2018-2019

REGULATIONS AND SYLLABUS

School of Technology
School of Commerce and Management

ASSAM
DON BOSCO UNIVERSITY

Tapesia Gardens | Azara, Guwahati - 781017
Sonapur - 782402 | Assam, India

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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.

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REGULATIONS

ASSAM DON BOSCO UNIVERSITY

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 Commerce (BCOM)	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 Choice Based Credit System (CBCS) shall be followed for the Graduate Degree Programmes. Credits are allotted to the various courses depending on the number of lecture/tutorial/laboratory hours per five-day cycle (one week) of classes assigned to them using the following general pattern:

3.1.1. Lecture : One hour per cycle/week is assigned 1 credit.

3.1.2. Tutorial : One hours per cycle/week is assigned 1 credit.

3.1.3. Practical : Two hours per cycle/week is assigned 1 credit.

3.2. The courses offered for the Graduate Degree Programmes are divided into two baskets – core courses and elective 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 said Degree Programme.

3.3.1 A student shall be required to take all the core courses offered for a particular programme.

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

3.4. Elective Courses: These are courses in the curriculum which give the student opportunities for specialisation and which cater to his/her interests and career goals.

These courses may be selected by the student and/or offered by the department conducting the programme, from those listed in the curriculum according to the norms laid down by the competent academic authority.

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

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 conducting the programme
School Core **(SC)**	Core courses which are offered by a department other than the department conducting 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 conducting the programme
School Elective **(SE)**	Elective courses which are offered by a department other than the department conducting the programme, from within the same School
Institutional Elective **(IE)**	Elective courses which are offered by departments of the University from Schools other than the parent School

3.6. 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.

3.7. 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 School. Students shall be awarded P/NP grades for the EAP, which shall be recorded in the Grade sheet but not taken into account for computing the SGPA and the CGPA.

3.8. 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.

3.9. 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 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.

3.13 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) 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 shall 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 recognised 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 in the Science Stream with 45% in the aggregate of all subjects and 45% in the aggregate of Physics, Chemistry and Mathematics	National Entrance Test such as JEE / State level entrance examination such as CEE or the ADBU Entrance Examination for Engineers
BCA, BCOM, BA Honours	Passed the qualifying examination in any stream with 45% marks in the aggregate of all subjects	Satisfactory performance in the Personal Interview
BSc Honours	Passed the qualifying examination in the science stream with 45% marks in the aggregate of Physics, Chemistry and Mathematics	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 Lateral Entry into the BTECH Programmes

4.6.1 Polytechnic diploma holders in different disciplines 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 60% marks in the aggregate in the relevant discipline and B.Sc. students who have secured a minimum of 50% 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.

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 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/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
$90 \le x \le 100$	O	Outstanding	10
$80 \le x < 90$	E	Excellent	9
$70 \le x < 80$	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:

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

Where GP_i = Grade points earned in the ith course
NC_i = Number of credits for the ith 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:

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

Where SGP_i = Semester Grade point average of ith semester
NSC_i = Number of credits for the ith semester
n = the number of semesters completed

7.3.3 The CGPA may be converted into a percentage, using the following formula:

for CGPA <= 9.0, Percentage marks = (CGPA x 10) – 5

for CGPA > 9.0, Percentage marks = (CGPA x 15) – 50

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 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	50
End-semester test / viva voce	40

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. Students of the BTECH Programme are required to undergo an Industry Training/Internship programme after the sixth semester in any industry or reputed organisation. BCOM students are required to do internship at the end of 4th or 5th semester.

8.5.2 Such programmes shall generally be of duration not less than 70 hours.

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, 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 Extra Academic Programmes 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 a period of six years from his/her enrolment for 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 Extra Academic Programmes 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. 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

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 inner family circle (restricted to only father, mother, siblings).

8.17.4 Students who have ‘X’ graded courses only in the last two semesters shall 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 twenty 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 a semester 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.

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

11.1.5 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)	6	3
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 choice based credit system shall be followed for the Post Graduate Degree Programmes. Credits are allotted to the various courses depending on the number of lecture/tutorial/laboratory hours per five-day cycle (one week) of classes assigned to them using the following general pattern:

3.1.1 Lecture : One hour per cycle/week is assigned 1 credit.

3.1.2 Tutorial : One hour per cycle/week is assigned 1 credit.

3.1.3 Practical : Two hours per cycle/week is assigned 1 credit.

3.2 The courses offered for the Post Graduate Degree Programmes are divided into two baskets – core courses and elective 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 said Degree Programme.

3.3.1 A student shall be required to take all the core courses offered for a particular programme.

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

3.4 **Elective Courses:** These are courses in the curriculum which give the student opportunities for specialisation and which cater to his/her interests and career goals. These courses may be selected by the student and/or offered by the department conducting the programme, from those listed in the curriculum according to the norms laid down by the competent academic authority.

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

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 conducting the programme
School Core **(SC)**	Core courses which are offered by a department other than the department conducting 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 conducting the programme
School Elective **(SE)**	Elective courses which are offered by a department other than the department conducting 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

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 requirements a student shall have to complete the requirements of Extra Academic Programmes (EAP) as may be prescribed by the School. 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 8 at the end of the first semester (third semester, in the case of MCA) may opt to take one audit course per semester from any Department from the second semester onwards (fourth semester, in the case of MCA), 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 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 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 of 50 % marks in the aggregate, with the relevant discipline as a subject	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 Lateral Entry into the MCA Programme

Students who have completed the BCA programme of Assam Don Bosco University shall be eligible for admission into the third semester of the MCA programme.

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
$90 \leq x \leq 100$	O	Outstanding	10
$80 \leq x < 90$	E	Excellent	9
$70 \leq x < 80$	A+	Very Good	8
$60 \leq x < 70$	A	Good	7
$50 \leq x < 60$	B	Average	6
$40 \leq x < 50$	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:

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

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:

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

Where SGP_i = Semester Grade point average of 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, using the following formula:
for CGPA <= 9.0, Percentage marks = (CGPA x 10) – 5
for CGPA > 9.0, Percentage marks = (CGPA x 15) – 50

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	60
End-semester test / Viva voce	40

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. 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 gradesheets 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 **Improvement Examination**

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

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

8.15.3 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	4	4	8
MSc	3	3	6
MTECH	2	2	4

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

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

8.16 **Special Examination**

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

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

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

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

8.16.3 Students who fail to secure 50% of the credits offered in the final semester shall not be eligible to appear for the special examinations. Such students will be governed by the provisions of clause 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).

8.16.4 Students who have 'X' graded courses only in the last two semesters shall 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.

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

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 a semester 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.

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

10.1.5 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 FOR MASTER'S 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.

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

3.6 In order to qualify for a Masters 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 six 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. Normally a student spends fifteen hours over two days per week in field work.

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.

4.3.5 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 MSC PSYCHOLOGY (PSYCHOLOGICAL COUNSELLING)

5.1 Field Work

Students shall take part in concurrent field work during the first three semesters in social service agencies, medical institutions, the criminal justice system, etc., 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. 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 one semester in an organisation which offers counselling help to clients. The supervised internship shall ordinarily be organised during the last semester of the programme. 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 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 MA EDUCATION

6.1 Specialisations

The Masters Degree Programme in Education 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.

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 and Audit

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. The students shall be trained in the principles and practice of performing a school audit and they shall undertake the audit of a school in groups during the course of the programme.

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.

7.0 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.

11.0 University Registration

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:

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

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 will be calculated using the following formula:

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

Where SGP_i = Semester Grade point average of 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, using the following formula:

for CGPA <= 9.0, Percentage marks = (CGPA x 10) – 5.
for CGPA > 9.0, Percentage marks = (CGPA x 15) – 50

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.

12.2.1 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	50
end-semester test / viva voce examination	40

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

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

12.8.2 He/she has satisfactory attendance during the semester according to the norms laid out in section 9 of these regulations.

12.8.3 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 a period of four years from his/her enrolment for 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 gradesheets 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 gradesheet issued in respect of the course under scrutiny.

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

14.12.5 **Application for re-examining of answer scripts**

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

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

14.12.7 Without prejudice to any of the clauses of section 14.12, a student who has been found to have used unfair means during an examination shall not be eligible to apply for scrutiny or re-evaluation of answer scripts.

14.13 **Improvement Examination**

14.13.1 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.

14.13.2 A student may choose no more than six courses (three in the Autumn semester and three in the Spring semester) for improvement examinations.

14.13.3 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.

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

14.14 **Special Examination**

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

14.14.1.1 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

14.14.1.2 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.

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

14.14.3 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).

14.14.4 Students who have ‘X’ graded courses only in the last two semesters shall 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.

14.14.5 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 a semester 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.

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 no dues to the University, Institute, Department, Hostels; and

16.1.5 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: BACHELOR'S 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:

Attendance Percent (x)	**Marks Allotted**	
	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	50
End Semester Test and/or Viva-Voce Examination	40
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 - MASTER'S DEGREE PROGRAMMES

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

Theory Courses

The different components of the scheme of in-semester Assessment and the weightages attached to them for the theory courses offered in the MSW, MSc-PC and MA-HR programmes 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 field work 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, Life Sciences, 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 9:00 am. 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 9:00 am. Immediately after assembly all should proceed to the classroom to start class at 9:10 am. 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 enter the university before 8:55 am. At the Azara campus, the University gates shall remain closed from 9:05 am to 9:20 am. Anybody entering the University after the gates open at 9:20 am shall not be given attendance for the first hour of class although he/she may be permitted to attend the class.

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 and other 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.

7.0 **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.

8.0 **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. Three of the most important activities are D'VERVE & BOSCOSIADE (intra-University sports and cultural festival), PRAJYUKTTAM (the inter-University technical festival) and CREAZONE (the University magazine). 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 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.

COURSE STRUCTURE
SCHOOL OF TECHNOLOGY

SCHOOL OF TECHNOLOGY
BACHELOR OF TECHNOLOGY (BATCH 2018-19)
COMPUTER SCIENCE AND ENGINEERING

Semester I						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	PSPT0038	Physics for Technologists	3-1-0	4	556
	Basic Science Course/IC	MACL0012	Mathematics I - Calculus and Linear Algebra	3-1-0	4	554
	Engineering Science Course/IC	CSPS0079	Programming for Problem Solving	3-0-0	3	194
Lab	Basic Science Course/IC	PSTC6016	Physics for Technologists- Lab	0-0-4	2	560
	Engineering Science Course/IC	CSPL6069	Programming for Problem Solving Lab	0-0-4	2	225
	Engineering Science Course/IC	CVED6024	Engineering Graphics and Design	1-0-4	3	473
	Mandatory Course/IC	BTIP7	Induction Programme	0-0-0	NC	99
Total Credits					**18**	

Semester II						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	CHEC0027	Engineering Chemistry	3-1-0	4	561
	Basic Science Course/IC	MAIN0013	Mathematics II- Multiple Integrals, Numerical Methods and Differential Equations	3-1-0	4	555
	Engineering Science Course/IC	EEBE0038	Basic Electrical Engineering	3-1-0	4	344
	Humanities & Social Sciences including Management/IC	LSEH0017	English	2-0-0	2	569
Lab	Basic Science Course	CHCE6006	Engineering Chemistry Lab1	0-0-4	1	563
	Engineering Science Course/IC	EEBL6027	Basic Electrical Engineering Laboratory	0-0-2	1	358
	Engineering Science Course/IC	MNWM6023	Workshop/Manufacturing Practice	1-0-4	3	408

	Humanities & Social Sciences including Management/IC	LSOC6004	Oral Communication Practice Lab	0-0-2	1	572
Total Credits					**20**	

Semester III						
Type	**Type of course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC		Mathematics-III	2-0-0	2	
	Engineering Science Course/IC		Analog Electronic Circuits	3-0-0	3	
	Professional Core Courses/DC		Object Oriented Programming	3-0-0	3	
	Professional Core Courses/DC		Digital Computer Design	3-0-0	3	
	Professional Core Courses/DC		Data Structure	3-0-0	3	
	Humanities & Social Sciences including Management/IC		Functional Principles of Management	3-0-0	3	
Lab	Engineering Science Course/IC		Analog Electronic Circuits	0-0-2	1	
	Professional Core Courses/DC		Object Oriented Programming Lab	0-0-4	2	
	Professional Core Courses/DC		Digital Computer Design Lab	0-0-4	2	
	Professional Core Courses/DC		Data Structure Lab	0-0-4	2	
Total Credits					**24**	

Semester IV						
Type	**Type of course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
	Professional Core Courses/DC		Discrete Mathematics	3-1-0	4	
	Professional Core Courses/DC		Computer Organization & Architecture	3-0-0	3	
	Professional Core Courses/DC		Relational Database Management Systems	3-0-0	3	
	Professional Core Courses/DC		Analysis and Design of Algorithms	3-0-0	3	
	Humanities & Social Sciences including Management/IC		Introduction to Organizational Behavior	3-0-0	3	
	Professional Core Courses/DC		Computer Organization & Architecture Lab	0-0-4	2	
	Professional Core Courses/DC		Relational Database Management Systems Lab	0-0-4	2	

	Professional Core Courses/DC		Analysis and Design of Algorithms Lab	0-0-4	2	
	Mandatory Course/IC		Environmental Sciences		0	
Total Credits					**22**	

Semester V						
Type	**Type of course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Courses/DC		Formal Language & Automata Theory	3-0-0	3	
	Professional Core Courses/DC		Operating Systems	3-0-0	3	
	Professional Core Courses/DC		Data Communication	3-0-0	3	
	Professional Elective Courses/DE		Information System Design/System Analysis and Design/ Software Engineering & Designing Concepts	3-0-0	3	
	Humanities & Social Sciences including Management/IC		Economics for Engineers	3-0-0	3	
Lab	Professional Core Courses/DC		Operating Systems Lab	0-0-4	2	
	Professional Core Courses/DC		Data Communication Lab	0-0-4	2	
Project	Project/DC		Mini Project-I	0-0-4	2	
	Mandatory Course/IC		Constitution of India/Essence of Indian Traditional Knowledge		0	
Total Credits					**21**	

Semester VI						
Type	**Type of course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Courses/DC		Compiler Design	3-0-0	3	
	Professional Core Courses/DC		Computer Networks	3-0-0	3	
	Professional Elective Courses/DE		Computer Graphics& Multimedia/ System Programming	3-0-0	3	
	Professional Elective Courses/DE		Microprocessor/ Embedded System	3-0-0	3	
	Open Elective Courses/IE		Production and Operations Management	3-0-0	3	
Lab	Professional Core Courses/DC		Compiler Design Lab	0-0-4	2	

	Professional Core Course/DC		Computer Networks Lab	0-0-4	2	
	Professional Elective Courses/DE		Computer Graphics & Multimedia Lab/ System Programming Lab	0-0-2	1	
	Professional Elective Courses/DE		Microprocessor Lab/ Embedded System Lab	0-0-2	1	
Project	Project/DC		Mini Project-II	0-0-4	2	
Total Credits					**23**	

Semester VII						
Type	**Type of course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC		Biology	2-0-0	2	
	Professional Elective Courses/DE		Artificial Intelligence/Robotics & Unmanned devices	3-1-0	4	
	Professional Elective Courses/DE		Data Warehousing and Data Mining/Machine Learning	3-0-0	3	
	Open Elective Courses/IE		Personal and Mobile Communications/Image Processing and pattern Recognition/Android Application Development Fundamentals	3-0-0	3	
Lab	Professional Elective Courses/DE		Artificial Intelligence Lab/Robotics & Unmanned devices Lab	0-0-2	1	
Project	Project/DC		Major Project- Phase I	0-0-8	4	
Total Credits					**17**	

Semester VIII						
Type	**Type of course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Elective Courses/DE		Emerging Trends in Computing-Cloud Computing/ E-Commerce and Data Security	3-0-0	3	
	Open Elective Courses/IE		Distributed Computing/ Network Security and Cryptography/Concepts of Advanced Operating Systems	3-0-0	3	
	Open Elective Courses/IE		Computer Vision/Speech Processing /Pattern Recognition/Natural Language Processing	3-0-0	3	
Project	Project/DC		Major Project- Phase II	0-0-12	6	
Total Credits					**15**	
Total Programme Credits					**161**	

ELECTRONICS AND COMMUNICATION ENGINEERING

Semester I						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	PSPT0038	Physics for Technologists	3-1-0	4	556
	Basic Science Course/IC	MACL0012	Mathematics I - Calculus and Linear Algebra	3-1-0	4	554
	Engineering Science Course/IC	CSPS0079	Programming for Problem Solving	3-0-0	3	194
Lab	Basic Science Course/IC	PSTC6016	Physics for Technologists- Lab	0-0-4	2	560
	Engineering Science Course/IC	CSPL6069	Programming for Problem Solving Lab	0-0-4	2	225
	Engineering Science Course/IC	CVED6024	Engineering Graphics and Design	1-0-4	3	473
	Mandatory Course/IC	BTIP7	Induction Programme	0-0-0	NC	99
Total Credits					**18**	

Semester II						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	CHEC0027	Engineering Chemistry	3-1-0	4	561
	Basic Science Course/IC	MAIN0013	Mathematics II-Multiple Integrals, Numerical Methods and Differential Equations	3-1-0	4	555
	Engineering Science Course/IC	EEBE0038	Basic Electrical Engineering	3-1-0	4	344
	Humanities & Social Sciences including Management/IC	LSEH0017	English	2-0-0	2	569
Lab	Basic Science Course	CHCE6006	Engineering Chemistry Lab1	0-0-4	1	563
	Engineering Science Course/IC	EEBL6027	Basic Electrical Engineering Laboratory	0-0-2	1	358
	Engineering Science Course/IC	MNWM6023	Workshop/Manufacturing Practice	1-0-4	3	408
	Humanities & Social Sciences including Management/IC	LSOC6004	Oral Communication Practice Lab	0-0-2	1	
Total Credits					**20**	

Semester III						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Course /DC		Electronic Devices	3-1-0	4	
	Professional Elective courses/ DE		Signal and Systems	2-1-0	3	
	Professional Core Course /DC		Network Theory	2-1-0	3	
	Professional Core Course /DC		Electromagnetic Waves	3-0-0	3	
	Basic Sciences Course /SC		Mathematics-III	2-1-0	3	
	Humanities and Social Science Course /IC		Humanities Subject	2-0-0	2	
	Mandatory Course/IC		Constitution of India	0-0-0	NC	
Lab	Professional Core Course /DC		Electronic Devices Lab	0-0-2	1	
	Professional Core Course /DC		Electromagnetic Waves Lab	0-0-2	1	
Total Credits					**20**	

Semester IV						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Course /DC		Analog Circuits	3-0-0	3	
	Professional Core Course /DC		Digital System Design	3-1-0	4	
	Engineering Science Course/IC		Electronic Engineering Materials	2-0-0	2	
	Professional Core Course /DC		Digital Signal Processing	2-1-0	3	
	Professional Core Course /DC		Probability Theory and Stochastic Processes	3-0-0	3	
	Humanities and Social Science Course /IC		Organization Behaviour	2-0-0	2	
	Professional Core Course /DC		Industrial Training	0-0-0	0	
Lab	Professional Core Course /DC		Digital System Design Lab	0-0-2	1	
	Professional Core Course /DC		Analog Circuits Lab	0-0-2	1	
	Professional Core Course /DC		Digital Signal Processing Lab	0-0-2	1	
	Professional Core Course /DC		Mini Project	0-0-4	2	
Total Credits					**22**	

Semester V						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Course /DC		Analog and Digital Communication	3-1-0	4	
	Professional Core Course /DC		Microprocessor and Microcontroller	3-0-0	3	
	Professional Core Course /DC		Computer Architecture	3-0-0	3	
	Professional Core Course /DC		Numerical Methods	3-0-0	3	
	Professional Elective Course /DE		Power Electronics/ Nanoelectronics/ Speech and Audio Processing/	3-0-0	3	
	Open Elective Course /SE		Robotics	3-0-0	3	
Lab	Professional Core Course /DC		Analog and Digital Communication Lab	0-0-2	1	
	Professional Core Course /DC		Microprocessor and Microcontroller Lab	0-0-2	1	
	Professional Core Course /DC		Mini Project	0-0-2	1	

Seminar	Professional Core Course /DC		Training Seminar	0-0-0	1	
Total Credits					**23**	

Semester VI						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	SE		Control System	3-0-0	3	
	Professional Core Course /DC		Computer Networks	3-0-0	3	
	Professional Core Course /DC		Electronic Measurements	2-0-0	2	
	Professional Elective Course/DE		CMOS/VLSI Design/ Biomedical Electronics/ Information Theory and Coding	3-0-0	3	
	Open Elective Course/IE		Nanotechnology	3-0-0	3	
	Humanities and Social Science Course /IC		Production and Operations Management	3-0-0	3	
	Professional Core Course /DC		Industrial Training	0-0-0	0	
Lab	Professional Core Course /DC		Electronic Measurements Lab	0-0-2	1	
	Professional Core Course /DC		Mini Project	0-0-4	2	
Total Credits					**20**	

