Methodology: Methods and Techniques, 4th Edition C.R. Kothari and Gaurav Garg, 2019, New Age International Publishers
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

MCAV0039 AUDIO-VIDEO EDITING (3-0-0)

COURSE OUTCOMES

CO1 Identify the importance of Sound and Sound SFX (Remembering)
CO2 Understand the techniques of audio recording and editing (Understanding)
CO3 Execute video and audio tracks with effects (Applying)
CO4 Differentiate between the different techniques of Video Editing (Evaluate)
CO5 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

	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

CO1 Identify different genres of television production (Remember)
CO2 Understand the intricacies and nuances of screenwriting (Understanding)
CO3 Distinguish various equipment and tools required for television and video production (Analyse)
CO4 Assess the importance of cinematography in television and video production (Evaluate)
CO5 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

	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:

CO1 Define the key terms related to sound (Remembering)
CO2 Explain the basic principles of sound production (Understanding)
CO3 Develop sound recording skills for visual media (Applying)
CO4 Distinguish between analogue sound and digital sound (Analysing)
CO5 Assess the acoustic quality of a room for sound production (Evaluating)
CO6 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

	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:

CO1 Define the key terms in political communication (Remembering)
CO2 Understand the different techniques of political communication (Understanding)
CO3 Critically analyse the relationship between media and politics (Analysing)
CO4 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, Pantheon Books
6) A Virtuous Circle: Political Communications in Post industrialist Societies, Pippa Norris, 2000, Cambridge University Press.

Mapping of COs to Syllabus

	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

CO1 Define the meaning and concept of news reporting and editing (Remembering)
CO2 Understand the organisational structure of a newsroom (Understanding)
CO3 Develop editing skills for the print media (Applying)
CO4 Differentiate between news reporting and editing (Analysing)
CO5 Assess the quality of an editor in publishing a newspaper (Evaluating)
CO6 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.

Module4: 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

	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

CO1 Define the key terms in health and environment communication (Remembering)
CO2 Explain different models and approaches of health and environment communication (Understanding)
CO3 Develop communication strategy for public health and environment protection (Applying)
CO4 Examine the role of media in social change (Analysing)
CO5 Assess the situation for communication intervention (Evaluating)
CO6 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

	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

CO1 Understand the meaning and concept of project proposal writing (Understand)
CO2 Identify the principles and approaches of programme management (Analyse)
CO3 Undertake critical review of C4D projects (Evaluate)
CO4 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

	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

CO1 List the basic models and steps of communication strategy planning (Remembering)
CO2 Understand the techniques of development communication planning (Understanding)
CO3 Assess the situation for development communication and intervention (Evaluating)
CO4 Examine the role of media in socio-economic development and social change (Analysing)
CO5 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 and Shirley a White, 1996, Sage Publications
7) Participatory Video: Images that Transform and Empower, A Shirley White, 2003, Sage India

Mapping of COs to Syllabus

	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

CO1 Identify the steps in communication strategy development (Remembering)
CO2 Explain the basic principles and development planning models (Understanding)
CO3 Analyse the relevance of theoretical frameworks of communication for development (Analyse)
CO4 Critically analyse the key components of communication strategies (Evaluate)

CO5 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

	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

CO1 Describe the key concepts of cultural and media studies (Remembering)
CO2 Understand the cultural dynamics of society with the help of contemporary theory (Understanding)
CO3 Examine the role of media in mediation of social identity (Analysing)
CO4 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

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

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

MCFA0049 FILM APPRECIATION (3-0-1)

COURSE OUTCOMES

CO1 Trace the origin and growth of cinema (Remembering)
CO2 Explain film structure and film language (Understanding)
CO3 Differentiate story, plot and subplot (Understanding)
CO4 Analyse cinema critically (Analysing)
CO5 Critique various film theories (Evaluating)
CO6 Develop skills to write film reviews and criticism (Creating)

Module 1: Growth and Development of Cinema (15 Lectures)

Origin and evolution of film - Meaning of cinema, Cinema and society, National and International perspective on cinema, Origin and evolution of film, Thomas Alva Edison, Lumiere Brothers, George Melies, Edwin S. Porter, D.W. Griffith.
Global history of cinema **-** Beginning of cinema in America and Europe, Emerging of Hollywood studios, Growth of cinema in Japan and Latin America, Alternative cinema.
History of Indian cinema **-** Beginning of cinema in India, Hindi cinema, regional cinema, Parallel film movements, Crossover cinema.
History of cinema in Northeast **-** Status of cinema in different states of Northeast, Cinema in Assam, Cinema in Manipur.

Module 2: Film Language, Structure and Narrative (15 Lectures)

Film Structure – Form and content of film, Structure: camera movement, lighting, editing, acting, sound, Computer Generated Imagery (CGI), Special effects.
Film Language - Semiotic theory of cinema, signs, symbols, codes, iconography, Mise- en-scene, Montage, Connotative and Denotative meanings.

Film Narrative - Fictional and non-fictional narrative, Significance and structural elements of narrative, Story and plot, Sub-plots, Deviant plot structure, Principles of plot construction.

Module 3: Film Movements, Theories and Genre (15 Lectures)

Film Movements **–** Soviet formalism, Avant garde, German expressionism, Italian neorealism, French new wave, Indian new wave.
Film Theories **–** Auteur theory, Psychoanalytic model, Feminist model, Cognitive model, Ideological model

Film Genre **–** Meaning and functions, Film genre and their characteristics, Classical Hollywood genre, Indian formula films.

Module 4: Technology and Film Criticism (15 Lectures)

Film and technology – Digital technology and cinema, YouTube
Film Criticism – Aesthetics of film, Writing film review and criticism, Film as art, Film Analysis, Textual and contextual analysis of films.

Suggested Readings:

1) Gokulsing, K. Moti & Dissanayake. *Handbook of Indian Cinemas* (Routledge, 2018)

2) Hill, John & Gibson, Pamela Church. *Film Studies* (Oxford Univ. Press, 2000).

3) Ray, Satyajit. *Our Films Their Films* (Orient Publishers, 1993).
4) Roberts, Graham & Wallis, Heather. *Introducing Film* (Arnold Publishers, 2003).

5) Stam, Robert. *Film Theory: An Introduction* (Blackwell Publishers, 2000).
6) Saran, Renu. *History of Indian Cinema* (Diamond Books).

Mapping of COs to Syllabus

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

MCFP6021 FINAL PROJECT

(5 Credits – 90 hours)

Project Description

Each student is required to produce a short film (documentary or fictional) during the 4th semester under the supervision of a faculty of the department. The students have to present a proposal on the short film production for the approval of the department. The approved proposal must be executed in the prescribed time by the department. This project will also be graded on creativity and technical skills – lighting, shooting, audio and editing.

Narrative Paperwork due before shooting:

1. Synopsis
2. Montage Outline
3. Treatment and Storyboard
4. Script
5. Full Production Plan/Schedule, Script Breakdown & Shot List and Location wise breakdown

Project Evaluation Criteria:

- Publicity – 10%
- Viva-Voce – 10%
- Paperwork – 20%
- Final Project – 60%

Last date of project submission: To be notified by the department

Film Screening: To be notified by the department

MCBJ0050 BUSINESS JOURNALISM (3-0-0)

COURSE OBJECTIVES

CO1 Describe the key terms related to business and finance (Remembering)
CO2 Understand different forms of business journalism (Understanding)
CO3 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, Business Line.
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, Terri Thomson, 2000

Mapping of COs to Syllabus

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

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

MCPM0051 PROJECT MONITORING AND EVALUATION (3-0-1)

COURSE OUTCOMES

CO1 Identify the data-gathering techniques of communication projects (Remembering)
CO2 Describe the project monitoring and evaluation processes (Understand)
CO3 Undertake critical analysis of evaluation data (Analyse)
CO4 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

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

CO4	H		H

MCFP6021 FINAL PROJECT

(5 Credit – 90 hours)

Project Description:

As a part of the final project, students will submit any of the following projects. They are expected to apply the concept, knowledge and skills gained during the course of the study while undertaking their final semester project. Each student will have to submit at least one of the following projects in consultation with the teacher/Mentor of the department and duly approved by the Head of the Department to complete the course.

- Design and create materials (print/audio-visual contents) for Communication for Development on any specific development issue.
- Conduct a detailed field study, design a strategic communication plan and submit a project proposal on any important development problems/issues.

Project Evaluation Criteria:

- Project activity assessment: 20%
- Evaluation of the 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.

MCCS6122 COMMUNICATION SKILLS (1-0-1)

COURSE OBJECTIVES

CO1 Identify the different styles of communication (Remembering)
CO2 Understand how to develop effective speaking skills (Understanding)
CO3 Evaluate various communication needs (Evaluating)
CO4 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, InternalOperational 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

	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

CO1 Demonstrate understanding on various forms of creative writing (Understanding)
CO2 Apply the techniques of creative writing for storytelling (Applying)
CO3 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, Adele Ramet, 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

	Module 1	Module 2	Module 3

CO1	H	H	
CO2	H	H	
CO3			H

MCEM6124 EVENT MANAGEMENT (1-0-1)

COURSE OUTCOMES

CO1 Understand the relevance of event management as a professional skill and career option (Understanding)
CO2 Demonstrate an in-depth understanding of the intricacies of managing an event (Applying)
CO3 Examine individual and team orientation in event planning and management (Analysing)
CO4 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 Shruti Arora, 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

	Module 1	Module 2	Module 3	Module 4
CO1	H			

CO2	H	H	H	H
CO3		H		H
CO4	H	H	H	H

PUBLIC RELATIONS AND CORPORATE COMMUNICATION (3-0-0)

COURSE OUTCOMES:

CO1 Define the meaning of public relations and corporate communication (Remember)
CO2 Understand the process of public relations and corporate communication (Understand)
CO3 Assess the needs for public relations and corporate communication in various fields (Evaluate)
CO4 Analyse the strategies for crisis management (Analyse)
CO5 Write and create public relations strategies and design corporate social responsibility projects (Create).

Module I: Introduction to Public Relations (10 Lectures)

Public Relations – meaning, definition, functions and history; Concept and types of publics, public opinion, persuasion and negotiation; PR and publicity, propaganda, lobbying, advertising; PR in government, public, private and NGO sector.

Module II: Process of Public Relations (15 lectures)

PR and various media, importance of media relations; Writing for public relations, corporate social responsibility; PR as a profession, qualities required for a PRO; Crisis management, PR strategy and campaign, case studies, PR video.

Module III: Introduction to Corporate Communication (10 Lectures)

Evolution and growth of corporate communication; Definition, scope, need and functions of corporate communication; Corporate communication mix, organizational structure; Corporate culture: types and need, corporate citizenship.

Module IV: Corporate Social Responsibility, Identity and Media Relations (10 lectures)

Defining different publics and their importance; Designing communication strategy for different publics; Theoretical concepts of CSR, various phases of CSR, Designing a CSR project, different case studies; Corporate identity; concepts, variables and process; Corporate communication tools and media handling; Crisis communication; Ethics in corporate communication.

Suggested Readings

1) Corporate Image of India, S.K. Roy, 1974, Sh. Ram Centre
2) Corporate Public Relations, R.K. Balan, 1992, Sterling Publisher
3) Corporate Communication, Jaishri Jethwaney, 2010, Oxford Publishers
4) Corporate Communication: A 21st Century Primer, Joseph Fernandez, Sage Publications
5) Handbook of Public Relations and Communication, Philip Lesley, 2007, Jaico Publishing House, 2007
6) Mass Communication in India, Keval J. Kumar, 2012, Jaico Publishing House
7) Positioning: The Battle for Your Mind, Al RiesAl, Jack Trout, 2000, McGraw-Hill, 1st Edition, 2000
8) Public Relations, Concepts, Strategies and Tools, Jaishri Jethwaney, 1994, Sterling Publishers,
9) Public relations, strategies and Tactics, Wilcox, Ault and Agee, 2003, Pearson Publication
10) Public Relations, Jaishri Jethwaney, 2002, Sterling Publishers
11) Public Relations: Principles and Practices, Iqbal Sachdeva, 2009, Oxford University Press
12) The Practice of Public Relations, Fraser.P. Seitel, 2011, Pearson
13) Naval Prabhakar& Narendra Basu, Public Relations: Principles & Functions, CommonWealth, 2007

MAPPING OF COURSES TO PO/PSO

BA Mass Communication (2020 Batch)

SL.	Name of Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
1.1	Introduction to Media and Communication	H	L	L	M	L		M	H	H	M	M	M
1.2	Introduction to Journalism	H	H	H	M	H	L	M	M	M	H	H	H
1.3	Professional Communication	L	H	H	H	M	L	H	L	L	H	M	M
2.1	History of Media	H	H		M	L		L	H	M	M	M	M
2.2	Visual Communication	H	H	M	M	M		H	H	M	H	M	H
2.3	Graphic Design	M	H	H	M	M		H	H	H	H	M	H
2.4	Basics of Communication	H	H	M	M	M	L	H	H	H	M	M	L
2.5	Community Media	H	H	H	H	M	M	H	M	M	M	M	H
3.1	Introduction to Broadcast Media	H	H	L	H	L	M	M	H	L	H	M	M
3.2	Television Production	M	H	L	H	M		H	H	H	H	M	H
3.3	Introduction to New Media	M	H	H	L	H		M	H	M	H	M	H
3.4	Media, Culture and Society	H	M	M	M	M	L	M	H	M	H	M	M
3.5	Radio Production	M	H	H	H	M	L	L	H	H	H	H	H
3.6	Introduction to Computer Applications	L	M	M	L	L	L	H	H	M	H	H	H
3.7	Basics of Photography	L	M	M	M	L	L	H	H	M	H	H	H
3.8	Photography	L	M	M	M	L	L	H	H	M	H	H	H
4.1	Advertising and Public Relation	H	H	H	M	M	L	L	H	H	H	M	M
4.2	Development Communication	H	H	H	H	M	M	M	M	M	H	M	H
4.3	Media Laws and Ethics	M	M	M	H	H	H	H	H	L	H	H	L
4.4	News Reading and Anchoring	H	H	H	H	H	H	H	H	H	H	M	H
5.1	Folk Media	M	H	H	H	H	M	L	H	M	L	M	L
5.2	Mobile Communication	M	H	H	L	M	L	M	H	M	H	H	H
5.3	Introduction to Research	H	H	H	M	H	M	H	M	H	H	H	M
5.4	Advanced	H	H	L	H	L		H	H	H	H	H	H

	Broadcast Media												
5.5	Media Management and Entrepreneurship	H	H	M	H	M	M	H	H	H	H	H	L
5.6	Art and Practice of Digital Photography	M	H	M		L		H	H	H	H	H	H
5.7	Photography	H	H	M	M	H		H	H	H	H	H	H
5.8	Communication and Disaster Management	M	H	H	H	H	H	M	H	H	H	H	M
5.9	Introduction to Animation and VFX	H	H	H	M	L		H	H	H	H	H	H
5.10	Animation and VFX	H	H	H	M	L		L	H	H	H	H	H
6.1	Global Media and Politics	H	L	M	H	H	L	L	H	H	L	M	M
6.2	Internship	H	H	H	H	H	M	H	H	H	M	H	H
6.4	Introduction to Film Studies	H	M	L		M		H	H	H	H	H	M
6.5	Documentary Production	H	H	H	M	M		H	H	H	H	H	H
6.6	Media in North East India	H	H	H	H	H	H	H	M	H	H	H	H
6.7	Human Rights and Conflict Reporting	M	H	H	H	H		M	L	H	H	H	H
6.8	Media Project	H	H	H	H	H	H	H	L	L	H	H	H
6.9	Dissertation	H	H	M	M	H		H		H	H	H	H

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 of Communication	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 and Practices 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 and Image 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 and Data 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	Communication Research 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-video Production	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, Ethics and 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-Video Editing	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 Reporting and 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 Analysis for Communication Strategy	H	H	H	H	M	H	M	M	H	H	H	H
3.4.1	Planning Models and Communication Approaches	H	H	H	H	M	H	H	M	H	H	H	H
4.1	Media and Cultural Studies	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 Monitoring and 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 (BA/MA)

Sl. No	**Name of Course**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
1.1	Communication Skills	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

DEPARTMENT OF PSYCHOLOGY

BA PSYCHOLOGY (HONOURS)

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 and counselling 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 – BA 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: 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 – BA Psychology

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

Sl. No.	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
1.1	Introduction to Psychology	M	L					H	M	M		M
1.2	Introduction to Psychology - Practicum	M	L					H	M	M		M

1.3	Biopsychology	H				M			H	M		L
1.3	General Psychology (GEC)	M		M		L	L	L	H	M		
2.1	Psychology of Individual differences	H		M	L	L		M	H	H	M	M
2.2	Statistical Methods for Psychological Research -I	H	L	L	L	M	L	M	H	H	H	M
2.3	Psychology for Health and Well being			M	M	M	L	H	H	M	M	M
3.1	Psychological Research	H				M		M	M		M	
3.2	Development of Psychological Thought	H		H		M	L	M	H	L	L	H
3.3	Social Psychology	M	M	L		M		L	L			
3.4	Stress Management (SE)			M	L		L	H	H	M	M	M
3.5	Psychology and Media (GEC)	M	H	H	M	M	L	L	M	M	L	H
3.6	Psychological Research-Practicum	H	M	M	L	H	L	L	M	H	H	L
4.1	Statistical Methods for Psychological Research -II	H		H		H			M		M	M
4.2	Developmental Psychology	M		M			M	M	H	M		
4.3	Applied Social Psychology	H	M	H	H	M	H	H	H	H	H	H
4.4	Emotional Intelligence (SE)											
4.5	Psychology at Work (GEC)	M	L	H	L		M		H	L		L
4.6	Applied Social Psychology-Practicum	H	H	H	L	H	M	L	M	H	H	M
5.1	Understanding Psychological Disorders	M	L	L	L	H	L	M	H	M	L	M
5.2	Organizational Behaviour	L				M		M		L		M
5.3.1	Positive	L					M		M		M	

	Psychology (DSE)											
5.3.2	Health Psychology (DSE)	H	L		M		H	H	H	M	M	L
5.3.3	Human Resource Management (DSE)	L				M		M		L		M
6.1	Understanding and dealing with Psychological Disorders	H	L	M		H	M	L	H	M	M	M
6.2	Counselling Psychology	H	M	H	M	H	L	M	H	H	H	M
6.3.1	Community Psychology (DSE)	L	H	H	H	M	M	M	H	M	L	H
6.3.2	Cultural and Indigenous Psychology (DSE)	H	M	H	H	M	M	H	H	L	M	H
6.3.3	Project/ Dissertation	H	L	L	L	M	L	M	H	H	H	M

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

understand the application of the field relating to different issues in psychology.

PSO 4: 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 5: 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
3.1	Marriage and Family Counseling	M	L	M	M	M		M		L	L	M	H	M
3.2	Addiction and Trauma Counseling	H	M	M	L	M	L	M	M	H	M	H	H	H
3.3	Marriage and Family Counseling-Practicum	M	H	M	L	H	L	H	M	H	M	H	H	H
3.4	Case Study and Documentation-I	H		L		M			M	M			M	
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	H	H	M		M	M			H	M	H	M	
3.8	Research Project Phase I	M		M					M		H	M		L
4.1	Psychological Testing	H	L	H	L	H	L	L	M	M	H	M	L	H
4.2	Disability Studies and Rehabilitation Psychology	M		L		M			M	M			M	
4.3	Case Study and Documentation-II	H	H	M	H	H	H	H	H	H	H	H	H	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

BACHELOR OF ARTS – HONOURS IN PSYCHOLOGY 2020

PCIP0122 INTRODUCTION TO PSYCHOLOGY (4-0-0)

(Credits: Theory-04)
Theory: 60 Lectures

Course Outcomes

CO1 Define psychology and define the various concepts. (Remembering)
CO2 Explain the nature and characteristics of psychological research and perspectives. (Understanding)
CO3 Analyse the basic principles and theories of intelligence, learning and memory and motivation. (Analysis)
CO4 Distinguish between various psychological researches (Understanding and analysis)
CO5 Explain the causes of forgetting and stages of memory (Remembering)
CO6 Apply research designs and approaches appropriately. (Application)

CO7 Evaluate modern and Indian perspectives of psychology (Evaluation)
CO8 Developing familiarity with individual level phenomenon such as intelligence, personality, learning, memory and motivation. (Evaluation)
CO9 Design research studies for psychological phenomena. (Creating)

Syllabus

Module I: Introduction (16 hours)

Nature of Psychology: Definition, Fields of psychology, Schools of modern psychology, Psychology in India: History and current status, Methods of psychology (with special emphasis. on Experimentation), Biological basis of human behavior (with emphasis on brain).

Module II: Learning, Memory and perception (16 hours)

Learning: Classical conditioning, instrumental learning, observational learning (socio-cognitive learning);

Memory: Models of memory: Information processing model (Sensory register, STM, LTM and concept of working memory), Levels of processing, Parallel Distributed Processing model, Reconstructive nature of memory; Forgetting, Improving memory

Perception: Top down and Bottom Up processes, Size Constancy, Depth Perception

Module III: Motivation & Emotion (12 hours)

Approaches to understanding motivation and Types of Motives

Elements of Emotions (components), Emotional Intelligence and Gender, Culture & emotions

Module IV: 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

	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	H
CO 2	H	H	H	H
CO 3	M	L	H	H
CO 4	M	L	M	H
CO 5	L		L	L
CO 6	H	H	H	H
CO 7	M	L	H	H
CO 8	M	L	M	H
CO 9	M		M	M

PCIP6104 INTRODUCTION TO PSYCHOLOGY – PRACTICUM (0-0-2)

PCBP0123 BIOPSYCHOLOGY (5-1-0)

(Credits: Theory-05, Tutorial-01)

Theory: 75 lectures

Tutorial: 15 hours

Course Outcomes

- CO1 Define the basic terms related to the field of Bio-psychology. Name different biological systems involved in psychological disorders. (Remembering)
- CO2 Learn the biological basis of psychological disorders. (Understanding)
- CO3 Make use of bio-psychological theories, and principles to enhance bio-psychological approaches for health promotion and illness prevention. Identify the difference among neurological and endocrine systems. (Applying)
- CO4 Examine the bio-psychological basis and its impact on the etiology and course of psychological disorders. (Analyzing)
- CO5 Explain the biological basis of psychological disorders. (Evaluating)
- CO6 Discuss the major theoretical perspective of bio-psychology. Develop the awareness of the biological basis of behavior. (Understanding)

Syllabus

Module I: Introduction to Bio-psychology (20 Hours)

Concept of biopsychology; Major theoretical perspectives: Rene Descarte, Phineas Gage, Charles Darwin; reductionism; Nature versus Nurture controversy; ethical issues.

Neurons, Synapses, Neurotransmitters.

The nervous system: Basic subdivisions- Peripheral and Central.

Hemisphere function: Sperry and the split –brain; Left handedness; Emotion and the right hemispheres.

Module II: Learning and Memory (20 Hours)

Anterograde and retrograde Amnesia.

Korsakoff's Psychosis.

Alzheimer disease.

Biochemistry of memory.

Module III: Sleep, Arousal and Biological Rhythms (15 Hours)

Concept of arousal; Physiological measures of arousal

Reticular Formation and Central arousal.

Biological rhythms.

Functions of sleep.

Module IV: Emotion and Motivation (20 Hours)

Anxiety; stress and arousal; Endocrine system: Structure and Functions, Major endocrine glands, Hormones: Types and Functions, Influence of hormones on human behavior.

Emotion – Central and Peripheral mechanisms.

Physiology of Hunger and Thirst.

Homeostasis; Obesity and Anorexia.

Tutorial (15 Hours)

1) Use of bio-feedback to understand brainwaves and other physiological functioning.

2) To demonstrate the assessment, scoring and assessment of some neuro-cognitive batteries

3) Visit to brain research centres for familiarity with techniques of brain mapping

4) Developing intervention techniques for behaviors such as eating and sleeping based on knowledge of the underlying social and biological mechanisms.

Suggested Readings

1) Breedlove, S. M., Rosenzweig, M. R., & Watson, N. V. , Biological Psychology: An introduction to behavioral, cognitive, and clinical neuroscience, Sinauer Associates, Inc., Sunderland, Massachusetts, 5th Edition, (2007).

2) Carlson N.R., Physiology of Behaviour, 6th edition, Allyn & Bacon: Boston, (1998).

3) Carlson, N. R., Foundations of physiological psychology. (Sixth Edition). Delhi: Pearson Education, (2012).

4) Green, S. Principles of biopsychology. UK: Lawrence Erlbaum Associates Ltd, (1995).

5) Pinel, J. P. J. Biopsychology, 8th Edition. Pearson Education, New Delhi, (2011).

Mapping of COs to Syllabus

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

PCGP0126 GENERAL PSYCHOLOGY (5-1-0)

(Credits: Theory-05, Tutorial-01)

Theory: 75 lectures

Tutorial: 15 hours

Course Outcomes

CO1 Define Psychology, name the different fields of Psychology, state the different theories of personality and intelligence, list the different developmental processes, name the different assessment tools of intelligence and personality, state the application of Psychology in different fields such as work, legal issues and health, state the theory of moral development. (Remembering)

CO2 Understand the meaning of Psychology, explain learning, explain the models of memory, classify the different types of motives, explain developmental processes through different theories/perspectives such as Piagetian, Freudian, classify different stages of moral development, explain emotional intelligence and its different components. (Understanding)

CO3 Apply the different theories of emotion to everyday life, determine the applicability of Psychology in different areas such as work, law and health, apply principles of learning to understand from real life examples, apply strategies for memory retrieval, apply approaches of motivation into practice. (Applying)

CO4 Identify different aspects of problem solving, analyze the strengths and weaknesses of different theories of intelligence, identify a good personality assessment tool, analyze the applicability of classical and operant conditioning, analyze the principles of reinforcement, identify positive and negative emotions. (Understanding)

CO5 Summarize the different theories of motivation and emotion, deduce the strengths and weaknesses of different psychological assessment tools, organize the developmental processes according to different theories, conclude the effectiveness of psychological knowledge in different fields. (Understanding)

CO6 Determine the nature of Psychology, assess the strengths and limitations of different theories of learning, evaluate the importance of positive and negative emotions, determine the causes of memory failure, evaluate the different stages of development, evaluate the different interventions related to health. (Understanding)

Syllabus

Module I: Orientation to Psychology (26 hours)

a) Nature, fields and applications of psychology;

b) Cognitive Processes: Learning, memory and problem solving;

c) Conative Processes: Motivation, types of motives (Sociogenic/Psychogenic motives);

d) Affective Processes: Emotion, Theories of Emotion, Positive and negative emotion

Module II: Psychology of Individual Differences (25 hours)

a) Theories of personality: Freudian psychoanalysis, type and trait; humanistic;

b) Theories of intelligence: Spearman 'g' theory, Sternberg and Gardner;

c) Emotional intelligence;

d) Assessment of intelligence and personality

Module III: Understanding Developmental Processes (15 hours)

a) Cognitive Development: Piaget;

b) Moral Development: Kohlberg;

c) Psycho-social Development: Erikson, Psychosexual Development: Freud.