Semester VII						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Course /DC		Microwave (Core)	3-0-0	3	
	Professional Elective Course /DE		Embedded System/ Mobile Communication	3-0-0	3	
	Professional Elective Course/DE		Wireless Sensor Network/ Satellite Communication	3-0-0	3	
	Open Elective Course/IC		Instrumentation and Sensor Technology	3-0-0	3	
	Humanities and Social Science Course/IC		Financial Management and Accounting	2-0-0	2	
Lab	Professional Core Course /DC		Project-I	0-0-8	4	
Seminar	Professional Core Course /DC		Training Seminar	0-0-0	1	
Total Credits					**19**	

Semester VIII						
Type	**Type of Course/**	**Course**	**Course Title**	**L-T-P**	**Credits**	**Page**

	Category	Code				
Theory	Professional Core Course /DC		Antenna and Wave Propagation (Core)	3-0-0	3	
	Professional Elective Course /DE		Fiber Optic Communication/ Digital Image and Video Processing/ Mixed Signal Design	3-0-0	3	
	Open Elective Course/IE		IoT-The future of technology	3-0-0	3	
	Open Elective courses/IE		Bioinformatics	3-0-0	3	
Lab	Professional Core Course /DC		Project-II	0-0-12	6	
Total Credits					**18**	
Total Programme Credits					**160**	

ELECTRICAL AND ELECTRONICS ENGINEERING

Semester I						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	PSPT0038	Physics for Technologists	3-1-0	4	556
	Basic Science Course/IC	MACL0012	Mathematics I - Calculus and Linear Algebra	3-1-0	4	554
	Engineering Science Course/IC	CSPS0079	Programming for Problem Solving	3-0-0	3	194
Lab	Basic Science Course/IC	PSTC6016	Physics for Technologists- Lab	0-0-4	2	560
	Engineering Science Course/IC	CSPL6069	Programming for Problem Solving Lab	0-0-4	2	225
	Engineering Science Course/IC	CVED6024	Engineering Graphics and Design	1-0-4	3	473
	Mandatory Course/IC	BTIP7	Induction Programme	0-0-0	NC	99
Total Credits					**18**	

Semester II						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	CHCE0027	Engineering Chemistry	3-1-0	4	561
	Basic Science Course/IC	MAIN0013	Mathematics II-Multiple Integrals, Numerical Methods and Differential Equations	3-1-0	4	555
	Engineering Science Course/IC	EEBE0038	Basic Electrical Engineering	3-1-0	4	344

	Humanities & Social Sciences including Management/IC	LSEH0017	English	2-0-0	2	569
Lab	Basic Science Course	CHEC6006	Engineering Chemistry Lab1	0-0-4	1	563
	Engineering Science Course/IC	EEBL6027	Basic Electrical Engineering Laboratory	0-0-2	1	358
	Engineering Science Course/IC	MNWM6023	Workshop/Manufacturing Practice	1-0-4	3	408
	Humanities & Social Sciences including Management/IC	LSOC6004	Oral Communication Practice Lab	0-0-2	1	572
Total Credits					**20**	

Semester III						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Courses/DC		Electrical Circuit Analysis	3-1-0	4	
	Professional Core Courses/DC		Analog Electronics	3-0-0	3	
	Professional Core Courses/DC		Electromagnetic Fields	3-1-0	4	
	Professional Core Courses/DC		Electrical Machines – I	3-0-0	3	
	Engineering Science Course/IC		Engineering Mechanics	3-1-0	4	
	Humanities & Social Sciences including Management/IC		Economics for Engineers	2-0-0	2	
Lab	Professional Core Courses/DC		Electrical Machines Laboratory - I	0-0-2	1	
	Professional Core Courses/DC		Analog Electronics Laboratory	0-0-2	1	
Total Credits					**22**	

Semester IV						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Courses/DC		Digital Electronics	3-0-0	3	
	Professional Core Courses/DC		Electrical Machines – II	3-0-0	3	
	Professional Core Courses/DC		Power Electronics	3-0-0	3	
	Professional Core Courses/DC		Signals and Systems	2-1-0	3	
	Basic Sciences Course/IC		Mathematics – III	3-1-0	4	

	Basic Sciences Course/IC		Biology - I	2-1-0	3	
	Humanities & Social Sciences including Management/IC		Organisational Behaviour	2-0-0	2	
Lab	Professional Core Courses/DC		Digital Electronics Laboratory	0-0-2	1	
	Professional Core Courses/DC		Power Electronics Laboratory	0-0-2	1	
	Professional Core Courses/DC		Mini Project-I	0-0-2	1	
Total Credits					**25**	

Semester V						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Courses/DC		Power Systems -I	3-0-0	3	
	Professional Core Courses/DC		Control Systems	3-0-0	3	
	Professional Core Courses/DC		Microprocessors	3-0-0	3	
	Professional Elective Courses/DE		Electrical Machine Design/Electromagnetic Waves	3-0-0	3	
	Open Elective Courses/SE/IE		Electronic Devices/Data Structures and Algorithms	3-0-0	3	
Lab	Professional Core Courses/DC		Microprocessors Laboratory	0-0-2	1	
	Professional Core Courses/DC		Power Systems Laboratory - I	0-0-2	1	
	Professional Core Courses/DC		Control Systems Laboratory	0-0-2	1	
Project	Professional Core Courses/DC		Mini Project-II	0-0-2	1	
Total credits					**19**	

Semester VI						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core Courses/DC		Power Systems - II	3-0-0	3	
	Professional Core Courses/DC		Measurements and Instrumentation	2-0-0	2	
	Professional Core Courses/DC		Electronic Design	1-0-0	1	
	Humanities & Social Sciences including Management/IC		Production and Operations Management	3-0-0	3	
	Professional Elective Courses/DE		Electrical Drives / High Voltage Engineering	3-0-0	3	

	Professional Elective Courses/DE		Digital Control Systems / Digital Signal	3-0-0	3	
	Open Elective Courses/SE/IE		Embedded Systems	3-0-0	3	
Lab	Professional Core Courses/DC		Power Systems Laboratory - II	0-0-2	1	
	Professional Core Courses/DC		Measurements and Instrumentation Lab	0-0-2	1	
	Professional Core Courses/DC		Electronic Design Laboratory	0-0-4	2	
Project	Professional Core Courses/DC		Mini Project-III	0-0-2	1	
Total Credits					**23**	

Semester VII						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
	Humanities & Social Sciences including Management/IC		Financial Management and Accounting	2-0-0	2	
	Professional Elective Courses/DE		Power System Protection / Wind and Solar	3-0-0	3	
	Professional Elective Courses/DE		Power Quality and FACTS / Power System	3-0-0	3	
	Open Elective Courses/SE/IE		Power Plant Engineering / Internet of Things	3-0-0	3	
	Open Elective Courses/SE/IE		Electrical Materials / Computer Networks	3-0-0	3	
	Professional Core Courses/DC		Training Seminar	0-0-2	1	
	Professional Core Courses/DC		Major Project Phase-I	0-0-6	3	
Total credits					**18**	

Semester VIII						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Elective Courses/DE		Electrical Energy Conservation and Auditing / Industrial Electrical Systems	3-0-0	3	
	Open Elective Courses/SE/IE		Analog and Digital Communication / Wavelet Transforms	3-0-0	3	
			Image Processing / Big Data Analysis	3-0-0	3	
Lab	Professional Core Courses/DC		Major Project Phase-II	0-0-12	6	
Total Credits					**15**	
Total Programme Credits					**160**	

CIVIL ENGINEERING

Semester I						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	CHCE0027	Engineering Chemistry	3-1-0	4	561
	Basic Science Course/IC	MACL0012	Mathematics I - Calculus and Linear Algebra	3-1-0	4	554
	Engineering Science Course/IC	EEBE0038	Basic Electrical Engineering	3-1-0	4	344
Lab	Basic Science Course	CHCE6007	Engineering Chemistry Lab	0-0-2	2	563
	Engineering Science Course/IC	EEBL6027	Basic Electrical Engineering Laboratory	0-0-2	1	358
	Engineering Science Course/IC	MNWM6023	Workshop/Manufacturing Practice	1-0-4	3	408
	Mandatory Course/IC	BTIP7	Induction Programme	0-0-0	NC	99
Total Credits					**18**	

Semester II						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	PSEP0039	Engineering Physics: Mechanics	3-1-0	4	557
	Basic Science Course/IC	MAIN0013	Mathematics II-Multiple Integrals, Numerical Methods and Differential Equations	3-1-0	4	555
	Engineering Science Course/IC	CSPS0079	Programming for Problem Solving	3-0-0	3	194
	Humanities & Social Sciences including Management/IC	LSEH0017	English	2-0-0	2	569
Lab	Basic Science Course/IC	PSEG6017	Physics Lab for Engineers	0-0-2	1	560
	Engineering Science Course/IC	CVED6024	Engineering Graphics and Design	1-0-4	3	473
	Humanities & Social Sciences including Management/IC	LSOC6004	Oral Communication Practice Lab	0-0-2	1	572

	Engineering Science Course/IC	CSPL6069	Programming for Problem Solving Lab	0-0-4	2	225
Total Credits					**20**	

Semester III						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Engineering Science Course/IC		Basic Electronics	1-0-0	1	
	Basic Science Course/IC		Biology for Engineers	2-0-0	2	
	Engineering Science Course/IC		Computer Aided Civil Engineering Drawing	1-0-0	1	
	Engineering Science Course/IC		Engineering Mechanics	3-1-0	4	
	Engineering Science Course/IC		Energy science and Engineering	1-1-0	2	
	Engineering Science Course/IC		Life Science	1-0-0	1	
	Basic Science Course/IC		Mathematics III	2-0-0	2	
	Humanities & Social Sciences including Management/IC		Effective Technical communication	3-0-0	3	
	Humanities & Social Sciences including Management/IC		Introduction to Civil Engineering	2-0-0	2	
	Engineering Science Course/IC		Basic Electronics Lab	0-0-2	1	
	Basic Science Course/IC		Biology for Engineers Lab	0-0-2	1	
	Engineering Science Course/IC		Computer Aided Civil Engineering Drawing Lab	0-0-2	1	
	Engineering Science Course/IC		Life Science-Lab	0-0-2	1	
Total Credits					**22**	

Semester IV						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Engineering Science Course/DC		Mechanical Engineering	2-1-0	3	
	Professional core course/DC		Instrumentation and sensor Technologies for Civil engineering Applications	1-1-0	2	
	Professional core course/DC		Engineering Geology	1-0-0	1	
	Professional core course/DC		Disaster Preparedness & Planning	1-1-0	2	
	Professional core course/DC		Introduction to Fluid Mechanics	2-0-0	2	
	Professional core course/DC		Introduction to Solid Mechanics	2-0-0	2	
	Professional core course/DC		Surveying & Geomatics	1-1-0	2	
	Professional core course/DC		Materials, Testing & Evaluation	1-1-0	2	
	Humanities and Social Sciences including Management courses/IC		Civil Engineering - Societal & Global Impact	2-0-0	2	
Lab	Professional core course/DC		Instrumentation & Sensor Technologies for Civil Engineering Applications	0-0-2	1	
	Professional core course/DC		Engineering Geology	0-0-2	1	
	Professional core course/DC		Introduction to Fluid Mechanics	0-0-2	1	
	Professional core course/DC		Surveying & Geomatics	0-0-2	1	
	Professional core course/DC		Materials, Testing & Evaluation	0-0-2	1	
	Mandatory Course/IC				NC	
Total Credits					**23**	

Semester V						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core course/DC		Mechanics of Materials	3-0-0	3	
	Professional Core course/DC		Hydraulic Engineering	2-0-0	2	

	Professional Core course/DC		Structural Engineering	2-1-0	3	
	Professional Core course/DC		Geotechnical Engineering	2-0-0	2	
	Professional Core course/DC		Hydrology & Water Resources Engineering	2-1-0	3	
	Professional Core course/DC		Environmental Engineering	2-0-0	2	
	Professional Core course/DC		Transportation Engineering	2-0-0	2	
	Humanities and Social Sciences including Management courses /IC		Professional Practice, Law & Ethics	2-0-0	2	
	Mandatory courses/IC		Constitution of India/ Essence of Indian Traditional	0-0-0	NC	
Lab	Professional Core course/DC		Geotechnical Engineering	0-0-2	1	
	Professional Core course/DC		Environmental Engineering	0-0-2	1	
	Professional Core course/DC		Transportation Engineering	0-0-2	1	
Total Credits					**23**	

Semester VI						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Core courses/DC		Construction Engineering & Management	2-1-0	3	
	Professional Core courses/DC		Engineering Economics, Estimation & Costing	2-1-0	3	
	Professional Elective courses/DE		Elective-I (Design of Concrete Structures I/Building construction practice/Design of Structural Systems	3-0-0	3	
			Civil Engineering Design I)			
	Professional Elective courses/DE		Elective-II(Structural Analysis I/Metal Structure Behavior – I/Design of Structural Systems)	3-0-0	3	
	Open Elective courses/IE		Open Elective-I (Humanities-) History of Science and Engineering	3-0-0	3	

	Professional Elective courses/DC		Elective-III (Soil Mechanics I/Railway Engineering Physico Chemical Processes of Water and Waste Water Treatment)	3-0-0	3	
	Professional Elective courses/DE		Elective-IV (Design of Steel Structures/Urban transportation planning/Port and Harbour Engineering)	3-0-0	3	
Lab	Professional Core courses/DC		Engineering Economics, Estimation & Costing-Lab	0-0-4	2	
Total Credits					**23**	

Semester VII						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Elective courses/DE		Elective V (Open Channel flow/Traffic Engineering and Management/ Structural Analysis II)	3-0-0	3	
	Professional Elective courses/DE		Elective-VI (Design of Concrete Structures II/Basics of Computational Hydraulics/Environmental Geotechnology/ Design of hydraulic structure/Irrigation Engineering)	3-0-0	3	
	Open Elective courses/IE		Open Elective-II Suggested (Metro Systems & Engineering)	3-0-0	3	
	Project/DC		Project-1 (Project work, seminar and internship in industry or at appropriate work place)	0-0-12	6	
Total Credits					**15**	

Semester VIII						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional Elective courses/DE		Elective VII (Bridge Engineering/Prestressed Concrete/ Soil Mechanics II/ Environmental Impact Assessment and Life Cycle Analysis)	3-0-0	3	

	Professional Elective courses/DE		Elective VIII (Structural Dynamics/ Earth quake Engineering/ Geographic Information Systems and Science/Port and Harbor Engineering/ Repairs and Rehabilitation of Structures)	2-0-0	2	
	Open Elective courses/IE		Open Elective-III-Environmental Law and policy/Soft skills and inter personal communication	3-0-0	3	
	Open Elective courses/IE		Open Elective-IV-Sustainable engineering and Technology-/Economic Policies in India	2-0-0	6	
Project	Project/DC		Project-2 (Continued from VII Semester, Project work, seminar and internship in industry or at appropriate work place)	0-0-12	6	
Total Credits					**16**	
Total Programme Credits					**160**	

MECHANICAL ENGINEERING

Semester I						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	CHCE0027	Engineering Chemistry	3-1-0	4	
	Basic Science Course/IC	MACL0012	Mathematics I - Calculus and Linear Algebra	3-1-0	4	
	Engineering Science Course/IC	EEBE0038	Basic Electrical Engineering	3-1-0	4	
Lab	Basic Science Course	CHCE6007	Engineering Chemistry Lab	0-0-2	2	
	Engineering Science Course/IC	EEBL6027	Basic Electrical Engineering Laboratory	0-0-2	1	
	Engineering Science Course/IC	MNWM6023	Workshop/Manufacturing Practice	1-0-4	3	
	Mandatory Course/IC	BTIP7	Induction Programme	0-0-0	NC	
Total Credits					**18**	

Semester II						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science Course/IC	PSET0040	Engineering Physics: Electromagnetic Theory	3-1-0	4	
	Basic Science Course/IC	MAIN0013	Mathematics II-Multiple Integrals, Numerical Methods and Differential Equations	3-1-0	4	
	Engineering Science Course/IC	CSPS0079	Programming for Problem Solving	3-0-0	3	
	Humanities & Social Sciences including Management/IC	LSEH0017	English	2-0-0	2	
Lab	Basic Science Course/IC	PSEG6017	Physics Lab for Engineers	0-0-2	1	
	Engineering Science Course/IC	CVED6024	Engineering Graphics and Design	1-0-4	3	
	Humanities & Social Sciences including Management/IC	LSOC6004	Oral Communication Practice Lab	0-0-2	1	
	Engineering Science Course/IC	CSPL6069	Programming for Problem Solving Lab	0-0-4	2	
	Mandatory Course/IC	BTCI6007	Constitution of India	0-0-0	NC	
Total Credits					**20**	

Semester III						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Basic Science course/IC		Physics II	3-0-1	4	
	Basic Science course/IC		Engineering Mathematics III	3-1-0	4	
	Basic Science course/IC		Biology	3-0-0	3	
	Engineering Science Course/IC		Basic Electronics Engineering	3-1-0	4	
	Engineering Science Course/IC		Engineering Mechanics	3-1-0	4	
	Professional core course/DC		Thermodynamics	3-1-0	4	
Total Credits					23	

Semester IV						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional core course/DC		Applied Thermodynamics	3-1-0	4	

	Professional core course/DC		Fluid Mechanics & Fluid Machines	03-01-00	4	
	Professional core course/DC		Strength of Materials	3-1-0	4	
	Engineering Science Course/IC		Materials Engineering	3-0-0	0	
	Professional core course/DC		Instrumentation & Control	3-0-0	3	
	Mandatory Course		Environmental Science	0-0-0	NC	
Total Credits					**18**	

Semester V						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional core course/DC		Heat Transfer	3-1-0	4	
	Professional core course/DC		Solid Mechanics	3-0-0	3	
	Professional core course/DC		Manufacturing Processes	3-1-0	4	
	Professional core course/DC		Kinematics & Theory of Machine	3-1-0	4	
	Humanities and Social Sciences including Management courses/IC		Humanities I/ Economics	3-0-0	3	
Lab	Professional core course/DC		Mechanical Engineering Lab (Fluid & Thermal)	0-0-4	2	
	Project(Summer internship)		Project I(Summer internship)/ Mini Project	0-0-2	1	
	Mandatory Course/IC		Essence of Indian Traditional Knowledge	0-0-0	NC	
Total Credits					**21**	

Semester VI						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional core course/DC		Manufacturing Technology	4-0-0	4	
	Professional core course/DC		Design of Machine Elements	3-1-0	4	
	Professional Elective courses/DE		Internal Combustion Engines/Mechatronic Systems	3-0-0	3	
	Professional Elective courses/DE		Composite Materials /Computer Aided Design	3-0-0	3	
	Humanities and Social		Open Elective	3-0-0	3	

	Sciences including Management courses/IC		(Humanities II)			
Lab	Professional core course/DC		Mechanical Engineering Lab (Design)	0-0-4	2	
Project	**Project(Summer internship)/DC**		Projects II (Summer internship)	0-0-6	3	
Total Credits					**22**	

Semester VII						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional core course/DC		Automation in Manufacturing	3-0-0	3	
	Professional Elective courses/DE		Refrigeration and Air Conditioning / Finite Element Analysis	3-0-0	3	
	Professional Elective courses/DE		Power Plant Engineering/ Gas Dynamics and Jet Propulsion	3-0-0	3	
	Open Elective courses/IE		Nanotechnology and Surface Engineering	3-0-0	3	
Lab	Professional core course/DC		Mechanical Engineering Lab (Manufacturing)	0-0-4	2	
Project	Professional core course/DC		Project III	0-0-10	5	
Total Credits					**19**	

Semester VIII						
Type	**Type of Course/ Category**	**Course Code**	**Course Title**	**L-T-P**	**Credits**	**Page**
Theory	Professional core course/DC		Automobile Engineering / Design of Transmission Systems	3-0-0	3	
	Professional core course/DC		Energy Conservation and Management	3-0-0	3	
	Open Elective courses/IE		Open Elective IV	3-0-0	3	
	Open Elective courses/IE		Open Elective V	3-0-0	3	
Project	Professional core course/DC		Project IV	0-0-12	6	
Total Credits					**18**	
Total Programme Credits					160	

BACHELOR OF TECHNOLOGY (BATCH 2017-18, 2016-17, 2015-16)