Module IV: Applications of Psychology (9 hours)

a) Work

b) Health

c) Law

Tutorial (15 hours)

Objective:

To better understand the concepts of Psychology and determine their applicability to real life situations.

Module I Orientation to Psychology (5 hours)

Doubt clearing sessions, Reflection papers, application of principles of learning, use of YouTube videos for memory retrieval strategies, identification of positive and negative emotions through different tools.

Module II Psychology of Individual Differences(5 hours)

Doubt clearing sessions, Reflection papers, introduction to different tools to measure intelligence, personality and emotional intelligence.

Module III Understanding Developmental Processes(3 hours)

Doubt clearing sessions, Reflection papers, conduction of conservation tasks (Piaget's theory of Cognitive Development), use of YouTube videos for moral dilemmas.

Module IV Applications of Psychology (2 hours)

Doubt clearing sessions, Reflection papers, review of research articles on application of Psychology.

Suggested Readings

1) Chadha, N. K. & Seth, S. The Psychological Realm: An Introduction. Pinnacle Learning, New Delhi, (2014).

2) Ciccarelli , S. K & Meyer, G.E. Psychology (South Asian Edition). New Delhi: Pearson, (2008).

3) Feldman.S.R.Essentials of understanding psychology (7th Ed.) New Delhi : Tata McGraw Hill, (2009).

4) Michael ,W., Passer, Smith,R.E. Psychology The science of mind and Behavior. New Delhi:Tata McGraw-Hill (2007).

Mapping of COs to Syllabus

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

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

PCPI0124: PSYCHOLOGY OF INDIVIDUAL DIFFERENCES (5-1-0)

(Credits: Theory-05, Tutorial-01)

Theory: 60 lectures

Course Outcomes

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

CO1 Define the key concepts of individual differences. (Remembering)
CO2 Recall dimensions of categorizing individuals contextually. (Remembering)
CO3 Interpret self enhancement. (Understanding)
CO4 Apply concepts of motivation and creative thinking (Applying)
CO5 Examine psychometric approaches to individual differences. (Analysing)
CO6 Determine cultural factors behind individual differences. (Evaluating)
CO7 Interpret potentialities of people beyond IQ. (Evaluating)
CO8 Compose new ideas to integrate existing space to enhance tolerance of differences. (Creating)
CO9 Create new techniques to enhance cognitive abilities ranging from adaptation to enhancement. (Creating)

Syllabus

Module I: Personalty (15 hours)

Personality: Nature of personality; Biological foundations of personality; Culture, gender and personality; Perspectives on personality: Psychodynamic, Phenomenological- humanistic and social cognitive.

Module II: Intelligence (15 hours)

Intelligence: Concept of intelligence: Psychometric and cognitive approaches to intelligence; Gardner's multiple intelligences; Emotional Intelligence, Heredity, environment and intelligence; Group differences in intelligence; Extremes of intelligence.

Module III: Understanding Self (10 hours)

Indian approach: Self and identity in Indian thought.

Module IV: Self Enhancement (20 hours)

Enhancing individual's potential: Self-determination theory; Enhancing cognitive potential, Self-regulation and self enhancement; Fostering creativity.

Suggested Readings

1) Carr, A. Positive psychology. Routledge (2011).

2) Chadha, N.K. & Seth, S. The Psychological Realm: An Introduction. Pinnacle Learning, New Delhi (2014).

3) Ciccarelli, S. K., & Meyer, G. E. Psychology: South Asian Edition. New Delhi: Pearson Education (2010).

4) MatthijsCornelissen, GirishwarMisra and SuneetVarma , Foundations of Indian Psychology (Vol. 1), Theories and concepts .Pearson (eds.) (2011).

5) Mentis, M., Dunn-Bernstein, M., Mentis, M., &Skuy, M. .Bridging learning: Unlocking cognitive potential in and out of the classroom. Corwin (2009).

6) Passer, M.W. & Smith, R.E. . Psychology: The science of mind and behaviour. New Delhi: Tata McGraw-Hill (2010).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5

CO 1	H	M	H	M	M
CO 2	M	H	M	H	M
CO 3	M	H	H	H	H
CO 4	H	M		M	
CO 5		H			H
CO 6	M		H	M	H
CO 7	H	H	M	M	
CO 8			M		M
C09	M	H	M	H	M

PCPI6105: PSYCHOLOGY OF INDIVIDUAL DIFFERENCES- PRACTICUM (0-0-2)

(Credits: Practicum-02)

Practicum: 60 lectures

Course Outcomes

CO1 Define the basic concepts of personality and intelligence. (Remembering)
CO2 Recall theoretical and psychometric categories of personality and intelligence. (Remembering)
CO3 Interpret application of individual difference principles to personality and intelligence. (Understanding)
CO4 Apply concepts of intelligence and personality in social interactions. (Applying)
CO5 Examine psychometric properties of a test and its significance. (Analysing)
CO6 Determine scoring of the tests. (Evaluating)
CO7 Interpret results in consideration to group differences and social-environmental factors. (Evaluating)
CO8 Create an imitation of a testing environment for proper conduction of psychological tests. (Creating)

Syllabus

Module I: Introduction to Personality Test (10 hours)

General Introduction to personality tests; Selected test: Theoretical Foundation, History, Objective; Psychometric Properties, Administration, Scoring and Results.

Module II: Administration (20 hours)

Basic Concepts; Mock: conduction, scoring, interpretation of results and discussion; Final: Conduction, scoring, interpretation of results and discussion.

Module III: Introduction to Intelligence Test (10 hours)

General Introduction to personality tests; Selected test: Theoretical Foundation, History, Objective; Psychometric Properties, Administration, Scoring and Results.

Module IV: Administration (20 hours)

Basic Concepts; Mock: conduction, scoring, interpretation of results and discussion; Final: Conduction, scoring, interpretation of results and discussion.

Suggested Readings

1) Carr, A. Positive psychology. Routledge (2011).

2) Chadha, N.K. & Seth, S. The Psychological Realm: An Introduction. Pinnacle Learning, New Delhi (2014).

3) Ciccarelli, S. K., & Meyer, G. E. Psychology: South Asian Edition. New Delhi: Pearson Education (2010).

4) MatthijsCornelissen, GirishwarMisra and SuneetVarma , Foundations of Indian Psychology (Vol. 1), Theories and concepts .Pearson (eds.) (2011).

5) Mentis, M., Dunn-Bernstein, M., Mentis, M., &Skuy, M. .Bridging learning: Unlocking cognitive potential in and out of the classroom. Corwin (2009).

6) Passer, M.W. & Smith, R.E. . Psychology: The science of mind and behaviour. New Delhi: Tata McGraw-Hill (2010).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M	M	M	M	M
CO 2	M		H		M
CO 3	M	M	H		H
CO 4	H	H	H	M	M
CO 5	H	H			H
CO 6		M	H	M	H
CO 7	H	H	M	M	H
CO 8	H	M	M	H	M

PCSR0125 Statistical Methods for Psychological Research-I (5-1-0)

(Credits: Theory-05, Tutorial-01)

Theory: 70 lectures

Tutorial: 15 hours

Course Outcomes

CO1 Define the basic concepts of research, identify major research designs and recognize the philosophical foundations of research. (Remembering)
CO2 To understand the importance of inferential statistics and scales of measurements. (Understanding)
CO3 To analyse the scope and uses of graphical representation of the quantitative data. (Analysing)
CO4 To use measures of Central Tendency and Measures of Variability in research. (Applicability)
CO5 To evaluate different research designs and their appropriate applicability. (Evaluation)
CO6 To create a research proposal using appropriate research design, graphical representation of data and statistical computation. (Creating)

Syllabus

Module I (15 Hours)

Introduction to Research, The Goals of Psychological Research, Paradigms of Research Overview of major research designs

Introduction to Statistics

Descriptive and Inferential Statistics; Variables and Constants; Measurement Scales.

Module II (15 hours)

Organizing Qualitative Data

Constructing a grouped frequency distribution, a relative frequency distribution and a cumulative frequency distribution; Computation of Percentiles and Percentile Ranks.

Graphic Representation of Data

The Histogram; Frequency Polygon; Bar Diagram; Pie Chart, Cumulative Frequency Graph; Factors Affecting the Shape of Graphs.

Module III (20 hours)

Measures of Central Tendency

The Mode, Median and Mean; Properties and Relative Advantages and Disadvantages of the Mode, Median and Mean; Central Tendency Measures in Normal and Skewed Distributions; The Effects of Linear Transformation on Central Tendency Measures.

Measures of Variability and Standard (z) Scores

The Range; The Interquartile and the Semi-Interquartile Range; The Average Deviation; The Variance; The Standard Deviation; Calculation of Standard Deviation from Raw Scores and Grouped Scores; Properties and Comparison of Measures of Variability; The Effect of Linear Transformation on Variability Measures; Standard Scores (z-score); Properties of z-scores.

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 IV (20 hours)

Correlation

Meaning of Correlation, Positive and Negative correlation, calculation of Correlation Coefficient, Calculating Pearson's Correlation Coefficient from Deviation Scores; Calculating Pearson's Correlation Coefficient from Raw Scores; Spearman's Rank- Order Correlation Coefficient

Random Sampling and Sampling Distributions Random Sampling:

Using a Table of Random Numbers; The Random Sampling Distribution of the Mean: An Introduction; Characteristics of the Random Sampling Distribution of the Mean; Using the Sampling Distribution of Sample Means to Determine the Probability for Different Ranges of Values of Sample Mean; Random Sampling With and Without Replacement.

Module V: Tutorial (15 hours)

1. Doubt Clarifying sessions and discussions

2. Reviewing research papers for ethical and moral considerations during research.

3. Activity on Scientific Writing: How to write research paper based on quantitative studies, APA style of writing and referencing, Plagiarism checks and other ethical considerations

4. Use of computers and familiarity with soft-ware for behavioural research: Creating spreadsheets, organizing and computing data, use of graphs, Introduction to statistical software like SPSS/PSPP

Suggested Readings

1) Data Communications and Networking, 4th Edition, Behrouz A Forouzan, 2007, TMH.

2) Computer Networks, 4th Edition, Andrew S Tannenbaum, 2003, PHI.

Mapping of COs to Syllabus

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

PCHW0127 Psychology for Health and Wellbeing (5-1-0)

(Credits: Theory-05, Tutorial-01)

Theory: 75 lectures

Tutorial: 15 hours

Course Outcomes

CO1 Define the basic terms related to the area of health and wellbeing. (Remembering)
CO2 Identifying stressors in one's life and how to manage them. (Remembering)
CO3 Interpreting variety of health enhancing, health protective, and health compromising behavior and their application in illness management. (Understanding)
CO4 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)
CO5 Make use of psychological principles to enhance health management not only in their own lives but in community as well. (Applying)
CO6 Examine the stress response and its impact on the etiology and course of many health-related problems. (Analyzing)
CO7 Estimate the approximate health hazards and Recommend the health enhancing behaviors. (Evaluating)
CO8 Develop awareness about the various health hazards and suitable ways of dealing with such risks effectively at the community level. (Creating)
CO9 Create an environment where individuals are able to find the balance between the inner strengths and the outside world. (Creating)

Syllabus

Module I: Illness, Health and Wellbeing (17 hours)

Continuum and Models of health and illness- Bio-Medical, Biopsychosocial, holistic health; health and wellbeing

Module II: Stress and Coping (20 hours)

Nature and sources of stress; Effects of stress on physical and mental health; Coping and stress management

Module III: Health Management (17 hours)

Health-enhancing behaviours; Health compromising behaviours; Health Protective behaviours; Illness Management

Module IV: Promoting Human strengths and life enhancement (21 hours)

Classification of human strengths and virtues; cultivating inner strengths: Hope and optimism; Gainful Employment and Me/We Balance.

Module V: Tutorials (15 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 I Illness, Health and Wellbeing (3hours)

Doubt clearing sessions/Assignments/tests with application-based questions

Module II Stress and Coping (4 hours)

Doubt clearing sessions/group activities/workshops/Assignments

Module III Health Management (4 hours)

Doubt clearing session/ Case study/Group discussion/Assignments

Module IV Promoting Human strengths and life enhancement (4 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 COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		H			M
CO 3			H		M
CO 4			M	H	
CO 5					H
CO 6		H	M		
CO 7	M	H	M		H
CO 8			H	H	M
CO 9				H	M

PCPR0128 PSYCHOLOGICAL RESEARCH (4-0-0)

Theory (4 credits – 60 hours)

Course/Learning Outcomes

CO1 Define the basic concepts of psychological research. (Remembering)
CO2 Understand the various approaches and research traditions in psychological research. (Understanding)
CO3 Application of different techniques and tools in psychological research. (Applying)
CO4 Analyse the effectiveness of various tools used in different types of research designs in psychological research. (Analysing)
CO5 Evaluate the significance of research in psychology and the advantages and disadvantages of the different orientations and research traditions. (Evaluating)
CO6 Design research problems, formulate hypothesis, and the steps involved in conducting psychological research. (Creating)

Syllabus

Module I: Introduction (20 hours)

Basics of Research in Psychology: What is Psychological Research? The Goals of Psychological Research; Principles ofGood Research; Ethics in Psychological Research.

Research Traditions: Quantitative and Qualitative Orientations towards research and their steps;Comparing qualitative and quantitative research traditions.

Formulating a problem and developing a Testable Research Question and Research Hypothesis.

Module II: Experimental Method (16 hours)

Types of Experimental Methods: Introduction to Experimental and Quasi-experimental Methods. Methods of Data Collection: Sampling (Probability and Non-Probability Sampling Methods).

Module III: Non-Experimental Methods – I (12 hours)

Case Study, Sociometry, Observation, Surveys, Focus Group Discussion, Interviews.

Module IV: Non-Experimental Methods - II (12 hours)

Psychological Testing: Standardization; Reliability, Validity and Norms of a Psychological Test; applications

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

	Module I	**Module II**	**Module III**	**Module IV**
CO 1	H	M	M	M
CO 2	M	M	M	M
CO 3		H	H	H
CO 4		H	H	H
CO 5	H	H	H	H
CO 6	H			

PCDT0129 DEVELOPMENT OF PSYCHOLOGICAL THOUGHT (5-1-0)

(6 Credits- 90 Hours)

COURSE OUTCOME:

CO1 Find and define key concepts of Psychology schools of thoughts (Remembering)
CO2 Comparison and Contrast between schools of thought & demonstrate fundamental knowledge and comprehension of the major concepts, theoretical perspectives, historical trends, and empirical findings (Understanding)
CO3 Apply psychology-specific content and effective self-reflection (Applying)
CO4 Contrast key concepts, principles and overarching themes (Analysing)
CO5 Critically evaluate sources of information in the field of psychology and major psychological school of thoughts (Evaluating)
CO6 Adapt and discuss the psychological principles and developing a working knowledge of the different content or program areas in psychology apply to behavioural phenomena (Creating)

Syllabus

Module-1: Understanding Psyche: Debates and Issues (15 hours)

Free will and determinism. Empiricism and rationality. Issues of Consciousness and Mind Body Relationship

(*Each of these debates and issues to be dealt with from the point of view of an East-West Comparison; Eastern perspective will include Yoga &Vedantic view)

Module-II: Schools of Psychology (25 Hours)

Early Schools of Psychology: Associationism, Structualism and Functionalism (Brief Introduction). Positivist Orientation: From behaviorism to cognition- Key contributions of Watson, Tolman, Hull, and Skinner; Cognitive revolution, Information Processing Model.

Module- III: Psychoanalytic and Humanistic-Existential Orientation (25 hours)

Freudian Psychoanalysis, The turn towards 'social' – Adler, Jung, Fromm, Ego psychology – Erik Erikson, Object relations; Cultural psychoanalysis (Sudhir Kakar), contributions of Phenomenologically oriented humanistic and existential thinkers.

Module –IV: 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 COs to Syllabus

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

PCSY0130 SOCIAL PSYCHOLOGY (5-1-0)

(6 Credits- 90 Hours)

COURSE OUTCOMES

CO1 Define social Psychology, historical perspectives. (Remembering)
CO2 Illustrate the interpersonal processes (Understanding)
CO3 Apply the keys aspects of individual processes in the social world (Applying)
CO4 Examine the individual processes in the social world (Analysing)
CO5 Explain the concept group, cooperation and conflict. (Evaluating)
CO6 Creatively give an idea of the implications of the individual processes in the social world (Creating)

Syllabus

Module I: Introduction (15 hours)

History of social psychology, Scope of social psychology, and to understand the individual in the social world

Module II: Individual Processes (15 hours)

Person perception, Attention-theories, biases and errors; Attitude: Formation, change and resistance to change

Module III: Interpersonal processes (10 hours)

Interpersonal attraction, prosocial behavior, aggression

Module IV: 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 COs to Syllabus

	MODULE-I	MODULE-II	MODULE-III	MODULE-IV
CO1	H			
CO2		H		
CO3	H			
CO4	H	H		H
CO5	H		M	
C06	H	M		H

PCSM0131 STRESS MANAGEMENT (2-0-0)

(2 credits – 30 hours)

Course/Learning Outcomes

CO1 Define stress and coping strategies and find the associated risk and protective factors. (Remembering)
CO2 Understand the health effects of stress and its causal factors. (Understanding)
CO3 Develop the ability to effectively utilise the coping strategies and stress management techniques. (Applying)
CO4 Categorise different types of stress and compare various types of coping strategies. (Analysing)
CO5 Assess the pervasive effect of stress in different areas of life and the effectiveness of various stress management techniques and coping strategies. (Evaluating)
CO6 Build the ability to make adjustments and manage to cope with stress more effectively. (Creating)

Syllabus

Module I: Stress (10 hours)

Introduction: Nature and symptoms of stress. Sources of stress: environmental, social, physiological and psychological.

Module II: Stress and health (8 hours)

Effects of stress on health, eustress

Module III: Managing stress-I (6 hours)

Methods: yoga, meditation, relaxation techniques.

Module IV: Managing stress-II (6 hours)

Problem focused and emotion focused approaches.

Suggested Readings:

1) Carr, A. (2004). Positive Psychology: The science of happiness and human strength.UK: Routledge.

2) DiMatteo, M.R. & Martin, L.R.(2002). Health psychology. New Delhi: Pearson

3) Neiten, W. & Lloyd, M.A (2007). Psychology applied to Modern life. Thomson Detmar Learning.

4) Sarafino, E.P. (2002). Health psychology: Bio psychosocial interactions (4th Ed.).NY: Wiley.

Mapping of COs to Syllabus

	Module I	**Module II**	**Module III**	**Module IV**
CO 1	H	H		H
CO 2	H	H		
CO 3			H	H
CO 4	H	H		H
CO 5		H	H	H
CO 6	M	M	H	H

PCPM0132 PSYCHOLOGY AND MEDIA (5-1-0)

(6 Credits- 90 Hours)

COURSE OUTCOME:

CO1 Outline the effect of media on human psyche (Remembering)
CO2 Gather a critical awareness of the underlying psychological processes and mechanisms (Understanding)
CO3 Determine the impact of psychological processes on advertising and promotional activities (Applying)
CO4 Analyse the influence of media on the perception and understanding of individuals (Analysing)
CO5 Assess the confluence of psychological mechanisms and media in a socio-cultural context (Evaluating)
CO6 Adapt approaches to media which would benefit the development of a health society (Creating)

Syllabus

Module I: Media and User (20 hours)

Understanding mass media; Issues in Media psychology: Construction of reality, media and culture, Media and ethics, regulation.

Module II: Media and advertising (15 hours)

Developing an effective advertising programme /media promotions/ campaigns for social marketing. Case studies in the Indian context.

Module III: Audio-Visual media (TV and movies) and Print media (25 hours)

Nature and their impact; Developmental issues: fantasy Vs reality, socialization, stereotyping, violence, and cybercrime. Case studies in the Indian context.

Module IV: Interactive and emerging technologies (15 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.

8) Wood, R.N. (1983). Mass Media and Individual. Minnesota: Woods.

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	H
CO 5		M	M	M
CO 6		H	H	M

PCPR6106 PSYCHOLOGICAL RESEARCH - PRACTICUM (0-0-2)

(2 credits – 60 hours)

Course/Learning Outcomes

CO1 Define the basic concepts of psychological research. (Remembering)
CO2 Understand the various techniques used in psychological research. (Understanding)
CO3 Application of different techniques and tools in psychological research. (Applying)
CO4 Analyse the effectiveness of various tools used in different types of research designs in psychological research. (Analysing)
CO5 Evaluate the significance of research in psychology and the advantages and disadvantages of the different orientations and research traditions. (Evaluating)
CO6 Build the ability to obtain and analyse data. (Creating)

Syllabus

The students are required to conduct two practicals, one from each of the following groups.

Module I:Experiment / Psychological testing (40 hours)

One experiment based on group data analysis/One psychological test based on group data analysis

Module II: Qualitative Research Methods (20 hours)

Interview/Observation/Projective / Semi Projective Tests/Case Study

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

	Module I	**Module II**

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

PCSM0133 STATISTICAL METHODS FOR PSYCHOLOGICAL RESEARCH-II (5-1-0)

(6 Credits-90 Hours)

Course Outcome

CO1 Define the basic concepts of inferential statistics, hypothesis testing, non-parametric data. (Remembering)
CO2 To understand the importance of inferential statistics and hypothesis testing.
CO3 (Understanding)
CO4 To analyse the scope and uses of inferential statistics and hypothesis testing in quantitative data. (Analysing)
CO5 To use the measures of inferential statistics and significance level in research. (Applicability)
CO6 To evaluate different types of inferential statistics, non-parametric statistics and hypothesis and their appropriate applicability. (Evaluation)
CO7 To develop an understanding of statistical computation using inferential statistics, usages of statistical software. (Creating)

Module I: Introduction to Inferential Statistics and Hypothesis Testing about Single Means (25 hours)

a) The meaning of Statistical Inference and Hypothesis Testing; Hypothesis Testing about Single Means (z and t); Assumptions in Testing a Hypothesis about a Single Mean; The Null and the Alternative Hypotheses; Choice of HA: One-Tailed and Two-Tailed Tests; Steps for Hypothesis Testing; Hypothesis Testing about a Single Mean – Calculation; The Statistical Decision regarding Retention and Rejection of Null Hypothesis; Estimating the Standard Error of the Mean when σ Is Unknown; The t Distribution; Characteristics of Student's Distribution of t; Computing t Using Definitional Formula Only; Levels of Significance versus p- Values.

b) Interpreting the Results of Hypothesis Testing : A Statistically Significant Difference versus a Practically Important Difference; Errors in Hypothesis Testing; Power of a Test.

Module II: Hypothesis Testing About the Difference Between Two Independent Means (25 hours)

a) The Null and Alternative Hypotheses; The Random Sampling Distribution of the Difference between Two Sample Means; Properties of the Sampling Distribution of the Difference between Means; Determining a Formula for t; Testing the Hypothesis of No Difference between Two Independent Means; Use of a One-Tailed Test; Assumptions Associated with Inference about the Difference between Two Independent Means

b) Hypothesis Testing About the Difference Between Two Dependent (Correlated) Means: The Null and Alternative Hypotheses; Determining a Formula for t; Degrees of Freedom for Tests of No Difference between Dependent Means; Testing a Hypothesis about Two Dependent Means using the formula involving standard errors and correlation only; Assumptions When Testing a Hypothesis about the Difference between Two Dependent Means.

Module III: Hypothesis Testing for Differences among Three or More Groups: One-Way Analysis of Variance (ANOVA) (25 hours)

a) The Null and Alternative Hypotheses; The Basis of One-Way Analysis of Variance: Assumptions Associated with ANOVA; Variation within and between Groups; Partition of the Sums of Squares; Degrees of Freedom; Variance Estimates and the F Ratio; The ANOVA Summary Table; Raw-Score Formulas for Analysis of Variance only; Comparison of t and F.

b) Hypothesis Testing for Categorical Variables and Inference about Frequencies: The Chi-Square as a Measure of Discrepancy between Expected and Observed Frequencies; Logic of the Chi-Square Test; Assumptions of Chi-Square; Calculation of the Chi-Square Goodness-of-Fit-Test- One Way Classification; Chi Square for Two Classification Variables-Contingency Table Analysis; Interpretation of the Outcome of a Chi-Square Test.

Module IV: Nonparametric Approaches to Data (15 hours)

a) Introduction to Distribution-free Nonparametric Tests; Comparison with Parametric Tests; Uses and Applications of

Nonparametric Tests.

b) 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.

Mapping of COs to Syllabus

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

PCDP0134 DEVELOPMENTAL PSYCHOLOGY (5-1-0)

(6 Credits-90 Hours)

COURSE OUTCOMES:

CO1 Define the concept of and process of human development across the life span. (Remembering)
CO2 Explain the various domains of human development (Understanding)
CO3 Utilize the knowledge of different theoretical perspectives, developmental tasks, adjustment process and hazards across the lifespan (Applying)
CO4 Analyse the sensitivity to socio-cultural context of human development. (Analysing)
CO5 Evaluate the lifespan perspective (Evaluating)
CO6 Adapt to the new principles of human development (Creating)

Syllabus

Module I: Introduction (15 hours)

Define the concept of Human Development. Theories, themes and research designs related to the study of human development

Module II: Periods of Life Span Development (25 hours)

Prenatal development, Birth and Infancy, Childhood, Adolescence, Adulthood

Module III: Domains of Human Development (25 hours)

Cognitive development: perspectives of Piaget and Vygotsky; Language development; Physical development; Emotional development; Moral development; Personality development

Module IV: 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: Psychology Press.