COMPUTER SCIENCE AND ENGINEERING

Type	Course Code	Course Name	Credits	Category	Page
Semester 3					
Theory	MAEM0009	Engineering Mathematics III	4	IC	551
	CSCD0028	Digital Computer Design	3	DC	135
	EECN0015	Circuit Theory and Networks	4	SC	317
	ECAE0017	Analog Electronic Circuits	4	SC	249
	CSOJ0029	Object Oriented Programming using Java	3	DC	136
	MTEC0068	Economics for Engineers	2	IC	477
Lab	EECN6005	Circuit and Networks Lab	2	SC	346
	ECAE6007	Analog Electronic Circuits Lab	2	SC	283
	CSOJ6017	Object Oriented Programming using Java Lab	2	DC	200
EAP	BTEAP3	Extra Academic Programmes	NC	IC	
Total Credits			**26**		
Semester 4					
Theory	MAEM0010	Engineering Mathematics IV	4	IC	552
	ECCT0020	Communication Techniques	3	SC	253
	CSCO0038	Computer Organisation and Architecture	4	DC	147
	CSDB0039	Relational Database Management Systems	4	DC	149
	CSSG0040	System Programming	3	DC	150
	MTOB0069	Introduction to Organisational Behaviour	2	IE	479
Lab	CSCD6026	Digital Computer Design lab	2	DC	204
	CSCO6027	Computer Organisation and Architecture Lab	2	DC	205
	CSSG6028	System Programming Lab	2	DC	205
	CSDB6029	RDBMS lab	2	DC	206
AP	BTEAP4	Extra Academic Programmes	NC	IC	
		Total Credits	**28**		
Semester 5					
Theory	CSMA0047	Microprocessors and Applications	4	DC	159
	CSOC0048	Operating Systems and Concepts	4	DC	160
	CSFL0049	Formal Language and Automata Theory	4	DC	161
	CSDC0050	Data Communication	4	DE	163
	CSIS0051	Information System Design	4	DE	164
	MTFP0070	Functional Principles of Management	2	IE	480
Lab	CSMA6047	Microprocessors and Applications lab	2	DC	214
	CSOC6048	Operating Systems and Concepts Lab	2	DC	214
	CSDC6049	Data Communication Lab	2	DE	215
Project	CSMI6050	Mini Project I	2	DC	216
EAP	BTEAP5	Extra Academic Programmes	NC	DC	NA
		Total Credits	**30**		
Semester 6					

Theory	CSNS0057	Computer Networks	4	DE	171
	CSSD0058	Software Engineering and Designing Concepts	3	DE	172
	CSAA0059	Analysis and Design of Algorithms	4	DC	173
	MADM0002	Discrete Mathematics	4	IC	546
	CSCD0060	Compiler Design	4	DC	174
	MTOM0071	Production and Operations Management	2	IE	481
Lab	CSNS6054	Computer Networks lab	2	DE	217
	CSCD6055	Compiler Design Lab	2	DC	218
	CSAA6056	Analysis and Design of Algorithms Lab	2	DC	218
	CSMI6057	Mini Project II	2	DC	219
AP	BTEAP6	Extra Academic Programmes	NC	IC	NA
Total Credits			**29**		
Semester 7					
Theory	CSAI0061	Artificial Intelligence	4	DE	175
	CSDW0056	Data Warehousing and Data Mining	4	DE	170
	CSGM0062	Computer Graphics and Multimedia	3	DE	176
	MTQM0072	Quality Management Systems	2	IE	483
	One Elective to be opted				
	CSEC0055	e-Commerce and Data Security	4	DE	169
	CSPM0063	Personal and Mobile Communications		DE	177
	CSIR0064	Image Processing and Pattern Recognition		DE	179
	CSAD0075	Android Application Development Fundamentals			191
Lab	CSAI6059	Artificial Intelligence Lab	2	DE	220
	CSGM6060	Computer Graphics and Multimedia Lab	2	DE	221
Seminar	CSTS6061	Training Seminar	2	DC	221
Project	CSMP6062	Major Project (Phase I)	4	DC	222
Total Credits			**27**		
Semester 8					
Theory	CSRE0065	Real Time and Embedded Systems	4	DE	180
	CSAP0066	Advanced Computer Architecture and Parallel Processing	3	DE	181
	CSET0067	Emerging Trends in Computing - Cloud Computing	3	DE	183
	PYTW0021	Thoughts That Shaped the World	2	IE	573
	MTFC0073	Financial Management and Accounting	3	IC	484
	One elective to be opted				
	CSDG0068	Distributed Computing	3	DE	184
	CSNC0069	Network Security and Cryptography		DE	185
	CSAO0070	Concepts of Advanced Operating Systems		DE	186
Project	CSMP6063	Major Project (Phase II) and Viva Voce	8	DC	223
Total Credits			**26**		

ELECTRONICS AND COMMUNICATION ENGINEERING

Type	Course Code	Course Name	Credits	Category	Page
Semester 3					
Theory	MAEM0009	Engineering Mathematics III	4	IC	551
	EECN0015	Circuit Theory and Networks	4	SC	317
	ECDC0015	Electronic Devices and Circuits	5	DC	246
	ECSS0016	Signals and Systems	3	DC	248
	CSOJ0029	Object Oriented Programming using Java	3	SC	136
	MTEC0068	Economics for Engineers	2	IC	477
Lab	EECN6005	Circuit and Networks Lab	2	SC	346
	ECDC6006	Electronic Devices and Circuits Lab	2	DC	283
	CSOJ6017	Object Oriented Programming using Java Lab	2	SC	200
AP	BTEAP3	Extra Academic Programmes	NC	IC	
		Total Credits	**27**		
Semester 4					
Theory	MAEM0010	Engineering Mathematics IV	4	IC	
	ECDL0018	Digital Electronics and Logic Design	4	DC/SC	240
	EEMT0017	Electro Magnetic Theory	3	SC	319
	EEEI0018	Electronic Instrumentation and Measurements	4	SC	321
	ECAC0019	Analog Integrated Circuits	4	DC/SC	251
	MTOB0069	Introduction to Organisational Behaviour	2	IE	479
Lab	ECDL6010	Digital Electronics and Logic Design lab	2	DC/SC	285
	EEEI6008	Electronic Instrumentation and Measurements Lab	2	SC	347
	ECAC6011	Analog Integrated Circuits lab	2	DC/SC	287
Project	ECMI6012	Mini Project I	2	DC	286
AP	BTEAP4	Extra Academic Programmes	NC	IC	NA
		Total Credits	**29**		
Semester 5					
Theory	ECMM0021	Microprocessors and Microcontrollers	4	DC/SC	254
	EECE0022	Control System Engineering	4	SC	325
	ECDP0022	Digital Signal Processing	3	DC	255
	ECAC0023	Analog Communication Techniques	4	DC	256
	ECME0024	Microwave Engineering	3	DC	258
	MTFP0070	Functional Principles of Management	2	IE	480
Lab	ECMM6020	Microprocessors and Microcontrollers lab	2	DC/SC	291
	ECAC6021	Analog Communication Techniques Lab	2	DC	292
	ECDP6022	Digital Signal Processing Lab	2	DC	292
Project	ECMI6023	Mini Project II	2	DC	293
EAP	BTEAP5	Extra Academic Programmes	NC	IC	NA
		Total Credits	**28**		
Semester 6					
Theory	EEPE0025	Power Electronics	4	SE	329
	ECAP0026	Antenna and Wave Propagation	3	DC	260

	ECVD0027	VLSI Design	4	DE	261
	ECCT0028	Digital Communication Techniques	4	DC	263
	ECAM0029	Adv Microprocessors and Embedded Systems	3	DE	265
	MTOM0071	Production and Operations Management	2	IE	481
Lab	ECVD6024	VLSI Design Lab	2	DE	293
	ECCT6025	Digital Communications Lab	2	DC	294
	ECME6026	Microwave and Antenna Engineering Lab	2	DC	295
	ECAM6027	Embedded Systems Lab	2	DE	296
Project	ECMI6029	Mini Project III	2	DC	298
AP	BTEAP6	Extra Academic Programmes	NC	IC	NA
Total Credits			**30**		
Semester 7					
Theory	ECFS0031	Fiber Optic and Satellite Communication	4	DC/SC	267
	EEEM0021	Electrical Machines	4	SC	324
	MTQM0072	Quality Management Systems	2	IE	483
	Two Electives to be opted				
	Elective 1				
	ECTS0032	Telecommunication Switching and systems	4	DE	269
	ECIP0033	Digital Image Processing		DE	270
	ECME0034	Microelectronics		DE	271
	Elective 2				
	CSAI0061	Artificial Intelligence	4	SE	175
	ECES0035	Embedded Systems		DE/SE	273
	ECLV0036	Low Power VLSI Design		DE	274
Lab	ECOP6030	Fiber Optic Lab	2	DC/SC	298
	EEEM6012	Electrical Machines Lab	2	SC	349
Seminar	ECTS6031	Training Seminar	2	DC	299
Project	ECMP6032	Major Project (Phase I)	4	DC	300
Total Credits			**28**		
Semester 8					
Theory	ECCC0037	Computer Communication	4	DE	275
	ECMC0038	Mobile Communication	4	DE/SE	276
	PYTW0021	Thoughts That Shaped the World	2	IE	573
	MTFC0073	Financial Management and Accounting	3	IC	484
	Any one elective to be opted				
	ECOD0039	Optoelectronic Devices	3	DE/SE	277
	ECSP0040	Speech Processing		DE	278
	ECNT0041	Introduction to Nanotechnology		DE	279
Project	ECMP6033	Major Project (Phase II) and Viva Voce	8	DC	301
Total Credits			**24**		

ELECTRICAL AND ELECTRONICS ENGINEERING

Type	Course Code	Course Name	Credits	Category	Page
Semester 3					
Theory	MAEM0009	Engineering Mathematics III	4	IC	551
	EECN0015	Circuit Theory and Networks	4	DC	317
	ECDC0015	Electronic Devices and Circuits	5	SC	246
	CSOJ0029	Object Oriented Programming using Java	3	SC	136
	EEMS0016	Electrical and Electronic Materials	3	DC	318
	MTEC0068	Economics for Engineers	2	IC	477
Lab	EECN6005	Circuits and Networks Lab	2	DC	346
	ECDC6006	Electronic Devices and Circuits Lab	2	SC	283
	CSOJ6017	Object Oriented Programming using Java Lab	2	SC	200
AP	BTEAP3	Extra Academic Programmes	NC	IC	NA
		Total Credits	**27**		
Semester 4					
Theory	MAEM0010	Engineering Mathematics IV	4	IC	552
	ECDL0018	Digital Electronics and Logic Design	4	SC	250
	EEMT0017	Electro Magnetic Theory	3	DC	319
	EEMN0019	Electro-Mechanical Energy Conversion I	4	DC	322
	EELM0020	Electrical and Electronic Measurements	4	DC	323
	MTOB0069	Introduction to Organisational Behaviour	2	IE	479
Lab	ECDL6010	Digital Electronics and Logic Design lab	2	SC	285
	EEMN6009	Electro-Mechanical Energy Conversion Lab I	2	DC	348
	EELM6010	Electrical and Electronic Measurements Lab	2	DC	348
Project	EEMI6011	Mini Project I	2	DC	349
AP	BTEAP4	Extra Academic Programmes	NC	IC	NA
		Total Credits	**29**		
Semester 5					
Theory	ECMM0021	Microprocessors and Microcontrollers	4	SC	254
	ECSP0025	Signal Processing	4	SE	259
	EECE0022	Control System Engineering	4	DC	325
	EEMN0023	Electro Mechanical Energy Conversion II	4	DC	326
	EEPS0024	Electrical Power Systems I	3	DC	328
	MTFP0070	Functional Principles of Management	2	IE	480
Lab	ECMM6020	Microprocessors and Microcontrollers lab	2	SC	291
	EECE6018	Control and Simulation Lab	2	DC	353
	EEMN6019	Electro Mechanical Energy Conversion Lab II	2	DC	354
Project	EEMI6020	Mini Project II	2	DC	355
AP	BTEAP5	Extra Academic Programmes	NC	IC	NA
		Total Credits	**29**		
Semester 6					
Theory	ECBC0030	Basic Communication Systems	3	SC	266
	EEPD0026	Power Electronics and Drives	4	DC	330
	EEPS0027	Electrical Power Systems II	4	DC	331

	EEHV0028	High Voltage Engineering	3	DE	332
	ECAC0019	Analog Integrated Circuits	4	SC	251
	MTOM0071	Production and Operations Management	2	IE	481
Lab	EEPD6021	Power Electronics and Drives Lab	2	DC	355
	ECAC6011	Analog Integrated Circuits Lab	2	SC	285
	ECSP6028	Signal Processing Lab	2	SE	297
Project	EEMI6022	Mini project III	2	DC	356
AP	BTEAP6	Extra Academic Programmes	NC	IC	NA
Total Credits			**28**		
Semester 7					
Theory	ECFS0031	Fiber Optic and Satellite Communication	4	SE	267
	EECE0029	Advanced Control System Engineering	4	DE	334
	EEPP0030	Power System Protection	4	DC	335
	MTQM0072	Quality Management Systems	2	IE	483
	One Elective to be opted				
	ECES0035	Embedded Systems	4	SE	273
	CSAI0061	Artificial Intelligence		SE	175
	EEIT0036	Instrumentation and Telemetry		SE	341
	EEUE0032	Utilization of Electrical Energy		DE	337
	EEPE0031	Power Plant Engineering		DE	336
Lab	EECE6023	Control System Engineering Lab	2	DE	356
	ECOP6030	Fiber Optic Lab	2	SE	298
Seminar	EETS6024	Training Seminar	2	DC	357
Project	EEMP6025	Major Project (Phase I)	4	DC	357
Total Credits			**28**		
Semester 8					
Theory	ECMC0038	Mobile Communication	4	SE	276
	EEED0033	Electrical Drives	4	DC	338
	PYTW0021	Thoughts That Shaped the World	2	IE	573
	MTFC0073	Financial Management and Accounting	3	IC	484
	One elective to be opted				
	EEAM0034	Energy Audit and Management	3	DE	339
	ECOD0039	Optoelectronic Devices		SE	277
	EEOC0035	Power System Operation and Control		DE	340
	EERE0037	Renewable Energy Sources and Management		SE	343
Project	EEMP6026	Major Project (Phase II) and Viva Voce	8	DC	358
Total Credits			**24**		

CIVIL ENGINEERING

Type	Course Code	Course Name	Credits	Category	Page
Semester 3					
Theory	MAEM0009	Engineering Mathematics III	4	IC	551
	CVSM0012	Strength of Materials	4	DC	419
	CVFM0013	Fluid Mechanics	4	DC	420
	CVES0014	Engineering Survey I	4	DC	421
	CVSB0015	Structural Elements of Building	4	DC	422
	MTEC0068	Economics for Engineers	2	IC	477
Lab	CVCT6004	Concrete Technology Lab	2	DC	463
	CVED6005	Civil Engineering Drawing	2	DC	464
	CVEM6006	Engineering Mechanics Lab	2	DC	464
AP	BTEAP3	Extra Academic Programmes	NC	IC	NA
		Total Credits	**28**		
Semester 4					
Theory	MAEM0010	Engineering Mathematics IV	4	IC	552
	CVSAS0016	Structural Analysis I	4	DC	424
	CVHM0017	Hydraulics and Hydraulic Machines	4	DC	425
	CVES0018	Engineering Survey II	4	DC	426
	CVEG0019	Engineering Geology	3	DC	428
	MTOB0069	Introduction to Organisational Behaviour	2	IE	479
Lab	CVFM6007	Fluid Mechanics Lab	2	DC	465
	CVES6008	Engineering Survey Lab I	2	DC	465
	CVEG6009	Engineering Geology Lab	3	DC	466
AP	BTEAP4	Extra Academic Programmes	NC	IC	NA
		Total Credits	**28**		
Semester 5					
Theory	CVSA0022	Structural Analysis II	4	DC	432
	CVDS0023	Design of Structures I	4	DC	434
	CVGE0024	Geotechnical Engineering I	4	DC	435
	CVTE0025	Transportation Engineering I	4	DC	436
	CVEE0026	Environmental Engineering I	4	DC	436
	MTFP0070	Functional Principles of Management	2	IE	480
Lab	CVGE6013	Geotechnical Engineering Lab	2	DC	468
	CVES6014	Engineering Survey Lab II	2	DC	468
Project	CVMI6015	Mini Project	2	DC	469
AP	BTEAP5	Extra Academic Programmes	NC	IC	NA
		Total Credits	**28**		
Semester 6					
Theory	CVSA0027	Structural Analysis III	4	DC	439
	CVDS0028	Design of Structures II	4	DC	440
	CVGE0029	Geotechnical Engineering II	4	DC	441
	CVEE0030	Environmental Engineering II	4	DC	442
	CVHW0031	Hydrology and Watershed Management	4	DC	443
	MTOM0071	Production and Operations Management	2	IE	481

Lab	CVTE6016	Transportation Engineering Lab	2	DC	469
	CVEE6017	Environmental Engineering Lab	2	DC	470
	CVCS6018	Comprehensive Surveying Camp	2	DC	470
Project	CVMI6019	Minor Project	4	DC	470
AP	BTEAP6	Extra Academic Programmes	NC	IC	NA
		Total Credits	**32**		
Semester 7					
Theory	CVEC0032	Estimation and Costing	4	DC	445
	CVIG0033	Irrigation Engineering	4	DE	446
	CVEG0034	Earthquake Engineering	4	DE	447
	CVTE0035	Transportation Engineering II	4	DC	448
	MTQM0072	Quality Management Systems	2	IE	483
	One Elective to be opted				
	CVOF0037	Open Channel Flow	3	DE	451
	CVFM0021	Finite Element Methods		DE	431
	CVBC0043	Basics of Computational Hydraulics			458
	CVTM0044	Traffic Engineering and Management			459
Lab	CVCA6020	Computer Applications in Civil Engineering	2	DC	471
Seminar	CVTS6021	Training Seminar	2	DC	471
Project	CVMP6022	Major Project (Phase I)	4	DC	472
		Total Credits	**28**		
Semester 8					
Theory	CVDS0038	Design of Structure III	5	DC	452
	CVWE0039	Water Resources Engineering	4	DE	453
	CVCM0040	Construction Management	2	DE	455
	PYPL0021	Thoughts That Shaped the World	2	IE	573
	MTFC0073	Financial Management and Accounting	3	IC	484
	One elective to be opted				
	CVGO0036	Elements of Geoinformatics	3	DE	450
	CVDM0041	Disaster Management		DE	456
	CVAF0042	Advanced Foundation Engineering		DE	458
Project	CVMP6023	Major Project (Phase II)	8	DC	472
		Total Credits	**27**		

MECHANICAL ENGINEERING

Type	**Course Code**	**Course Name**	**Credits**	**Category**	**Page**
Semester 3					
Theory	MAEM0009	Engineering Mathematics III	4	IC	551
	MNFM0029	Fluid Mechanics I	4	DC	390
	MNEM0004	Engineering Materials	3	DC	363
	MNMT0005	Manufacturing Technology I	4	DC	365
	MNTD0006	Thermodynamics	4	DC	366
	MTEC0068	Economics for Engineers	2	IC	477
Lab	MNEM6002	Engineering Mechanics Lab	2	DC	397
	MNWP6003	Workshop Practice II	2	DC	397

	MNDG6005	Machine Drawing and Computer Graphics	3	DC	399
AP	BTEAP3	Extra Academic Programmes	NC	IC	NA
		Total Credits	**28**		
Semester 4					
Theory	MAEM0010	Engineering Mathematics IV	4	IC	552
	MNTM0007	Theory of Machines	4	DC	367
	MNTF0030	Fluid Mechanics II	4	DC	391
	MNSM0009	Strength of Materials	4	DC	368
	EEEM0021	Electrical Machines	4	DC	324
	MTOB0069	Introduction to Organisational Behavior	2	IE	479
Lab	MNET6006	Engineering Materials lab	2	DC	399
	MNFM6007	Fluids Mechanics Lab	2	DC	400
	EEEM6012	Electrical Machines Lab	2	DC	349
AP	BTEAP4	Extra Academic Programmes	NC	IC	NA
		Total Credits	**28**		
Semester 5					
Theory	MNHM0010	Hydraulics Machinery	3	DC	370
	MNDM0011	Dynamics of Machines	4	DC	371
	MNMT0012	Manufacturing Technology II	4	DC	372
	MNAT0013	Applied Thermodynamics	3	DC	373
	MNMD0014	Machine Design I	4	DC	374
	MTFP0070	Functional Principles of Management	2	IE	480
Lab	MNTM6008	Theory of Machines Lab	2	DC	401
	MNTD6021	Thermodynamics Lab	2	DC	398
	MNHY6010	Hydraulics Lab	2	DC	402
	MNMI6011	Mini Project I	2	DC	402
AP	BTEAP5	Extra Academic Programmes	NC	IC	NA
		Total Credits	**28**		
Semester 6					
Theory	MNOR0015	Operations Research	4	DE	375
	MNMM0016	Mechanical Measurement	3	DC	376
	MNHT0031	Heat Transfer I	4	DC	392
	MNMD0018	Machine Design II	4	DC	377
	MNMT0019	Engineering Metrology	3	DE	378
	MTOM0071	Production and Operations Management	2	IE	481
Lab	MNHT6022	Heat Transfer Lab	2	DC	407
	MNMM6013	Engineering Metrology and Measurement Lab	2	DE	403
	MNMD6014	Machine Design and Drawing Lab	2	DC	403
Project	MNMP6015	Minor Project	2	DC	404
AP	BTEAP6	Extra Academic Programmes	NC	IC	NA
		Total Credits	**29**		
Semester 7					
Theory	MNMS0020	Manufacturing Methods	4	DC	379
	MNIC0033	Internal Combustion Engines	3	DC	395