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

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

PCPA0135 APPLIED SOCIAL PSYCHOLOGY-THEORY (4-0-0)

4 credits (60 Hours)

Course Outcomes:

CO1 Define concepts in applied social psychology. (Remembering)
CO2 Recall theoretical background for applied approach of social psychology. (Understanding)
CO3 Interpret diversity is population dynamics. (Analyzing)
CO4 Apply concepts of intervention based on case studies of social psychology (Applying)
CO5 Examine relevance of social psychology aspects in health and legal system. (Evaluation)
CO6 Determine effective intervention programme to various need based contexts. (Creating)

Syllabus

Module 1: Introduction (12 hours)

Nature of applied Social Psychology, Social influences on behavior, Levels of analysis, Methodological approaches – Participatory Action and Learning research techniques.

Module 2: Applying Social Psychology- I (18 hours)

Environment: Restorative effects of nature; Resource dilemma, Built environment, Environmental hazards.

Population: Population density, Territory, Personal space, Crowding, Urbanisation.

Diversity: Ideological perspectives on diversity; Perspectives of Non dominant cultural groups, Reducing Prejudice.

Module 3: Applying Social Psychology- II (18 hours)

Work: Work place behavior- motivation, job performance, and job satisfaction; Workplace stress; Balancing home and work life; Consumer behavior.

Health: Symptom perception, compliance, health enhancing behavior, wellbeing.

Legal system: Investigation interviews, events in the court room, prison setting.

Module 4: Intervention and Evaluation (12 hours)

Impact analysis; Process of intervention; need for evaluation for effective programme. Case studies in Indian context.

Suggested Readings

1) Kloos, B., Hill, j., Thomas, E., Wandersman, Elias, M. J., & Dalton, J.H. (2012). Community psychology: Linking individuals and communities. Wadsworth, Cengage.

2) Mikkelson, B. (1995). Methods for development work and research: A guide for practitioners. New Delhi: Sage.

3) Schneider, F.W., Gruman, A., Coults, L .M. (Eds.). (2012). Applied social psychology: Understanding and addressing social and practical problems. New Delhi: Sage publications.

4) Smith, P.B., Bond, M.H., & Kagitcibasi, C. (2006). Understanding social psychology across cultures. New Delhi: Sage Publication.

Mapping of COs to Syllabus

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

PCEM0136 EMOTIONAL INTELLIGENCE (2-0-0)

(2 credits – 30 hours)

Course Outcomes

CO1 Define the basic concepts of emotional intelligence in different contexts. (Remembering)
CO2 Explain different concepts of emotional intelligence. (Understanding)
CO3 Apply the theoretical concepts of emotional intelligence into real life settings. (Applying)
CO4 Analyse the managing emotions. (Analyzing)
CO5 Evaluate Relationships, Conflict Management, And Effective Leadership. (Evaluating)
CO6 Discuss applications of emotional intelligence. (Creating)

Syllabus

Module I: Introduction (10 hours)

Emotional Intelligence, Models of Emotional Intelligence. EQ competencies: self-awareness, self-regulation, motivation, empathy, and interpersonal skills. Importance of Emotional Intelligence

Module II: Knowing One's and Others' Emotions (8 hours)

Levels of emotional awareness. Recognizing emotions in oneself. The universality of emotional expression. Perceiving emotions accurately in others

Module III: Managing Emotions (6 hours)

The relationship between emotions, thought and behaviour. Techniques to manage emotions

Module IV: Applications (6 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 COs to Syllabus

	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			

PCPW0137 PSYCHOLOGY AT WORK (5-1-0)

(6 Credits- 90 Hours)

Course outcomes

CO1 Define and recognise the significance of values in an individual and applying them in their life and profession (Remembering)

CO2 Differentiating between ethical and unethical practices and working out strategy to actualize a harmonious environment wherever they work (Understanding)

CO3 Applying professional ethics and implementing it in professional set up (Applying)

CO4 Analyse and examine the development of beliefs, attitudes and habits displaying morality using simulated situations (Analysing)

CO5 Determine the harmonious relationships based on trust and respect for themselves, for others and for their profession (Evaluating)

CO6 Developing a deeper understanding of conceptual and theoretical bases of job satisfaction, motivation and employees' work attitudes and their relationship with performance and organizational outcomes (Creating)

Syllabus

Module- 1: Introduction to I/O Psychology (10 hours)

Definition, Brief History, Contemporary Trends and Challenges, I/O Psychology in India.

Module –II: Job Satisfaction and Work Motivation (20hours)

Concept of Job satisfaction and work motivation, causes of Job Satisfaction, outcomes of Job Satisfaction, Theories of Work Motivation and Applications

Module -III: Communication in Organizations (20 hours)

Communication process, purpose of communication in organizations, communication networks, barriers to effective communication, managing communication

Module- IV: Leadership (25 hours)

The meaning of leadership, early approaches to leadership, contemporary approaches to Leadership-Transformational & Transactional Leadership; Leadership in a Globalized World, Indian perspective on leadership.

Suggested Readings:

1) Adler, N.J. (1997). Global Leaders; A Dialogue with future history, Journal of InternationalManagement, 2, 21-33.

2) Adler, N.J. (1997).Global Leadership: Women Leaders. Management International Review,Vol. 37, International Human Resources and Cross Cultural Management, 171-196.

3) Chadha, N.K. (2007). Organizational Behavior. Galgotia Publishers: New Delhi.

4) Greenberg, J. & Baron, R.A. (2007). Behaviour in Organizations (9th Ed.). India: DorlingKindersley

5) Griffin, R.W. & Moorhead, G. (2009).Organizational Behavior: Managing People &Organizations. Biztantra publishers

6) Robbins, S. P. & Judge, T.A. (2007).Organizational Behavior. 12th Edition. New

7) Delhi: Prentice Hall of India.

8) Robbins, S. P. & Judge, T.A. (2008). Essentials of Organizational Behavior. 9th

9) Edition. New Delhi: Prentice Hall of India.

10) Singh, K. (2010). Organizational Behavior: Texts & Cases. India: Dorling Kindersley

Mapping of COs to Syllabus:

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

PCAP6107 APPLIED SOCIAL PSYCHOLOGY – PRACTICUM (0-0-2)

(2 Credits– 60 hours)

Course Outcomes:

CO1 Define the basic concepts of interpersonal relationships and occupational stress. (Remembering)
CO2 Recall theoretical and psychometric categories of social relationship dynamics and work environment and positive psychology. (Remembering)
CO3 Interpret application of organizational psychology principles to social relationships at work. (Understanding)
CO4 Apply concepts of sociometry in social interactions. (Applying)
CO5 Examine psychometric properties of a test and its significance. (Analysing)
CO6 Determine scoring of the tests and interpretation of test scores. (Evaluating)

Module I: Introduction to Sociometry (10 hrs)

Introduction to Sociometry; Theoretical Foundation, History, Objective; Technique, Administration, Scoring and Interpretation of Results.

Module II: Administration (20 hrs)

Basic Concepts; Mock: conduction, scoring, interpretation of results and discussion; Final: Conduction, scoring, interpretation of results and discussion.

Module III: Introduction to Occupational Stress (10 hrs)

General Introduction to Occupational Stress; Selected test: Theoretical Foundation, History, Objective; Psychometric Properties, Administration, Scoring and Results.

Module IV: Administration (20 hrs)

Basic Concepts; Mock: conduction, scoring, interpretation of results and discussion; Final: Conduction, scoring, interpretation of results and discussion.

Suggested readings:

1) Psychodrama Since Moreno: Innovations in Theory and Practice, Chapter: Sociometry and sociodynamics, Publisher: Routledge, Sabelli & Sabelli (1994), London and New York, Editors: P Holmes, M Karp, M Watson.

2) Monir Rostampoor-Vajari, What is sociometry and how can we apply it in our life?, 2012, AASS, Vol. 2, No. 4, pp. 570-573.

3) Occupational and Environmental Health, Chapter: Occupational Stress, Publisher: Oxford University Press, Landsbergis et al. (2017), Editors: Barry S. Levy

4) Intervention in Occupational Stress: A Handbook of Counselling for Stress at Work (Counselling in Practice) 1st Edition,Randall Ross (Author), Elizabeth M. Altmaier, *SAGE Publications Ltd; 1st edition (1994)*

5) Occupational Stress: A Handbook (series in health psychology and behavioral medicine) 2nd Edition, Eds. Rick Crandall, Pamela L Perrewe, CRC Press; 2nd edition (February 2, 1995)

Mapping of COs to Syllabus

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

Mapping of Courses with POs/PSOs

Sl. No.	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
1.1	Introduction to Psychology	M	L					H	M	M		M
1.2	Introduction to Psychology - Practicum	M	L					H	M	M		M
1.3	Biopsychology	H				M			H	M		L
1.3	General Psychology (GEC)	M		M		L	L	L	H	M		
2.1	Psychology of Individual differences	H		M	L	L		M	H	H	M	M
2.2	Statistical Methods for Psychological Research -I	H	L	L	L	M	L	M	H	H	H	M
2.3	Psychology for Health and Well being			M	M	M	L	H	H	M	M	M
3.1	Psychological Research	H				M		M	M		M	
3.2	Development of Psychological Thought	H		H		M	L	M	H	L	L	H
3.3	Social Psychology	M	M	L		M		L	L			

3.4	Stress Management (SE)			M	L		L	H	H	M	M	M
3.5	Psychology and Media (GEC)	M	H	H	M	M	L	L	M	M	L	H
3.6	Psychological Research-Practicum	H	M	M	L	H	L	L	M	H	H	L
4.1	Statistical Methods for Psychological Research -II	H		H		H			M		M	M
4.2	Developmental Psychology	M		M			M	M	H	M		
4.3	Applied Social Psychology	H	M	H	H	M	H	H	H	H	H	H
4.4	Emotional Intelligence (SE)											
4.5	Psychology at Work (GEC)	M	L	H	L		M		H	L		L
4.6	Applied Social Psychology-Practicum	H	H	H	L	H	M	L	M	H	H	M
5.1	Understanding Psychological Disorders	M	L	L	L	H	L	M	H	M	L	M
5.2	Organizational Behaviour	L				M		M		L		M
5.3.1	Positive Psychology (DSE)	L					M		M		M	
5.3.2	Health Psychology (DSE)	H	L		M		H	H	H	M	M	L
5.3.3	Human Resource Management (DSE)	L				M		M		L		M
6.1	Understanding and dealing with Psychological Disorders	H	L	M		H	M	L	H	M	M	M
6.2	Counselling Psychology	H	M	H	M	H	L	M	H	H	H	M

6.3.1	Community Psychology (DSE)	L	H	H	H	M	M	M	H	M	L	H
6.3.2	Cultural and Indigenous Psychology (DSE)	H	M	H	H	M	M	H	H	L	M	H
6.3.3	Project/ Dissertation	H	L	L	L	M	L	M	H	H	H	M

BACHELOR OF ARTS – HONOURS IN PSYCHOLOGY (2019 AND 2018)

PCSP0115 SOCIAL PSYCHOLOGY

(4 Credits-60 Hours)

COURSE OUTCOMES

- CO1 Define the basic terms related to social psychology like Impression formations, social cognitions, social influence and aggression. (Remembering)
- CO2 Choose different theoretical approaches to explain human behaviour. (Remembering)
- CO3 Understand the evolution of the study of human behaviour in the context of society. (Understanding)
- CO4 Analysing the factors that influence social behaviour, impression formation and formation of the attitudes. (Analyse)
- CO5 Examine the determinants of interpersonal attraction and affiliation, Pro social behaviour and aggression. (Analyse)
- CO6 Make use of theoretical understanding of these social factors in analysing human behaviour in the real life contexts. (Application)
- CO7 Evaluate the attribution theories and biases and understand attitude-behaviour link. (Evaluation)
- CO8 Evaluate the effectiveness of different approaches to social psychology in predicting human behaviour in their social contexts. (Evaluation)
- CO9 Develop explanations for human behaviour in more accurate ways and thereby maintaining healthy interpersonal relationships. (Creating)

Syllabus

Module I: Introduction (10 hours)

Nature and scope of social psychology; Overview of the history of social psychology (including development in India), Theories of social psychology

Module II: Understanding self and others (20 Hours)

Self: Learning about the self; Person Perception: Forming impressions of others, Social Cognitions, Attribution theories and biases, Attitude, Attitude-Behaviour link

Module III*: Social relations and influences (20 Hours)*

Interpersonal attraction and affiliation; Personal relations: Self disclosure, commitment, responses to dissatisfaction, conflict, Pro-social behaviour: Helping influences; Social influences: Conformity, compliance and obedience, Aggression

Module IV*: Group Dynamics and Inter-group relations (10 Hours)*

Nature of groups, Consequences of belonging (performance, decision making, cooperation and competition), Nature of intergroup relations (prejudice, intergroup conflict, intervention techniques)

Suggested Readings

1) Crisp, R.J. and Turner, R.N. Essential Social Psychology. New Delhi: Sage Publications India Pvt Ltd. (2007).

2) Misra,G. and Dalal,A.K. Social Psychology in India: Evolution and Emerging trends. Edited by Ajit.K.Dalal and Girishwar Misra.New Directions in Indian Psychology,Volume I:Social Psychology. New Delhi: Sage Publications India Pvt.Ltd. (2001).

3) Myers, D.G. Social Psychology, 7 th international edition.New York: McGraw Hill Companies. (2002)

4) Taylor ,S .E, Peplau, L.A and Sears, D.O. Social Psychology, 12th edition. New Delhi: Pearson Prentice-Hall of India Pvt Ltd. (2006) .

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		H			M
CO 3			H		M
CO 4			M	H	
CO 5					H
CO 6		H	M		
CO 7	M	H	M		H
CO 8			H	H	M
CO 9				H	M

PCFW6101 FIELD WORK

(4 Credits-60 Hours)

COURSE/LEARNING OUTCOMES

CO1 Define counselling and mental illnesses (Remembering)
CO2 Understand the value of supervision (Understanding)
CO3 Apply the theoretical principles to individuals at various setups (Applying)
CO4 Distinguish clinical features of different mental illnesses. (Analysing)
CO5 Evaluate the models of mental health and illness. (Evaluate)
CO6 Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Create)

Syllabus

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 fulfill 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

	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

PCPP6102 PSYCHOLOGY PRACTICUM I

(4 Credits – 60 hours)

COURSE OUTCOMES

CO1 Define the basic terms related to cognitive functioning, personality, projective techniques and clinical rating scales.
CO2 Choose a suitable method of psychological test to administer on a subject. (Remembering)
CO3 Classify the various types of psychological tests on the basis of their use. (Understanding)
CO4 Make interpretations and draw conclusions based on the norms given in the manual. (Applying)
CO5 Examine the details of the rating scale/ test, the aim, applications, procedure of administration and subject results. (Analysing)
CO6 Recommend the use of a suitable psychological assessment for a particular disorder. (Evaluating)
CO7 Estimate the purpose and importance of each of these tests. (Evaluating)
CO8 Test the administrator's decision making process to select a particular test for assessment of a given psychological disorder. (Creating)
CO9 Develop techniques for carrying out group based small quantitative research projects. (Creating)

Syllabus

Module I: Introduction to Clinical Rating Scales (15 hours)

Introduction to Clinical Rating Scales; Purpose of various rating scales; Beck Depression Inventory (BDI): basic concepts, administration, scoring, results and interpretation; Indian Scale for Assessment of Autism (ISAA): basic concepts, administration, scoring, results and interpretation.

Module II: Projective Tests: Thematic Apperception Tests (12 hours)

Introduction to Projective tests; importance and purpose; various types of projective tests; Thematic Apperception Test (TAT): Introduction, basic concepts, themes, administration, scoring, results and interpretation.

Module III: Assessment of Cognitive Functioning (20 hours)

Definition of Intelligence and IQ measures, Types of Intelligence tests used; Definition and types of Learning and Memory; Vineland Social Maturity Scale (VSMS): basic concepts, administration, scoring and interpretation; Binet-Kamat Test of Intelligence (BKT): basic concepts, administration, scoring, results and interpretation; Mazes experiment: basic concepts, administration, scoring, results and interpretation.

Module IV: Introduction to Personality Tests (13 hours)

Definition of Personality; Measurement of Personality; Various types of Personality tests (MMPI, NEO-FFI); Eysenck Personality Questionnaire: basic concepts, administration, scoring, results and interpretation.

Suggested Readings

1) Baron,R.A. Psychology. 3rd edition.Delhi:Prentice Hall.(1995).
2) Morgan,C.T, King,R.A., Weisz,J.R., and Schopler,J. Introduction to Psychology, 7th edition,24th reprint.New Delhi:TataMcGraw-Hill. (2004).
3) Gregory, R.J. Psychological Testing: History, Principles, and Applications (4 th Ed.).New Delhi: Pearson Education. (2006).
4) Baron, Robert A. and Byrne, D. Social Psychology 8 th Edition (Reprint).New Delhi : Prentice- Hall of India Pvt Ltd. (2001) .
5) Carson,R.C., Butcher,J.N and Mineka,S. Abnormal psychology. 13th Edition. New Delhi: Pearson Education. (2004).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M	M	M	M	M
CO 2	M		H		M
CO 3	M	M	H		H
CO 4	H	H	H	M	M
CO 5	H	H			H
CO 6		M	H	M	H
CO 7	H	H	M	M	H
CO 8	H	M	M	H	M
C09	M	H	M	H	M

PCHP0116 HEALTH PSYCHOLOGY

(3 credits – 45 hours)

COURSE/LEARNING OUTCOMES

CO1 Define the basic terms related to the field of health psychology. (Remembering)
CO2 Choose suitable health promotion methods (Remembering)
CO3 Learn the nature of stress response and the subsequent etiology and cause of health related problems. (Understanding)
CO4 Make use of psychological research methods, theories, and principles to enhance bio-medical approaches for health promotion and illness prevention. (Applying)
CO5 Examine the stress response and its impact on the etiology and course of many health related problems. (Analysing)
CO6 Recommend the health promotion methods. (Evaluating)
CO7 Estimate the approximate health hazards related to health compromising behaviors. (Evaluating)
CO8 Test an individual's different health promoting and health compromising lifestyle habits. (Creating)
CO9 Develop awareness about the stressful impact of disabling/life-threatening illness on the patient and their family members. (Creating)

Syllabus

Module I: Introduction to Health Psychology (7 lectures)

Definition, nature and scope of health psychology, emergence of health psychology, goals of health psychology, traditional Indian healing system and health care networks in India.

Module II: Biological Basis of Health and Illness (13 lectures)

The nervous system, endocrine system, cardiovascular system, digestive system, respiratory system, reproductive system, genetic process, immune system, and related disorders.

Module III: Theories of Health Behavior (15 lectures)

Motivational models, behavioral enhancement models, efficacy theories, Socio-cultural factors in health behavior.

Module IV: Health Promotion and Illness Prevention (10 lectures)

Definition of stress, psycho-physiological consequences of stress, chronic diseases, health promotion, health compromising behavior.

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

	Module 1	Module 2	Module 3	Module 4
CO 1	H			H
CO 2				H
CO 3				H
CO 4	M			
CO 5		M		M
CO 6			M	M
CO 7				H
CO 8				M
CO 9		M	M	M

PCEP0117 ENVIRONMENTAL PSYCHOLOGY

(3 credits – 45 hours)

Course Outcomes

CO1 Define the key concepts in Environmental Psychology. Recall theoretical perspectives, various factors on interaction, adversities and application for sustenance (Remembering)
CO2 Explain population specific perspectives of nurture of nature. (Understanding)
CO3 Apply knowledge about adversities to minimize their maladaptive consequences. (Applying)
CO4 List current areas in need of pro-environmental behavior. (Analyzing)
CO5 Assess psychological impact of pro-environmental movements. Examine existing barriers to adaptability due to normalized anti-environment acts. (Evaluating)
CO6 Operate awareness amongst the public about the restorative nature of the environment. Plan alternatives to existing work and residential designs for enhancement of quality of life. (Creating)

Syllabus

Module I: Introduction (12)

Definition purpose and history of environmental psychology; Theories of environmental Psychology; Research studies in environmental psychology

Module II: Interacting Factors (10)

Human factors: Cognition, Attitude, Judgement, Personality and Spatial Behavior.

Environmental factors: Natural Environment (Climate and landscape, destructive and restorative properties), Built environment (Design/Architecture as server of consumer needs, technology and environment)

Module III: Adversities (10)

Social and collective dilemmas; Stressors; Environmental Disasters and their psychological consequences

Module IV: Applied perspective (13)

Pro-environmental behavior; Utilisation of resources; Sustainable development; Principles of problem focused counseling and psychotherapy.

Suggested Readings

1) Gifford , R. Environmental psychology: Principles and practice (4th ed.). Colville, WA: Optimal Books. (2007)

2) Berleant , A. , & Carlson , A. (Eds.). The aesthetics of natural environments. Peterborough, Ontario: Broadview Press.

(2004)

3) Bechtel , R. B. , & Churchman , A. (Eds.). Handbook of environmental psychology. New York: Wiley.(2002)

4) Gardner , G. T. , & Stern , P. C. Environmental problems and human behavior (2nd edition). Boston, MA: Pearson Custom Publishing .(2002)

5) Hall , E. T. Beyond culture . Garden City, NY : Doubleday & Company .(1976)

6) Norman , K. L. Cyberpsychology: An introduction to human - computer interaction . New York: Cambridge University Press . (2008).

Mapping of COs to Syllabus

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

PCPT0018 PSYCHOLOGICAL TESTING

(4 Credits - 60 hours)

COURSE OUTCOMES

CO1 Define the basic concepts of psychological testing. (Remembering)
CO2 Choose a suitable method of data analysis. (Remembering)
CO3 Classify the group and individual techniques of psychological testing. (Understanding)
CO4 Make use of different statistical concepts in data analysis. (Applying)
CO5 Examine the results of the statistical data analysis. (Analyzing)
CO6 Recommend the suitable technique (qualitative/quantitative) of data collection/interview in applied settings. (Evaluating)
CO7 Estimate the reliability/validity of a test. (Evaluating)
CO8 Test the assumptions of normality in a data set. (Creating)
CO9 Develop a psychological tool using appropriate norms of tool construction. (Creating)

Syllabus

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, Typesof 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,ProjectiveTechniques: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 GrothMarnat, G.(2006). Psychological Testing and Assessment. Boston, MA: Pearson (12th ed.) (2006).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M	M	H	M	M
CO 2	H	H	M		H
CO 3		H		H	
CO 4		H			M
CO 5	M			H	
CO 6	M	M	H	M	H
CO 7	H		M	M	H
CO 8	H	M			M
C09		H	M	H	

PCPP6103 PSYCHOLOGY PRACTICUM II

(4 Credits – 60 hours)

COURSE OUTCOMES

CO1 Define the basic terms related to cognitive functioning, personality, projective techniques and clinical rating scales. (Remembering)
CO2 Choose a suitable method of psychological test to administer on a subject. (Remembering)
CO3 Classify the various types of psychological tests on the basis of their use. (Understanding)
CO4 Make interpretations and draw conclusions based on the norms given in the manual. (Applying)
CO5 Examine the details of the rating scale/ test, the aim, applications, procedure of administration and subject results. (Analysing)
CO6 Recommend the use of a suitable psychological assessment for a particular disorder. (Evaluating)
CO7 Estimate the purpose and importance of each of these tests. (Evaluating)
CO8 Test the administrator's decision making process to select a particular test for assessment of a given psychological disorder. (Creating)
CO9 Develop techniques for carrying out group based small quantitative research projects. (Creating)

Syllabus

Module I: Introduction to Clinical Rating Scales (20 hours)

ADHD Symptoms Checklist-4: basic concepts, administration, scoring, results and interpretation; Hamilton's Anxiety Rating Scale-II (HAM-A II): basic concepts, administration, scoring, results and interpretation.

Module II: Projective Tests: Rorschach Psychodiagnostic Test (15 hours)

Rorschach Inkblot Test: Introduction, basic concepts, themes, administration, scoring, results and interpretation.

Module III: Assessment of Cognitive Functioning (15 hours)

Developmental Screening Test (DST): basic concepts, administration, scoring and interpretation; Malin's Intelligence Scale for Indian Children (MISIC): basic concepts, administration, scoring, results and interpretation; Seguin's Form Board Test (SFBT): basic concepts, administration, scoring, results and interpretation.

Module IV: Introduction to Personality Tests (10 hours)

Cattell's 16 Personality Factors Questionnaire (16PF): basic concepts, 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,24th reprint.NewDelhi:TataMcGraw-Hill.

3) Gregory, R.J. (2006). Psychological Testing: History, Principles, and Applications (4 th Ed.).New Delhi: Pearson Education.

4) Baron, Robert A. and Byrne, D. (2001) .Social Psychology 8 th Edition (Reprint).New Delhi : Prentice-Hall of India Pvt Ltd.

5) Carson,R.C., Butcher,J.N and Mineka,S.(2004). Abnormal psychology. 13th Edition. New Delhi: Pearson Education

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M	M	H	M	M
CO 2	H	H	M	H	
CO 3	M	M		H	H
CO 4		H	H		M
CO 5	H	H	M	H	H
CO 6	M	M	H	M	
CO 7	H		H	M	H
CO 8	M	M			
C09	M	H	M	H	M

PCPY0119 POSITIVE PSYCHOLOGY

(3 Credits – 45 Hours)

COURSE OUTCOMES

CO1 Define positive psychology and its basic concepts. (Remembering)
CO2 Realize the existence of positive emotions in day to day life (Remembering)
CO3 Grasp basic cognitive states and processes in positive psychology (Understanding)
CO4 Identify individual strengths and sources of resilience. (Applying)
CO5 Classify the sources of resilience in different life stages (Analyzing)
CO6 Distinguish different mechanisms in flow and happiness (Evaluating)
CO7 Explain different psychological assessment to measure strengths in individuals. (Evaluation)
CO8 Develop an awareness of applications and implications of positive psychology concepts and theories. (Creating)
CO9 Equip himself/herself with the skill and competence to apply positive psychology principles in a range of environments to increase individual and collective wellbeing (Creating)

Syllabus

Module I: Introduction (10 hours)

Introduction to Positive Psychology ,Goals and assumptions, Historical background, Perspectives on Positive Psychology: Western and Eastern, Character Strengths and virtues.

Module II: Positive emotions, Well-being and Happiness (15 hours)

Positive emotions, positive subjective experience, Components of flow, Conditions and mechanisms of flow, Positive and negative consequences of flow experience, Meaning and nature of happiness, Psychology of well-being

Module III: Positive Cognitive States and Processes (10 hours)

Resilience: meaning and types; Sources of resilience in children; Sources of resilience in adulthood and later life; Optimism

Module IV: Applications of Positive Psychology (10 hours)

Increasing optimism, Discovering strength, Mindfulness, Positive coping strategies; Positive psychology in building relationship

Suggested Readings

1) Baumgardner, S.R. Crothers M.K. Positive psychology. Upper Saddle River, N.J.: Prentice Hall. (2010).

2) Carr, A. Positive Psychology: The science of happiness and human strength.UK: Routledge. (2004).

3) Peterson, C. A Primer in Positive Psychology. New York: Oxford University Press. (2006).

4) Seligman, M.E.P. Authentic Happiness: Using the New Positive Psychology to Realize Your Potential for Lasting Fulfillment. New York: Free Press/Simon and Schuster. (2002).

5) Snyder, C.R., & Lopez,S.J. Positive psychology: The scientific and practical explorations of human strengths. Thousand Oaks, CA: Sage. (2007).

6) Snyder, C. R., & Lopez, S. (Eds.). Handbook of positive psychology. New York: Oxford University Press. (2002).

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

PCOB0120 ORGANISATIONAL BEHAVIOUR (3-0-0)

(3 Credits – 45 Hours)

COURSE/LEARNING OUTCOMES

CO1: Define the key concepts of Organisational Psychology. (Remembering)

CO2: Recall theoretical perspectives, diversities, adversities and techniques of management. (Remembering)

CO3: Explain various organizational contexts in the globalised world.(Understanding)

CO4: Apply knowledge of selection and training in consulting sectors. (Applying)

CO5: List current areas in need of upgrading. (Analyzing)

CO6: Assess psychological impact on organization and vice-versa . (Evaluating)

CO7: Examine modern day challenges to success in organization. (Evaluating)

CO8: Plan novel strategies for organizational change. (Creating)

CO9: Plan alternatives to a homogenous human resource. (Creating)

Syllabus

Module I: Foundation (15 lectures)

History of organizational psychology; Principles; Theoretical frameworks: cognitive framework, behavioral framework and social learning; Challenges and opportunities of organizational behavior.

Module II: Individual and Social Aspects (15 lectures)

Individual: Cognition, Attitude, Personality and Life Skills.

Social factors: Culture and its dimensions; integration of individuals into organizations; Challenges of cultural change.

Module III: The psychology of Management (15 lectures)

Environmental analysis in organization; Principles and techniques of selection; Training and development; Organizational change.

Suggested Readings

1) Levy Paul. Industrial/Organizational Psychology: Understanding the Workplace. Worth Publishers. (2009).
2) Furnham Adrian.The Psychology of Behaviour at Work: The Individual in the Organization. Psychology Press. (1997).
3) Rothman Ian, Cooper L. C. Work and Organizational Psychology. Routledge. (2015)
4) Wayne F.C., Herman A. Applied Psychology in Human Resource Management: Pearson New International Edition. Pearson Education Limited. (2013).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2	M		H
CO 3	M	M	M
CO 4			H
CO 5			M
CO 6	M	H	
CO 7	M		
CO 8			M
CO 9		M	M

PCAA0121 ADVANCED ABNORMAL PSYCHOLOGY

(3 Credits-45 Hours)

COURSE OUTCOMES

CO1 Define mental health and mental illness. (Remembering)
CO2 Relate to classification in Psychiatry (DSM 5 and ICD 10). (Remembering)
CO3 Explain different clinical assessment of abnormal behaviour. (Understanding)
CO4 Identify clinical features of Schizophrenia, Mood disorder, OCD and Developmental Disorders. (Applying)
CO5 Classify the neurotic and psychotic disorders. (Analyzing)
CO6 Distinguish different psychological disorders on the basis of its symptoms. (Evaluating)
CO7 Explain and evaluate psychological interventions for different mental disorders. (Evaluation)
CO8 Develop awareness about the myths and misconceptions of abnormal behavior. (Creating)
CO9 Create case study and diagnose patients based on the clinical features and develop Psychological interventions. (Creating)

Syllabus

Module I: Understanding abnormality (7 hours)

Understanding mental health and mental illness; Definition and criteria of abnormality; Classification system in mental illnesses: DSM 5 and ICD 10, Clinical assessment

Module II: Developmental Disorders (12 hours)

Intellectual Disability, Autism Spectrum Disorders, ADHD, Learning Disabilities: Subtypes, Clinical features and Psychological Management

Module III: Major Psychological Disorders (18 hours)

a) Schizophrenia Spectrum and other psychotic disorders: Subtypes, clinical features, etiology, psychological management.

b) Mood Disorders: Subtypes, clinical features, etiology, psychological management.

c) Obsessive Compulsive and Related Disorders: Subtypes, clinical features, etiology, psychological management.

Module IV: Substance related Disorders and Eating Disorders (8 hours)

a) Substance related Disorders: Subtypes, clinical features, etiology, psychological management.

b) Eating Disorders: Subtypes, clinical features, etiology, psychological management.

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) Brewer,K. (2001). Clinical Psychology. Oxford : Heinemann Educational Publishers

3) Carson, R.C., Butcher,J.N.,Mineka,S.& Hooley,J.M. (2008). Abnormal Psychology. New Delhi: Pearson.

4) Kearney, C. A. & Trull, T. J. (2012). Abnormal Psychology and Life: A dimensional approach. New Delhi : Cengage learning.

5) 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

	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2	M		H
CO 3	M	M	M
CO 4			H
CO 5			M
CO 6	M	H	
CO 7	M		
CO 8			M
CO 9		M	M

Mapping of Courses with POs/PSOs

Sl. No.	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
5.1	Scientific Methodology	M	L					H	M	M		M
5.2	Environmental Studies	H				M			H	M		L
5.3	Social Psychology	M		M		L	L	L	H	M		
5.4	Field Work	H		M	L	L		M	H	H	M	M

5.5	Psychology Practicum I	H	L	L	L	M	L	M	H	H	H	M
5.6.1	Health Psychology			M	M	M	L	H	H	M	M	M
5.6.2	Environmental Psychology	H				M		M	M		M	
6.1	Psychological Testing	H	L	L	L	M	L	M	H	H	H	M
6.2	Psychology Practicum II	M	L					H	M	M		M
6.3	Project Work	H	L	L	L	M	L	M	H	H	H	M
6.4.1	Positive Psychology	L					M		M		M	
6.4.2	Organizational Behaviour	L				M		M		L		M
6.4.3	Advanced Abnormal Psychology	H	L	M		H	M	L	H	M	M	M

MSc PSYCHOLOGY

PCTP0020 THEORIES OF PERSONALITY

(4 Credits- 60 hours)

COURSE/LEARNING OUTCOMES

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

CO1 Define personality. (Remembering)
CO2 Explain the rationale behind the theories of personality. (Understanding)
CO3 Identify the impact of environment and genetics in development of personality. (Applying)
CO4 Analyse modifications of self in perceiving environment. (Analysing)
CO5 Assess the relation between cultural and personality. (Evaluating)
CO6 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 Test

Objective 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.

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

PCMH0021 CONCEPTS OF MENTAL HEALTH AND ILLNESS-I

(4 Credits - 60 hours)

COURSE OUTCOMES

CO1 Define mental health and illnesses and list categories of mental illness as specified in DSM and ICD (Remembering)
CO2 Classify and categorise mood disorders, obsessive compulsive and related disorders, anxiety disorders (Understanding)
CO3 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)
CO4 Analyse the distinction between normality and abnormality. Distinguish clinical features of different mental illnesses. (Analysing)
CO5 Evaluate Bio Psycho Social models and other models of mental health and illness. (Evaluate)
CO6 Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Syllabus

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

	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

CO1 Define the basic concepts of research and recognize the philosophical foundations of research. (Remembering)
CO2 Understand the steps in conducting research and the major research designs. (Understanding)
CO3 Analyse the collected data in research using different statistical measures. (Analysing)
CO4 Apply research design, tools and statistical measures to carry out research in social sciences. (Applying)
CO5 Compare natural and social sciences as well as the different approaches and research designs most commonly used in social sciences research. (Evaluating)
CO6 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 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

	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

CO1 Define the basic concepts of cognitive psychology, identify major theoretical foundations and recognize the historical background of cognitive psychology. (Remembering)
CO2 To understand the relationship between mind, brain and behaviour. (Understanding)
CO3 To analyse the scope and application of cognitive psychology. (Analysing)
CO4 To use measures of cognitive psychology in research and practice. (Applying)
CO5 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)

Syllabus

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

	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

PCEC0013 EASTERN APPROACHES TO PSYCHOLOGY AND COUNSELLING

(3 Credits-45 Hours)

Course Outcomes

CO1 Define the basic terms related to the different eastern approaches of psychology. (Remembering)
CO2 Classify among Indian/Chinese/Japanese approaches to psychology. (Understanding)
CO3 Make use of the appropriate Indian/Chinese/Japanese approaches to psychology in applied settings. (Applying)
CO4 Examine ancient and contemporary eastern approaches of psychology. (Analysing)
CO5 Recommend the suitable approach in applied settings. (Evaluating)
CO6 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

	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			

PCGP0024 GENERAL PSYCHOLOGY

(3 credits – 45 hours)

Course/Learning Outcomes

CO1 Define psychology, name the different fields of psychology, list the different areas in which psychology is applicable. (Remembering)
CO2 Understand how the visual and auditory systems work. (Understanding)
CO3 Apply the theories of learning to modify behavior and application of different strategies for memory improvement. (Applying)
CO4 Analyse the strengths and weaknesses of the important theories of psychology. (Analysing)
CO5 Evaluate the contribution of psychology in different fields. (Evaluating)
CO6 Create a basic idea of personality and the important theories of personality. (Creating)

Syllabus

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

	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

1.7 PRACTICUM - I

(2 credits – 60 hours)

Course/Learning Outcomes

CO1 Define the important concepts of psychology research, and assessment techniques. (Remembering)
CO2 Understand the importance and steps associated with planning and conducting an experiment. (Understanding)
CO3 Apply the basic concepts of research and assessment techniques in measuring important psychological constructs associated with positive psychology. (Applying)
CO4 Categorize different types of intelligence assessment techniques. (Analyzing)
CO5 Evaluate the importance of different types of assessment techniques and measurement tools. (Evaluating)
CO6 Design and conduct an experiment. (Creating)

Syllabus

Module I: Introduction to Practicum (9 hours)

Primary modes of psychological enquiry: Experimental method, Observation, Survey, and Interview

Psychometric 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

	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			

PCPG6018 PERSONAL GROWTH I(P/NP)

(2 Credits - Workshop and assignment mode)

Course Outcomes

CO1 Understand the basic principles of psychology (Remembering)
CO2 Understand personality traits, values, skills and interests. (Understanding)
CO3 Gain self-awareness and emotional awareness (Applying)
CO4 Set specific, achievable short- and long-term goals (Analysing)

Syllabus

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

1) Psychology of Success: Finding Meaning in Work and Life, 5th Edition, Denis Waitley, 2010, McGraw-Hill

Mapping of COs to Syllabus

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

CO 3	M	H	H	H
CO 4			H	

Masters in Science – Psychology 2nd Semester

PCCM0025 CONCEPTS OF MENTAL HEALTH AND ILLNESS-II

(4 Credits – 60 Hours)

Course Outcomes

CO1 Define mental illnesses. (Remembering)
CO2 Classify and categorise developmental disorders, schizophrenia, personality disorders, substance related disorders, eating disorders and neurocognitive disorders. (Understanding)
CO3 Apply diagnostic criteria categorise developmental disorders, schizophrenia, personality disorders, substance related disorders, eating disorders and neurocognitive disorders to diagnose individuals with mental illnesses. (Applying)
CO4 Analyse the distinction between normality and abnormality. Distinguish clinical features of different mental illnesses. (Analysing)
CO5 Explain the causal factors of mental health and illnesses. (Evaluating)
CO6 Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Syllabus

Module I: Introduction (10 hours)

Causal Factors of abnormal behavior: Causes and Risk Factors for Abnormal Behavior

Clinical Assessments and diagnosis and treatment

Module II: Developmental Disorders (Symptoms, etiology and treatment) (15 hours)

Intellectual Disability

Autism Spectrum Disorders

ADHD

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 in India. New Delhi: Sage, (2003).

Mapping of COs to Syllabus

	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:

CO1 Identifying biological bases of behavior. (Remembering)
CO2 Associating the role of the nervous system with behavior and emotions. (Understanding)
CO3 Examining the impact of bio chemicals in behavior and mental health at a conceptual level. (Applying)
CO4 Mapping the biological markers of individual difference. (Analyzing)
CO5 Reflecting on genetic and chromosomal bases of psychopathology. (Evaluating)
CO6 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.andSmith,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.

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

PCPT0027 PSYCHOLOGICAL TESTING

(4 Credits - 60 hours)

Course Outcomes

CO1 Define the basic concepts of psychological testing. (Remembering)
CO2 Classify the group and individual techniques of psychological testing. (Understanding)
CO3 Make use of different statistical concepts in data analysis. (Applying)
CO4 Examine the results of the statistical data analysis. (Analysing)
CO5 Recommend the suitable tool for data collection/interview in applied settings. (Evaluating)
CO6 Test the psychometric properties of a tool and develop a psychological tool using appropriate norms of tool construction. (Creating)

Syllabus

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

	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:

CO1 Define the basic terms related to the field of health psychology. (Remembering)
CO2 Learn the approaches to changes in health behavior(Understanding)
CO3 Make use of psychological research methods, theories, and principles to enhance biopsychosocial approaches for health promotion and illness prevention. (Applying)
CO4 Examine the stressors and its impact on the etiology and course of many health related problems. (Analyzing)
CO5 Estimate the management of various health related disorders. (Evaluating)
CO6 Devise policies of health care delivery system beneficial to the public. (Creating)

CO7 Develop awareness about the stressful impact of disabling/life-threatening illness on the patient and their family members as well as the health care providers. (Creating)

Syllabus

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

	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

PCSP0006 INTRODUCTION TO SOCIAL PSYCHOLOGY

(3 Credits – 45 hours)

Course Outcomes

CO1 Define the basic concepts of social psychology in different contexts. (Remembering)
CO2 Explain different concepts of social processes, social influence, group dynamics and group influence. (Understanding)
CO3 Apply the theoretical concepts of social psychology into real life settings. (Applying)
CO4 Analyze the difference between social perception and social cognition as well as prejudice, stereotype, discrimination. (Analyzing)
CO5 Compare different types of groups and their functional systems. (Evaluating)

CO6 Discuss various social problems in light of the theoretical concepts of social psychology. (Creating)

Syllabus

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

	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			

2.6 PRACTICUM-II

(2 Credits, 60 Hours)

Course Outcomes

CO1 Define the basic terms related to aptitude, personality, projective techniques, positive emotions, posttraumatic growth and clinical rating scales.
CO2 Classify the various types of psychological tests on the basis of their use. (Understanding)
CO3 Make interpretations and draw conclusions based on the norms given in the manual. (Applying)
CO4 Examine the details of the rating scale/ test, the aim, applications, procedure of administration and results. (Analysing)
CO5 Estimate the purpose and importance of each of these tests. (Evaluating)
CO6 Test the administrator's decision-making process to select a particular test for assessment of a given psychological condition. (Creating)

Syllabus

***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,24th reprint.New Delhi:TataMcGraw-Hill.
3) Gregory, R.J. (2006). Psychological Testing: History, Principles, and Applications (4 th Ed.).New Delhi: Pearson Education.
4) Baron, Robert A. and Byrne, D. (2001) .Social Psychology 8 th Edition (Reprint).New Delhi : Prentice-Hall of India Pvt Ltd.
5) Carson,R.C., Butcher,J.N and Mineka,S.(2004). Abnormal psychology. 13th Edition. New Delhi: Pearson Education

Mapping of COs to Syllabus

	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

2.7 FIELD WORK

(2 Credits)

Course Outcomes

CO1 Define counselling and mental illnesses (Remembering)
CO2 Understand the value of supervision (Understanding)
CO3 Apply the theoretical principles to individuals at various setups (Applying)
CO4 Distinguish clinical features of different mental illnesses. (Analysing)
CO5 Evaluate the models of mental health and illness. (Evaluate)
CO6 Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Syllabus

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 asrequested 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

	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

2.8 Psychological First Aid (P/NP)

(2 Credits - Workshop and assignment mode)

Course Outcomes

CO1 Remember the basic concepts of psychological first aid. (Remembering)
CO2 Understand the steps of psychological first aid. (Understanding)
CO3 Gain self-awareness and awareness about emergency care. (Applying)
CO4 Plan specific, achievable remedial measures (Analysing)

Syllabus

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

1) Psychology of Success: Finding Meaning in Work and Life, 5th Edition, Denis Waitley, 2010, McGraw-Hill.

Mapping of COs to Syllabus

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

Masters in Science-(Counselling Psychology) 3rd Semester

PCFP0029 FOUNDATIONS OF COUNSELLING PSYCHOLOGY

(4 Credits, 60 Hours)

Course Outcomes

CO1 Define the basic concepts of counselling psychology, identify major theoretical foundations and recognize the historical background of counselling psychology. (Remembering)
CO2 To understand the professional therapist-client relationship in a therapeutic setting. (Understanding)
CO3 To analyse the scope and application of counselling psychology. (Analysing)
CO4 To use the therapeutic skills of counselling psychology in practice. (Applying)
CO5 To evaluate different counselling models, therapeutic skills and their appropriate applicability. (Evaluation)
CO6 To develop an understanding of counselling skills, therapies and ethical guidelines of counselling practice. (Creating)

Syllabus

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

	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

CO1 Define the basic concepts and goals of child counseling (Remembering)
CO2 Understand the specific issues faced by children and youth, especially pertaining to education, and career. (Understanding)
CO3 Apply the skills and techniques of counselling in child and youth-counselor relationship (Applying)
CO4 Compare and contrast among the major learning styles models and theories in counseling (Analyzing)
CO5 Appraise the significance of the child-counsellor relationship, and major theories in the counseling process. (Evaluating)
CO6 Build on the traditional views of learning styles models and improve counselling skills. (Creating)

Syllabus

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 settings

Techniques 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

	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

CO1 Define the concept of rehabilitation and list the methods of assessment and interventions for various disabilities (Remembering)
CO2 Illustrate the scope of rehabilitation psychology (Understanding)
CO3 Plan assessments and interventions for various learning, intellectual and physical disabilities and apply the models of rehabilitation in practice (Applying)
CO4 Analyse the general functions of rehabilitation psychology (Analysing)
CO5 Compare and conclude on the prevention and early intervention for various disability (Evaluating)
CO6 Modify the flaws in the successful implementation of various acts related to disability (Creating)

Syllabus

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

	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

Masters in Science-(Clinical Psychology) 3rd Semester

PCFC0034 FOUNDATION OF CLINICAL PSYCHOLOGY

(4 Credits-60 hrs.)

Course Outcomes

- CO1 Definition of clinical psychology, acquire knowledge and understanding the philosophical roots and historical events that have shaped the field of clinical psychology (Remembering)
- CO2 Explore the underlying philosophical assumptions, individual contributors, and various forces that served to shape the emerging field of clinical psychology (Understanding)
- CO3 Demonstrate familiarity with scientific, ethical, legal, and practice-oriented issues in the field (Applying)
- CO4 Acquire a basic understanding of western (and, to an extent, Indian) philosophical thought, to articulate a philosophy of their own, and apply that philosophy to their professional work in field of clinical Psychology (Applying)
- CO5 Think critically about the science of psychology, analyse psychological theory, research, and practice in a historical context, and develop ideas, critiques, and conclusions of their own (Analysis)
- CO6 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)

Competencies in Clinical Psychology (18 hours)

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
6) Delhi: Sage publication
7) Gregory, R. J. (2000). Psychological testing: History, principles, and applications (3rd Ed.). Boston: Allyn & Bacon.
8) Wolman, B.B. (1965). Handbook of clinical psychology. N.Y: McGraw Hill INC

9) Groth-Marnat, G. (1999). Handbook of psychological assessment, 3rded. New York: John Wiley & Sons, Inc.

Course outcomes (COs) Mapping

	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

CO1 Define the concept of assessment (Remembering)
CO2 Gather the significance and scope of psychological assessment in diagnosis and intervention (Understanding)
CO3 Apply various approaches of assessment in practice (Applying)
CO4 Estimate the appropriate assessments for different population as per the diagnoses. (Analysing)
CO5 Assess the socio-cultural factors in various assessments aiding in the diagnoses. (Evaluating)
CO6 Design psychopathology formulation which will impede the process of effective therapeutic sessions. (Creating)

Syllabus

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

	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

CO1 Define forensic psychology and the role of a Forensic Psychologist. (Remembering)
CO2 Illustrate on the nature of crime. (Understanding)
CO3 Examine the social, psychological theories of crime. (Analysing)
CO4 Apply the methods of forensic psychological investigation. (Applying)
CO5 Explain the concept of Juvenile delinquency, sexual offenders and serial offenders. (Evaluating)
CO6 Create an idea about the importance of Forensic psychological assessment into practice. (Creating)

Syllabus

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

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

3.4 PRACTICUM-III

(2 credits – 60 hours)

Course/Learning Outcomes

CO1 Define the basic concepts of disability, intelligence and personality assessment. (Remembering)
CO2 Extend the theoretical knowledge of disability, personality and intelligence theories and assessment techniques into practice. (Understanding)
CO3 Make use of the important measurement tools to learn administration and scoring. (Applying)
CO4 Examining test scores and interpretation of results. (Analyzing)
CO5 Evaluate the importance of personality, intelligence and disability assessment. (Evaluating)
CO6 Construct conclusion from the results of psychological assessment. (Creating)

Syllabus

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

	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

PCRP6020 RESEARCH PROJECT PHASE I (4 Credits)

Course outcomes

CO1 Knowledge of the major theoretical approaches and findings in psychology. (Remembering)
CO2 Demonstrate knowledge about the research methods used in psychology,. (Understanding)
CO3 Apply the knowledge for preparing research design, and data analysis. (Applying)
CO4 Critically analyse information related to the study of behaviour and mental processes, and use the critical assessment in forming conclusions and arguments. (Analysing)
CO5 Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria. (Evaluating)
CO6 Develop the understanding of how to prepare a research proposal. (Creating)

Syllabus

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

	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

CO1 Remembering the personal integrity, accountability, professional deportment and concern for the welfare of others. (Remembering)
CO2 Understanding of Psychological disorders, empathy, reflective practice, and self-care. (Understanding)

CO3 Applying scientific, theoretical, contextual approach to the discipline (Applying)
CO4 Analyse the symptom severity and clinical features of disorders. (Analysing)
CO5 Determine ethical and Legal guidelines of practice (Evaluating)

Develop effective work skills, including cognitive and expressive skills, self-directed learning & continuing education. (Creating)

Syllabus

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

	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 tothe community and utilizing the vacation optimally.

Course Outcomes

CO1 Define the clinical features of psychological disorders. (Remembering)
CO2 Demonstrate fundamental knowledge and comprehension of the major concepts, theoretical perspectives, historical trends, and empirical findings in psychology. (Understanding)
CO3 Develop Scientific reasoning and critical thinking, including effective research methodology in solving problems related to behavior and mental processes. (Applying)
CO4 Analyse ethically and socially responsible behaviors for professional and personal settings, including development of values that build diverse communities. (Analysing)
CO5 Determine their basic area of interest to work further/specialize in clinical setting. (Evaluating)
CO6 Develop the competence in writing case studies, and interpersonal communication skills. (Creating)

Syllabus

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 tothe community and utilizing the vacation optimally.

Mapping of COs to Syllabus

	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

CO1 Define mental illnesses and rehabilitation. (Remembering)
CO2 To understand counselling in real life setting. (Understanding)
CO3 To apply theoretical principles in order to understand the functioning of various mental health settings (Applying)
CO4 Distinguish clinical features of different mental illnesses. (Analysing)
CO5 Explain the importance of different models of mental health and illnesses in assessment. (Evaluating)
CO6 Develop practical knowledge about different psychological practice and rehabilitation setting. (Creating)

Syllabus

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

	Module 1	Module 2
CO1	H	H
CO 2	H	
CO 3		H
CO 4	H	
CO 5	H	M
CO 6	H	

Masters in Science-(Counselling Psychology) 4th Semester

PCAT0032 ADDICTION AND TRAUMA COUNSELLING

(3 Credits- 45hours)

COURSE OUTCOMES

CO1 Define substance related disorders according to the classification of DSM 5/ICD-10. (Remembering)
CO2 Compare and contrast different psychological interventions for addiction related psychological disorders. (Understanding)
CO3 Categorize the sources of trauma and trauma intervention. (Analysing)
CO4 Apply psychological interventions and techniques on trauma victims. (Applying)
CO5 To evaluate the effectiveness of Psychodynamic approach, CBT, MET, Group intervention in dealing with substance addiction. (Evaluating)
CO6 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)
3) Wright, H. N. (2003). *The new guide to crisis and trauma counseling*. Gospel Light Publications.
4) Levers, L. L. (2012). *Trauma counseling: Theories and interventions*. Springer Publishing Company.
5) Trauma counselling - Theories and Interventions,LopezLevers, Lisa
6) Spiers, T. (Ed.). (2018). *Trauma: a practitioner's guide to counselling*. Routledge.