	MNVC0022	Vibration of Mechanical Systems and Control	4	DC	381
	MNHT0032	Heat Transfer II	3	DC	394
	One Elective to be opted				
	MNNM0023	Numerical Methods in Mechanical Engineering	3	DE	382
	MNPP0024	Power Plant Engineering		DE	383
	MTQM0072	Quality Management Systems	2	IE	483
Lab	MNVC6016	Vibration of Mechanical Systems and Control Lab	2	DC	404
	MNIC6017	Internal Combustion Engine Lab	2	DC	405
Seminar	MNTS6018	Training seminar	2	DC	406
Project	MNMP6019	Major Project (Phase I)	4	DC	406
		Total Credits	**29**		
Semester 8					
Theory	MNIE0025	Industrial Engineering	5	DE	384
	MNRA0026	Refrigeration and Air Conditioning	4	DE	386
	PYTW0021	Thoughts That shaped the World	2	IE	573
	MTFC0073	Financial Management and Accounting	3	IC	484
	One Elective to be opted				
	MNDM0027	Computer Aided Design and Manufacturing	3	DE	388
	MNAE0028	Automobile Engineering		DE	389
Project	MNMP6020	Major Project (Phase II) and Viva Voce	8	DC	406
		Total Credits	**25**		

BACHELOR OF COMPUTER APPLICATIONS (BCA)

Type	**Course Code**	**Course Name**	**Credits**	**Category**	**Page**
Semester 1					
Theory	LSCE0001	Communicative English I	2	IC	564
	CSCF0011	Computer Fundamentals	4	DC	114
	CSCP0077	Computer Programming in C Language	3	DC	101
	CSIF0012	Information Security Fundamentals	4	DC	115
	MABM0006	Basic Mathematics	4	IC	549
Lab	LSCE6001	Communication Practice Lab I	1	IC	570
	CSCF6006	Computer Fundamentals lab	2	DC	196
	CSCP6067	Computer Programming in C lab	2	DC	225
AP	ICEAP1	Extra Academic Programmes	NC	IC	NA
		Total Credits	**22**		
Semester 2					
Theory	LSCE0002	Communicative English II	2	IC	566
	CSDS0025	Data Structures Using C	4	DC	132
	CSNW0026	Network Fundamentals	3	DC	133
	CSWT0027	Web Technologies	4	DC	134
	CSLD0002	Digital Logic Design	4	DC	102

Lab	LSCE6002	Communicative English II lab	1	IC	571
	CSDS6014	Data Structures using C lab	2	DC	200
	CSNW6015	Computer Networks Fundamentals lab	2	DC	200
	CSWT6016	Web Technologies lab	2	DC	200
	CSDL6003	Digital Logic Design lab	2	DC	196
AP	ICEAP2	Extra Academic Programmes	NC	IC	NA
		Total Credits	**26**		
Semester 3					
Theory	CSOA0018	Computer Organization and Architecture	4	DC	123
	CSOS0035	Introduction to Operating Systems	4	DC	145
	CSSD0036	System Analysis and Design	4	DC	146
	MTFP0070	Functional Principles of Management	2	IE	480
	CSIG0078	Introduction to Computer Graphics	2	DC	194
	MADM0002	Discrete Mathematics	4	IC	546
Lab	CSOA6011	Computer Organization and Architecture lab	2	DC	199
	CSOS6024	Introduction to Operating Systems lab	2	DC	204
	CSIG6068	Introduction to Computer Graphics Lab	2	DC	225
AP	ICEAP3	Extra Academic Programmes	NC	IC	NA
		Total Credits	**26**		
Semester 4					
Theory	CSDB0039	Relational Database Management Systems	4	DC	149
	CSSE0046	Basic Software Engineering	4	DC	158
	MAPT0008	Probability theory	3	IC	550
	CSTC0014	Theory of computation	3	DC	117
	CSOP0016	Object Oriented Programming and Design	4	DC	120
Lab	CSDB6029	RDBMS Lab	2	DC	206
	CSSE6034	Basic Software Engineering Lab	2	DC	210
	CSOP6009	Object Oriented Programming and Design Lab	2	DC	198
AP	ICEAP4	Extra Academic Programmes	NC	IC	NA
		Total Credits	**24**		
Semester 5					
Theory	MTOB0001	Organizational Behavior	4	IC	475
	MTAF0002	Accounting and Financial management	4	IC	476
	CSDC0050	Data Communication	4	DC	163
	CSIJ0071	Introduction to Java Programming	4	DC	187
Lab	CSDC6049	Data Communication lab	2	DC	215
	CSIJ6064	Introduction to Java Programming Lab	2	DC	223
Project	CSMI6065	Mini Project - BCA	4	DC	224
		Total Credits	**24**		
Semester 6					
Theory	CHES0002	Environmental Studies	2	IC	560
	Electives : One elective to be opted for				
	CSCL0072	Cloud Computing	4	DE	188

	CSNW0073	Network Security		DE	189
	CSMC0074	Mobile Communication		DE	190
Project	CSMP6066	Major Project - BCA	16	DC	224
		Total Credits	**22**		
Total Programme Credits			**144**		

MASTER OF COMPUTER APPLICATIONS (MCA)

Type	Course Code	Course Name	Credits	Category	Page
Semester 1					
Theory	CSLD0002	Digital Logic Design	4	DC	102
	CSPC0003	Programming and Problem Solving through C	4	DC	103
	MTOB0001	Organisational Behaviour	4	IC	475
	MTAF0002	Accounting and Financial Management	4	IC	476
	MADM0002	Discrete Mathematics	4	IC	546
Lab	CSPC6002	Programming and Problem Solving Through C Lab	2	DC	196
	CSDL6003	Digital Logic Design Lab	2	DC	196
AP	MCEAP1	Extra Academic Programmes	NC	IC	NA
		Total Credits	**24**		
Semester 2					
Theory	CSTC0014	Theory of Computation	3	DC	117
	CSDS0015	Data Structures Using C ++	4	DC	118
	CSOP0016	Object Oriented Programming and Design	4	DC	120
	CSDM0017	Database Management Systems I	4	DC	121
	CSOA0018	Computer Organisation and Architecture	4	DC	123
	MAPT0008	Probability Theory	3	IC	550
Lab	CSDS6008	Data Structures Using C++ Lab	2	DC	198
	CSOP6009	Object Oriented Programming and design Lab	2	DC	198
	CSDM6010	Database Management Systems I Lab	2	DC	199
	CSOA6011	Computer Organisation and Architecture lab	2	DC	199
AP	MCEAP2	Extra Academic Programmes	NC	IC	NA
		Total Credits	**30**		
Semester 3					
Theory	CSCG0030	Computer Graphics	3	DC	138
	CSDC0031	Data Communication and Networks I	4	DC	139
	CSOS0032	Operating Systems	4	DC	140
	CSDA0033	Design and Analysis of Algorithms	4	DC	142
	CSPJ0034	Programming Through Java	4	DE	143
Lab	CSOS6018	Operating Systems Lab	2	DC	201
	CSDA6019	Design and Analysis of Algorithms Lab	2	DC	202
	CSPJ6020	Programming Through Java Lab	2	DE	202
	CSCG6021	Computer Graphics Lab	2	DC	203

AP	MCEAP3	Extra Academic Programmes	NC	IC	NA
		Total Credits	**27**		
Semester 4					
Theory	CSSE0041	Software Engineering	4	DC	151
	CSDC0042	Data Communication and Networks II & Network Programming using Linux	4	DC	153
	CSDM0043	Database Management Systems II	4	DC	154
	CSIT0044	Internet Technology and Applications	3	DE	156
	CSSG0040	System Programming	3	DC	150
	CSEP0045	Enterprise Resource Planning	3	DE	157
Lab	CSDC6030	Data Communication and Networks II and Network programming Using Linux Lab	2	DC	206
	CSIT6031	Internet Technology and Applications Lab	2	DE	208
	CSDM6032	Database Management Systems II Lab	2	DC	208
	CSSG6028	System Programming Lab	2	DC	205
AP	MCEAP4	Extra Academic Programmes	NC	IC	NA
		Total Credits	**29**		
Semester 5					
Theory	CSPA0052	Principles of Artificial Intelligence	4	DE	165
	CSET0053	Emerging Trends in Cloud Computing	4	DE	166
	CSRM0076	Introduction to Research Methodology and Statistical Tools	3	DC	192
	Electives: One elective to be opted for				
	CSCL0054	Cyber Law and IT Security	4	DE	168
	CSEC0055	E-Commerce and Data Security		DE	169
	CSDW0056	Data Warehousing and Data Mining		DE	170
	CSAD0075	Android Application Development Fundamentals		DE	191
	Audit Courses				
	LSCS0016	Communication Skills	NC	IE	
	CMES0023	Entrepreneurship	NC	IE	512
Lab	CSPA6051	Principles of Artificial Intelligence Lab	2	DE	216
	CSRM6052	Introduction to Research Methodology and Statistical Tools Lab	2	DC	216
Project	CSMN6053	Minor Project - MCA	4	DC	217
		Total Credits	**19**		
Semester 6					
Project	CSMP6058	Major Project - MCA	12	DC	219
Total Credits			**12**		
Total Programme Credits			**145**		

MASTER OF TECHNOLOGY (MTECH)
COMPUTER SCIENCE AND ENGINEERING

Type	Course Code	Course Name	Credits	Category	Page
Semester 1					
Theory	CSDA0004	Design and Analysis of Algorithms	3	DC	105
	CSOS0005	Advanced Operating Systems	3	DC	106
	CSTM0006	Theory of Computation and Mathematical Concepts	3	DC	108
	Specialization Courses: Two courses to be opted				
	Artificial Intelligence				
	CSAI0007	Artificial Intelligence and Expert systems	4	DE	109
	CSNL0008	Natural Language Processing	3	DE	110
	Computer Networks and Information Security				
	CSCN0009	Advanced Computer Networks	4	DE	111
	CSNC0010	Number Theory and Cryptography	3	DE	113
Lab	**Specialization Lab I**				
	CSAI6036	Artificial Intelligence I Lab	2	DE	210
	CSCN6037	Computer Networks and Information Security I: Advanced Computer Networks Lab		DE	211
	Specialization Lab II				
	CSAI6039	Artificial Intelligence II Lab	2	DE	211
	CSCN6040	Computer Networks and Information Security II Lab		DE	211
		Total Credits	**20**		
Semester 2					
Theory	CSCI0019	Computational Intelligence	4	DC	124
	MARM0005	Research Methodology and Statistical Tools	2	SC	548
	CSSE0020	Software Engineering and Design Practices	3	DC	125
	Specialization Courses: Two courses to be opted				
	Artificial Intelligence				
	CSML0021	Machine Learning	4	DE	127
	CSCV0022	Computer Vision and Image Analysis	3	DE	128
	Computer Network and Information Security				
	CSMC0023	Mobile and Cellular Network Security	4	DE	129
	CSNS0024	Network Security and Forensics	3	DE	131
Lab	**Specialization Lab III**				
	CSAI6042	Artificial Intelligence III Lab	2	DE	212
	CSCN6043	Computer Networks and Information Security III Lab		DE	212
	Specialization Lab IV				
	CSAI6045	Artificial Intelligence IV Lab	2	DE	213

	CSCN6046	Computer Networks and Information Security IV Lab		DE	213
Total Credits			**20**		
Semester 3					
Seminar	CSRS6022	Research Seminar - MTECH	4	DC	203
Project	CSMP6023	Project phase I - MTECH	12	DC	203
Total Credits			**16**		
Semester 4					
Project	CSMP6033	Project Phase II - MTECH	16	DC	209
TOTAL CREDITS			**72**		

MASTER OF TECHNOLOGY (MTECH)
ELECTRONICS AND COMMUNICATION ENGINEERING

Type	Course Code	Course Name	Credits	Category	Page
Semester 1					
Theory	MALA0003	Linear Algebra and Random Processes	3	IC	547
	ECCI0004	Digital Communication and Information Systems	3	DC	231
	ECFT0003	Microelectronics Fabrication Technology	3	DC	230
	ECDP0002	Digital Signal Processing	4	DC/SC	228
	Specialisation Course				
	Specialization 1: Optical Electronics				
	ECOE0005	Optical Electronics	3	DE/SE	232
	Specialization 2: Embedded Systems				
	ECES0006	Embedded Systems and Applications	3	DE	233
	Specialization 3: Digital Signal Processing				
	ECSP0007	Statistical Signal Processing	3	DE	234
Lab	**Specialisation Lab I**				
	ECOE6014	Optical Electronics Lab	2	DE	287
	ECES6015	Embedded System and Application Lab		DE	288
	ECSP6016	Statistical Signal Processing Lab		DE	288
	ECDP6002	Digital Signal Processing Lab	2	DC/SC	280
Seminar	ECRS6003	Research Seminar I	1	DC	281
Total Credits			**21**		
Semester 2					
Theory	ECWC0008	Wireless Communication System	4	DC	236
	ECNE0009	Nanotechnology and Nanoelectronics	3	DC	238
	MARM0005	Research Methodology and Statistical Tools	2	IC	548
	Specialization Courses				
	Specialization 1: Optical Electronics				
	ECOC0010	Optical Fiber Communication and Networks	4	DE	239
	ECOI0011	Optoelectronic Instrumentation	3	DE	241

	Specialization 2: Embedded Systems				
	ECES0012	Embedded systems and Applications II	4	DE	242
	ECDP0013	Digital Signal Processor	3	DE	243
	Specialization 3: Digital Signal Processing				
	ECIS0014	Digital Image and Speech Processing	4	DE	245
	ECDP0013	Digital Signal Processor	3	DE	243
	ECNE6004	Nanotechnology Lab	2	DC	282
	Specialization Lab II				
Lab	ECCM6017	Optical Communication Lab		DE	289
	ECSA6018	Embedded Systems and Applications Lab	2	DE	290
	ECDS6019	Digital Image and Speech Processing Lab		DE	290
		Total Credits	**20**		
Semester 3					
Seminar	ECRS6008	Research Seminar II - MTECH	4	DC	184
Project	ECMP6009	Project Phase I - MTECH	12	DC	234
Total Credits			**16**		
Semester 4					
Project	ECMP6013	Project Phase II - MTECH	16	DC	287
		Total Credits	**16**		
TOTAL PROGRAMME CREDITS			**73**		

MASTER OF TECHNOLOGY (MTECH)
ELECTRICAL AND ELECTRONICS ENGINEERING

Type	**Course Code**	**Course Name**	**Credits**	**Category**	**Page**
Semester 1					
	MALA0003	Linear Algebra and Random Processes	3	IC	547
	ECDP0002	Digital Signal Processing	4	SC	228
	Specialisation Courses				
	Specialization 1: Power Electronics and Power Systems				
	EEAP0002	Advanced Power Electronics	3	DE	303
Theory	EESP0003	Switchgear and Advanced Power System Protection	3	DE	304
	EEAE0004	Application of Power Electronics in Power System	3	DE	305
	Specialization 2: Control and Instrumentation Engineering				
	EECS0005	Advanced Control Systems	3	DE	306
	ECOE0005	Optical Electronics	3	DE	232
	EEIN0006	Industrial Instrumentation	3	DE	307
	Specialisation Lab I				
Lab	EEPS6013	Power System and Power Electronics Simulation Lab	2	DE	350
	EECS6014	Control System Simulation Lab		DE	351
	ECDP6002	Digital Signal Processing Lab	2	SC	280

Seminar	EERS6003	Research Seminar I - MTECH	1	DC	345
Total Credits			**21**		
Semester 2					
Theory	EEOT0007	Optimization theory and applications	3	DC	309
	EEES0008	Embedded systems and application	4	DC	310
	MARM0005	Research Methodology and Statistical tools	2	IC	548
	Specialization 1: Power Electronics and Power Systems				
	EEED0009	Advanced Electric Drives	3	DE	311
	EEAP0010	Advanced Power System Analysis	3	DE	312
	EEIC0011	Power system interconnection and control	3	DE	313
	Specialization 2: Control and Instrumentation Engineering				
	EEAI0012	Advanced Instrumentation	3	DE	314
	EEOC0013	Optimal Control Systems	3	DE	315
	EEPI0014	Process Control instrumentation	3	DE	316
Lab	**Specialization Lab II**				
	EESE6015	Power System and Power Electronics Lab	2	DE	351
	EECI6016	Control and Instrumentation Engineering Lab		DE	352
Total Credits			**20**		
Semester 3					
Seminar	EERS6006	Research Seminar II - MTECH	4	DC	346
Project	EEMP6007	Project Phase I - MTECH	12	DC	347
Total Credits			**16**		
Semester 4					
Project	EEMP6017	Project Phase II - MTECH	16	DC	353
Total Credits			**16**		
TOTAL PROGRAMME CREDITS			**73**		

MASTER OF TECHNOLOGY (MTECH)

CIVIL ENGINEERING (Construction Engineering and Management)

Type	Course Code	Course Name	Credits	Category	Page
Semester 1					
Theory	MANM0004	Numerical Methods	3	IC	548
	CVPM0001	Project Management in Construction	4	DC	410
	CVCE0002	Construction Methods and Equipment Management	4	DC	411
	CVRT0020	Rural Construction Technology	4	DC	429
	Elective I				
	CVFM0021	Finite Element Methods	3	DE	431
	CVSM0006	Structural Masonry		DE	413
Lab	CVCE6003	Construction Engineering and Management Software Laboratory	2	DC	462
Total Credits			**20**		

Semester 2					
Theory	CVFI0008	Financing Infrastructure Projects	4	DC	414
	CVCT0009	Advanced Concrete Technology	4	DC	416
	CVIP0004	Infrastructure Planning	4	DC	412
	MARM0005	Research Methodology and Statistical Tools	2	IC	548
	Elective II:				
	CVTE0010	Advanced Transportation Engineering	3	DE	417
	Elective III:				
	CVHR0011	Structural Health Monitoring and Rehabilitation of Structures	3	DE	412
Total Credits			**20**		
Semester 3					
Seminar	CVRS6010	Research Seminar	4	DC	466
Project	CVMP6011	Project Phase I - MTECH	12	DC	467
Total Credits			**16**		
Semester 4					
Project	CVMP6012	Project Phase II - MTECH	16	DC	467
Total Credits			**16**		
TOTAL PROGRAMME CREDITS			**72**		

SCHOOL OF COMMERCE AND MANAGEMENT

BACHELOR OF COMMERCE

Type	Course Code	Course Name	Credits	Category	Page
Semester 1					
Theory	LSBC0003	Business Communication I	2	IC	567
	CMFA0001	Financial Accounting	4	DC	485
	CMME0002	Micro-Economics	4	DC	487
	MABS0011	Business Mathematics	4	IC	553
	CMPM0003	Principles of Management	4	DC	488
	CMCA0004	Introduction to Computer Applications	2	DC	489
Lab	CMCA6001	Computer Applications Lab	2	DC	489
	LSBC6003	Business Communication Practice Lab	1	IC	572
AP	CMEAP1	Extra Academic Programmes	NC	IC	
		Total Credits	**23**		
Semester 2					
Theory	LSBC0004	Business Communication II	2	IC	568
	CMHR0024	Fundamentals of Human Resource Management	4	DC	513
	CMOE0006	Macro Economics	4	DC	492
	CMIE0007	Introduction to IT and E-Commerce	4	DC	493
	CMCB0008	Corporate and Business Law	3	DC	495
	CMST0009	Business Statistics	4	DC	497
	CMAC0010	Corporate Accounting	4	DC	498
AP	CMEAP2	Extra Academic Programmes	NC	IC	
		Total Credits	**25**		
Semester 3					
Theory	CMMA0005	Management Accounting	4	DC	491
	CMMK0012	Marketing Management	4	DC	499
	CMFS0013	Indian Financial System	4	DC	500
	CMBI0014	Practice of Banking and Insurance	4	DC	501
	CMTX0015	Taxation	4	DC	502
	CMFR0016	Financial Reporting	4	DC	504
AP	CMEAP3	Extra Academic Programmes	NC	IC	
		Total Credits	**24**		
Semester 4					
Theory	CMAA0017	Audit and Assurance	4	DC	505
	CMGR0018	Governance, Risk and Ethics	4	DC	506
	CMFG0019	Financial Management	4	DC	507
	CMBL0020	Banking Law and Practice	4	DC	508
	CMCA0021	Cost Accounting	4	DC	509
	CMED0022	Entrepreneurship Development	3	DC	511
Lab	CMAS6002	Accounting Software Lab	3	DC	540

AP	CMEAP4	Extra Academic Programmes	NC	IC	
Semester 5					
Theory	CMCO0025	Capital Market Operations	3	DC	514
	CMPI0026	Financial Planning and Investment	3	DC	515
	CHES0002	Environmental Studies	2	DC	560
	Specialisation: International Accounting and Finance				
	CMRP0027	Corporate Reporting	4	DE	515
	CMAY0028	Business Analysis	4	DE	516
	CMSP0029	Accounting for Service and Public Finance	4	DE	517
	Specialisation: Finance and Investment				
	CMIB0030	Investment Banking	4	DE	518
	CMIM0031	Investment Management	4	DE	519
	CMCF0032	Corporate Finance	4	DE	520
Project	CMPJ6003	Project Phase I	1	DC	
		Total Credits	**21**		
Semester 6					
Theory	CMFN0033	Advanced Financial Management	4	DC	521
	CMFS0034	Financial Securities and Derivatives	2	DC	522
	Specialisation: International Accounting and Finance				
	CMPT0035	Advanced Performance Management	4	DE	522
	CMAT0036	Advanced Taxation	4	DE	523
	CMAU0037	Advanced Audit and Assurance	4	DE	524
	Specialisation: Finance and Investment				
	CMFX0038	Commodities and Forex Management	4	DE	526
	CMPF0039	Portfolio Management	4	DE	527
	CMAL0040	Alternative Investments	4	DE	527
Internship	CMIN6004	Internship	2	DC	
Project	CMPJ6005	Project Phase II	2	DC	
		Total Credits	**26**		
Total Programme Credits			**141**		

MASTER OF COMMERCE

Type	Course Code	Course Name	Credits	Category	Page
Semester 1					
	CMOT0041	Organizational Theory and Behavior	4	DC	528
Theory	CMBD0042	Business Statistics and Decisions	4	DC	529
	CMFY0043	Financial Statement Analysis	4	DC	531
	CMMG0044	Managerial Economics	4	DC	532
	CMAG0045	Cost and Management Accounting	4	DC	533
		Total Credits	**20**		
Semester 2					
	CMRC0046	Research Methodology in Commerce	4	DC	534
Theory	CMBE0047	Business Environment	3	DC	535
	CMBL0048	Business Law	3	DC	536
	CMFI0049	Corporate Finance	4	DC	537
	CMPG0050	Principles of Marketing	4	DC	538
	CMBS0051	International Business	4	DC	539
		Total Credits	**22**		
Semester 3					
	CMSH0052	Strategic Human Resource Management	4	DC	NA
Theory	CMCR0053	Consumer Behaviour	4	DC	NA
	CMDS6006	Dissertation-I	4	DC	NA
	Specialisation: Accounting and Taxation				
	CMTM0054	Corporate Tax Management	4	DE	NA
	CMAF0055	Accounting Theory and Financial Reporting	4	DE	NA
	Specialisation: Finance and Investment				
	CMCR0056	Advance Corporate Finance	4	DE	NA
	CMBK0057	Investment Banking	4	DE	NA
	Specialisation: Management				
	CMIG0058	International Marketing	4	DE	NA
	CMBC0059	Business Ethics and Corporate Governance	4	DE	NA
		Total Credits	**20**		NA

Type	Course Code	Course Name	Credits	Category	Page
Semester 4					
	CMEM0060	Entrepreneurship Management and E-Commerce	2	DC	NA
Theory	CMDS6007	Dissertation-II	6	DC	NA
	Specialisation: Accounting and Taxation				NA
	CMMD0061	Modern Accounting	4	DE	NA
	CMAV0062	Advance Accounting	4	DE	NA
	Specialisation: Finance and Investment				
	CMFI0063	Financial Institution Management	4	DE	NA
	CMPN0064	Portfolio Management	4	DE	NA
	Specialisation: Management				
	CMIL0065	Management of Industrial Laws	4	DE	NA

	CMSM0066	Supply Chain Management and Logistics	4	DE	NA
Total Credits			**20**		
Total Programme Credits			**78**		

BACHELOR OF ARTS - HONOURS IN ECONOMICS

Type of Course/Category	Course Code	Course Name	Credits (L-T-P)	Page
Semester I				
Core Paper1/DC	ENME0001	Micro Economics-I	5-1-0	541
Core Paper2/DC	ENQM0002	Quantitative Methods in Economics-I	5-1-0	541
Ability Enhancement compulsory Course - 1/IC	LSEC0018	English-I	2-0-0	570
General Elective – I//IE/SE/DE	ENMB0003	Money, banking and Finance	5-1-0	548
	ENES0004	Economy, State and Society		
	ENIE0005	Indian Economics-I		
Total Credits			**20**	
Semester II				
Core Paper3/DC	ENSM0006	Statistical Methods for Economics	5-1-0	543
Core Paper4/DC	ENMC0007	Macro Economics-I	5-1-0	544
Ability Enhancement compulsory Course - 1/IC	**CHES0002**	Environmental Studies	2-0-0	560
General Elective - II/IE/SE/DE	ENIM0008	Indian Monetary System	2-1-0	545
	ENIN0009	Indian Economics-II		
	LSEC0019	English-II		
Total Credits			**20**	
Semester III				
Core Paper5/DC		Quantitative Methods in Economics-II	5-1-0	
Core Paper6/DC		Mathematics-I	5-1-0	
Core Paper7/DC		Micro Economics-II	5-1-0	
Skill Enhancement Course 1/IE		Introduction to Computer Applications Theory/ Lab	2-0-0	
General Elective - III/IE/SE/DE		International Economics	5-1-0	
		Alternative English-I		
		Developmental Economics-I		
Total Credits			**26**	
Semester IV				
Core Paper8/DC		Macro Economics-II	5-1-0	
Core Paper9/DC		Mathematical Economics	5-1-0	
Core Paper10/DC		Mathematics-II	5-1-0	
Skill Enhancement Course 2/IE		Organisational Behaviour	2-0-0	
General Elective – IV/IE/SE/DE		Environmental Economics	5-1-0	
		Alternative English-II		
		Developmental Economics-I		

Total Credits			**26**	
Semester V				
Core Paper11/DC		Indian Economy-I	5-1-0	
Core Paper12/DC		Developmental Economics-II	5-1-0	
Discipline Specific Elective I/DE		Economic History of India-1857-1947	5-1-0	
		Public Finance		
		Financial Market Operations		
Discipline Specific Elective II/DC		Welfare Economics	5-1-0	
		Industrial Economics		
		History of Economic Thought -I		
Total Credits			**24**	
Semester VI				
Core Paper13/DC		Developmental Economics-II	5-1-0	
Core Paper14/DC		Indian Economy-II	5-1-0	
Discipline Specific Elective III/DE		Agricultural Economics	5-1-0	
		History of Economic Thought -II		
		Econometrics-I		
Discipline Specific Elective IV/DE		Financial Securities and derivatives	5-1-0	
		Project and Dissertation		
		Econometrics-I		
Total Credits			**24**	
Total Programme Credits			**140**	

DETAILED SYLLABUS

SCHOOL OF TECHOLOGY

BTIP7: MANDATORY INDUCTION PROGRAM

(Duration: 3 Weeks)

The AICTE in its model curriculum proposed an induction programme of three-weeks duration for all students to help them adjust to the new environment of Engineering courses. It aims to equip students with communication skills, human values, and acquaint them with the culture of the institution.

The following list presents the topics covered in the Mandatory Induction Program conducted at Don Bosco College of Engineering and Technology.

1. Physical activity – Yoga and sports activity (indoor and outdoor)
2. Creative arts through Extra-curricular clubs e.g., music & singing, dance, drama, debating & quiz, art & craft, photography
3. Universal Human Values – Managing Change (special talks by experts)

a. Home away from home
b. Exploring freedom
c. Forming friendship
d. Coping skills – dealing with loneliness
e. Stress and unhealthy food habits
f. Dealing language barriers – tests on communication skill for future follow up.
g. Sexual orientation / courting / sexual harassment

4. Literary exposure through Literary Club
5. Proficiency Modules – Psychological tests and orientation, introduction to Co-curricular clubs and innovations
6. Lectures by eminent people – in-campus invited Guests and over SKYPE
7. Visit to local areas – visit to industry and institutions of repute
8. Familiarization to departments and common facilities
9. Mentoring system – introduction and assignment of mentors
10. Selection / election of Class Representatives for college association
11. Health check-up for all with documentation for future reference
12. Library Orientation, Introduction to ERP and e-Resources, filling up “Online anti-ragging affidavit” by all.

Evaluation of every individual student will be done based on performance over variety of competitions during the 3-week period in order to have a qualitative metrics for each student.

SCHOOL OF TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING AND INFORMATION TECHNOLOGY

Vision

Creating an intense teaching and research environment that moulds individuals into competent professionals who are innovative and committed to meet real world challenges.

Mission

1. To produce competent Computer Science professionals by promoting excellence in education and training.
2. To inculcate the spirit of self-sustainability through research, consultancy, development activities and lifelong learning.
3. To extend technical expertise to meet real world challenges and play a leading role in technical innovation, creativity and application development.
4. To infuse a sense of commitment in individuals for the betterment of the society through technology.

Programme Educational Objectives (PEOs)

1. To prepare the students to have strong foundation in computer science engineering with impetus to higher studies, consultancy, research and development.
2. To prepare the students to be self sustainable and proficient to meet the real world challenges ethically and responsibly, in service to socio-economic development of the society.
3. To inculcate the spirit of life-long learning, understanding, and applying new ideas and technologies to provide novel engineering solutions in the rapidly changing environment.

CSCP0001: PROGRAMMING IN C LANGUAGE

(3 credits – 45 hours)

Objectives: *This first course in Computer Programming aims to develop the analytical skills of the students for creative problem solving using computers. Specifically, this course will*

- *discuss basic concepts of data representation*
- *enable the student to develop solutions for common problems.*
- *familiarize the student with the grammar and syntax of C language and teach him/her to translate pseudo-code into C programs, understanding the steps involved in the execution of a C program.*
- *make him/her well conversant with managing functions*
- *get introduced to pointers, arrays, structures and files in C.*
- *provide an insight to use C + + Language and object-oriented concepts.*

Module I: Introduction to Computers, Data representation, Programming and Programming Languages (5 hours)

a) Introduction to Computers: Definition of data, information and processing, basic Computer operations, applications of information systems.
b) Introduction to structured programming and problem solving methods: flowcharting, pseudo code.

Module II: Programming in C Language (18 hours)

a) Fundamentals : Overview of C language - basic structure of a C program, the compilation process in C, types of errors, characteristics of a good program, character set, identifiers, keywords, data types, constant and variables, statements, operators and expressions, precedence of operators, data type conversions. Statements -input-output, assignments, control structures: branching and looping.
b) Data representation in Computers: Base of a number system, types of number systems - binary, octal, hexadecimal, conversion between number systems, coding schemes.
c) Arrays and Strings: One-dimensional arrays, multidimensional arrays and their applications, character arrays and string-handling functions.
d) C Functions: Need for modular programs, categories of functions, user defined and standard functions, function prototypes, formal and actual arguments, parameter passing, recursion, storage classes.

Module III: Pointers, Structures and File handling (12 hours)

a) Pointers: Understanding pointers, pointer expressions.
b) Structures and Unions: Declaration of structures and simple implementation of structures, Unions.
c) File handling: file management – open, close, input/output operations.

Module IV: Introduction to Object-oriented Programming (10 hours)

a) Concepts, Need for OOP, Characteristics of OOP: Data hiding, Data encapsulation, Class, Objects, Inheritance, Polymorphism.
b) Getting started with C++ syntax, operators, flow control, simple functions.
c) Classes and Objects, data members and member functions, private, public construction, visibility modes, Inheritance: Base and derived classes.

COURSE / LEARNING OUTCOMES

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

CO1: List the different ways of representing an algorithm and define the purpose of using a procedural language like C. (*Knowledge*)

CO2: Explain the concept of various data types like int, char, float etc. and describe control structures available in C. (*Comprehension*)

CO3: Apply their knowledge to solve conversions between different number system. (*Application*)

CO4: Analyze the purpose of using call by value and call by reference and compare their uses. (*Analysis*)

CO5: Develop programs based on the knowledge they have gained on array, structure and union. Also, they will be able to design a program with the help of using pointers. (*Synthesis*)

CO6: Depending on the problem domain and input pattern students will be able to choose the appropriate data type and will be able to justify their decision to use a particular compound data type. (*Evaluation*)

Suggested Readings

1. Balagurusamy, E., Computer fundamentals and C Programming, 1st Ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
2. Gottfried, Byron S., Programming with C, 2nd Ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2006.
3. Kanetkar, Y., Let us C, 8th Ed., BPB Publication, New Delhi, 2007.
4. Ramaswamy, S., Radhaganesan., Programming in C, 1st Ed., Scitech Publications Pvt. Ltd., India, 2007.
5. Kernighan, B.W., and Ritchie, Dennis M., The C Programming Language, 2nd edition, Prentice Hall Pvt Ltd, New Jersey, 1988.
6. E. Balaguruswamy, Object Oriented Programming in C++, Tata McGraw Hill.

CSLD0002: DIGITAL LOGIC DESIGN

(4 credits–60 hours)

Objectives*: The topics below cover some of the basic understanding of a digital computer. The aim is to give an overview of the computer and its functions, with specific references to some of its parts. The student will also get an understanding of the application of Bool-ean Algebra in computer science and applications.*

Module I: Introduction to organization of digital computer (12 Hours)

Block diagram of a computer: Input Unit, Output Unit, Storage Unit, CPU. Control Unit, Arithmetic Logic Unit. System bus. Stored program concept. Number systems. Binary Arithmetic, Floating point number representation, Normalization of point number representation, Fixed point number representation, Signed-magnitude rep-resentation, overflow, underflow, Computer codes; Error detection and correction codes, parity, parity generator, parity checker.

Module II: Memory Unit (12 Hours)

Memory Hierarchy, Main Memory, Memory Address Map. Semiconductor Memory; Different types Cache Memory: Levels of Cache, Locality of reference, hit and miss; Magnetic Memory; Optical Memory

Module III: Boolean Algebra, Simplification of Boolean Functions (12 Hours)

Boolean Algebra: Various Boolean operations; Postulates, Theorems, Duality, Bool-ean functions, Canonical forms, Representation of Boolean expressions using truth tables, logic gates.Boolean expressions minimization using Karnaugh map, Realiza-tion of canonical forms from Karnaugh map, Don't Care Conditions - problems using Don't care conditions, benefit of using Don't care conditions. Tabulation method/Quine- Mc Kluskey method, prime implicants.

Module IV: Combinational Logic and Sequential Logic (24 Hours)

a) Brief introduction to Microprocessor, Integrated circuits, SSI, MSI, LSI, VLSI, IC Digital logic families- TTL, ECL, MOS, CMOS and I2L.

b) Positive and negative logic. Characteristic of IC logic families - fanout, power dissipa-tion, propagation delay, noise margin.

c) Digital devices: Logic gates, wired-logic, 8 non-degenerate forms of NOR and NAND, multilevel NAND and NOR gates (Boolean function implementation using block dia-gram method, analysis procedure, deviation of Boolean function by algebraic ma-nipulation, derivation of truth table, block diagram transformation), buffer, 3-state buffer, high impedance state, Realization of other logic functions using NAND/NOR gates. Drawing logic diagrams for different types of Boolean expression derived from truth tables; A brief introduction to Combinational and sequential circuits. Differ-ence between Combinational and sequential circuits; Arithmetic circuits: Half-adder, Full-adder, Binary Adder, Binary Parallel Adder, BCD Adder, Binary Adder-Subtractor, Half-subtractor, Half-subtractor , Binary Incrementer, carry propagation, look ahead carry, carry generator, magnitude comparator.; Encoders, Decoders, Multiplexers, Demultiplexers

d) Code conversion, BCD-to-Excess3 Code converter. Analysis of Combinational circuits.

e) Flip-flops: Different types of flip-flops, Flip-flop excitation tables, characteristic equa-tions, truth tables, Triggering of Flip-flops.

f) Registers: Registers (Register with Parallel Load), Shift registers(serial transfer, Bi-directional Shift Registers With Parallel Load, serial adder, Serial Register);

g) Counters: Asynchronous counters, Synchronous counters; Binary Counter with Par-allel Load, binary Ripple Counter, BCD ripple counter, synchronous binary counter, binary count-up-down counter, BCD synchronous counter, Decade Counter, Mod 6 counter. Timing sequences- word-time generation, timing signals, Johnson counter. Designing of counters using excitation tables of flip flops. Designing of counters using state equations.

COURSE / LEARNING OUTCOMES

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

CO1: Define the components of the computer such as Input / output devices, CPU, Control unit and ALU. They will be able to describe various gates and digital devices of Digital Logic design. (*Knowledge*)

CO2: Evaluate various Boolean expressions derived from truth tables. (*Evaluation*)

CO3: Analyze the Boolean expressions and circuit diagrams and provide the simplified expression to implement practically with minimum number of logic gates. (*Analysis*)

CO4: Implement the Error detection and Error correction codes. Students will be able to implement the Boolean expressions using Logic gates to design combinational and sequential circuits. (*Application*)

CO5: Propose and design simplified Boolean function to develop logic circuits. (*Synthesis*)

CO6: Understand the various concepts of Boolean algebra, Microprocessor, Integrated Circuits and Memory unit. (*Comprehension*)

Suggested Readings

1. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India Pvt. Ltd., New Delhi, 1994
2. Thomas L. Floyd, Digital Fundamentals, Fifth Edition, Pearson Education, 2002
3. V. Carl Hamacher, Zvonko G. Vranesic, Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996

CSPC0003: PROGRAMMING AND PROBLEM SOLVING THROUGH C

(4 credits – 60 hours)

Objectives: *The objective of the course is to introduce the fundamentals of C programming language and develop the skills for solving problems using computers. After completion of this course, a student will be able to*

- *Understand and use the process of abstraction using a programming language such as 'C'.*
- *Enable the student to develop solutions for common problems.*

- *Familiarize the student with the syntax of C language and teach him/her to translate pseudo-code into C programs, understanding the steps involved in the execution of a C program.*
- *Make student well conversant with managing functions.*
- *Get introduced to pointers, arrays, structures and files in C.*
- *Understand the basics of graphics programming, VDU and interaction with hardware through C.*

Module I: C fundamentals (16 Hours)
Algorithms, key features of algorithms, flowcharts, pseudocode, structured programming languages, files used in C program, design and implementation of correct, efficient and maintainable programs, 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 in C, precedence and associativity of operators, type conversion and typecasting, preprocessor.

Module II: Decision Control Statements, Loops and Functions (13 hours)
Decision Control Statements and Loops: Introduction to decision control statements, conditional branching statements, goto statements, while loop, do-while loop, for loop, nested loops, break and continue statements.
C Functions: Need for functions, function declaration and definition, user defined and library functions, passing parameters to function, return statement, scope of variables, storage classes, recursive functions.

Module III: Arrays, Strings and Pointers (12 hours)
Arrays and Strings: One-dimensional arrays, passing array to function, multidimensional arrays and their applications, character arrays and string operations.
Pointers: Introduction to pointers, pointer expressions, null pointers, generic pointers, pointers and arrays, drawback of pointers, dynamic memory allocation.

Module IV: Structures, Files and Preprocessor Directives (12 hours)
Structures and Unions: Declaration of structures and simple implementation of structures, unions, enumerated data types, structures and functions, pointer to structure.
Files: Introduction to files, file management – open, close, input/output operations, Commandline arguments.
Preprocessor Directives: Introduction to preprocessor directives, macros and file inclusion.

Module V: VDU Basics and Graphics Programming (10 hours)
VDU Basics: Screen memory accessing, memory segments, far pointers, writing to VDU memory, text
mode, color attribute, Interrupts, interrupt vector table, WORD register, BYTE register, DOSinterrupts, BIOS interrupts, int86() functions and intdos() functions(make, remove, change directory and delete file).
Graphics Programming: Library file-graphics.h, 2-D Coordinate system, Built-in Graphics Functions.