Mapping of COs to Syllabus

	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

CO1 Define the basic concepts of marriage and counselling. (Remembering)
CO2 Classify different developmental and emotional issues in different family life stages. (Understanding)
CO3 Identify the classical schools of marriage and family counselling. (Applying)
CO4 Analyse the Bowen's intergenerational approach. (Analysing)
CO5 Explain different therapeutic approaches of marriage and family counselling. (Evaluating)
CO6 Discuss the processes of counselling couples with special issues/problems. (Creating)

Syllabus

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, Guilford Publications.
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

	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			

Masters in Science-(Clinical Psychology) 4th Semester

PCPC0037 PSYCHOTHERAPY

(4 Credits – 60 hours)

Course Outcomes

CO1 Define psychotherapy. (Remembering)
CO2 Classify and categorise major disorders with respect to psychotherapy. (Understanding)
CO3 Apply psychotherapeutic concepts and constructs to diagnose and intervene individuals with mental illnesses. (Applying)
CO4 Analyse the distinction among different types of psychotherapy. (Analysing)
CO5 Evaluate the applicability different types to psychotherapy to mental health and illnesses. (Evaluating)
CO6 Create a psychotherapeutic intervention plan for patients on the basis of clinical features, diagnosis criteria and therapist 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 combinations

Family therapy

Group therapy

Module IV: Cognitive Behavioural Interventions (15 hours)

Behaviour therapy techniques

Cognitive modification procedures

Cognitive behaviour therapy: specific applications in various psychological disorders

Dialectic 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: Institute for 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

	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)

CO1 Define the basic concepts of Neuropsychology and naming different biological systems involved in Neurological disorders. (Remembering)
CO2 Explain the neuropsychological basis of human behaviour. (Understanding)
CO3 Identify the difference and relation among brain structures, neurological and endocrine systems. (Applying)
CO4 Classify the sub-systems of the central nervous system of the brain. (Analysing)
CO5 Compare different neuropsychological systems causing Neuro-pathology. (Evaluating)
CO6 Discuss the major theoretical perspective, develop the awareness of the neuropsychological basis of behaviour and can 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 neuropsychological assessment (Vol. 1); Personality assessment (Vol. 2); Behavioral assessment (Vol. 3). NY: Wiley

Course outcomes mapping (COs)

	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

4.3 PRACTICUM-IV

(2 Credits, 60 hours)

COURSE/LEARNING OUTCOMES (COs)

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

CO1 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)
CO2 Classify the various types of psychological and neuropsychological tests on the basis of their use. (Understanding)
CO3 Make interpretations and draw conclusions based on the norms given in the manual. (Applying)
CO4 Examine the details of the rating scale/ test, the aim, applications, procedure of administration and subject results. (Analysing)
CO5 Recommend the use of a suitable psychological assessment for a particular disorder. (Evaluating)
CO6 Test the administrator's decision making process to select a particular test for assessment of a given psychological disorder. (Creating)

Syllabus

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

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

Cos	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

4.4 RESEARCH PROJECT PHASE II (6 Credits)

Course outcomes

CO1 Knowledge of the major theoretical approaches and findings in psychology. (Remembering)
CO2 Demonstrate knowledge about the research methods used in psychology,. (Understanding)
CO3 Apply the knowledge for preparing research design, and data analysis. (Applying)
CO4 Critically analyse information related to the study of behaviour and mental processes, and use the critical assessment in forming conclusions and arguments. (Analysing)

CO5 Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria. (Evaluating)
CO6 Develop the understanding of how to prepare a research proposal. (Creating)

Syllabus

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

	RESEARCH PROJECT PHASE I
CO 1	H
CO 2	M
CO 3	H
CO 4	H
CO 5	M
CO 6	H

4.5 SUPERVISED INTERNSHIP II

(8 Credits)

Course Outcomes

CO1 Remembering and identifying intervention. (Remembering)
CO2 Understanding dynamics of history taking and therapeutic approach to psychological counselling. (Understanding)
CO3 Apply the, theories skills and ethics in counselling. (Applying)
CO4 Analyse the trial and error essence of a counselling relationship and client needs. (Analysing)
CO5 Evaluate ethico-legal situations. (Evaluating)
CO6 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

	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	

Mapping of Courses with POs/PSOs

Sl. No.	Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PS O1	PS O2	PS O3	PS O4	PS O5
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	H		M	L	H	L	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 Counselling (SE)	M	L	M	L	M	L	L	L	H	M	H	H	M
1.6	General Psychology (SE)	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 (P/NP)	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 (SE)	H	L	M	L		L	M	M	M	M	L	H	M
2.5	Introduction to Social Psychology (SE)	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 Psychol	M	H	M	L	H	L	H	M	H	M	H	H	H

	ogy													
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	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 Counseling	H	M	M	L	M	L	M	M	H	M	H	H	H
4.2	Marriage and Family Counseling	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	Psychodiagnostics	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

DEPARTMENT OF SOCIAL WORK

PROGRAMME: MASTER OF SOCIAL WORK (MSW)

PROGRAMME OUTCOMES

PO1 Critical Thinking and Professional Judgment: Apply theoretical knowledge to make a critical analysis, intervene using innovative frameworks and evaluate and follow up.

PO2 Effective Communication: Engage in inter-personnel, behavioural change communication and be proficient in Information Communication Technology.

PO3 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

PO4 Effective Citizenship: Engage in service learning and community engagement programmes for contributing towards achieving of local, regional and national goals.

PO5 Ethics: To engage in social work practice as per National Association of Social Worker's ethical framework.

PO6 Environment and Sustainability: Participate and promote World sustainable development goals 2030.

PO7 Self-directed and Life-long Learning: Engage in continuous learning for professional growth and development.

PO8 Scientific Temper: - Gaining aptitude for research for contribution to knowledge enterprise and documentation of social work theory and practice.

PROGRAMME SPECIFIC OUTCOMES

PSO1 Conceptual clarity: Students get familiarized and attain conceptual clarity in social work theories, perspectives, models, methods and processes of social work practice.

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.

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.

PSO4 Attitudinal change: Working with the personal self for meaningful and enriching social work professional career.

COURSES OFFERED IN MSW

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
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 COURSES WITH POs/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	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 Services	H		H		M			M	H	H	H	H
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
Value Added Courses													
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

THEORY COURSES

SWHI0035: HISTORY, IDEOLOGIES AND FIELDS OF SOCIAL WORK (3-0-0)

(3 Credits - 45 hours)

Course Outcomes:

CO1 Introduce the basic concepts of social work to the students. (Understanding)
CO2 Introduce to the students the history and philosophy of social work, its methods and fields (Remembering)
CO3 Introduce social work as a profession (Applying)
CO4 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:

	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*:*

CO1 Introduce the basic concepts of human growth and development. (Remembering)
CO2 Introduce the Personality theories (Understanding & Applying)
CO3 Introduce the Concept of Mental Health and discuss the role of social worker in promoting it. (Understanding and Creating))
CO4 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:

	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, POLITY AND ECONOMICS(2-0-0)

(2 Credits - 30 hours)

Course Outcomes:

CO1 Understand the major social institutions, structure, stratification and to develop an understanding on the different social problems in the society; (Remembering and Understanding)
CO2 Understand and define basic concepts of economic and political theories ;(Remembering and Understanding)
CO3 Explain how the economic and political institutions are organized, and how they have a bearing on human society ;(Applying)
CO4 Critically analyze and present the growth and development experience of India; (Analyzing)
CO5 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 (6 hours)

Social structure and stratification: Caste, Class, Tribes, Gender, Religion

Structural Functionalism approach; Conflict/ Dialectical approach; Symbolic Interactionism

Inclusion-exclusion: Power, Privilege and Oppression

Module II: Social Institutions (4 hours)

a) Social Institutions: Marriage, Family, Religion, Education, Economy, Politics, etc.

b) Social problems: Causes and Consequences of different Social Problems in India

Module III: Economics and development (5 hours)

a) Concept and definition: economy, demand and supply, national income, standard of living, per-capita income, poverty and its measurement

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

Module IV: India's development experience (5 hours)

a) India's experience of colonialism

b) Ideological hues impacting India's economic policy

c) Rise of self-reliance and economic nationalism during the independence movement

d) Post-independence trajectory- agrarian reforms and rural development

e) Liberalisation of India's economy and its impact on welfare measures of the state; Planned Economy to NITI Aayog shift

Module V: Politics and political systems (5 hours)

State: origins and elements

b) Sovereignty, power, authority, legitimacy, liberty, equality and justice

c) Political thought: behaviouralism, post behaviouralism, liberalism, idealism, anarchism, and Marxism

d) Citizenship: rights and duties

Module VI: Indian political system (5 hours)

a) Making of India: political nationalism- India as a nation of diversity

b) Idea on state and nation: Gandhi, Nehru and Ambedkar

c) The Constitution of India, and the Federal characteristic of Indian state

d) North East India: decentralised governance- philosophy, practice, and experiences

e) Political movements in Northeast India

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, NGender 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 freedom. 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: Gyan Prakashan. (2013).

17) Xaxa, V. State Society and Tribes. New Delhi: Pearson Education. (2014).

Mapping of COs to Syllabus:

	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)

(3Credits– 45hours)

COURSE OUTCOMES:

CO1 Define and spell community organisation and social action as methods in social work education and practice. (Remembering)
CO2 Explain the concepts related to community organisation and social action as methods of social work education and practice. (Understanding)
CO3 Apply the understanding of the concepts of community organisation and social action in the fields of practice. (Applying)
CO4 Analyze various field situations and apply the relevant methods to address social concerns. (Analyzing)
CO5 Assess and choose community organisation or social action strategies to address social issues. (Evaluating)
CO6 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, Methods for Community Participation – a Complete Guide for Practitioners, Vistaar Publications, New Delhi, 2002
6) Prasad, Ankit, Social Welfare and Social Action. New Delhi: Mittal Publications
7) Ross. M.G., Community Organisation. Theories, Principles, and Practices, Harper and Row, New York, 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) Zastrow H. Charles – The Practice of Social Work – A Comprehensive Work text, 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:

	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 Outcomes:

CO1 Understand the interrelatedness of human life and environment (Understanding)
CO2 Develop an understanding of problems arising out of environmental degradation and globalization (Analysing)
CO3 Understand the roles of State in disaster management (Evaluating)
CO4 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) 9Canton, 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:

	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:

CO1 Understand the concept of gender, patriarchy, gender roles and relationships. (Remembering and Understanding)
CO2 Study the feminist theories, women's movements, and women's development(Remembering and Understanding)
CO3 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)
CO4 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 Constructionof 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:

	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:

CO1 Introduce the concept of social casework as a method of social work practice and the tools used in Casework. (Remembering, Understanding & Applying)
CO2 Introduce the approaches to Case work. (Remembering, Understanding & Applying)
CO3 Introduce Casework process and the techniques used. (Understanding, Applying, Analyzing & Evaluating)
CO4 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:

	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:

CO1 Understand the concept of groups and its importance and influence on individuals (Remembering and Understanding)
CO2 Understand social group work as a method of social work (Remembering and Understanding)
CO3 Develop skills to apply group work methods in various settings (Creating and Evaluating)
CO4 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:

	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*:*

- CO1 Define and show social science research and social work research and the application of statistics in social work practice.(Remembering)
- CO2 Explain and discuss social work research as a method of social work and its application in addressing social issues. (Understanding)
- CO3 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)
- CO4 Analyze various social issues and use research methods, strategies and data to suggest solutions. (Analyzing)
- CO5 Assess relevant research methods and techniques in carrying out social work research. (Evaluating)
- CO6 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; Measuresof 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:

	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 Outcomes:

CO1 Develop an understanding of social welfare administration as a method of social work (Remembering)
CO2 Understand the various components of social welfare administration (Understanding)
CO3 Understand the concept and theories of Development (Analysing)
CO4 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 Rulesapplicable 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:

	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:

CO1 Introduce the concept and different types of disabilities.(Remembering, Understanding & Applying)
CO2 Introduce the Legislations for Persons with disabilities. (Remembering, Understanding & Applying)
CO3 Introduce the concept of Inclusive Education in India. (Understanding, Applying, Analyzing, Evaluating and Creating)
CO4 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) 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:

	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:

CO1 Provide an understanding on social legislation and social action with relevance to social work practice (Remembering and Understanding)

CO2 Develop an understanding about various social welfare legislations with specific reference to different groups of people; 9 Evaluating and Creating)

CO3 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)

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:

	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:

CO1 Define, identify and explain the meaning and concept of a social work perspectives (Remembering and Understanding)
CO2 List, define and classify the perspectives that have prominently informed social work practice ;(Applying and Analysing)
CO3 Locate and critically evaluate the relevance of perspectives in social work fields of practice ;(Evaluating and Creating)
CO4 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:

	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:

CO1 Define the concepts, approaches, policies and strategies of community development (rural, tribal and urban) (Remembering)

CO2 Discuss and explain the development issues of communities – tribal, rural and urban (Comprehension)
CO3 Apply the knowledge and skills acquired in social work education to address issues of marginilisation, exclusion and oppression. (Application)
CO4 Able to analyse various developmental issues and address them by applying relevant empowerment and development models and approaches in social work practice (Analyse)
CO5 Able to assess development concerns, and adopt and apply models and approaches of development for alleviation and reduction of community inequities (Evaluating)
CO6 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:

	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:

CO1 Understand the context, meaning and relevance of decentralised governance for urban, rural and tribal areas. (Remembering and Understanding)
CO2 Develop knowledge about the structure and functioning of governing bodies at various levels. (Creating and Evaluating)
CO3 Develop an understanding to the various constitutional amendments for better governance and development (Creating and Evaluating)
CO4 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:

	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:

CO1 Define family and marriage, and theories associated with these concepts in the context of prevalent customary and legal instruments and explain how the differential structure of families affect its dynamics and processes(Remembering and Understanding)

CO2 Assess and present the gender relations in society in the context of patriarchal social structure (Evaluating and Creating)

CO3 Apply social work theoretical models for conceptualizing intervention plans that are best-suited for addressing problems located in different family structures (Applying and Analysing)

CO4 Identify and evaluate the different plans and schemes of the government of India pertaining to family development and welfare (Evaluating)

Module I: Family and Marriage as Social Institutions (11 hours)

Concept of family- Origin, Types of Family, and Functions of Family; Concept, Types and Functions of Marriage; Constitutional Instruments on Family, Marriage and Divorce in India

Module II: Family life cycle and dynamics (11 hours)

Family Life Cycle approach; Family Dynamics – Power, Myths, Role, Relationship; Gender and Patriarchy; Implications of Patriarchal Social Structure and Crises of Violence against Women in Families-Global, National and Local; Family Assessment

Module III: Family in the Context of Globalization (11 hours)

Changing situations in Family, Marriages and Marital Relationship; Alternative Family and Marriage Patterns and Structures-

Dual earner /Career Families and Implications; Single Parent families, Female headed Households, Reconstituted / Step families; Childless Families; Same-sex Families, Consensual Unions, and live-in Relationships; Displacement and Disaster (War, Conflict, riots and Natural Calamities) generated changes in the Family and Implications; Vulnerability of Families due to Poverty, Caste, Race, and Ethnicity

Module IV: Social Work with Families- Interventions, Techniques and skills (12 hours)

Family Centered Social Work – Problem Solving Approach; Family life-cycle and life enrichment programmes – Developmental Approach; 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) 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

Mapping of COs to Syllabus:

	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:

CO1 Understand the process of socialization of a child (Remembering and Understanding)
CO2 Understand health and children's' health i.e. Both mental and physical well-being. (Remembering and Understanding)
CO3 Analyze the difficult situations faced by children in the present context. (Analysing)
CO4 Know the national and international efforts for child welfare and the child related laws. (Remembering and Understanding)
CO5 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:

	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 Outcomes:

CO1 Introduce the historical development of medical social work in western countries and in India. (Remembering)
CO2 Students will develop an insight on the impact of disease on the individual and his/her social system.
CO3 (Understanding)
CO4 Students would learn to implement social work intervention strategies in medical and psychiatric settings. (Applying)
CO5 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:

	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 Outcomes:

CO1 *Introduce* the concept of mental health, normal and abnormal behaviour, meaning of psychiatry and its history. (Remembering)
CO2 Students will develop the skills of assessment of mental illness. (Applying)
CO3 Students will learn about various mental illnesses affecting people. (Applying)
CO4 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, 4thEdition. 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:

	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:

CO1 Understanding the structure and functioning of an organization (Remembering and Understanding)
CO2 To develop the skills for Organisation Development Process(Evaluating and Creating)
CO3 To establish and manage any development organisation.(Evaluating and Creating)
CO4 To introduce the students to organisational structure and management (Remembering and Understanding)
CO5 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 (10thEd.), 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 (10thed.), New Delhi: Prentice Hall of India, 2002

Mapping of COs to Syllabus:

	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:

CO1 Develop an understanding about the social policies and decision making process of the government in planning for development in India. (Evaluating and Creating)

CO2 Understand the Governmental efforts for development of Rural, Tribal and Urban communities (Remembering and Understanding)
CO3 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:

	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:

CO1 Introduce and help students understand the psychological, legal and cultural definitions of child and childhood (Remembering and Understanding)
CO2 Introduce students to the major personality theories of psychology thus enabling them to understand human behaviour. (Applying and Analysing)

CO3 Help students discover the different factors that influence development and behavior of children (Evaluating and Creating)

CO4 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:

	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:

CO1 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)

CO2 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)

CO3 Make the students understand the role, functions and powers of the UN agencies and their mandate in working towards the cause of children(Analysing)

CO4 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:

	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:

CO1 Understand the key concepts and issues related to Social Development (remembering and Understanding)
CO2 Promote alternative paths of Social Development that promotes the wellbeing of Individuals, families and communities (Creating and Evaluating).
CO3 Develop an understanding of social policy in the perspective of the national goals as stated in the constitution. (Creating and Evaluating)
CO4 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:

	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:

CO1 Understand the importance and process of planning, methodology for planning and formulating projects using the Logical Framework Analysis (Remembering and Understanding)
CO2 Develop an understanding of the problems and issues faced by the poor and the marginalized (Creating)
CO3 Develop an insight into the different strategies and approaches commonly adopted by Development Organisations for Project Management (Applying and Analysing)
CO4 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:

	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:

CO1 Define health, disease, epidemiology, health policies, health education and related terms of community health and population studies (Remembering)
CO2 Explain the concepts of health, health indicators and relevance of social work in health (Understanding)
CO3 Apply and knowledge and understanding of the concepts of community health in social work practice for development (Application)
CO4 Able to analyse various health issues in communities, and suggest and apply solutions to community health concerns (Analyse)
CO5 Able to assess and choose health intervention plans and policies for community needs (Evaluate)
CO6 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:

	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:

CO1 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)

CO2 Build capacity among the students for critical reflection and analysis of community development issues pertaining to the disempowered ;(Applying and Analysing)

CO3 Build upon the existing understanding of community dynamics, structures and experiences ;(Evaluating and Creating)

CO4 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:

	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:

CO1 Develop an understanding of the feminist perspective of women empowerment (Remembering and Understanding)
CO2 Understand the status of women in the present social, political and economic context (Remembering and Understanding)
CO3 Develop an understanding of the women's problems and issues (Analyse)
CO4 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 atWorkplace (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:

	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:

CO1 Understand the context, responses and practice framework for special-care-needs families (Remembering and Understanding)
CO2 Imbibe and become familiar with practice principles, values and ethics while dealing with families with special needs (Remembering and Understanding)
CO3 Develop skills required for meaningful intervention (Applying and Analysing)
CO4 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:

	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:

CO1 Introduce the field of psychiatric social work and comprehend the roles and responsibilities of psychiatric social workers (Remembering and Understanding)

CO2 Introduce the concept of rehabilitation and the application of different therapeutic interventions (Understanding and Applying)

CO3 Introduce different non-pharmacological therapeutic approaches used in psychiatry (Understanding, Analyzing and Applying).

CO4 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:

	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:

CO1 Define the concept of health, community health and health care services. (Remembering)
CO2 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)
CO3 Make use of the knowledge on health education and health promotion in the field of work. (Applying)
CO4 Analyze the important strategies and approaches of social work in community health. (Analyzing)
CO5 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)
CO6 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:

	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:

CO1 Understand HRM as a profession. (Remembering and Understanding)
CO2 Understand the role of HRM in business. (Remembering and Understanding)
CO3 Equip learners with knowledge, skills, attitude, professional competencies and social sensitivities essential for a successful career in HRM. (Applying and Analyzing)
CO4 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:

	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:

CO1 Introduce students into CSR concepts (Understanding)
CO2 DevelopcompetenciesforeffectivefieldinterventionsresearchandmanagementofCSR interventions (Applying)
CO3 DevelopaninsightintopresentCSRstrategiesandmodelbusinessorganization (analysing)
CO4 Enablestudentswithconceptualclarityonneed,purposeandrelevanceofresearchapplicability in CSRpractice (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:

	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:

CO1 Understand the children with special needs and develop skills in social work intervention (Remembering and Understanding)

CO2 Understand the context, responses and practice framework for inclusive programs and special-care-needs families (Remembering and Understanding)

CO3 Imbibe and become familiar with practice principles, values and ethics while dealing with families with special needs (Applying and Analyzing)

CO4 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:

	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

SWSW0069: CHILD CENTERED SOCIAL WORK PRACTICE (3-0-0)

(3 Credits – 45 hours)

Course Outcomes:

CO1 Understand different social work perspectives on working with children. (Remembering and Understanding)
CO2 Recognize the role of families and other stakeholders in child protection and demonstrate methods of strengthening families for child protection. (Applying and Analysing)
CO3 Develop advanced intervention skills in working with children, adolescents and their families. (Evaluating and Creating)
CO4 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 CareInstitutions, 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
8) Gangrade, K. D., working with Community at the Grassroot level: Strategies and Programmes, New Delhi: Radha Publications, 2001
9) Datar, S.; Baviskar, R. (et al), Skill Training for Social Workers: A Manual, London: Sage, 2010
10) D'Souza, B. & Sonawat, R., Handbook for Children in Difficult Situations: Activity Manual for Marginalised Adolescent (Vol. 1) Mumbai: Tej-Prasarni, 2003
11) Graves, D. H., Writing: Teachers and Children at Work. 20th Anniversary Edition, Portsmouth: NH Heinemann, 2003
12) Butler, I. & Roberts, G., Social Work with Children and Families: Getting into Practice (2nd Ed), London: Jessica Kingsley Publishers Ltd., 2004
13) Komanduri A. & Vennam U., Family-Centred Interventions in Indian Journal of Social Work (70) 2, 2009
14) Sanders, P., First Steps in Counselling: A Students' Companion for Basic Introductory Courses. PCCS Books, 2002
15) Jones. N. Richard., Theory and Practice of Counselling and Therapy. Sage Publication, 1995
16) Jones. N. Richard, Basic Counselling Skills: A helper's Manual. Sage Publication, 2003

Mapping of COs to Syllabus:

	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 COURSE

SWRB6014 Results Based Management of Projects and Programmes (15-0-15)

(2 Credits 30 hours)

Course Outcomes:

CO1 Understand the importance and process of Result based management of projects and programmes and formulating projects using the Logical Framework Analysis
CO2 Develop an understanding of the problems and issues faced by the poor and the marginalized
CO3 Develop an insight into the different strategies and approaches commonly adopted by Development Organisations for Project Management
CO4 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:

	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

SWAW6015 Academic Writing, Research Proposal Development and Dissertation Writing Course (15-0-15)

(2 credits - 30 hours)

Course Outcomes:

CO1 Remember the concepts and meaning related to academic and professional writing. (Remembering)
CO2 Understand the different components, stages and steps of academic writing, research proposal development and dissertation writing. (Understanding)
CO3 Able to apply the skill of professional and academic writing into practice. (Applying)
CO4 Able to analyse different types of writing in professional life. (Analyzing)
CO5 Able to review and evaluate writing styles in keeping with the framework of different professional and academic writing. (Evaluating)
CO6 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:

	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

SWWD6016 Working with Diversity (15-0-15)

(2 Credits 30 hours)

Course Learning Objectives:

CO1 Reflect on your own diversity (reflection), how it impacts on others (reflexivity) and how it informs to the development of critical cultural competence
CO2 Understand the key theories related to the concept of diversity
CO3 Critique the theoretical approaches of Equality, Human Rights and Diversity as they are applied in practice
CO4 Apply the Diversityapproach to current global issues including Covid-19
CO5 Raise awareness of diversity throughan 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 Structuresof 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 Texts:

1) The lecturers for each week provide two academic readings linked to the weekly lecture. However, the following texts are recommended for a general overview of the field of diversity.

2) Thompson, N. (2011). Promoting Equality: Working with Difference and Diversity. Palgrave Macmillan. (Electronic book ordered for UEF students)

3) Thompson, N. (2016). Anti-discriminatory practice: Equality, diversity and social justice. Macmillan International Higher Education.

4) 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)

5) Marsiglia, F. F., Kulis, S. S., & Lechuga-Peña, S. (2021). Diversity, Oppression, & Change: Culturally Grounded Social Work. Oxford University Press, USA.

6) Online Journals:

   a) Journal of Ethnic and Cultural Diversity in Social Work

   b) Journal of Multicultural Social Work

Mapping of COs to Syllabus:

	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

PRACTICUM

SWFR6008: CONCURRENT FIELDWORK I (6 credits):200 hours of Fieldwork in 15 weeks(0-0-16)

Expected Outcomes:

CO1 Students are exposed to the community and community issues
CO2 The students understand the dynamics and issues in the community and become aware of the sensitivities of people while working with them.
CO3 Students get a close feel of the community and community settings
CO4 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.
CO5 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:

CO1 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 Outcomes:

CO1 Learn the basic computer applications, those are useful for a social worker (Remembering)
CO2 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:

	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:

CO1 The students focus on their Area of Concentration / Specialization .
CO2 Enable the students to become more proficient in the field and apply relevant skills and techniques in handling real situations.
CO3 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.

SWDI6011: DISSERTATION (2-2-2)

(6 Credits: 90 hours in 15 weeks)

Course Outcomes:

CO1 Develop the skills of Literature Review, Research Methods, Research Analysis and writing of dissertation

Process

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.

SWCF6012: CONTINUOUS FIELD WORK II (0-0-200)

(6 credits: 200 hours fieldwork in one month)

Expected Outcome:

CO1 The students focus on their Area of Concentration / Specialization.
CO2 Enable the students to become more proficient in the field and apply relevant skills and techniques in handling real situations.
CO3 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.