COURSE / LEARNING OUTCOMES

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

CO1: Define and describe various terms and concepts of C programming language. (*Knowledge*)

CO2: Comprehend or interpret information based on their understanding of the concepts of C language's syntax, data types, control statements, functions, pointers, arrays, structures, pointers, files, graphics and hardware programing using C. (*Comprehension*)

CO3: Solve problems using standard algorithms and translate pseudo-codes into C programs and implement them. (*Application*)

CO4: Apply their analytical skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. (*Analysis*)

CO5: Combine the various concepts and ideas learnt in C to plan, propose and develop a product. (*Synthesis*)

CO6: Evaluate various algorithms used for searching, sorting etc. in terms of correctness and computation cost. (*Evaluation*)

Suggested Readings

1. Thareja, R., Computer Fundamentals and Programming in C, Oxford University Press, New Delhi.
2. Balagurusamy, E., Computer Fundamentals and C Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Gottfried, Byron S., Programming with C (Schaum's Outlines Series), Tata McGraw Hill Publishing Company Limited, New Delhi.
4. Kanetkar, Y., Let us C, BPB Publication, New Delhi.
5. Kernighan, B.W., and Ritchie, Dennis M., The C Programming Language, Prentice Hall Pvt. Ltd, New Jersey.

E-resource for learning

C, www.spoken-tutorial.org

CSDA0004: DESIGN AND ANALYSIS OF ALGORITHMS

(3 credits-45 hours)

***Objectives**: This course exposes the student to fundamental notions and techniques for the design and analysis of efficient algorithms and also explores a variety of applications. At the completion of the course, the student will be familiar with the most important algorithms and algorithm paradigms, skilled in analyzing algorithms and applying it to a variety of analysis techniques, able to adapt techniques demonstrated in the context of one algorithm to a new application area.*

Module I (10 hours)

Analyzing Algorithms and problems. Classifying functions by their asymptotic growth rate. Recursive procedures. Recurrence equations - Substitution Method, Recursion Tree, Master Theorem. Design Techniques- Divide and Conquer, Dynamic Programming, Greedy, Backtracking.

Module II (10 hours)

Analysis of searching and sorting. Insertion sort, Quick sort, Merge sort and Heap sort. Binomial Heaps and Fibonacci Heaps, Lower bounds for sorting by comparison of keys. Comparison of sorting algorithms. Amortized Time Analysis. Binary Search Trees - All operations, Red-Black Trees - Insertion and Deletion.

Module III (15 hours)

Graphs and Graph traversals, Strongly connected components of a Directed graph. Biconnected components of an undirected graph. Transitive closure of a Binary relation. Warshall's algorithm for Transitive closure. Single-source shortest paths, All pair shortest path in graphs. Dynamic programming, Elements of dynamic programming, Longest Common Subsequence, Constructing optimal binary search trees, Greedy Algorithms, Elements of greedy strategy.

Module IV (15 hours)

Complexity Theory - Introduction. P and NP. NP-Complete problems. Approximation algorithms. Bin packing, Graph coloring. String matching – Rabin-Karp algorithm, Traveling salesperson Problem. Related case studies.

COURSE / LEARNING OUTCOMES

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

CO1: Know the formal definition of algorithms, importance of analysis of an algorithm and their asymptotic bounds. Students would get familiar with different types of problem and their solutions. (*Knowledge*)

CO2: Understand different design strategies such as brute force, divide and conquer, dynamic programming, greedy and backtracking used for the design of algorithms. (*Comprehension*)

CO3: Design and analyse algorithms for given problems. (*Application*)

CO4: Compare and analyse different design strategies. (*Analysis*)

CO5: Design new algorithms for given problems by using most appropriate algorithmic strategy considering the problem domain. (*Synthesis*)

CO6: Assess an algorithm in terms of correctness, computation cost and memory space used. (*Evaluation*)

Suggested Readings

1. T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, 3rd ed, PHI.
2. V. Aho, J. E. Hopcroft and J. D. Ullman, The Design and Analysis of Algorithms, Addison-Wesley, 1974.
3. Basu, Design Methods and Analysis of Algorithms, PHI
4. M. R. Garey and D. S. Johnson, Computers and Intractability: A Guide to the Theory of NP Completeness, Freeman, 1979.

CSOS0005: ADVANCED OPERATING SYSTEMS

(3 credits - 45 hours)

Objectives*: This course provides an overview of the advanced operating system along with the concepts of distributed operating system, distributed deadlocks, failure recovery, fault tolerance and Multiprocessor Operating System. After completing this course, the student should be able to recognize the underlying concepts and principles of advanced operating systems understand the structure and components of traditional OSs and acquire skills to deal with common operating systems like UNIX, Linux and Windows.*

Module I (10 hours)

Overview - Functions of an Operating System – Design Approaches – Types of Advanced Operating Systems - Synchronization Mechanisms – Concept of a Process, Concurrent Processes – The Critical Section Problem, Other Synchronization Problems – Language Mechanisms for Synchronization – Axiomatic Verification of Parallel Programs - Process Deadlocks - Preliminaries – Models of Deadlocks, Resources, System State – Necessary and Sufficient conditions for a Deadlock – Systems with Single-Unit Requests, Consumable Resources, Reusable Resources. Architectures of Distributed Systems - System Architecture types - issues in distributed operating systems - communication networks – communication primitives. Theoretical Foundations - inherent limitations of a distributed system – lamp ports logical clocks – vector clocks – casual ordering of messages – global state – cuts of a distributed computation – termination detection. Distributed Mutual Exclusion – introduction – the classification of mutual exclusion and associated algorithms.

Module II (13 hours)

Introduction – Issues – Communication Primitives – Inherent Limitations - Lamport's Logical Clock; Vector Clock; Causal Ordering; Global State; Cuts; Termination Detection. Distributed Mutual Exclusion – Non-Token Based Algorithms – Lamport's Algorithm - Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm – Distributed Deadlock Detection – Issues –Centralized Deadlock-Detection Algorithms - Distributed Deadlock-Detection Algorithms. Agreement Protocols– Classification - Solutions –Applications. Deadlock handling strategies in distributed systems – issues in deadlock detection and resolution – control organizations for distributed deadlock detection. Agreement protocols – introduction-the system model, a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture – mechanism for building distributed file systems – design issues – log structured file systems.

Module III (14 hours)
Distributed shared memory-Architecture– algorithms for implementing DSM – memory coherence and protocols – design issues. Distributed Scheduling – introduction – issues in load distributing – components of a load distributing algorithm – stability – load distributing algorithm – performance comparison – selecting a suitable load sharing algorithm – requirements for load distributing -task migration and associated issues. Failure Recovery and Fault tolerance: introduction– basic concepts – classification of failures – backward and forward error recovery, backward error recovery- recovery in concurrent systems – consistent set of check points – synchronous and asynchronous check pointing and recovery – check pointing for distributed database systems- recovery in replicated distributed databases. Protection and security -preliminaries, the access matrix model and its implementations.-safety in matrix model- advanced models of protection. Data security - cryptography: Model of cryptography, conventional cryptography- modern cryptography, private key cryptography, data encryption standard- public key cryptography - multiple encryption - authentication in distributed systems.

Module IV (8 hours)
Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues- threads- process synchronization and scheduling. Real-Time OS: Characteristics of real time OS, Hard Versus Soft Real-Time Systems, Real-Time communications, Real-Time Scheduling, case study: Windows CE, PalmOS . Recent topics in OS: multiprocessor OS, Database OS, concurrency control algorithms. Database Operating systems :Introduction- requirements of a database operating system Concurrency control : theoretical aspects - introduction, database systems - a concurrency control model of database systems- the problem of concurrency control - serializability theory- distributed database systems, concurrency control algorithms - introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms - concurrency control algorithms, data replication.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO1: Outline the potential benefits of distributed systems. (*Knowledge/Comprehension*)
CO2: Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security. (*Synthesis*)
CO3: Apply standard design principles in the construction of distributed systems. (*Application*)
CO4: Select appropriate approaches for building a range of distributed systems, including some that employ middleware. (*Analysis*)
CO5: Have knowledge of real time operating systems. (*Knowledge*)

Suggested Readings

1. Mukesh Singhal, Niranjan G.Shivaratri, Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems, TMH, 2001
2. Andrew S.Tanenbaum, Modern operating system, PHI, 2003
3. Pradeep K.Sinha, Distributed operating system-Concepts and design, PHI, 2003
4. Andrew S.Tanenbaum, Distributed operating system, Pearson education, 2003

CSTM0006: THEORY OF COMPUTATION AND MATHEMATICAL CONCEPTS

(3 credits - 45 Hours)

Objective*: The objective of the Theory of Computation is to introduce and study abstract, mathematical models of computation (such as finite state, push down and Turing machines etc.), and to use the abstract machine models to study the ability to solve computational problems. At the complete course students will be able to use regular expression effectively and appropriately, construct derivations and parse trees, write simple programs for a Turing machine, understand the equivalence of grammars, languages and automata and translate between grammars, languages and automata.*

Module I: Theory of Automata (7 Hours)

Definition of an Automaton, Description of a Finite Automaton, Transition Systems, Properties of Transition Functions, Acceptability of a String by a Finite Automaton, Nondeterministic Finite State Machines, The Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata.

Module II: Formal Languages, Regular Sets and Regular Grammars (8 Hours)

Definition of formal languages, Chomsky Classification of Languages, Languages and Their Relation, Recursive and Recursively Enumerable Sets, Operations on Languages, Languages and Automata; Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma for Regular Sets, Application of Pumping Lemma, Regular Sets and Regular Grammars Exercises.

Module III: Context-free Languages (10 Hours)

Context-free Languages and Derivation tree, Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars, Pumping Lemma for Context-free Languages, Properties of Context Free Language-Closure Properties-Periodicity Properties-Determinism and Parsing, Top Down and Bottom up Parsing, Decision Algorithms for Context-free Languages Exercises

Module IV: Pushdown Automata Turing Machines and Linear Bounded Automata (10 Hours)

Basic Definitions, Acceptance by PDA, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata; Turing machine Model, Representation of Turing Machine, Language Acceptability by Turing Machines, Design of Turing Machines, Universal Turing Machine and Other Modification, The Model of Linear Bounded Automaton, Turing Machines and Type 0 Grammars, Linear Bounded Automata and Languages, Halting Problem of Turing Machines.

Module V: Mathematical Concepts (10 Hours)

Matrix analysis - Linear Systems - Gaussian elimination, Cholesky factorization, Least Squares Problems, Random Variables and Probability Distributions-distribution function, normal distribution, Random Process, Random Processes, Markov Process-Markov Chain.

COURSE / LEARNING OUTCOMES

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

CO1: Describe basic terminology like Deterministic and Non deterministic automata, Pushdown Automata, Parse Tree, Regular Languages, Turing Machines etc. (*Knowledge*)

CO2: Explain the concepts, core terms and tools used in automata theory (*Comprehension*)

CO3: Correctly use the techniques, components and tools of a typical automated machine and apply it in designing new machines (*Application*)

CO4: Learn which input pattern would be accepted by a Turing Machine, Pushdown Automata, Finite Automata etc. (*Application*)

CO5: Compare and contrast various types of machines in Automata theory and relate it to everyday appliances like washing machines, fans, etc (*Analysis*)

CO6: Design new automata for given problems by using most appropriate algorithmic strategy considering the problem domain. (*Synthesis*)

CO7: Design an automata and evaluate it in terms of correctness, computation cost and complexity. (*Evaluation*)

Suggested Readings

1. K.L.P. Mishra, N. Chandrasekaran, Theory of Computer Science, BPB Publication, Prentice-Hall of India, Second Edition.
2. H.R. Lewis and C.H.Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall of India.
3. J.C. Martin, Introduction to Languages and the Theory of Automata, Tata McGraw-Hill.
4. C.H. Papadimitriou, Computation Complexity, Second Edition, Prentice Hall of India.
5. Hopcroft. J.E. and J.D. Ullman Introduction To Automata Theory, Languages and Computation, Addison-Wesley, Reading Mass 1979
6. V. Rajaraman, Computer Oriented Numerical Methods, Publisher PHI Learning Pvt. Ltd., 1993
7. Roger A. Horn, Charles R. Johnson, Matrix Analysis, Publisher Cambridge University Press, 1990
8. Henry Stark, John William Woods, Probability, Random Processes, and Estimation Theory for Engineers, Prentice-Hall
9. A.M.Natarajan, A.Tamilarasi, Probability Random Process and Queuing Theory, New Age International Publishers

CSAI0007: ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

(4 credits - 60 Hours)

Objectives*: The topics below cover fundamental concepts and techniques in artificial intelligence. Students also learn the latest AI techniques along with the programming languages used in AI problem solving.*

Module I: Artificial Intelligence: History and Applications (5 hours)

Introduction, Intelligence, Artificial Intelligence, Progress of Artificial Intelligence, Modeling, Simulation and AI, Intelligent Agents

Module II: Knowledge representation: Reasoning, Issues and Acquisition (15 hours)

Introduction, Propositional Calculus, Predicate Calculus, Rule-based Knowledge Representation, symbolic Reasoning under uncertainty, Basic knowledge Representation Issues, Knowledge acquisition; Expert systems – history and survey of expert systems, expert system shells, introduction to CLIPS, Representing Knowledge in Uncertain domains, Bayesian networks

Module III: State Space Search: Implementation and Applications (10 hours)

Introduction, State Space Search, Strategies for State Space Search, Implementation of Graph Search, search based on Recursion, Pattern-directed search, Production systems

Module IV: Heuristic Search (15 hours)

Introduction, Search as a Problem-solving Technique, Heuristic search, Techniques for Heuristic search, admissibility, Monotonicity and Informedness, Heuristic Classification, Local search algorithms, Constraint satisfaction problems

Module V: Selected Topics In AI (15 hours)

Learning, Natural Language Processing, applications of search Techniques in Game playing and Planning; Artificial Intelligence Problem-Solving Languages – PROLOG, LISP

COURSE / LEARNING OUTCOMES

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

CO1: Identify the need of incorporating human intelligence into machine and define the basic terms related to the concept of knowledge and representation, learning and reasoning, communication and language processing. (*Knowledge*)

CO2: Define problem state space, design algorithms to solve problems, generalized schema for knowledge interpretation and planning and language processing. (*Comprehension*)

CO3: Compute and demonstrate the problem in terms of state space and apply different AI algorithms to solve problems and construct a logic to represent knowledge in computational domain and also to interpret the natural language. (*Application*)

CO4: Compare and analyse the performance of algorithms based on problem domain. (*Analysis*)

CO5: Design and create new intelligent algorithm for application development by integrating experience based learning. (*Synthesis*)

CO6: Judge and assess the algorithms based on completeness, optimality, space and time complexity for solving a problem in intelligent manner. (*Evaluation*)

Suggested Readings

1. N.P. Padhy, Artificial Intelligence and Intelligent Systems, 4th impression, Oxford University Press
2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education
3. Elaine Rich and Kevin Knight, Artificial lntelligence, McGraw Hill
4. Nils J. Nilsson, Artificial Intelligence- A New Synthesis, Elsevier

CSNL0008: NATURAL LANGUAGE PROCESSING

(3 credits - 45 hours)

Objectives*: The goals for this course are to study: (a) algorithms and methods for building computational models of natural language understanding, including syntactic analysis, semantic representations, discourse analysis, and statistical and corpus-based methods for text processing and knowledge acquisition, (b) issues involved in natural language understanding, (c) applications that can benefit from natural language processing, such as information extraction, question answering, machine translation, and spoken language understanding. By the end of the course, students will have a good understanding of and appreciation for natural language processing, and have the necessary skills to build natural language processing tools.*

Module I: Introduction (10 hours)

Introduction to NLP, Knowledge in language processing, Representation and Understanding, Organization of NLP systems, Models and algorithms, Linguistic Essentials

Module II: Grammars and Parsing - Syntactic Processing (15 hours)

Collocations; Regular Expression and Automata; Morphology and Finite-State Transducers; N-grams; Word Classes and Part-of-Speech Tagging; Context-Free Grammars for English; Parsing with Context-Free Grammars: Top-down parsing, Bottom-up parsing; Features and Unification; Lexicalized and Probabilistic Parsing

Module III: Semantic processing (10 hours)

Representing Meaning; Semantic Analysis: Integrating semantic analysis to parsers, Semantic Grammars; Lexical Semantics; Word Sense Disambiguation and Information Retrieval: Selection-Restriction based disambiguation, Machine learning approaches; Dictionary based approaches, Information retrieval

Module IV: Pragmatics (7 hours)

Discourse, Dialogue and Conversational Agents: Dialogue acts, Automatic Interpretation of Dialogue acts; Natural Language Generation: Discourse Planning; Machine Translation: Direct

Translations, Translation using Statistical techniques

Module V: NLP Applications and Tools (3 hours)
Sentiment Analysis, Text Summarization, Text Entailment, Machine Translation, Question Answering, Cross Lingual Information Retrieval (CLIR), NLTK, WordNet

COURSE / LEARNING OUTCOMES

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

CO1: Define the various terms related to Natural Language Processing. (*Knowledge*)
CO2: Explain the stages of a Natural Language Processing (NLP) system. (*Comprehension*)
CO3: Implement methods for morphological analysis of natural language. (*Application*)
CO4: Calculate bigram probabilities and smoothed bigram probabilities. (*Application*)
CO5: Compare the working of different part of speech taggers. (*Analysis*)
CO6: Evaluate performance of part-of-speech taggers. (*Evaluation*)
CO7: Compare the different approaches to syntax and semantic processing. (*Analysis*)
CO8: Describe the methods used for representing meaning. (*Comprehension*)
CO9: Describe approaches to discourse processing, dialogue processing, natural language generation and machine translation. (*Comprehension*)
CO10: Explain the machine learning techniques used in NLP. (*Comprehension*)
CO11: Summarize the various corpora used in natural language research. (*Synthesis*)

Suggested Readings
1. D. Jurafsky, J. H. Martin, Speech and Language Processing, Pearson Education
2. Christopher D. Manning, HinrichSchütze, Foundations of Statistical Natural Language Processing, The MIT Press, Cambridge, Massachusetts
3. James Allen, Natural Language Understanding, Pearson Education
4. Philipp Koehn, Statistical Machine Translation. Cambridge.
5. Joshua Bengio, Learning Deep Architectures for AI.
6. Frederick Jelinek. 1998. Statistical Methods for Speech Recognition.MIT Press.
7. Steven Bird, Ewan Klein, Edward Loper, Natural Language Processing with Python, O'Reilly Media.
8. Jacob Perkins, Python Text Processing with NLTK 2.0 Cookbook, O'Reilly Media.

CSCN0009: ADVANCED COMPUTER NETWORKS

(4 credits - 60 hours)
Objectives*: The course provides an understanding of the overriding principles of computer networking, including network type, functionality, protocol design, protocol layering, and performance evaluation along with principles embodied in the protocols designed for the application layer, transport layer, network layer, and link layer of a networking stack.*

Module I (10 hours)
An overview of network architecture and basic concepts, Network Principle, Network Services and layered architecture: TCP/IP Model, OSI Model,Types of network, Virtual circuits, Fixed size packets, variable size packets, Integrated service,, IP over ATM, Wireless networks : Wireless communication basics, architecture, mobility management, wireless network protocols. Bluetooth (802.15.1), Wi-Fi (802.11), WiMAX (802.16), Optical Network : links, WDM system, Optical LANs, Optical paths and networks. Networking Devices: Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure IPv4 and building blocks: Data link layer and medium access control protocols; Principles of Link Layer Protocols, Ethernet, PPP, CSMA, VLANs. Support Protocols: DHCP, ARP, ICMP.

Module II (15 hours)
Performance of Networks, Control of networks: objectives and methods of control, Circuit switched networks, datagram and ATM networks. Mathematical background for control of

networks like Circuit switched networks, Datagram and ATM networks, IP addressing and routing: Routing in Internet; OSPF, RIP, BGP, Mobile IP: characteristics, Mobile IP operation, Multicast Routing Protocols, Address shortage; CIDR, NAT - Impact on routing, Advanced Routing -Voice and Video over IP (RTP, RSVP, QoS), IPv6: Why IPv6, basic protocol, extensions and options, support for QoS, security, role of switching paradigms etc.,MPLS, Traffic Engineering (TE) and TE with MPLS and VPN.

Module III (10 hours)
Network functions: neighbor discovery, auto-configuration, Changes to other protocols. Application Programming Interface for IPv6. Security related issues. Mobility in networks. Transport Layer: Duties of transport layer, Multiplexing, Demultiplexing, Sockets, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Congestion control, Flow control, Quality of services (QOS).