SWSL0200: PARTICIPATORY SERVICE LEARNING-RURAL PRACTICUM(30-0-50)

Credits: 2 (30 Hours)

Course Outcomes:

- CO1 Understanding the meaning and objectives of service learning and participatory approach to social development (Remembering and Understanding)
- CO2 Learn and apply various methods, techniques and strategies for participatory rural/urban mapping, development and communication (Applying)
- CO3 Appraising the spatial, temporal and relational aspects of communities in the village/urban settings by application of participatory learning, action and reflection (Evaluating)
- CO4 Being familiar with culture, tradition, customs and social change and transformation processes of a rural/urban locality(Creating);
- CO5 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:

	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	

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- BA ENGLISH (HONOURS)

PROGRAM OUTCOMES (PO)

PO1 **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.

PO2 **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.

PO3 **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in a group setting.

PO4 **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.

PO5 **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your actions and accept responsibility for them.

PO6 **Environment and Sustainability:** Understand the issues of environmental context and sustainable development.

PO7 **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 (PSO)

PSO1: To familiarize the students with the different genres of English literature and understand the various literary techniques employed in the prescribed texts.

PSO2: To develop a critical aptitude in the analysis of the literary texts and apply relevant literary theories and approaches in the study of the texts.

PSO3: To understand the means of effective communication and enhance the creative use of language.

PSO4: To develop the technical skills and ethical decisions appropriate for the holistic professional development in terms of new entrepreneurial ideas in related fields.

PSO5: To create avenues for sharing the results of academic and disciplinary learning through the preparation and publication of research materials.

LIST OF COURSES

1.5 British Poetry and Drama: 14th to 17th Centuries
1.6 British Poetry and Drama 17th and 18th Centuries
1.7 English Communication/MIL
1.8 Academic Writing and Composition
2.1 British Literature: 18th Centuries
2.2 British Romantic Literature
2.3 Environmental Studies
2.4 Contemporary India: Women and Empowerment
3.1 British Literature- 19th Century
3.2 British Literature: The Early 20th century
3.3 European Classical Literature
3.4 Creative Writing
3.5 Soft Skills
3.6 Language and Linguistics
4.1 Indian Classical Literature
4.2 American Literature
4.3 Modern European Drama
4.4 English Language Teaching
4.5 Translation Studies
4.6 Language, Literature and Culture
5.1 Post-Colonial Literature
5.2 Indian Writing in English
5.3 Literary Criticism
5.4 British Literature: Post World War II
5.5 Literature of Indian Diaspora
5.6 Science Fiction and Detective Literature
6.1 Popular Literature
6.2 Women's writings
6.3 Literary Theory
6.4 Travel Writing
6.5 Partition Literature
6.6 Autobiography

MAPPING of COURSES to PO/PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
1.1	H						H	H	M	H		M
1.2	H		M					H	H			M
1.3	H		H		H		M	M			M	H
1.4		H	H				L			H	M	
2.1	H						H	H	H	H		
2.2	H	H	H	H		H		H			M	
2.3	H	M		H	H		H	H	H		H	H
2.4					H	H	M				M	M
3.1	H	L	H			M	H		H			M
3.2	H			M	L			H			L	H
3.3	H		L	M	L			H	H			H
3.4				M	H		H				M	L

3.5		H	H	L	M		M			H	M	
3.6		M					H			M	H	M
4.1	H			L	M			H	H			
4.2	H				M		H	H				H
4.3	H		M	L	M			H	H			H
4.4	M	H	M	M			H			H		M
4.5	M	L	L	L	M			M	H		M	M
4.6	M	H	M	M	M		M	M	L	M	M	L
5.1	M		H	L	M		M	M	M		H	H
5.2	H	H	L				H	H	H			H
5.3	H	H	L				H		H			H
5.4			M		M		H	H	H			H
5.5	M		M		M		M	M	H		L	
5.6	M		M		L		M	M	H			M
6.1	H	M	H					H	H		H	H
6.2	H	H	H	H			H		H			H
6.3		H					H		H			H
6.4	H	M	M	M	L		H	H	H			H
6.5	M		M		M		H	M	H			M
6.6	M	M	L				M	M	H	M	L	L

DETAILED SYLLABUS

THEORY COURSES

EGBP0101: BRITISH POETRY AND DRAMA: 14 TO 17 CENTURY (5-1-0)

(Credits: Theory- 5, Tutorial-1)

Course Outcomes

1. Define and identify the role of various genres, themes and style pertaining to the prescribed periods of English literature. (Remembering)
2. Critically read and describe the various genres from the concerned periods. (Understanding)
3. Apply historical events and changes in reading of the texts. (Applying)
4. Analyse the socio-political and literary shift in the literature of the age. (Analysing)
5. Evaluate and justify the plot, theme, characters and context of the selected texts. (Evaluating)
6. Design an innovative understanding of the texts based on its social and cultural set up. (Creating)

Module I: Selected Poetry (35 lectures)

Geoffrey Chaucer- "The Wife of Bath's Prologue" Edmund Spenser- Selections from Amoretti: Sonnet LXVII 'Like as a huntsman...'

Sonnet LVII 'Sweet warrior...'

Sonnet LXXV 'One day I wrote her name...' John Donne-

"The Sunne Rising" "Batter My Heart"

"Valediction: forbidding mourning"

Module II: Selected Drama (40 lectures) Christopher Marlowe- *Doctor Faustus* William Shakespeare-*Macbeth*

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.

Mapping of COs to Syllabus

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

EGBL0102: BRITISH LITERATURE: 18th CENTURY (5-1-0)

(Credits: Theory- 5, Tutorial-1)

Course Outcomes

1. Describe the historical and literary contexts of the eighteenth century along with the writers. (Remembering)
2. Differentiate the eighteenth century from the rest of literary periods of England. (Understanding)
3. Apply the understanding of the historical contexts in reading the literary texts. (Applying)
4. Illustrate the literary texts as representative of the historical events. (Analysing)
5. Summarize the thematic concerns of the given literary texts. (Evaluating)
6. Develop a pertinent interpretation of the given literary texts. (Creating)

Module I: Selected Drama (15 lectures)

William Congreve- *The Way of the World*

Module II: Selected Fiction (35 lectures)

Jonathan Swift- *Gulliver's Travels* (Books III and IV)

Laurence Sterne- *The Life and Opinions of Tristram Shandy, Gentleman*

Module III: Selected Poetry (25 lectures)

Thomas Gray- "Elegy Written in a Country Churchyard" Samuel Johnson-"London"

Suggested Readings

1. Collier, Jeremy. A *Short View of the Immorality and Profaneness of the English Stage.* Routledge, 1698.
2. Defoe, Daniel. "The Complete English Tradesman."(Letter XXII), "The Great Law of Subordination Considered." (Letter IV), and "The Complete English Gentleman." *Literature and Social Order in Eighteenth- Century England*, edited by Stephen Copley, Routledge, 1984.
3. Johnson, Samuel. "Essay 156." *The Rambler*, *Selected Writings: Samuel Johnson*, edited by Peter Martin, Harvard University Press, 2009, pp.194–7.
   ---. "Chapter 10.", *Rassela,* OUP, 1819, pp. 38-42.
   ---."Pope's Intellectual Character: Pope and Dryden Compared.", "The Life of Pope."The Norton Anthology of English Literature, vol.1, edited by Stephen Greenblatt, 8 edition, W.W. Norton & Company, 2006, pp. 2693-4, 2774-7

Mapping of COs to Syllabus

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

EGPD0103: BRITISH POETRY AND DRAMA: 17 AND 18 CENTURIES (5-1-0)

(Credits: Theory- 5, Tutorial-1)

Course Outcomes

1. Identify the representative literary trends of the ages. (Remembering)
2. Critically read and interpret the literary genres of the period. (Understanding)
3. Apply the technique of mock heroism in reading a few texts. (Applying)
4. Analyze the social and political scenario pertaining to the Puritan to Neoclassical period. (Analysing)
5. Assess and evaluate the plot, theme, characters and context of the selected drama. (Evaluating)
6. Formulate an innovative theoretical reading of the text. (Creating)

Module I: Selected Poetry (35 lectures)

John Milton- *"Paradise Lost"*: Book1

Alexander Pope- *"The Rape of the Lock"* (Canto 1&2)

Module II: Selected Plays (40 lectures)

John Webster- *The Duchess of Malfi* Aphra Behn- *The Rover*

Suggested Readings

1. Dryden, John. "A Discourse Concerning the Origin and Progress of Satire". *The Norton Anthology of English Literature*.vol. 1, 9th Edited by Stephen Greenblatt. New York: Norton 2012. pp.1767–8
2. Hobbes, Thomas. *The Leviathan* selections from Part I. New York: Norton, 2006. chaps. 8, 11, and 13
3. Machiavelli, Niccolo. *The Prince*. Edited and translated by Robert M. Adams, New York: Norton, 1992. chaps. 15, 16, 18, and 25
4. The Gospel according to St. Luke. chaps. 1–7 and 2–4 The Holy Bible, Genesis, chaps.1–4

Mapping of COs to Syllabus

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

EGLE0104: BRITISH LITERATURE: 19th CENTURY (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes

1. Describe the historical context and literary figures of the nineteenth century. (Remembering)

2. Understand the difference of the nineteenth century from the rest of the literary periods. (Understanding)
3. Examine the historical matters of the nineteenth century in the literary texts. (Applying)
4. Critically analyse the representation of the historical events in the given literary texts. (Analysing)
5. Evaluate the plot, themes, characterisation, narrative techniques and rhetoric of the given literary texts. (Evaluating)
6. Build relevant arguments regarding the thematic concerns and literary techniques of the literary texts. (Creating)

Module I: Selected Fiction (40 lectures)

Jane Austen - *Pride and Prejudice*

Charlotte Bronte- *Jane Eyre*

Charles Dickens– *Hard Times*

Module II: Selected Poetry (35 lectures)

Christina Rossetti: "The Goblin Market"

Alfred Tennyson: "The Lady of Shalott", "Ulysses", "The Defence of Lucknow" Robert Browning: "My Last Duchess", "The Last Ride Together", "Fra Lippo Lippi"

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. New York: Norton, 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

Mapping of COs to Syllabus

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

EGWC0105: ACADEMIC WRITING AND COMPOSITION (5-1-0)

(Credits: Theory- 5, Tutorial-1)

Course Outcomes

1. Define and identify the role of academic writing and its component (Remembering)
2. Discuss the significance of critical thinking.(Understanding)
3. Examine the ways of summarizing and paraphrasing a text. (Applying)
4. Categorize the components of the argument and writing process. (Analysing)
5. Summarize a piece of writing with literary significance. (Evaluating)
6. Formulate literary piece with the help of the skills acquired. (Creating)

Module I: Introduction to writing (15 lectures)

Introduction to the Writing Process

Introduction to the Conventions of Academic Writing

Module II: General Principles of Summarizing (15 lectures)

Writing in one's own words: Summarizing and Paraphrasing

Module III: Development of Critical Thinking (20 lectures)

Critical Thinking: Synthesis, Analyses, and Evaluation

Module IV: Development of Argument, Citation and Reviewing (25 lectures)

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. Leki, Ilona. *Academic Writing: Exploring Processes and Strategies.*CUP, 1998.

Mapping of COs to Syllabus

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

EGEC0107: ENGLISH COMMUNICATION (2-0-0)

(Credits: Theory- 02)

Course Outcomes

1. Define the theories of Communication, its types and modes. (Remembering)
2. Explain various dimensions of communication skills. (Understanding)
3. Use the correct and suitable art of communication in today's world of complexities, multiplicities and competition. (Applying)
4. Analyse the difference in personal and professional interactions. (Analysis)
5. Evaluate different documents and reports, prepared or presented. (Evaluating)
6. Summarize various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments. (Creating)

Module I: Introduction (6 lectures)

Theory of Communication, Types and modes of Communication

Module II: Language of Communication (6 lectures)

Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers and Strategies, Intra-personal, Inter-personal and Group communication

Module III: Speaking Skills (6 lectures)

Monologue, Dialogue, Group Discussion Effective Communication/ Mis- Communication, Interview, Public Speech

Module IV: Reading and Understanding (6 lectures)

Close Reading, Comprehension, Summary, Paraphrasing, Analysis and Interpretation Translation (from Indian language to English and vice-versa) Literary/ Knowledge Texts

Module V: Writing Skills

Documenting, Report Writing, Making notes, Letter writing

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.

Mapping of COs to Syllabus

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

EGWE0113: CONTEMPORARY INDIA: WOMEN AND EMPOWERMENT (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes:

1. Trace the developmental history of Women Empowerment in India vis-à-vis significant socio-political events (Remembering)
2. Develop an understanding of the space accorded to women in India through history (Understanding)
3. Apply relevant literary theories and approaches to the study of texts under scrutiny (Application)
4. Analyse the manner in which the social construction of gender comes about (Analysing)
5. Critique the given and stereotypical notions of gender constructions (Evaluation)
6. Summarize and offer a critique of the evolution of Women's Empowerment both in terms of policy and discourse. (Creating)

Module I: Social Construction of Gender (15 lectures)

Masculinity and Femininity Patriarchy

Women in Community

Module II: History of Women's Movements in India (Pre & Post Independence) (15 lectures)

Women and Nation Women and the Partition

Women and Political Participation Women in the Public and Private Spaces

Module III: Women and Law (15 lectures)

Women and the Indian Constitution

Personal Laws (Customary practices on inheritance and Marriage) Workshop on legal awareness

Module IV: Women's Body and the Environment (15 lectures)

State interventions, Khap Panchayats, Female foeticide, Domestic violence, Sexual harassment Eco-feminism and the Chipko Movement

Module V: Female Voices (15 lectures)

Kamala Das, "The Old Playhouse" Mahashweta Devi, *Mother of 1084* Krishna Sobti, *Zindaginama*

Suggested Reading:

1. Butalia, Urvashi. *The Other Side of Silence: Voices from the Partition of India.* USA: Duke University Press,2000.
Menon, Nivedita. *Gender and Politics in India: Themes in Politics. India: OUP, 2001.*

2. Mies, Maria and Vandana Shiva. *Ecofeminism.* Zed Books, 2nd edition, 2014.
3. Sanagari, Kumkum. *Recasting Women: Essays in Colonial History*. USA: Rutgers University Press, 1989.
4. Sarkar, Tanika and Sumit Sarkar. *Women and Social Reform in Modern India*- Vol 1 & Vol. India: Permanent Black, 2011.
5. Walsh, Judith. *Domesticity in Colonial India: What Women Learned When Men Gave Them Advice*. USA: Rowman and Littlefield, 2004.

Mapping of COs to Syllabus

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

EGBR0114: BRITISH ROMANTIC LITERATURE (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes

1. Identify the essence of Romanticism in the selected texts.(Remembering)
2. Describe the recurrent themes pertaining to Romantic age as reflected in the texts prescribed. (Understanding)
3. Examine the Romantic concepts like Imagination, Fancy and Nature with reference to the prescribed texts. (Applying)
4. Analyze the plot, theme and characters as explored in the prescribed novel. (Analyzing)
5. Evaluate the text from a socio-political context of the Romantic Period. (Evaluating)
6. Build a critical reading of the selected texts from a Romantic perspective. (Creating)

Module I: Selected Poetry (50 lectures)

William Blake 'The Lamb', 'The Chimney Sweeper' (from *The Songs of Innocence* and *The Songs of Experience*) 'The Tyger' (*The Songs of Experience*) 'Introduction' to *The Songs of Innocence*

Robert Burns 'A Bard's Epitaph', 'Scots Wha Hae'

William Wordsworth 'Tintern Abbey' 'Ode: Intimations of Immortality' Samuel Taylor Coleridge 'Kubla Khan' 'Dejection: An Ode' Lord George Gordon: Noel Byron 'Childe Harold': canto III, verses 36–45 (lines 316–405); canto IV, verses 178–86 (lines 1594–674)

Percy Bysshe Shelley 'Ode to the West Wind' 'Ozymandias' 'Hymn to Intellectual Beauty' John Keats 'Ode to a Nightingale' 'To Autumn', 'On First Looking into Chapman's Homer'

Module II: Selected Novel (25 lectures)

Mary Shelley's *Frankenstein*

Suggested Readings

1. William Wordsworth, 'Preface to Lyrical Ballads', in *Romantic Prose and* Poetry, ed. Harold Bloom and Lionel Trilling (New York: OUP, 1973) pp. 594–611.
2. 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.
3. Jean-Jacques Rousseau, 'Preface' to *Emile or Education,* tr. Allan Bloom (Harmondsworth: Penguin, 1991).
4. Samuel Taylor Coleridge, *Biographia Literaria*, ed. George Watson (London: Everyman, 1993) chap. XIII, pp.161–66.

Mapping of COs to Syllabus

	MODULE 1	MODULE 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4		H
CO 5		H
CO 6	H	H

EGEC0115: BRITISH LITERATURE: THE EARLY 20TH CENTURY (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes

1. Recognize the impact of urbanization, industrialization, late capitalism and competitive imperialism through their representation in British literature. (Remembering)
2. Understand the concepts like Colonialism, Modernism and Psychoanalysis from their reading of the prescribed texts. (Understanding)
3. Apply a philosophical outlook to engage creatively and conscientiously with social issues arising in a multicultural context. (Applying)
4. Analyze the various genres of literature, such as poetry and novel vis-à-vis the context of modernism (Analyzing)
5. Assess and compare the thematic concerns in the works of the modern writers (Evaluate)
6. Summarize and critically appreciate the poems prescribed in the course (Creating)

Module I: Novels (39 lectures)

Heart of Darkness: Joseph Conrad *Sons and Lovers*: D.H. Lawrence *Mrs. Dalloway:* Virginia Woolf

Module II: Poetry (36 lectures)

'Leda and the Swan', 'The Second Coming', 'No Second Troy' 'Sailing to Byzantium'- W.B. Yeats

'The Love Song of J. Alfred Prufrock', 'Sweeney among the Nightingales', 'The Hollow Men'- T.S. Eliot

Suggested Readings

1. Sigmund Freud, 'Theory of Dreams', 'Oedipus Complex', and 'The Structure of the Unconscious', in *The Modern Tradition*, ed. Richard Ellman et. al. (Oxford: OUP, 1965) pp. 571, 578–80,559–63.
2. T.S. Eliot, 'Tradition and the Individual Talent', in *Norton Anthology of English Literature,* 8th ed., vol. 2, ed. Stephen Greenblatt (New York: Norton, 2006) pp. 2319–25.
3. Raymond Williams, 'Introduction', in *The English Novel from Dickens to Lawrence* (London: Hogarth Press, 1984) pp. 9–27.

Mapping of COs to Syllabus

	MODULE 1	MODULE 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4		H
CO 5	H	H
CO 6		H

EGCL0116: EUROPEAN CLASSICAL LITERATURE (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes

1. Define the concepts of epic, tragedy, comedy, satire, catharsis etc. (Remembering)
2. Understand the significance and importance of Western Classical Literature (Understanding)
3. Apply the knowledge and understanding of Western mythology in the study of literary texts (Application)
4. Illustrate the recurrent themes and motifs of the texts under study (Analyzing)
5. Examine the plot, theme and characters of the prescribed texts (Evaluation)
6. Create a comparative study of the selected texts focusing on the commonalities and dissimilarities (Creating)

Module I: Selected Greek texts (35 lectures)

Homer- *The Iliad,* tr. E.V. Rieu (Harmondsworth: Penguin, 1985).

Sophocles- *Oedipus the King*, tr. Robert Fagles in *Sophocles: The Three Theban Plays* (Harmondsworth: Penguin, 1984).

Module II: Selected Roman texts (40 lectures)

Plautus- *Pot of Gold,* tr. E.F. Watling (Harmondsworth: Penguin, 1965).

Ovid- *Selections from Metamorphoses* 'Bacchus', (Book III), 'Pyramus and Thisbe' (Book IV), 'Philomela' (Book VI), tr. Mary M. Innes (Harmondsworth: Penguin, 1975).

Horace Satires I: 4, in *Horace: Satires and Epistles and Persius: Satires*, tr. Niall Rudd (Harmondsworth: Penguin, 2005).

Suggested Readings:

1. Aristotle, *Poetics*, translated with an introduction and notes by Malcolm Heath, (London: Penguin, 1996) chaps. 6– 17, 23, 24, and 26.
2. Horace, *Ars Poetica*, tr. H. Rushton Fairclough, *Horace: Satires, Epistles and Ars Poetica* (Cambridge Mass.: Harvard University Press, 2005) pp.451–73.
3. Plato, *The Republic,* Book X, tr. Desmond Lee (London: Penguin, 2007).

Mapping of COs to Syllabus

	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

EGCW0117: CREATIVE WRITING (2-0-0)

(Credits: Theory-02)

Course Outcomes

1. Define the different creative techniques adopted by different writers in their work. (Remembering)
2. Interpret the emerging techniques of creativity inherent in different branches of literature- poetry, fiction, essays and Drama. (Understanding)
3. Apply different tropes and figures of speech to enhance creativity in literary and non- literary texts. (Applying)
4. Examine the most significant topics like creativity in Drama, novels, poems, speeches, writing for radio, television as well as psychological testing of creativity. (Analyzing)
5. Evaluate different literary and non- literary texts with reference to different seminal texts as well as existing paradigms of creativity tests. (Evaluating)
6. 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 (6 lectures)
Introduction; Objectives of Creative writing; History of Creative Writing as an academic pursuit, Different types of Creative Writing; Scope and Area of Creative Writing

Module II: The Art and craft of writing (6 lectures)
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 (6 lectures)
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: Writing for Media (6 lectures)
Writing a film / book review; Narrative or discursive essay / article; Personal and business letters; Writing a Business proposal; Report writing; Poetry writing; Short story writing; Dramatic dialogue writing; Designing a Website; Writing for the New Media; Poster writing; Advertisement; CV writing; Newspaper article and editorial; Emails and Blogs; Writing for Radio and Television

Module V: Preparing for publication (6 lectures)
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 Everett, Nick. "Creative Writing and English."*The Cambridge Quarterly*. Vol. 34 ed.3
2. Jones, Leo. *Cambridge Advanced English: Student's Book*. Cambridge University Press, 1991
3. Palmer, A.J. *Writing and Imagery- How to Deepen Your Creativity and Improve Your Writing.* Aber Books, 2010 Seely, John. *The Oxford Guide to Writing and Speaking*. Oxford University Press. 1998.

Mapping of COs to Syllabus

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

EGSS0118: SOFT SKILLS (2-0-0)

(Credits: Theory- 02)

Course Outcomes

1. Define soft-skills. (Remembering)
2. Explain the importance of soft-skills in personal and professional life. (Understanding)
3. Apply soft-skills at a work-place. (Applying)
4. Analyze the different aspects of soft-skills. (Analyzing)
5. Assess the do's and don'ts of grooming and etiquette. (Evaluating)
6. Integrate the ideas pertaining to teamwork, leadership and adaptability to help in personality building. (Creating)

Module I: Soft Skills Part I (15 lectures)
Teamwork; Emotional Intelligence

Module II: Soft Skills Part II (15 lectures)
Adaptability; Leadership; Problem solving
Note: *Hands on training session to be conducted on "Leadership and Problem Solving" (from Module 2) through Workshop.*

Suggested Readings

1. Mitra, Barun. *Personality Development and Soft Skills*.OUP. 2016.
2. Sharma, Prashant. *Soft Skills: Personality Development for Life Success*. BPB Publications. 2018. Butterfield, Jeff. *Soft Skills for Everyone*. Cengage Learning. 2011.
3. K., Alex. *Soft Skills.*S. Chand & Co. Ltd. 2008.
4. Chauhan, Gajendra S. *Soft Skills: An Integrated Approach to Maximise Personality.* Willey. 2015

Mapping of COs to Syllabus

	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

EGLL0119: LANGUAGE AND LINGUISTICS (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes

1. Define the historical development of languages, language varieties and language change. (Remembering)
2. Explain the theoretical foundations of language. (Understanding)
3. Determine the morpho-phonemic properties of human speech sounds. (Applying)
4. Classify the phonemic inventory of the English Language and categorize the human speech sounds. (Analyzing)
5. Assess the word relations pertaining to different languages. (Evaluating)
6. Create language models to identify linguistic structures by integrating the morpho-syntactic properties of different languages. (Creating)

Module I: Language (18 lectures)
Language and communication; language varieties: standard and non- standard language; language change.

Module II: Theoretical Foundations (18 lectures)
Swiss Structuralism, American Structuralism- Its course and development.

Module III: Phonology and Morphology (19 lectures)
Basic concepts: phoneme, allophone, morpheme, allophone, inflectional and derivational morphology, compounding and word formation patterns.

Module IV: Syntax and semantics (20 lectures)
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., R. A. Demers and R, M. Harnish, Linguistics: An Introduction to Language and Communication, 2nd ed.
3. Fromkin, V., and R. Rodman, An Introduction to Language, 2nd ed. (New Yourk: Holt, Rinehart and Winston, 1974) 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 Syllabus

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

EGIC0120: INDIAN CLASSICAL LITERATURE (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes

1. Define the significance of Indian Classical Literature. (Remembering)
2. Summarize the plot of the prescribed texts. (Understanding)
3. Examine the dramatic techniques employed in the prescribed plays. (Applying)
4. Analyze the recurrent themes adopted by classical Indian writers. (Analyzing)
5. Evaluate the role of characters, plots and themes as portrayed in the prescribed texts. (Evaluate)
6. Formulate a critical understanding based on the reading of the prescribed texts. (Creating)

Module I: Selected text of Kalidasa and Vyasa (40 lectures)

Kalidasa *Abhijnana Shakuntalam,* tr. Chandra Rajan, in *Kalidasa: The Loom of Time* (New Delhi: Penguin, 1989). Vyasa 'The Dicing' and 'The Sequel to Dicing, 'The Book of the Assembly Hall', 'The Temptation of Karna', Book V '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 (35 lectures)

Sudraka *Mrcchakatika*, tr. M.M. Ramachandra Kale (New Delhi: Motilal Banarasidass, 1962).

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.

Mapping of COs to Syllabus

	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

EGAM0121: AMERICAN LITERATURE (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes

1. Identify the American context in the prescribed texts. (Remembering)
2. Discuss the pertinent themes pertaining to the American socio-political conditions. (Understanding)
3. Illustrate concepts like American Dream, Social Realism and Transcendentalism in relation to the prescribed texts. (Applying)
4. Analyze the role of characters, plots and settings as depicted in the texts prescribed. (Analyzing)
5. Evaluate the role of various genres like novel, poem and drama with reference to the American context. (Evaluate)
6. Generate critical interpretations of the various texts included in the course. (Creating)

Module I: Selected Texts (50 lectures)

Tennessee Williams: *The Glass Menagerie* Toni Morrison: *Beloved*

Edgar Allan Poe 'The Purloined Letter'

F. Scott Fitzgerald 'The Crack-up' William Faulkner 'Dry September'

Module II: Selected poetry (25 lectures)

Anne Bradstreet 'The Prologue'

Walt Whitman Selections from *Leaves of Grass*: 'O Captain, My Captain', 'Passage to India' (lines1–68) 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 Syllabus

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

EGME0122: MODERN EUROPEAN DRAMA (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes

1. Define the various dramatic movements emerging during the modern era in Europe. (Remembering)
2. Interpret the texts in relation to the dramatic techniques adopted. (Understanding)
3. Examine the role of the stage, performance and setting used in the play. (Applying)
4. Analyze the socio-political contexts surrounding the text. (Analyzing)
5. Assess the development of drama from Realism and Epic Theatre till the Theatre of the Absurd. (Evaluating)
6. Build a critical perspective of the various texts prescribed in the syllabus. (Creating)

Module I: Selected plays on Realism and Epic theatre (40 lectures)

Henrik Ibsen: *Ghosts*

Bertolt Brecht: *The Good Woman of Szechuan*

Module II: Selected play on Theatre of Absurd (35 lectures)

Samuel Beckett: *Waiting for Godot*

Eugene Ionesco: *Rhinoceros*

Suggested Readings

1. Constantin Stanislavski, *An Actor Prepares*, chap. 8, 'Faith and the Sense of Truth', tr. Elizabeth Reynolds Hapgood (Harmondsworth: Penguin, 1967) sections 1, 2, 7, 8, 9, pp. 121–5,137–46.
2. Bertolt Brecht, 'The Street Scene', 'Theatre for Pleasure or Theatre for Instruction', and 'Dramatic Theatre vs Epic Theatre', in *Brecht on Theatre: The Development of an Aesthetic*, ed. and tr. John Willet (London: Methuen, 1992) pp. 68–76,121–8.
3. George Steiner, 'On Modern Tragedy', in *The Death of Tragedy* (London: Faber, 1995) pp.303–24.

Mapping of COs to Syllabus

	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

EGLT0123: ENGLISH LANGUAGE TEACHING (2-0-0)

(Credits: Theory 02)

Course Outcomes

1. Define the fundamental concepts of English Language Teaching. (Remembering)
2. Describe the theoretical aspects of English Language Teaching. (Understanding)
3. Apply different language assessment skills to test the competence and performance of ELT learners. (Applying)
4. Analyze the issues related to language acquisition. (Analyzing)
5. Compare and evaluate the feasibility of the methodologies applied for the language teaching. (Evaluating)
6. Design syllabi for English language teaching and formulate lesson plans to execute the course objectives of the syllabi prepared. (Creating)

Module I: Fundamental concepts ELT and Structures of English language: (7 lectures)

Introduction, Fundamental concepts of ELT, Structures of English language: Basics of English Phonology, Morphology, Syntax and Semantics.

Module II: Methods of Teaching English Language and Literature: (8 lectures)

Theoretical aspects of Language acquisition: English as second language, The Grammar-Translation Method, The Direct Method,

The Audio-Lingual Method, The Bi-Lingual Method, The Designer Methods, Use of Language Model.

Module III: Assessing Language Skills: (7 lectures)
Reading assessments, pedagogical competence, testing and evaluation.

Module IV: Materials and methods for Language Teaching: (8 lectures)
Design Syllabi for ELT, Formulate lesson plan, Teaching English for academic and business purpose, Use of Technology in Language Teaching, Developing study materials.

Suggested Readings

1. Penny Ur, *A Course in Language Teaching: Practice and Theory* (Cambridge: CUP, 1996).
2. Marianne Celce-Murcia, Donna M. Brinton, and Marguerite Ann Snow, *Teaching English as a Second or Foreign Language* (Delhi: Cengage Learning, 4th edn, 2014).
3. Adrian Doff, *Teach English: A Training Course For Teachers* (Teacher's Workbook) (Cambridge: CUP, 1988).
4. *Business English* (New Delhi: Pearson, 2008).
5. R.K. Bansal and J.B. Harrison, *Spoken English: A Manual of Speech and Phonetics* (New Delhi: Orient BlackSwan, 4th edn, 2013).
6. Mohammad Aslam, *Teaching of English* (New Delhi: CUP, 2nd edn, 2009).
7. Ray Mackay, *A Basic Introduction to English Language Teaching* (Oxford).

Mapping of COs to Syllabus

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

EGTS0124: TRANSLATION STUDIES (2-0-0)

(Credit: Theory-02)

Course Outcomes

1. Define history, theories and methodologies of Translation Studies (Remembering)
2. Understand the significance and importance of translation in a multilingual and multicultural society like India (Understanding)
3. Apply different modes and types of translation such as literal, literary, communicative, audio-visual translation (Applying)
4. Examine critically the basic concepts and terms used in translation studies vis-à-vis their use in the practice of translation (Analyzing)
5. Evaluate the process of translation through the examination of standard translated literary and non-literary texts (Evaluation)
6. Create and offer a Critique of works in translation (Creating)

Module I: Introduction to Translation (6 lectures)
Introducing Translation: a brief history and significance of translation in a multi linguistic and multicultural society like India.

Module II: Types/ modes in Translation (6 lectures)
Semantic/Literal translation Free/sense/literary translation Functional/communicative translation Technical / Official Transcreation Audio-visual translation

Module III: Basic Concepts and Terms used in Translation Studies (8 lectures)

a. Introducing basic concepts and terms used in Translation Studies through relevant tasks, for example: Equivalence, Language variety, Dialect, Idiolect, Register, Style, Mode, Codemixing/ Switching.

Module IV: The Process of Translation (10 lectures)

Defining the process of translation (analysis, transference, restructuring) through critical examination of standard translated literary/non-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.
5. Newmark, Peter. *A Textbook of Translation*. London: Prentice Hall, 1988.
6. Nida, E.A. and C.R. Taber. *The Theory and Practice of Translation.* Leiden: E.J. Brill, 1974.
7. Toury, Gideon. *Translation Across Cultures*. New Delhi: Bahri Publications Private Limited, 1987.

Mapping of COs to Syllabus

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

EGLA0125: LANGUAGE, LITERATURE AND CULTURE (5-1-0)

(Credits: Theory-5, Tutorial- 1)

Course Outcomes

1. Define basic concepts of language, literature and culture (Remembering)
2. Understand the intrinsic relationship between language, literature and culture (Understanding)
3. Illustrate the structure and function of language and its literary and cultural significance (Application)
4. Analyze the recurrent themes and forms of Indian literature through ages (Analyzing)
5. Compare the cultural cross-currents through ages in Indian literature in particular and society in general (Evaluation)
6. Develop a holistic approach towards literature and its critical interpretation through the lenses of language and culture (Creating)

Module I: Language (30 lectures)

a) Language and Communication, What is Language, the Definition of Language, the Characteristics of Human language, Why Does Language Matter?

b) How Language Function: Speaker – Listener –Message; Phonology Morphology Syntax and Semantics (only terms and definitions will be asked) Phonemes, phonetic transcription and phonology; Morphemes: free and bound morphemes Simple complex compound words Inflectional/ derivational morphology; the process of word formation; Basic notions of syntactic constituents and phrase structure Clauses and sentences

c) 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 II: Indian Literature (30 lectures)

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: Sudraka, *Mrichchhakatika*: The Making of a Breach

Chapter 3: Ilanko Atikal, *Cilappatikaram*: The Book of Mathurai Chapter 4: Mirabai, 'I Know Only Krisna'

Chapter 5: Amir Abul Hasan Khusrau, 'Separation'

Chapter 6: Asadullah Khan Ghalib, 'Desires Come by the Thousands' Chapter 7: Faiz Ahmad Faiz, 'Do Not Ask'

Chapter 8: Subramania Bharati, 'The Palla Song' Chapter 9: Rabindranath Tagore, 'The Cabuliwallah' Chapter 10: Shrilal Shukla, 'Raag Darbari'

Chapter 11: Ismat Chugtai, 'Touch-Me-Not' Chapter 12: Amrita Pritam, 'To Waris Shah'

Chapter 13: Masti Venkateshalyengar, 'Venkatashami's Love Affair' Chapter 14: Indira Goswami, 'The Journey'

Chapter 15: Omprakash Valmiki, 'Joothan' Chapter 16: Shrikant Mahapatra, Folk Songs

Module III: Culture and Society in Contemporary India (15 lectures)

The Idea of Culture; Culture and the Media; '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; 'Towards a Definition of Culture', in *India and World Culture;* 'Culture and Ideology', in *Culture, Ideology and Hegemony: Intellectual and Social Consciousness in Colonial India Communications and Culture*; *Journalism: Changing Society Emerging Trends.*

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. R. W. Bailey and J. L. Robinson, eds, *Varieties of present-day English* (New York: Macmillan 1973).
4. J. A. Fishman, *Sociolinguistics: A Brief Introduction* (Mass: Newbury House Rowley, 1971).
5. R. S. Gupta and K. S. Agarwal. *Studies in Indian Sociolinguistics* (New Delhi: Creative Books, 1996).
6. R. A. Hudson, *Sociolinguistics* (Cambridge: Cambridge University Press, 1980). Geoffrey Leech and Michael Short,*Style in Fiction* (London: Longman, 1981).
7. Sisir Kumar Das, ed., *A History of Indian Literature* (New Delhi: SahityaAkademi,1995)

Mapping of COs to Syllabus

	MODULE 1	MODULE 2	MODULE 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4		H	
CO 5		H	H
CO 6	H	H	H

EGPL0126: POST-COLONIAL LITERATURES (5-1-0)

(Credits: Theory-06)

Course Outcomes

1. Relate the various critical elements in adherence to the Post-colonial literature. (Remembering)
2. Distinguish the Historical context of the Post-colonial literature and the use of racist and colonial undertones in the texts under study. (Understanding)
3. Classify 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. (Application)
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. Examine and evaluate the significance of the 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. Discuss, summarise and critically appreciate the literary and the thematic aspects of the texts under study. (Creating)

Module I: Selected Novels (35 lectures)

Chinua Achebe *Things Fall Apart*

Gabriel Garcia Marquez *Chronicle of a Death Foretold*

Module II: Selected Short Fiction/ Short Stories (20 lectures)

Bessie Head 'The Collector of Treasures'

Ama Ata Aidoo 'The Girl who can' Grace Ogot 'The Green Leaves'

Module III: Selected Poetry (20 lectures)

Pablo Neruda 'Tonight I can Write', 'The Way Spain Was' Derek Walcott 'A Far Cry from Africa', 'Names'

David Malouf 'Revolving Days', 'Wild Lemons'

Mamang Dai 'Small Towns and the River', 'The Voice of the Mountain'

Suggested Readings

1. Franz Fanon, 'The Negro and Language', in *Black Skin, White Masks*, tr. Charles Lam Markmann (London: Pluto Press, 2008) pp.8–27.
2. Ngugi wa Thiong'o, 'The Language of African Literature', in *Decolonising the Mind* (London: James Curry, 1986) chap.1, sections 4–6.
3. Gabriel Garcia Marquez, the Nobel Prize Acceptance Speech, in *Gabriel Garcia Marquez: New Readings*, ed. Bernard McGuirk and Richard Cardwell (Cambridge: Cambridge University Press, 1987).
4. Gandhi, Leela. *Postcolonial Theory: A Critical Introduction*. Columbia University Press. 1998. Loomba, Ania. *Colonialism/ postcolonialism*. Routeledge. 1998.

Mapping of Cos to Syllabus

	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

EGIE0127: INDIAN WRITING IN ENGLISH (5-1-0)

(Credits: Theory-06)

Course Outcomes

1. Define the literature produced in India in English (Remembering)
2. Explain and comment on the poems and fictional works produced in India in their various socio-cultural context (Understanding)
3. Classify and apply different critical theories involved in the production of the selected indigenous texts (Applying)
4. Analyse the style and writing techniques of the Indian writers writing in English through critical reading of their works (Analysing)
5. Evaluate the contribution of the Indian writers in English to the development of Indian English literature and their treatment and representation of the Indian ethos in a global forum (Evaluating)
6. Summarise and critically appreciate the literary works and find out the commonalities in terms of themes and issues (Creating)

Module I: Selected novels (25 lectures)

R. K. Narayan *Swami and Friends*

Anita Desai *In Custody*

Module II: Selected Poetry (25 lectures)

H.L.V. Derozio 'Freedom to the Slave', 'The Orphan Girl' Kamala Das 'Introduction', 'My Grandmother's House' Nissim Ezekiel 'Enterprise', 'The Night of the Scorpion'

Robin S. Ngangom The Strange Affair of Robin S. Ngangom', 'APoem for Mother'

Module III: Selected Short Fiction (25 lectures)

Mulk Raj Anand 'Two Lady Rams' Salman Rushdie 'The Free Radio' Rohinton Mistry 'Swimming Lesson' Shashi Despande 'The Intrusion'

Urvashi Butalia 'The Other Side of Silence'

Suggested Readings

1. Raja Rao, Foreword to *Kanthapura* (New Delhi: OUP, 1989) pp. v–vi.
2. Salman Rushdie, 'Commonwealth Literature does not exist', in *Imaginary Homelands* (London: Granta Books,1991) pp. 61–70.
3. Meenakshi Mukherjee, 'Divided by a Common Language', in *The Perishable Empire* (New Delhi:OUP,2000) pp.187–203.
4. Bruce King, 'Introduction', in *Modern Indian Poetry in English* (New Delhi: OUP, 2nd edn,2005) pp. 1–10.

Mapping of COs to Syllabus

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

EGLM0128: LITERARY CRITICISM (5-1-0)

(Credits: Theory-06)

Course Outcomes

1. Define key critical terms and concepts. (Remembering)
2. Distinguish between the various ideas of western literary criticism from the time of Aristotle to the Modern Period. (Understanding)
3. Find out the implications of the key ideas on the prose, poetry, drama and fiction in literature (Applying)

4. Analyse a representative critical text in literature. (Analysing)
5. Assess the works of the significant literary thinkers in the history of English literature. (Evaluating)
6. Discuss and summarise the key concepts of the various critical text. (Creating)

Module I: Literary Criticism: Romantic Period (25 lectures)

William Wordsworth: Preface to the *Lyrical Ballads* (1802)

S. T. Coleridge: *Biographia Literaria.* Chapters IV, XIII and XIV

Module II: Literary Criticism: Early Twentieth Century (25 lectures)

Virginia Woolf: Modern Fiction

T.S. Eliot: "Tradition and the Individual Talent" 1919 "The Function of Criticism" 1920

Module III: Literary Criticism: Late Twentieth Century (25 lectures)

I.A. Richards: *Principles of Literary Criticism* Chapters 1, 2 and 34. London 1924 and *Practical Criticism.* London, 1929.

Cleanth Brooks: "The Heresy of Paraphrase", and "The Language of Paradox" in

The Well-Wrought Urn: Studies in the Structure of Poetry (1947)

Maggie Humm: *Practising Feminist Criticism: An Introduction.* London 1995

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

Mapping of COs to Syllabus

	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

EGLD0129: LITERATURE OF THE INDIAN DIASPORA (5-1-0)

(Credits: Theory-06)

Course Outcomes

1. Define the various attributes of the Indian diaspora and the 'ambivalence' of their attitudes towards their own motherland as well as their adopted homeland. (Remembering)
2. Demonstrate the quest for cultural identity on the part of the citizens of Indian diaspora and would be able to understand the psychological, social and political problems associated with diaspora culture. (Understanding)
3. Apply the themes of these texts to further explore the conscientiousness of the relationship between the 'homeland' and the 'diaspora'. (Applying)
4. Discover our own country from a different prism through the eyes of writers who have lived in a composite culture. (Analysing)
5. Assess and evaluate the selected texts vis -a - vis their context and socio political and cultural background. (Evaluating)
6. Discuss, summarise and critically appreciate the selected poems and other literary texts. (Creating)

Module I: Selected Fiction Part I (35 lectures)

M. G. Vassanji-*The Book of Secrets*

Rohinton Mistry- *A Fine Balance*

Module II: Selected Fiction Part II (40 lectures)

Meera Syal-"Anita and Me" Jhumpa Lahiri-*The Lowland*

Meena Alexander- *Manhattan Music*

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

Mapping of COs to Syllabus

	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	M

EGPW0130: BRITISH LITERATURE: POST WORLD WAR II (5-1-0)

(Credits: Theory-06)

Course Outcomes

1. Locate significant historical events during and after World War II (Remembering)
2. Understand the socio-political and economic context of post World War II British literature (Understanding)
3. Identify socio-historical, political changes in England after World War II (Application)
4. Critically analyze the link changes in social norms to new literary forms (Analysis)
5. Examine the post World War II literary trends in English and the rise of the postmodernist aesthetics (Evaluating)
6. Formulate an understanding of the rise of multiculturalism in England, migration, importance of location vis-à- vis the self and the other (Creating)

Module I: Selected Novels (45 lectures)

John Fowles- *The French Lieutenant's Woman* Jeanette Winterson- *Sexing the Cherry*

Hanif Kureshi- *My Beautiful Launderette*

Module II: Selected Poetry (30 lectures)

Phillip Larkin 'Whitsun Weddings', 'Church Going' Ted Hughes 'Hawk Roosting', 'Crow's Fall' Seamus Heaney 'Digging', 'Casualty'

Carol Anne Duffy 'Text', 'Stealing'

Suggested Readings

1) Alan Sinfield, 'Literature and Cultural Production', in *Literature*, *Politics and Culture in Postwar Britain* (Berkley and Los Angeles: University of California Press, 1989) pp.23–38.
2) Seamus Heaney, 'The Redress of Poetry', in *The Redress of Poetry* (London: Faber, 1995) pp. 1–16.
3) Patricia Waugh, 'Culture and Change: 1960-1990', in *The Harvest of The Sixties: English Literature And Its Background,*

1960-1990 (Oxford: OUP, 1997).

Mapping of COs to Syllabus

	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

EGSD0131: SCIENCE FICTION AND DETECTIVE LITERATURE (5-1-0)

(Credits: Theory-06)

Course Outcomes

1. Define the conventions of the genre (Remembering)
2. Interpret works of science fiction and detective fiction from a variety of contexts (Understanding)
3. Apply critical insight in interpretations of science and detective fiction (Application)
4. Illustrate the relationship between science fiction, detective or crime fiction and mainstream literature (Analysis)
5. Examine the origin and historical development of science fiction (Evaluating)
6. Formulate the connection between science fiction and detective fiction and the impact of changing technology and social systems on people (Creating)

Module I: Selected Fiction Part I (35 lectures)

Wilkie Collins- *The Woman in White*

Arthur Conan Doyle- *The Hound of the Baskervilles*

Module II: Selected Fiction Part II (40 lectures)

Raymond Chandler- *The Big Sleep*

H. R. F. Keating- *Inspector Ghote Goes by Train*

Agatha Christie- *The Mysterious Affair at Styles*

Suggested Readings

1) J. Edmund Wilson, 'Who Cares Who Killed Roger Ackroyd?', *The New Yorker,* 20 June1945.
2) George Orwell, *Raffles and Miss Blandish*, available at:<www.george- orwell.org/Raffles_and_Miss_Blandish/0.html>
3) W.H. Auden, *The Guilty Vicarage*, available at: <harpers.org/archive/1948/05/the-guilty-vicarage/>
4) Raymond Chandler, 'The Simple Art of Murder', *Atlantic Monthly*, Dec. 1944, available at:<http://www.en.utexas.edu/amlit/amlitprivate/scans/chandlerart.html

Mapping of COs to Syllabus

	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

EGPL0132: POPULAR LITERATURE (5-1-0)

(Credits: Theory-06)

Course Outcomes:

1. Define poplar literature and its distinct characters (Remembering)
2. Critically interpret and understand the elements of popular literature (Understanding)
3. Apply various interpretative frameworks to their reading of selected works of popular literature (Application)
4. Analyse the themes and motifs in the works under study (Analysis)
5. Examine the style and techniques of the writers in creating popular literature (Evaluation)
6. Summarise and offer a comprehensive understanding of the selected works of popular literature (Creating)

Module I: Selected Fiction (60 lectures)

Lewis Carroll- *Through the Looking Glass* Agatha Christie- *The Murder of Roger Ackroyd* Shyam Selvadurai- *Funny Boy*

Module II: Selected Biography (15 lectures)

Durgabai VyamandSubhash Vyam- *Bhimayana: Experiences of Untouchability /*
Autobiographical Notes on Ambedkar(For the Visually Challenged students)

Suggested Readings

1) Chelva Kanaganayakam, 'Dancing in the Rarefied Air: Reading Contemporary Sri Lankan Literature' (*ARIEL*, Jan. 1998) rpt, Malashri Lal, Alamgir Hashmi and Victor J.Ramraj, eds., *Post Independence Voices in South Asian Writings* (Delhi: Doaba Publications, 2001) pp. 51–65.
2) Sumathi Ramaswamy, 'Introduction', in *Beyond Appearances?: Visual Practices and Ideologies in Modern India* (Sage:Delhi, 2003) pp. xiii–xxix.
3) 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.
4) Felicity Hughes, 'Children's Literature: Theory and Practice', *English Literary History*, vol.45, 1978, pp. 542–61.

Mapping of COs to Syllabus

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

EGWW0133: WOMEN'S WRITING (5-1-0)

(Credits: Theory- 06)

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 and the progress in gender and literature. (Analysing)
5. Evaluate the interdisciplinary aspect in the various texts. (Evaluating)
6. Discuss and summarise the meanings, ideas and thoughts regarding gender and its connection with literature. (Creating)

Module I: Selected Poetry (25 lectures)

Emily Dickinson 'I cannot live with you', 'I'm wife; I've finished that' Sylvia Plath 'Daddy' 'Lady Lazarus'
Eunice De Souza 'Advice to Women', 'Bequest'

Module II: Selected Fiction and Short Fiction (25 lectures)
Alice Walker *The Color Purple*
Charlotte Perkins Gilman 'The Yellow Wallpaper' Katherine Mansfield 'Bliss'
Mahashweta Devi 'Draupadi', tr. Gayatri Chakravorty Spivak (Calcutta: Seagull, 2002)

Module III: Selected Non-fiction (25 lectures)
Mary Wollstonecraft- *A Vindication of the Rights of Woman* (New York: Norton, 1988) chap.1, pp. 11–19; chap.2, pp. 19–38.
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.
Rassundari Debi. Excerpts from *Amar Jiban* in Susie Tharu and K. Lalita, eds. *Women's Writing in India,* vol.1 (New Delhi: OUP, 1989) pp.191–2.

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 Syllabus

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

EGLY0134: LITERARY THEORY (5-1-0)

(Credits: Theory- 06)

Course Outcomes
1. Define these modern theories. (Remembering)
2. Explain genesis and growth of the modern critical theories in the context of literary texts. (Understanding)
3. Utilize the contemporary theories in the critical analysis of various literary texts. (Applying)
4. Analyse the theories and generate a new approach of looking at literary texts. (Analysing)
5. Evaluate the texts in terms of their political, social, psychoanalytical, feministic and economic implications.
6. (Evaluating)
7. Develop a more profound critical approach after the study of these theories. (Creating)

Module I: Marxism (18 lectures)
Antonio Gramsci, 'The Formation of the Intellectuals' and 'Hegemony (Civil Society) and Separation of Powers', in *Selections from the Prison Notebooks*, ed. and tr. Quentin Hoare and Geoffrey Novell Smith (London: Lawrence andWishart,1971) pp. 5, 245–6.

Louis Althusser, 'Ideology and Ideological State Apparatuses', in *Lenin and Philosophy and Other Essays* (New Delhi: Aakar Books, 2006) pp.85–126.

Module II: Feminism (18 lectures)

Elaine Showalter, 'Twenty Years on: *A Literature of Their Own* Revisited', in *A Literature of Their Own: British Women Novelists from Bronte to Lessing* (1977. Rpt. London: Virago, 2003) pp. xi–xxxiii.

Luce Irigaray, 'When the Goods Get Together' (from *This Sex Which is Not One),* in *New French Feminisms,* ed. Elaine Marks and Isabelle de Courtivron (NewYork: Schocken Books, 1981) pp. 107–10.

Module III: Poststructuralism (18 lectures)

Jacques Derrida, 'Structure, Sign and Play in the Discourse of the Human Science', tr. Alan Bass, in *Modern Criticism and Theory:* A *Reader,* ed. David Lodge (London: Longman, 1988) pp. 108–23.

Michel Foucault, 'Truth and Power', in *Power and Knowledge*, tr. Alessandro Fontana and Pasquale Pasquino (New York: Pantheon, 1977) pp.109–33.

Module IV: Postcolonial Studies (21 lectures)

Mahatma Gandhi, 'Passive Resistance' and 'Education', in *Hind Swaraj and Other Writings*, ed. Anthony J Parel (Delhi:CUP,1997) pp.88–106.

Edward Said, 'The Scope of Orientalism' in *Orientalism* (Harmondsworth: Penguin, 1978) pp. 29–110. Aijaz Ahmad, "Indian Literature": Notes towards the Definition of a Category', in

In Theory: Classes, Nations, Literatures (London: Verso, 1992) pp.243–285.

Suggested Readings

1) Terry Eagleton, *Literary Theory: An Introduction* (Oxford: Blackwell, 2008).
2) Peter Barry, *Beginning Theory* (Manchester: Manchester University Press, 2002).