Module IV (15 hours)
Ad Hoc Networking: An Introduction, A DoD Perspective on Mobile Ad Hoc Networks, Types of protocol for Adhoc network, Workability of DSDV, AODV, DSR protocol, Securities in Adoc network, Wireless Sensor Networks: Sensor Networks and Protocol Structures, Clustering Protocols, Routing Protocols, Multimedia Networking, IP Security: IPSec, TLS, SSL, Application Layer: Domain Name Space (DNS), Web.

Module V (10 hours)
Introduction (passwords, security questions, challenge-response), phising, cookies, web management, JavaScript and same origin, click jacking and cross site request forgeries, stream ciphers, attacks on 802.11b/WEP, CSS(cross site scripting), MIFARE,attacks on TCP/IP,DNS, Memory corruption,stuxnet, Viruses and root kits, worms and botnets, Email security (Distribution list, Establishing keys), Packet filters, Application level gateways, Encrypted tunnels, DoS attack, DDosS attack. principle of least privilege trust, trusted computing basics, reference monitors, inline reference monitors and access control, Secure multi party computation, secure two party models. Mobile code security Digital Defense. Introduction to IDS.

COURSE / LEARNING OUTCOMES

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

- CO1: Know about various computer architecture, basic concept, network principles, mobility management, network performance, routing techniques, neighbour discovery, Ad hoc network, network security etc. (*Knowledge*)
- CO2: Distinguish various network architecture and their related properties. (*Comprehension*)
- CO3: Implement different network architecture using network simulator. They will also be able to generate different attack scenerios in the testbed. (*Application*)
- CO4: Compare and contrast different network architecture as well as protocols based on performance parameters. (*Analysis*)
- CO5: Understand network security issues in terms of different architecture as well as protocol. (*Synthesis*)
- CO6: Design the network architecture based on demand. (*Evaluate*)

Suggested Readings

1. TCP/IP Guide freely available from http://www.tcpipguide.com.
2. Peterson and Davie, Computer Networks: A Systems Approach
3. Andrew S. Tanenbaum, Computer Networks, PHI
4. Lerry L. Peterson and Bruce S. Davie, Computer Networks – A system approach, 4th Edition
5. Behrouz A. Forouzan, Data communication and Networking, Tata McGraw-Hill.
6. William Stallings, Data and Computer Communication, Pearson Education.
7. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education.
8. TCP/IP vol.1 by Richard Stevens

CSNC0010: NUMBER THEORY AND CRYPTOGRAPHY

(3 credits - 45 hours)

***Objectives**: The objective of this course is to provide basic knowledge in elementary number theory that includes computational aspects of application in cryptography. The course also includes preliminary testing and factorization. Then its objective is to provide knowledge and application of public key cryptographic system. Finally it provides in depth knowledge of elliptic curve cryptography. At the end of the course students should submit one assignment based on application of cryptography system.*

Module I: Elementary number theory (10 Hours)

Divisibility, Division Algorithm, Euclidean Algorithm, Congruences, Existence of infinite many primes, Fermat's little theorem, Wilson's theorem, Chinese Remainder theorem, Calculating modular square and cubic roots, Euler Phi-function, Euler totient function, multiplicative property, Primitive Roots, Quadratic Residues

Module II: Primality testing and factorization (10 Hours)

Primality Tests, Pseudoprimes, Carmichael Numbers, Fermat's pseudoprimes, Euler pseudoprimes, Factorization by Pollard's Rho method, Simple Continued Fraction, simple infinite continued fractions, Approximation to irrational numbers using continued fractions, Continued Fraction method for factorization.

Module III: Public Key Cryptosystem (15 Hours)

Traditional Cryptosystem, limitations, Public Key Cryptography, Diffie-Hellmann key exchange, Discrete Logarithm problem, One-way functions, Trapdoor functions, RSA cryptosystem, Digital signature schemes, Digital signature standards, RSA signature schemes, Knapsack problem, ElGamal Public Key Cryptosystem, Attacks on RSA cryptosystem: Common modulus attack, Homomorphism attack, timing attack, Forging of digital signatures, Strong primes, Safe primes, Gordon's algorithm for generating strong primes, Linear cryptanalysis and differential cryptanalysis.

Module IV: Elliptic Curve Cryptography (most critical module) (10 Hours)

Definition of elliptic curves. Group law. Endomorphisms and isomorphisms. j-invariant. Elliptic curves in SAGE.Elliptic curve over finite fields(Torsion points. Frobenius morphism. Group structure and group order. Hasse's theorem. Supersingular curves. Discrete logarithm problem), Pairing-based cryptography(Abstract properties of pairings. Pairing-friendly elliptic curves. Boneh-Franklin identity-based encryption. Boneh-Lynn-Shacham signatures. Boneh-Goh-Nissim homomorphic encryption), Generating elliptic curves for cryptography(Schoof's algorithm. Complex multiplication. Generating pairing-friendly curves)

COURSE / LEARNING OUTCOMES

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

CO1: Identify, recognize the primary elements of number theory and their significance in cryptographic algorithms. (*Knowledge*)

CO2: Predict and illustrate the different postulates and mathematically driven protocols inherent to the concept of number theory. (*Comprehension*)

CO3: Use the rules intrinsic to number theory to interpret and study the results of some existing ciphers. (*Application*)

CO4: Analyse the logic and methods behind the major proofs in Number Theory and their significance in cryptography. (*Analysis*)

CO5: Synthesize the concepts adhered to number theory to have a deeper understanding of some modern day ciphers. (*Synthesis*)

CO6: Evaluate, assess and critique any design built on the concept of number theory. (*Evaluation*)

Suggested Readings

1. Wenbo Mao, Modern Cryptography: Theory and Practice, Hewlett-Packard Company.
2. Neal Koblitz, A Course in Number Theory and Cryptography, Graduate Texts in Mathematics, Vol. 114
3. Zihao Jiang, Applications of Number theory in Cryptography
4. Lawrence C. Washington, Elliptic curves: number theory and cryptography, Chapman and Hall/CRC

CSCF0011: COMPUTER FUNDAMENTALS

(4 credits - 60 hours)

Objectives*: This course provides an introduction to the fundamentals and basic requirements of computer science. This course will enable the student to gain an understanding of the core concepts and technologies which constitute Information Technology and to articulate and demonstrate these basic fundamental concepts.*

Module I: Introduction to Computers (12 hours)

Introduction, brief history of development of computers, characteristics of computers, block diagram of computer; types of computers and features, analog, digital, hybrid, general, special purpose, micro, mini, mainframe supercomputers. Types of personal computers – desktop, laptop, palmtop etc. , types of programming languages (machine languages, assembly languages, high level languages, 4GL), data organization, drives, files, directories., basic components of computer system; Von Neumann architecture.; types of memory (primary and secondary) RAM, ROM, PROM, EPROM; secondary storage devices (FD, CD, HD, Pen drive) I/O devices (Scanners, Plotters, LCD, Plasma Display)

Module II: Data representation and operations (8 hours)

Simple model of memory, bits and bytes, introduction to binary, Hexadecimal, Octal, Decimal systems, conversion from one system to another, simple addition, subtraction, multiplication.

Module III: Algorithm and Flowcharts (10 hours)

Algorithm: Definition, Characteristics, Advantages and disadvantages, Examples Flowchart: Definition, Define symbols of flowchart, Advantages and disadvantages, examples.

Module IV: Operating System and Computer Software(12 hours)

a) Introduction to O.S., historical evolution - first generations, second generations, third generations, fourth generation, phases of evolution-serial processing, simple batch systems, multi-programmed batch systems, time-sharing systems, personal-computer systems (PCs), parallel systems, multi processing system – symmetric, asymmetric, distributed system, real-time systems, need of Operating system, comparative study of popular operating systems. DOS – history, files and directories, internal and external commands, batch files, types of Operating systems, introduction to Windows, Linux, UNIX operating systems.
b) Need of software, types of software, system software and application software, Application software-word processing, spreadsheet, presentation graphics, database management software.Introduction to Computer virus.Introduction to Internet and E-mail; searching information through a search engines (google, altavista, sulekha, khoj etc)

Module V: Windows Operating System (8 hours)

Introduction to microsoft windows; features of windows; Various versions of windows and its use; working with windows; my Computer and Recycle bin ; Desktop, Icons and Windows Explorer; working with files and folders; simple operations like copy, delete ,moving of files and folders from one drive to another, installing and uninstalling new hardware and software programs on computer.

Module VI: Unix Operating System (10 hours)
Introduction to UNIX OS, Salient features of UNIX, UNIX system architecture, shells and types of shells, file management, directories, file permissions, pipes and filters, various processes-foreground, background, parent, child, zombie, daemon; basic UNIX commands (log in, create/delete files/directories, listing files/directories, changing permission of files/directories etc), advanced UNIX commands (creating, listing and stopping process, printing files, sending E-mails etc), Built-in Functions (abs, log, sin, cos etc), signals and traps, system calls-basic idea,the UNIX file system.

COURSE / LEARNING OUTCOMES

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

CO1: Systematically understand the fundamental concepts of computers that includes understanding the hardware and software components as well as the role of each of these components. (*Knowledge*)
CO2: Have a conceptual understanding of the various number systems as well as conversion from one number system to another and basic arithmetic binary operations. (*Comprehension*)
CO3: Work with files, folders, and applications. (*Application*)
CO4: Analyze problems and develop a flowchart and/or an algorithmic solution for the same. (*Analysis*)
CO5: Have a clear understanding of the role of an operating system (OS) and the various OS available for use with special reference to Windows and Unix. (*Synthesis*)
CO6: Learn to use Windows and Unix Operating Systems efficiently to analyze the structure and design of each of these two operating Systems. (*Evaluation*)

Suggested Readings

1. Rajaraman, V. Fundamentals of Computers, PHI Publications
2. Sinha P.K. Fundamental of Computers
3. Suresh Basandra, Computers Today
4. Kanetkar Y, UNIX Shell Programming
5. Manuals of Office Software

CSIF0012: INFORMATION SECURITY FUNDAMENTALS
(3 credits – 45 hours)

Objectives*: Introduces concept of information security and discuss need for organizational policy to define required services such as confidentiality, authentication, integrity, nonrepudiation, access control, and availability, and mechanisms to implement those services. Covers different types of security including physical security, computer security, and network security; common threats to and attacks against information systems, including accidental damage.*

Module I: Information Security, Legal, Ethical and Professional issues related to information security (15 hours)
General security concepts and introduction to what is an "info sphere", inside the security mind, operational security and people's role in information security, components and characteristics of an information system, threats to an information system, ethical and professional issues.

Module II: Configuring network connectivity, Security policy and procedures (20 hours)
Network configuration, troubleshooting connectivity issues, remote access protocols and configuration, security in systems's project management, access control fundamentals, authentication and account management.

Module III: Information Security components (8 hours)
Physical threats to the information facility, firewalls, host hardening, application security, data protection , incident response , cryptography and security response

Module IV: Identification, assessment and control of risks related to Information Security (7 hours)
Risk identification and assessment, business continuity and risk control strategies , major security models

COURSE / LEARNING OUTCOMES

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

CO1: Gain the following characteristics: i. Knowledge of Specifics: Understand and identify different terminology such as infosphere, information system, network troubleshooting, host hardening; ii. Knowledge of ways and means of dealing with specifics: Understand and learn different network topologies, information security components, risk assessment; iii. Knowledge of the universals and abstractions in a field: Understand the theory behind configuring access control fundamentals, incident response, cryptography, security model. (*Knowledge*)
CO2**:** Distinguish different threats to an information system, describe authentication and account management, interpret security response in a network (*Comprehension*)
CO3: Apply the knowledge to troubleshoot a network, configure firewall in a network, and apply host hardening in a organization. (*Application*)
CO4: Analyze the different connectivity issues, authentication and account management, compare different risk assessment and mitigation techniques (*Analysis*)
CO5**:** Correlate different activities into different layers of an information system, setup host hardening and firewall in a network (*Synthesis*)
CO6**:** Judge the need of an information system and methodologies to implement it, evaluate.(*Evaluation*)

Suggested Readings
1. Whitman, Michael, Security+ Guide to Network Security Fundamentals, Course Technology, 4 th edition ISBN: 9781111640125
2. Thomas R.Peltier, Justin Peltier, John Blackley, "Information Security Fundamentals", Auerbach Publications.

CSDS0013: ADVANCED C AND DATA STRUCTURES
(3 credits – 45 hours)

Objectives: *The objective of this course is to enable the student of Engineering to*
- *make him/her well conversant with managing functions, pointers, arrays, structures in C.*
- *apply abstract data structures in problem solving and make comparative analysis of algorithms to obtain efficient program design.*

Module I: Advanced C (6 hours)
a) Pointers: chain of pointers, pointers and arrays, array of pointers, pointer to functions-passing parameters by value and by reference, dynamic memory allocation; Recursion.
b) Structures: pointers and structures.
c) Files: Sequential file handling, Indexed Sequential files, Reading and writing in random access files.

Module II: Preliminaries (3 hours)
Introduction to Data Structures; Development and analysis of algorithms.

Module III: Linear Data Structures (8 hours)
Arrays; Stacks and stack application; Queues; Linked lists, circular and doubly linked lists.

Module IV: Non-linear Data structures (8 hours)

a) Binary trees; representation in memory, traversals and operations.
b) Introduction to graphs, sequential representation of graphs, graph traversals- BFS, DFS,Shortest path algorithms -(Dijkstra's) Minimum Spanning trees - (Kruskal's, Prim's)

Module V: Advanced Data Structures (10 hours)

Binary search trees, AVL trees, B trees.

Module VI: Sorting and Searching (10 hours)

a) Searching and data modification: Linear search, binary search, hashing techniques and collision resolution
b) Sorting techniques: selection, insertion, quick, radix, merge, merge-sort and heap sort.

Suggested Readings

1. Lipschutz, S., Data structures, Indian Adapted Ed, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006
2. Gilberg, Richard F. Forouzan, and Behrouz A., Data Structures, 2nd Ed, Course Technology, Cengage Learning, New Delhi, 2005.
3. Pai, G A, Data Structures and Algorithms, 1st Ed, Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2008.
4. Langsam, Augenstein, and Tanenbaum, Data Structures Using C And C++, 2nd Ed, Phi Publication, New Delhi, 2007.
5. Krishnamoorthy R., Kumaravel, and G . Indirani, Data Structures Using C, 1st Ed., Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2008.
6. Horowitz, Sahni, Susan Freed, Fundamentals of Data Structures in C, 2nd Edition,University press, 1997
7. Amiya Kumar Rath, Alok Kumar Jagdev, Data Structures using C, 2nd Edition, Scitech Publication, New Delhi, 2009

CSTC0014: THEORY OF COMPUTATION

(3 credits – 45 hours)

Objective*: The objective of the Theory of Computation is to introduce and study abstract, mathematical models of computation (such as finite state, pushdown and Turing machines), and to use the abstract machine models to study the ability to solve computational problems. At the complete course students will be able to use regular expression effectively and appropriately, construct derivations and parse trees, write simple programs for a Turing machine, understand the equivalence of grammars, languages and automata and translate between grammars, languages and automata.*

Module I Theory of Automata (12 Hours)

Definition of an Automaton, Description of a Finite Automaton, Transition Systems, Properties of Transition Functions, Acceptability of a String by a Finite Automaton, Nondeterministic Finite State Machines, The Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata.

Module II Formal Languages, Regular Sets and Regular Grammars (10 Hours)

Definition of formal languages, Chomsky Classification of Languages, Languages and Their Relation, Recursive and Recursively Enumerable Sets, Operations on Languages, Languages and Automata; Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma for Regular Sets, Application of Pumping Lemma, Regular Sets and Regular Grammars Exercises.

Module III Context-free Languages (11 Hours)

Context-free Languages and Derivation tree, Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars, Pumping Lemma for Context-free Languages, Decision Algorithms for Context-free Languages Exercises

Module IV Pushdown Automata Turing Machines and Linear Bounded Automata (12 Hours)
Basic Definitions, Acceptance by pda, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata; Turing machine Model, Representation of Turing Machine, Language Acceptability by Turing Machines, Design of Turing Machines, Universal Turing Machine and Other Modification, The Model of Linear Bounded Automaton, Turing Machines and Type 0 Grammars, Linear Bounded Automata and Languages, Halting Problem of Turing Machines, NP-Completeness.

COURSE / LEARNING OUTCOMES

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

CO1: Describe basic terminology like Deterministic and Non deterministic automata, Pushdown Automata, Parse Tree, Regular Languages, Turing Machines etc. (*Knowledge*)
CO2: Explain the concepts, core terms and tools used in automata theory. (*Comprehension*)
CO3: Correctly use the techniques, components and tools of a typical automated machine and apply it in designing new machines. (*Application*)
CO4: Learn which input pattern would be accepted by a Turing Machine, Pushdown Automata, Finite Automata etc. (*Application*)
CO5: Compare and contrast various types of machines in Automata theory and relate it to everyday appliances like washing machines, fans, etc. (*Analysis*)
CO6: Design new automata for given problems by using most appropriate algorithmic strategy considering the problem domain. (*Synthesis*)
CO7: Design an automata and evaluate it in terms of correctness, computation cost and complexity. (*Evaluation*)

Suggested Readings

1. K.L.P. Mishra, N. Chandrasekaran, Theory of Computer Science, BPB Publication, Prentice-Hall of India, Second Edition.
2. H.R. Lewis and C.H.Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall of India.
3. H.E. Hopcraft and J.D. Ullamn, Introduction to Automata Theory, Languages and Computation, Narosa Publications.
4. J.C. Martin, Introduction to Languages and the Theory of Automata, Tata McGraw-Hill.
5. C.H. Papadimitriou, Computation Complexity, Addison-Wesley.

CSDS0015: DATA STRUCTURES USING C++

(4 credits – 60 hours)

Objective*: The objective of the course is to learn how to create data structures in a computer language, such as C++, to represent a collection of similar data, and how to process these data most efficiently for solving problems. After completion of this course, a student will be able to*

- *Understand and use the process of abstraction using a programming language such as 'C++'*
- *Implement various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs*
- *Understand various searching and sorting techniques.*
- *It is expected that the student has adequate knowledge of C++ language basics, functions, arrays, structures, pointers and dynamic memory allocation.*

Module I Arrays and Lists (16 Hours)

a) Data Type, Abstract Data Type, Data Structure, Fundamental and Derived Data Types; Array as a data structure, Representation of arrays: single and multidimensional, Address calculation using column and row major ordering; insertion and deletion in arrays; use of arrays for matrix representation and manipulation (addition, multiplication), use of arrays for large integer representation and their addition.

b) Linked List as a data structure; operations on lists; singly linked list (with one or two external pointers), doubly linked list, circular list; use of linked lists for polynomial representation and manipulation (addition and multiplication), and sparse matrix representation and manipulation (inputting, adding, and displaying in matrix form)

Module II Stacks and Queues (14 Hours)

Stacks and Queues as data structures; implementation of stacks and queues using arrays and linked lists; Circular Queue, Priority Queue; Application of stacks : Conversion of infix(containing arithmetic operators including exponential operator, and parenthesis) to postfix and prefix expressions; evaluation of postfix expression

Module III Trees and Graphs (16 Hours)

a) Binary Trees and General Trees, Representation of trees using linked lists, Binary tree traversal methods, recursive and non-recursive algorithms for traversal methods, Binary search trees (creation, insertion and deletion of a node), threaded binary trees (construct and traverse a right in-threaded binary tree); Height balanced (AVL) binary trees (construct and traverse an AVL tree), multi-way search trees (construction and traversal); B-tree (construction and traversal of a B-tree of given order)

b) Introducing Graphs; Graph representation : Adjacency matrix, adjacency lists, incidence matrix, Traversal schemes : Depth first search, Breadth first search (Recursive and non-recursive algorithms); Shortest Path algorithms (Dijkstra's), Spanning tree, Minimal spanning tree algorithms (Kruskal's algorithm)

Module IV Searching and Sorting (14 Hours)

Linear and binary search, Indexed search; Hashing, Hash Functions (division method, mid square method, folding), Analysis of ideal hash function; Conflict resolution (linear and quadratic probe, double hashing, separate chaining, coalesced chaining); Analysis of collision resolution techniques; Sorting algorithms(Insertion, Selection, Bubble, Quick, Merge, Radix, Heap)

COURSE / LEARNING OUTCOMES

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

CO1: Students would be able to list different data structures and define the purpose of using data structure. (*Knowledge*)

CO2: Students would be able to explain the concept of various data structure like stack, queue, linked list, tree, graph etc. and describe their working mechanism. (*Comprehension*)

CO3: Students would be able to apply their knowledge to solve practical problems like- expression conversion using stack, process management using queue and memory management using linked list and B tree. (*Application*)

CO4: Students would be able to compare the efficiency of various data structure related algorithms with respect to time and space complexity. They would also be able to modify a weak algorithm into a more efficient one. (*Analysis*)

CO5: Students will be able to develop algorithms based on the knowledge they have gained to design cost effective and user friendly application using C++ programming language. (*Synthesis*)

CO6: Depending on the problem domain and input pattern students would be able to choose the appropriate data structure and would be able to justify their decision to use a particular data structure by evaluating the required parameters. (*Evaluation*)

Suggested Readings

1. Y. Langsam, M.J. Augenstein, A.M. Tenenbaum, Data Structures Using C and C++, Second Edition, Prentice Hall of India, 2000.