Mapping of COs to Syllabus

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

EGPL0135: PARTITION LITERATURE (5-1-0)

(Credits: Theory- 06)

Course Outcomes

1. Define partition literature and its characteristic features (Remembering)
2. Explain the socio-political context of partition and its representation in literature (Understanding)
3. Apply critical insight in the reading and interpretation of various writings on partition (Application)
4. Analyse the concepts of colonialism, nationalism, communalism based on their reading of the texts under study (Analysis)
5. Evaluate complex issues like homelessness and exile vis-à-vis women, children and impact of partition on them through the reading of literature (Evaluation)
6. Develop a critical insight regarding partition and its commonalities, complexities and expression in literature (Creating)

Module I: Selected Novels (30 lectures)

Intizar Husain *Basti*, tr. Frances W. Pritchett (New Delhi: Rupa, 1995). Amitav Ghosh, *The Shadow Lines.*

Module II: Selected Short Stories (30 lectures)

Dibyendu Palit, 'Alam's Own House', tr. Sarika Chaudhuri, *Bengal Partition Stories*: *An Unclosed Chapter*, ed. Bashabi Fraser (London: Anthem Press, 2008) pp. 453–72.

Manik Bandhopadhya, 'The Final Solution', tr. Rani Ray, *Mapmaking: Partition Stories from Two Bengals*, ed. Debjani Sengupta (New Delhi: Srishti, 2003) pp.23–39.

Sa'adat Hasan Manto, 'Toba Tek Singh', in *Black Margins: Manto*, tr. M. Asaduddin (New Delhi: Katha, 2003) pp. 212–20.

Lalithambika Antharajanam, 'A Leaf in the Storm', tr. K. Narayana Chandran, in *Stories about the Partition of India* ed. Alok Bhalla (New Delhi: Manohar, 2012) pp. 137–45.

Module III: Selected Poetry (15 lectures)

Faiz Ahmad Faiz, 'For Your Lanes, My Country', in *In English: Faiz Ahmad Faiz, A Renowned Urdu Poet*, tr. And ed. Riz Rahim (California: Xlibris, 2008) p.138.

Jibananda Das, 'I Shall Return to This Bengal', tr. Sukanta Chaudhuri, in *Modern Indian Literature* (New Delhi: OUP, 2004) pp.8–13.

Gulzar, 'Toba Tek Singh', tr. Anisur Rahman, in *Translating Partition*, ed. Tarun Saintet. al. (New Delhi: Katha, 2001)

Suggested Readings and Screenings:

1) Ritu Menon and Kamla Bhasin, 'Introduction', in *Borders and Boundaries* (New Delhi: Kali for Women, 1998).
2) Sukrita P. Kumar, *Narrating Partition* (Delhi: Indialog, 2004).
3) Urvashi Butalia, *The Other Side of Silence: Voices from the Partition of India* (Delhi: Kali for Women, 2000).
4) Sigmund Freud, 'Mourning and Melancholia', in *The Complete Psychological Works of Sigmund Freud*, tr. James Strachey (London: Hogarth Press, 1953) pp. 3041–53.

Films

Garam Hawa (dir. M. S. Sathyu, 1974).

Khamosh Paani: Silent Waters (dir. Sabiha Sumar, 2003).

Subarnarekha (dir. Ritwik Ghatak, 1965)

Mapping of COs to Syllabus

	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	M
CO 5	H	H	H
CO 6	H	H	H

EGTW0136: TRAVEL WRITING (5-1-0)

(Credits: Theory 06)

Course Outcomes

1. Define travel writing and its specific characteristics (Remembering)
2. Describe the emergence and development of travel writing as a literary genre (Understanding)
3. Apply theories post-colonialism, orientalism and transculturation in their reading of the selected literary texts
4. Illustrate the commonalities in travel writing with reference to the politics of the perspective of an 'insider' and 'outsider'
5. Assess the thematic concerns of the travel writers across time and space (Evaluation)
6. Create a comprehensive knowledge of the process of creating travel narrative in relation to ethnography, gender, religion and globalization (Creating)

Module I: Selected Writings I (40 lectures)

Ibn Battuta: 'The Court of Muhammadbin Tughlaq', Khuswant Singh's *City Improbable: Writings on Delhi*, Penguin Publisher
Al Biruni: Chapter LXIII, LXIV, LXV, LXVI, in *India by Al Biruni*, edited by Qeyamuddin Ahmad, National Book Trust of India
Mark Twain: *The Innocent Abroad* (Chapter VII, VIII and IX), (Wordsworth Classic Edition)
Ernesto Che Guevara: *The Motorcycle Diaries: A Journey around South America* (the Expert, Home land for victor, The city of viceroys), Harper Perennial

Module II: Selected Writings II (35 lectures)

William Dalrymple: *City of Dijnn* (Prologue, Chapters I and II) Penguin Books
Rahul Sankrityayan: *From Volga to Ganga* (Translation by Victor Kierman), (Section I to Section II) Pilgrims Publishing
Nahid Gandhi: *Alternative Realties: Love in the Lives of Muslim Women*, Chapter 'Love, War and Widow', Westland, 2013
Elisabeth Bumiller: *May You be the Mother of a Hundred Sons: a Journey among the Women of India*, Chapters 2 and 3, pp. 24-74 (New York: Penguin Books, 1991)

Suggested Readings

1) Susan Bassnett, 'Travel Writing and Gender', in *Cambridge Companion to Travel Writing*, ed. Peter Hulme and Tim Young (Cambridge: CUP, 2002) pp, 225-241
2) Tabish Khair, 'An Interview with William Dalyrmple and Pankaj Mishra' in *Postcolonial Travel Writings: Critical Explorations*, ed. Justin D Edwards and Rune Graulund (New York: Palgrave Macmillan, 2011), 173-184
3) Casey Balton, 'Narrating Self and Other: A Historical View', in *Travel Writing: The Self and The Other* (Routledge, 2012), pp.1-29
4) Sachidananda Mohanty, 'Introduction: Beyond the Imperial Eyes' in *Travel Writing and Empire* (New Delhi: Katha, 2004) pp. ix–xx.

Mapping of COs to Syllabus

	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

EGAU0137: AUTOBIOGRAPHY (5-1-0)

(Credits: Theory- 06)

Course Outcomes

1. Define life writing. (Remembering)
2. Illustrate the different types of life writing (Understanding)
3. Apply the narrative techniques while reading a piece of life writing. (Applying)
4. Analyse the life of an author/writer critically. (Analysing)
5. Evaluate a representative biographical text using the literary techniques. (Evaluating) 6: Discuss the different styles of writing a biography. (Creating)

Module I: Selected Writings I (35 lectures)

Jean-Jacques Rousseau's *Confessions*, Part One, Book One, pp. 5-43, Translated by Angela Scholar (New York: Oxford University Press, 2000).Benjamin Franklin's *Autobiography*, pp.5-63, Edited by W. Macdonald (London:
J. M. Dent and Sons, 1960).
M. K. Gandhi's *Autobiography or the Story of My Experiments with Truth*, Part I Chapters II to IX, pp. 5-26 (Ahmedabad:

Navajivan Trust, 1993). Annie Besant's *Autobiography*, Chapter VII, Atheism As I Knew and Taught It, pp. 141-175 (London: T. Fisher Unwin, 1917).

Module II: Selected Writings II (40 lectures)

Binodini Dasi's *My Story and Life as an Actress*, pp. 61-83 (New Delhi: Kali for Women, 1998).
A. Revathi's *Truth About Me: A Hijra Life Story*, Chapters One to Four, pp. 1-37 (New Delhi: Penguin Books, 2010.) Richard Wright's *Black Boy*, Chapter 1, pp. 9-44 (United Kingdom: Picador, 1968). Sharankumar Limbale's *The Outcaste*, Translated by Santosh Bhoomkar, pp.1-39 (New Delhi: Oxford University Press, 2003)

Suggested Readings:

1) James Olney, 'A Theory of Autobiography' in *Metaphors of Self: the meaning of autobiography* (Princeton: Princeton University Press, 1972) pp. 3-50.
2) Laura Marcus, 'The Law of Genre' in *Auto/biographical Discourses* (Manchester: Manchester University Press, 1994) pp. 229-72.
3) Linda Anderson, 'Introduction' in *Autobiography* (London: Routledge, 2001) pp.1-17.
4) Mary G. Mason, 'The Other Voice: Autobiographies of women Writers' in *Life/Lines: Theorizing Women's Autobiography*, Edited by Bella Brodzki and Celeste Schenck (Ithaca: Cornell University Press, 1988) pp.19-44.

Mapping of COs to the Syllabus

	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

PROGRAMME – MA ENGLISH

PROGRAMME OUTCOMES (PO)

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 (PSO)

PSO1: To familiarize with the writers of English literature across different ages and continents, their theories, perspectives, models and methods.**PSO2:** To be able to demonstrate competence in analysis and critically analyse scholarly work in the areas of English language teaching, literary research and translation.

PSO3: To enhance literary and critical thinking.

PSO4: Application of the knowledge of Literature, theories, research and skills in different fields of literary practice.

PSO5: To develop the technical skills and ethical decisions 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	PO 2	P O 3	PO4	P O 5	P O 6	PO 7	PO 8	PS O1	PS O2	PS O3	PS O4	PS O 5
1.1									H				
1.2									H				
1.3									H				
1.4	L								M	M		H	
1.5	M								H	M			
1.6	M								H	M			
1.7		H		M	M								L
1.8				M	H		M						
1.9				L	M		H				M	M	
1.10		H						M		H		H	M
1.11	M		M					M		H	M	H	L
2.1					L				H				
2.2	H										H		
2.3									H				
2.4		H								H		M	M
2.5									H	M			
2.6	L						M		H		M		
2.7						H							
2.8				H	H			L					
2.9	M		L	L	H					M	M		
2.10				L					H		L		
2.11	M		H					M		H	L	H	M
3.1									H				
3.2	M								H	L	M		
3.3									H				
3.4	H									M	H	L	
3.5	M				M		H		L	M	M	L	
3.6		M								H		M	
3.7									H				
3.8	M						M		H	M		L	
3.9	H		H					M		H	M	M	M
4.1									H		M		
4.2									H		L		
4.3		L								H		M	
4.4									H				
4.5	M						M		H	M	H		
4.6	H		H					M		H	M	H	H

DETAILED SYLLABUS

THEORY COURSES

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)

a) 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:

COs	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:

COs	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	

EGSD0003: SHAKESPEAREAN DRAMA I - COMEDY AND HISTORY PLAYS (4-0-0)

(Credits: 04)

Course Outcomes:

1. Define a Shakespearean Drama as a literary genre (Remembering).
2. Explain the significant stages in the texts of Shakespearean Comedy and a Historical play (Understanding).
3. Identify and differentiate a given text as a work of Shakespearean Comedy or a Historical play (Applying).
4. Analyse the theme, plot and characterization, use of literary devices and settings in a given Shakespearean text as a work of Comedy or History (Analysing).
5. Evaluate the characteristic features and creative energy of Shakespeare through the study of a Comedy and a Historical play (Evaluating).
6. Compile the content, style and the literary aspects of the given Shakespearean text as a work of Comedy or History (Creating).

Module I: Comedies (25 lectures)

a) Shakespeare's *The Tempest*

b) Shakespeare's *A Midsummer Night 's Dream*

Module II: History Plays (25 lectures)

a) Shakespeare's *Henry V*

b) Shakespeare's *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

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.

Mapping of COs to Syllabus:

COs	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H
CO5	H	H
CO6	H	H

EGRP0004: RHETORIC AND PROSODY (2-0-0)

(Credits: 02)

Course Outcomes:

1. Recall the different figures of speech based on Comparison (Remembering)
2. Classify the differences between Metonymy and Synecdoche (Understanding)
3. Apply the rules of prosody in scanning a piece of poetry (Applying)
4. Distinguish between Irony and Sarcasm (Analysing)
5. Explain the different figures of speech used in a passage (Evaluating)
6. Discuss the dominant types of meters used in English versification (Creating)

Module I: Introduction to Rhetoric (10 lectures)

Rhetoric; Difference between Grammar and Rhetoric; Relation between Rhetoric and Emotion; Rhetoric and Oratory; Prosody; Difference between Poetry and Prose; Syllable, Foot, Accent, Pitch; Primary and Secondary accent; Rules governing Accent; Rhythm, Rhyme, Metre; Scansion

Module II: Figures of Speech (10 lectures)

Contribution of Figures of Speech to Literary Expression, Classification of Figures of Speech, Figures based on Similarity or Resemblance, Association, Contrast or Difference, Imagination, Indirectness, Sound, Construction; Miscellaneous Figures of Speech

Module III: Prosody: Different kinds of Metre and Poetry (10 lectures)

Types of Metre; Special Metres; Types of Poetry

Suggested Readings:

1. Bhattacharya, Arunodoy. *Studies in English Rhetoric and Prosody.* Books Way.
2. Chakraborti, M.*Principles of English Rhetoric and Prosody*. Kolkata: The World Press Pvt. Ltd.
3. Corbett, Edward P.J. and Connors, Robert J. *Classical Rhetoric for the Modern Student.* OUP.
4. Lanham, Richard A. *A Handlist of Rhetorical Terms*, University of California Press.

Mapping of COs to Syllabus:

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

EGTS0005: T.S. ELIOT (3-0-0)

(Credits: 03) Course Outcomes:

1. Define Modern poetry as a literary genre and T.S. Eliot as a Modernist poet (Remembering)
2. Outline the style and characteristic features of T.S Eliot poetry (Understanding)
3. Identify the salient features of Modern poetry through the works of T.S.Eliot (Applying)
4. Analyse T.S. Eliot's works in terms of theme, technique, prosody, approach, focus, vision and influences (Analysing)
5. Evaluate the influences, impact and effectiveness of the works of T.S. Eliot (Evaluating)
6. Discuss and summarize the various literary and poetic aspects of his works against the individual and socio- political propensities (Creating)

Module I: Introduction to T.S. Eliot. (10 lectures)

Modern English Poetry. Life and Career of T.S. Eliot. Formative influences on the poet. Characteristics of the poet's mind and art. Themes, poetic techniques and features found in his poetry. T.S Eliot 's contribution to poetry, society and life.

Module II: Prescribed Texts of T.S. Eliot. (35 lectures)

a) "The Waste Land"
b) *The Murder in the Cathedral*

Suggested Readings:

1. The prescribed texts in the course
2. Behr, Cardene. *T.S. Eliot: A Chronology of His Life and Works*. Macmillan.
3. Eliot, T.S. "Hamlet and His Problem (1919)," "The Metaphysical Poets "(1921), "Religion and Literature" (1935) in *Selected Essays, 1917-1932*, Faber and Fabre 1999.
4. Haughton, Hugh and Valerie Eliot. *The Letters of T. S. Eliot: Volume 1: 1898-1922*. Yale University Press, 2011.
5. Moody, David. A. *The Cambridge Companion to T.S. Eliot*. CUP.

Mapping of COs to Syllabus:

COs	Module 1	Module 2
CO1	H	
CO2	H	
CO3	H	
CO4	H	H
CO5	H	H
CO6	H	H

EGTH0006: THOMAS HARDY (3-0-0)

(Credits: 03)

Course Outcomes:

1. Define English Victorian novel and Thomas Hardy as a Victorian novelist (Remembering)
2. Demonstrate the characteristic features of Thomas Hardy's fiction (Understanding)
3. Identify the Victorian elements and modernist features in the works of Thomas Hardy (Applying)
4. Analyse critically Hardy's style through the theme, plot, characterization and settings found in the prescribed texts (Analysing)
5. Evaluate Hardy's works in terms of the philosophical content, Historical perspective, literary aspect and language and style (Evaluating)
6. Discuss and summarize the thematic content, approach, literary aspects, and socio- political background of the period in Hardy's fiction (Creating)

Module I: Introduction to Thomas Hardy (10 lectures)

English Victorian Novel. Life and Career of Thomas Hardy. Formative influences on the writer. Characteristic features of the individual novelist. Themes, Wessex setting and Techniques used in his novels. Writer's contribution to the art of Novel writing and society.

Module II: Prescribed Texts of Thomas Hardy (35 lectures)

a) *Tess of D' Urbervilles*
b) *Far From the Madding Crowd*
c) "The Three Strangers"

Suggested Readings

1. The prescribed texts.
2. Allen, Walter E. *The English Novel: A Short Critical History.* London: Phoenix.
3. Bayley, J. *An Essay on Thomas Hardy.* Cambridge.
4. Drabble, M. *The Genius of Thomas Hardy*. London

Mapping of COs to Syllabus:

COs	Module 1	Module 2
CO1	H	
CO2	H	M
CO3	H	M
CO4	M	H
CO5	H	H
CO6	M	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:

COs	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

COs	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H
CO5	H	H

CO6	H	H

EGSH0010: SHAKESPEAREAN DRAMA II - TRAGEDY AND TRAGI-COMEDY (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)
7.

Module I: Tragedy (30 lectures)

a) William Shakeaspear: *Macbeth*
b) William Shakespear: *King Lear*

Module II: Tragi-Comedy (30 lectures)

a) William Shakespeare: *The Merchant 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.
6. *English Critical Texts:* 1975, Oxford

Mapping of COs to Syllabus

COs	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

COs	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

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

EGIW0013: INDIAN WOMEN WRITERS (3-0-0)

(Credits: 03)

Course Outcomes

1. Define the literature by women in India in English. (Remembering)
2. Summarize and critically appreciate the selected literary works and find out the commonalities in terms of themes and issues. (Understanding)
3. Apply feminist theories and feminist reading techniques to critically interpret and assess the selected texts. (Applying)
4. Analyse the contribution of women writers to the Indian English literary tradition. (Analyzing)
5. Judge the essence of women's literature and appreciate the gamut of women's lives and concerns as represented in literature. (Evaluating)
6. Construct a critical reading of the poetry, drama, short stories and novels produced by women of India in different historical periods. (Creating)

Module I: Selected Poets (12 lectures)

a) Toru Dutt: "Sita"

b) Sarojini Naidu: "The Gift of India"

c) Kamala Das: "The Old Playhouse"

Module II: Selected Playwrights and Short Story Writers (15 lectures)

a) Manjula Padmanabhan: *Harvest*

b) Mahasweta Devi: "Draupadi"

Module III: Selected Novelists (18 lectures)

a) Easterine Kire: *Mari*

b) Kiran Desai: *The Inheritance of Loss*

Suggested Readings

1. *Undoing Gender*, 1st Edition, Butler, Judith. 2004, Routledge.
2. *Literature and Gender*, 1st Edition, Goodman, L, 1996, Routledge.
3. Indian Women Writers in English, 1st Edition, Mohanty, S.K., 2012, Surendra Publications.
4. Unbound: 2,000 years of Indian Women's Writing, 1st Edition, Zaidi, Annie (ed.), 2015, Aleph Book Company.

Mapping of COs to Syllabus

COs	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

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

COs	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

COs	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

COs	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

COs	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 Edition, University Press of Kentucky, 1993.
4. Alaimo, Stacy and Susan Hekman. Material Feminisms. Indiana University Press, 2008. Project MUSE

Mapping of COs to Syllabus

COs	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

COs	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

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

EGIM0021: INTRODUCTION TO MODERN EUROPEAN LITERATURE I (3-0-0)

(Credits: 03)

Course Outcomes

1. Recall the vast body of writings of European Literature. (Remembering)
2. Interpret the emerging trends of European Literature through the genres of poetry and fiction. (Understanding)
3. Apply critical reading skills to study the emerging and vibrant areas of literature at a wider range. (Applying)
4. 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)
5. Evaluate the core issues as depicted in the literature of Modern Europe. (Evaluating)
6. 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 (15 lectures)

a. "The Albatross": Charles Baudelaire
b. "The Apple Orchard": Rainer Maria Rilke

Module III: Modern European Fiction (20 lectures)

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

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

EGAL0022: COLONIAL AND POST-COLONIAL AFRICAN LITERATURE I (3-0-0)

(Credits: 03)

Course Outcomes

1. Define the complexities of race, gender and identity related to African literature. (Remembering)
2. Illustrate the vast body of writings in English from Africa. (Understanding)
3. Apply critical reading skills to interpret the vibrant area of literature. (Applying)
4. Analyse the specific issues such as colonialism, identity and unity, cultural loss, ethnic specificity and universality in the literature of Africa during and after the Colonial Period. (Analysing)
5. Evaluate the specific issues pertaining to the colonial experience and literature of Africa. (Evaluating)
6. Discuss various African literary texts from a critical perspective. (Creating)

Module I: Selected Poetry (10 lectures)

a. "Koening of the River": Derek Walcott
b. "The Fisherman's Invocation": Gabriel Okara

Module II: Fiction (20 lectures)

a. *No Longer at Ease*: Chinua Achebe

b. *Purple Hibiscus*: Chimamanda Ngozi Adichie

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.

Mapping of COs to Syllabus

COs	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

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. *Morning Raga*: Mahesh Dattani

b. "The Road to Salvation": Munshi Premchand

Module III: Selected Fiction (20 lectures)

a. *Coolie*: Mulk Raj Anand
b. *Fasting, Feasting*: Anita Desai

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.

Mapping of COs to Syllabus

COs	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

COs	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

COs	Module 1	Module 2

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

EGEL0026: INTRODUCTION TO MODERN EUROPEAN LITERATURE II (3-0-0)

(Credits: 03)

Course Outcomes

1. Relate the characteristics of modern European literature with the readings of other modern European texts (Remembering)
2. Interpret different representative texts of European literature- poetry, fiction and Drama. (Understanding)
3. Identify modernist aspects of contemporary European literatures (Applying)
4. 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)
5. Evaluate the overall Western modern philosophy in the works of the various writers of the area. (Evaluating)
6. 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. *Six Characters in Search of an Author:* Luigi Pirandello

b. *Rosencrantz and Guildenstern are Dead:* Tom Stoppard

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.*
4. Penguin, 1976.
5. Cohen, Walter. A *History of European Literature*. Oxford University Press, 2017.
6. Cohen, J.M. *A History of Western Literature.* Transaction Publishing, 2007.
7. Hamburger, Michael. *The Truth of Poetry: Modernist Poetry since Baudelaire*. Anvil Press Poetry, 2004.
8. Moretti, Franco(Ed.). *The Novel*. Princeton UP, 2006.
9. Nicoll, Allardyce. *British Drama*. Barnes & Noble, 1961.

Mapping of COs to Syllabus

COs	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
CO6	H	H	H

EGPC0027: COLONIAL AND POST-COLONIAL AFRICAN LITERATURE II (3-0-0)

(Credits: 03)

Course Outcomes

1. Define the complexities of race, gender and identity related to African literature. (Remembering)
2. Interpret the emerging genres of African English literature- poetry, and fiction (Understanding)
3. Apply theoretical assumption as well as critical reading skills to the study of African literature. (Applying)
4. Analyse the post-colonial issues of identity unity, cultural loss, ethnic specificity, universality in the literature of Africa in both Colonial and post-colonial contexts. (Analysing)
5. Assess the plot, theme, characters and context of the selected texts. (Evaluating)
6. Create an intense theoretical paradigm for the reading of the text. (Creating)

Module I: Selected Poetry (10 lectures)

a. "On Being Brought from Africa to America": Phillis Wheatley

b. "Telephone Conversation": Wole Soyinka

Module II: Selected Fiction (20 lectures)

a. *Infinite Riches*: Ben Okri

b. *July's People*: Nadine Gordimer

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. Thiong'o, Ngugi wa. *Decolonising the Mind*, East African Educational Publishers, 1986.

Mapping of COs to Syllabus

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

COs	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	

EGSM6001: SEMINAR AND PRESENTATION I (0-0-1)

(Credit: 01)

Course Outcomes:

1. Define academic writing, seminar presentation and publication (Remembering).
2. Identify research topics for sustained and rigorous investigation so that original write- ups can be developed (Understanding).
3. Assess and evaluate the various works of literature to write research reports and papers (Applying).
4. Prepare write-ups for scholarly journals by doing analysis of textual evidence (Analysing).
5. Estimate critical reading, research, discussion and composition around a particular topic/theme or subject

(Evaluating).

6. Synthesize and expand their abilities to absorb, synthesize and construct arguments in a close-knit community (Creating)

Module I: Introduction to Seminar (2 Lectures)

Basics of Seminar:

a) Definition of Seminar

b) Types of Seminar: Students Seminar, National Seminar, International Seminar. Purpose of the seminar.

c) The object of study

d) The scope of study

Module II: Introduction to Seminar (3 Lectures)

Methodology:

a) Steps to write a seminar paper/Research Methodology.

b) Topics of the seminar paper. Presentation:

a) How to present a seminar paper: paralinguistic features.

b) Mode of Presentation: Essay-type Presentation, Paper Presentation, Powerpoint(Ppt.) Presentation

Module III: Practical (15 Lectures)

a) Two presentations per period.

b) Each will be allotted 10-15 minutes for presentation. 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	Module 3
CO1	H		
CO2	H		
CO3	H	H	
CO4		H	
CO5		H	H
CO6		H	H

EGSP6002: SEMINAR AND PRESENTATION II (0-0-1)

(Credit: 01)

Course Outcomes

1. Define academic writing, seminar presentation and publication.(Remembering)
2. Identify research topics for sustained and rigorous investigation so that original write- ups can be developed. (Applying)
3. Estimate and expand their abilities to absorb, synthesize and construct arguments in a close-knit community. (Evaluating)
4. Assess and evaluate the various works of literature to write research reports and papers. (Evaluation)
5. Develop critical reading, research, discussion and composition around a particular topic/ theme or subject. (Creating)
6. Compose write-ups for scholarly journals by doing analysis of textual evidence. (Creating)

Module I: Making an Argument in Research Paper (3 lectures)

a) Beginning: Choosing a topic
b) Body of the Research Paper.
c) Review of Literature.
d) Developing an argument.
e) Bringing a critical interpretation into writing.
f) Framing the Conclusion.
g) Referencing and Citation.
h) Bibliography

Module II: Practical (17 lectures)

a) Two presentations per period.
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	
CO2	H	
CO3	H	H
CO4	H	
CO5	M	H
CO6	M	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

COs	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 – DISSERTATION (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

COs	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

EGSL0200: SERVICE LEARNING- LANGUAGE COMMUNICATION (2-0-0)

(Credit: Theory - 2)

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

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

VALUE ADDED COURSE 1 (UG)

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

COs	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

VALUE ADDED COURSE 2 (PG)

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

COs	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

Our Vision

"To mould intellectually competent, morally upright, socially committed and spiritually inspired persons at the service of India and the world of today and tomorrow, by imparting holistic and personalised education"

ASSAM DON BOSCO UNIVERSITY

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Assam

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Guwahati – 781004
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