2. E. Horowitz, Sahni, D. Mehta, Fundamentals of Data Structures in C++, Galgotia Publication, 2002.
3. S. Chattopadhyay, D. Ghosh Dastidar, M Chattopdhyay, Data Structures Through C Language, BPB Publication, 2001.
4. Seymour Lipschutz, Theory and Problems of Data Sturctures, Schaum's Outline Series, International Edition, MacGraw Hill, 1986.
5. Niklaus Wirth, Algorithms + Data Structures = Programs, Prentice Hall of India, 1998.
6. Y.P. Kanetkar, Data Structures Through C Language, BPB Publishers, 2002.

CSOP0016: OBJECT ORIENTED PROGRAMMING AND DESIGN

(4 credits – 60 hours)

***Objective**: The Main aim of this paper is to give the students a broad understanding of the object oriented approach to problem solving through C++. It provides a practical, productive way to develop software for most applications. It also includes an introduction to object-oriented design, which can promote a better understanding of the requirements, cleaner designs, and more maintainable systems.*

Module I Introduction To Object-Orientation Concepts And OOP (16 Hours)

a) Introduction to Object-Oriented Programming: Basic concepts of OOP (Abstraction, Encapsulation, Inheritance, Polymorphism), comparison of procedural programming and OOP; code reusability, creating new data types. C++ Language basics, cin and cout, << and >> operators, setw and endl, Control statements, differences between C and C++.
b) Classes and Objects: C++ extension to structures, member access operators static members, arrays of objects, returning objects from functions, Friend functions, Pointers to members, Friend classes, stack class.
c) Constructors: Default constructors, overloaded constructors, constructors with default arguments default constructor, copy constructor, dynamic constructor, destructors.

Module II Templates and Exception Handling (12 Hours)

a) Templates: string template, instantiation, template parameters, type-checking, function templates, template argument deduction, specifying template arguments, function template overloading, default template arguments, specialisation, conversions.
b) Exception handling: Error handling, grouping of exceptions, catching exceptions, catch all, re-throw, resource management, auto ptr, exceptions and new, resource exhaustion, exceptions in constructors, exceptions in destructors, uncaught exception, standard exceptions.

Module III Inheritance, Virtual Functions and Polymorphism (16 Hours)

a) Overloading: Defining operator overloading, operator function as member function and friend function, overloading unary and binary operators, type conversions, function overloading.
b) Inheritance: Types of inheritance, Defining derived class, Access specifiers: public, private and protected; public and private inheritance, accessing base class members, ambiguity in multiple inheritance, virtual base classes, abstract classes, Derived class constructor with arguments, Initialization lists in constructors, classes within classes.
c) Virtual functions and polymorphism: Virtual functions, pure virtual functions, abstract classes, implementation of virtual functions (virtual pointers and virtual tables in classes with virtual functions), this pointer, static and dynamic binding, virtual functions in derived classes, object slicing, virtual functions and constructors, calling virtual functions from constructors, destructors and virtual destructors, calling virtual functions from destructors, virtual base classes, Rules for virtual functions.
d) File handling and streams.
e) Basics of file handling in C++, classes for stream operations, operations on files, file opening modes, file pointer, error handling during file operations

Module IV Object Oriented Design (16 Hours)
Overview of object oriented designing (concepts), steps involved in object oriented designing, advantages of OOD, what is modeling, why modeling is required, UML, different views captured by UML diagrams, Use Case diagram(actors, generalization, association, include dependency, extend dependency etc.),organization of use cases, Use Case Packaging, constraints in use case models, how to find out actors, use cases and use case relationships, Class diagrams, representations, association and links, aggregation, composition, dependency, constraints, interaction diagrams(sequence diagrams and collaboration diagrams), representation, boundary objects, controller objects, entity objects, Booch's object identification method, CRC cards, equivalence of sequence diagram and collaboration diagrams, activity diagrams, representation(action states, action flow, object flow, initial state , final state etc..), swim lanes, branching, fork, join etc, OOD goodness criteria.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO1: Describe the various features of Object Oriented programming by utilizing the C++ language construct. (*Knowledge*)
CO2: Explain the standard library, scope and lifetime of a variable and various control statements used in C++ program. (*Comprehension*)
CO3: Interpret the concept of classes and object in C++ and apply exception handling to solve various exceptions. (*Application*)
CO4: Contrast the different type of inheritance and polymorphism and analyze it in resolving various problems. (*Analysis*)

Suggested Readings

1. E. Balagurusamy, Object-Oriented Programming with C++, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Nabajyoti Barkakati, Object-Oriented programming in C++, Prentice hall of India private Limited, New Delhi, 2005.
3. James Rumbaugh, Micheal Blaha, William Premerlani, Frederick Eddy, William Loorenson, Object-Oriented Modeling and Design, Prentice hall of India private Limited, New Delhi, 2005.
4. Bjarne Stroustrup, The C++ Programming Language, Special edition, Pearson Education Publication.
5. David Parsons, Object-Oriented Programming with C++, BPB Publications, B-14 Cannaught Place, New Delhi.
6. Grady Booch, Object-Oriented Analysis and Design with Applications, Second Edition, Addison-Wesley Publishing Company.
7. Steve Qualline, Practical C++ Programming, Second Edition, Shroff publishers and Distributors Private limited.

CSDM0017: DATABASE MANAGEMENT SYSTEMS I
(4 credits – 60 hours)

Objective*: The objective of this course is to introduce to the students the fundamental concepts necessary for designing, using and implementing database systems and applications. The course stresses on database modeling and design, physical file storage techniques and language facilities provided by database management systems.*

Module I: Introduction and Conceptual Data modeling (18 Hours)
a) Introduction: Introduction to databases, characteristics of the database approach, database users and designers, role of a DBA, advantages of using a DBMS, data models, schemas, instances, DBMS architecture (Three-Schema Architecture), Database systems-Network, Hierarchical, Relational, Data Independence

b) Conceptual Data Modeling: Phases of database design, entity type, entity set, attributes, keys, value sets, relationships, relationship types, relationship sets, relationship instances, relationship degree, role names, recursive relationships, constraints on relationship types, attributes of relationship types, weak entity types, ER Diagram, naming conventions and design issues, EER concepts.

Module II: Relational Data Model and Structured Query Language (18 Hours)
Relational model concepts: Domain, attribute, tuple, relation, characteristics of relations, relational databases, relational database schemas, relational constraints (Domain constraint, constraints on null), entity integrity, referential integrity, foreign keys. ER to Relational mapping algorithm, Case study.
Relational Algebra: basic relational algebra operations-SELECT, PROJECT, UNION, INTERSECTION, SET DIFFERENCE, Cartesian PRODUCT, JOIN, Aggregate functions
Relational Calculus: Tuple Relational Calculus, Domain Relational Calculus
SQL: Characteristics of SQL, Data types in SQL, Types of SQL commands
Data Definition Commands: CREATE SCHEMA, CREATE TABLE, DROP TABLE, ALTER TABLE .
Single table query commands: SELECT, SELECT with WHERE, SELECT with ORDER BY, SELECT with GROUP BY, SELECT with GROUP BY and HAVING, SQL built-in functions - SUM, MIN, MAX, COUNT, AVG.
Multi-table query commands: Retrieval using sub-query, JOIN, EXIST and NOT EXIST
Special operators: IS NULL, IS NOT NULL, BETWEEN..AND, IN, LIKE, ANY, ALL
Data changing commands: INSERT, DELETE, UPDATE

Module III: Functional Dependencies and Normalization (10 Hours)
Functional Dependencies, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Multivalued Dependencies, Join Dependencies, Fourth Normal Form, Fifth Normal Form, Denormalization

Module IV: File Organization (14 Hours)
Introduction to storage hierarchies, hardware descriptions of disk devices, Magnetic Tape Storage Devices, RAID technology, Organization of file records on disk (record and record types, Fixed- length records, variable-length records, record blocking, spanned and unspanned records, allocating file blocks on disk, file headers), Operations on Files (Open, Reset, Find, Read, Delete, Modify, Insert, Close), primary methods of file organization -Heap Files, Sorted Files, Hashed Files.Types of Single-level Ordered Indexes (Primary Indexes, Clustering Indexes, Secondary Indexes), Multilevel Indexes: Basic technique, Multilevel indexing using B tree and B+ tree,Indexing on multiple keys

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO1: Understand the basic concepts of database management and its applications in various database projects. (*Analysis*)
CO2: Use relational algebra, TRC, and SQL to solve queries related to database tables. (*Application*)
CO3: Design ER diagrams and schema diagrams for various database-oriented projects. (*Synthesis*)
CO4: Understand the file organization for storing database records. (*Comprehension*)

Suggested Readings

1. R Elmasri, SB Navathe, Fundamentals of Database Systems, Addision, Wesley, 3rd Edition, 2000.
2. Silberschatz, HF Korth, S Sudarshan, Database System Concepts, Tata- McGraw Hill, 1997.
3. Bipin Desai, An Introduction to Database Systems, Galgotia Publications (West Publishing), 1991.

4. DM Kroenke, Database Processing: Fundamentals, Design and Implementation, Prentice-Hall of India, (Eighth Edition) 2002.
5. GW Hansen, JV Hansen, Database Management and Design, Prentice-Hall of India, (2nd Edition) 2001.
6. Thomas M Connolly, Carolyn E Begg, Database Systems, A Practical Approach to Design, Implementation and Management, Addison Wesley Longman Ltd. 1999.

CSOA0018: COMPUTER ORGANIZATION AND ARCHITECTURE

(4 credits – 60 hours)

Objective*: This course aims to provide the student with the concepts and basic knowledge necessary to understand the organisation and architecture of computing systems.*

Module I: Arithmetic Logic Unit (10 Hours)

Addition and Subtraction (Addition and Subtraction with Signed-Magnitude Data, Hardware Implementation, Addition and Subtraction with Signed-2's Complement Data); Booth's Multiplication Algorithm; Division Algorithm; Floating-Point Arithmetic Operations (Addition, Subtraction, Multiplication, Division).

Module II: Control Unit (12 Hours)

a) Major Components of a CPU; General Register Organization; Stack Organization (Register Stack, Memory Stack, Reverse Polish Notation); Subroutine Call and Return; Fetch Routine; Types of Interrupts; Characteristics of Complex Instruction Set Computer (CISC) and Reduced Instruction Set Computer(RISC)
b) Micro operations, Control Function, Role of Three-State Bus Buffers in Memory Transfers; Arithmetic Microoperations, Logic Microoperations, Shift Microoperations; Microprogrammed Control and Hardwired Control; Control Memory, Control Word, Microinstruction, Microprogram, Mapping of Instructions; Instruction Formats(Three-Address Instructions, Two-Address Instructions and Zero-Address Instructions); Addressing modes.

Module III: Parallel Processing and Multiprocessors (14 Hours)

a) Parallel Processing: Flynn's Classification of computers; Pipelining, Data Dependency, Handling of Branch Instructions, Delayed Load, Delayed Branch; Vector Processing, Supercomputers; Array Processors.
b) Multiprocessors: Tightly Coupled, Loosely Coupled; Interconnection Structures (Time-Shared Common Bus, Multiport Memory, Crossbar Switch, Multistage Switching Network, Hypercube Interconnection); Interprocessor Arbitration (Serial Arbitration Procedure, Parallel Arbitration Logic, Rotating Daisy-Chain); Interprocessor Communication and Synchronization, Mutual Exclusion with a Semaphore.

Module IV: Memory Organization (14 Hours)

Hardware Organization for Associative Memory; Mapping methods for Cache Memory (Associative Mapping, Direct Mapping, Set-Associative Mapping), Write Through, Write Back, Cache Initialization, Cache Coherence; Virtual Memory, Memory management hardware.

Module V: Input-Output Organization (10 Hours)

Input Output Interface, I/O Bus, Memory Bus, Isolated I/O, Memory-Mapped I/O; Asynchronous Data Transfer, Strobe Control, Handshaking; Modes of Transfer- viz. Direct Memory Access, Programmed I/O, and Interrupt-Initiated I/O; Priority Interrupt (Daisy-Chain Priority, Parallel Priority Interrupt, Priority Encoder); Input-Output Processor; Serial Communication(Character-Oriented Protocol and Bit-Oriented Protocol).

COURSE / LEARNING OUTCOMES

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

CO1: Apply the knowledge of performance metrics to find the performance of systems. (*Application*)

CO2: Describe the different types of data representations in computer. (*Knowledge*)
CO3: Categorize different types of computers. (*Analysis*)
CO4: Hypothesize high performance computer architecture design. (*Synthesis*)
CO5: Identify the problems in components of computer. (*Knowledge*)
CO6: Illustrate the system bus design. (*Comprehension*)
CO7: Describe the memory hierarchy model. (*Knowledge*)
CO8: Discriminate different types of computer based on Flynn's taxonomy. (*Evaluation*)
CO9: Explain the different types of cache memory mapping. (*Comprehension*)
CO10: Express different data representation schemes of computer. (*Comprehension*)

Suggested Readings

1. M. Morris Mano, Computer System Architecture, Third Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
2. V. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, Computer Organization, Fourth Edition, McGraw Hill, 1996
3. William Stallings, Computer Organization and Architecture, Sixth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2002

CSCI0019: COMPUTATIONAL INTELLIGENCE

(4 credits – 60 hours)

***Objective**: The objective of this course in Computational intelligence is to introduce post graduate students to computational intelligence and adaptive systems, and apply their knowledge to solve problems involving real-life application.*

Module I: Artificial Neural Networks (17 hours)

a) Introduction to Computational Intelligence, Computational Intelligence Paradigms
b) The Artificial Neuron: Calculating the Net Input Signal, Activation Functions, Artificial Neuron Geometry, Artificial Neuron Learning
c) Learning Networks : Supervised Learning Neural Networks: Neural Network Types, Supervised Learning Rules, Functioning of Hidden Units, Ensemble Neural Networks; Unsupervised Learning Neural Networks : Background, Hebbian Learning Rule, Principal Component Learning Rule, Learning Vector Quantizer-I, Self-Organizing Feature Maps; Radial Basis Function Networks: Learning Vector Quantizer-II, Radial Basis Function Neural Networks
d) Reinforcement Learning: Learning through Awards, Model-Free Reinforcement Learning Model, Neural Networks and Reinforcement Learning
e) Performance Issues (Supervised Learning): Performance Measures, Analysis of Performance, Performance Factors

Module II: Evolutionary computation (15 hours)

a) Introduction to Evolutionary Computation: Generic Evolutionary Algorithm, Representation - The Chromosome, Initial Population, Fitness Function, Selection, Reproduction Operators, Stopping Conditions, Evolutionary Computation versus Classical Optimization
b) Genetic Algorithms: Canonical Genetic Algorithm, Crossover, Mutation, Control Parameters, Genetic Algorithm Variants, Advanced Topics, Applications; Genetic Programming: Tree-Based Representation, Initial Population, Fitness Function, Crossover Operators, Mutation Operators, Building Block Genetic Programming
c) Evolutionary Programming: Basic Evolutionary Programming, Evolutionary Programming Operators, Strategy Parameters, Evolutionary Programming Implementations, Advanced Topics, Applications; Evolution Strategies: (1 + 1)-ES, Generic Evolutionary Strategy Algorithm, Strategy Parameters and Self-Adaptation, Evolutionary Strategy Operators, Evolutionary Strategy Variants, Advanced Topics, Applications of Evolutionary Strategies; Differential Evolution: Basic Differential Evolution, DE-x-y-z, Variations to Basic Differential Evolution, Differential Evolution for Discrete-Valued Problems, Advanced Topics, Applications

d) Cultural Algorithms: Culture and Artificial Culture, Basic Cultural Algorithm, Belief Space, Fuzzy Cultural Algorithms
e) Advanced Topics - Coevolution: Coevolution Types, Competitive Coevolution, Cooperative Coevolution

Module III: Computational Swarm Intelligence (10 hours)

a) Particle Swarm Optimization: Basic Particle Swarm Optimization, Social Network Structures, Basic Variations, Basic PSO Parameters, Single-Solution Particle Swarm Optimization, Advanced Topics, Applications
b) Ant Algorithms: Ant Colony Optimization Meta-Heuristic, Cemetery Organization and Brood Care, Division of Labor; Advanced Topics, Applications

Module IV: Artificial Immune Systems (10 hours)

a) Natural Immune Systems: Classical View, Antibodies and Antigens, The White Cells, Immunity Types, Learning the Antigen Structure, The Network Theory, The Danger Theory
b) Artificial Immune Models: Artificial Immune System Algorithm, Classical View Models, Clonal Selection Theory Models, Network Theory Models, Danger Theory Models, Applications and Other AIS Models

Module V: Fuzzy Systems (8 hours)

a) Fuzzy Sets: Formal Definitions, Membership Functions, Fuzzy Operators, Fuzzy Set Characteristics, Fuzziness and Probability; Fuzzy Logic and Reasoning: Fuzzy Logic, Fuzzy Inference; Fuzzy Controllers: Components of Fuzzy Controllers, Fuzzy Controller Types
b) Rough Sets: Concept of Discernibility, Vagueness in Rough Sets, Uncertainty in Rough Sets

COURSE / LEARNING OUTCOMES

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

CO1: Identify the need of computational intelligence paradigm, define clever algorithms based on neural network, evolutionary concepts, swarm intelligence, natural immune system and approximate the uncertainty and vagueness in data through fuzzy logic. (*Knowledge*)
CO2: Define and design clever algorithm to solve real time problems, generalized knowledge and comprehend it. (*Comprehension*)
CO3: Compute and demonstrate the algorithm to solve real world problem. (*Application*)
CO4: Compare and analyse the performance of algorithms. (*Analysis*)
CO5: Design and create new intelligent algorithm for application development by integrating experience based learning. (*Synthesis*)
CO6: Judge and assess the algorithms based on completeness, optimality, space and time complexity best suited for solving a problem in intelligent manner. (*Evaluation*)

Suggested Readings

1. Andries Engelbrecht, Computational Intelligence: An Introduction, Wiley and Sons
2. David Poole, Alan Mackworth, Randy Goebel, Computational Intelligence: A Logical Approach, Oxford University Press.
3. Computational Intelligence, An International Journal, Wiley -Blackwell

CSSE0020: SOFTWARE ENGINEERING AND DESIGN PRACTICES

(3 credits – 45 hours)

Objective*: The main purpose of this course is to impart knowledge on the principles of software development life cycle, process of development, modeling and design. This will also discussed the different architectural patterns and some case studies that use design practices.*

Module I: Introduction (5 hours)
Software Engineering Process, Generic process model, Prescriptive process model, unified process, Agile development Process- Extreme Programming etc.

Module II: Software Requirements and Analysis (10 hours)
Requirements Engineering-Establishing the Groundwork, Eliciting Requirements, Developing use cases scenarios, Building the requirements model, Validating Requirements, Requirements Analysis, Requirements Modeling Strategies

Module III: Software Design (10 hours)
Design Process: Abstraction, Architecture, patterns, Modularity, Information Hiding, Functional Independence, Refinement, Object Oriented Design Concepts, Design Model: Data, Architectural, Interface, Component, Deployment Level Design Elements. Overview of different design schemes-Use Case Diagrams, Class Diagrams, Interaction Diagrams, State chart Diagrams, Activity Diagrams, Package Diagrams, Component Diagrams and Deployment Diagrams etc, and design of Knowledge based systems

Module IV: Design Patterns (10 hours)
Software architecture: Architectural Styles, Pipes and filters, Blackboard, Distributed system, Interactive system, Adaptive system; Patterns and its category, Relationship between patterns, Pattern Description, View handler, Pattern system, Pattern Classification, Pattern Selection, implementation guidelines, Patterns in Software architecture

Module V: Event handling and Synchronization Patterns (10 hours)
Event Handling Patterns, Reactor, Proactor, Acceptor, Connector, Synchronization Patterns, Locking, Scoped, Thread, Interface Locking Optimization etc.

COURSE / LEARNING OUTCOMES

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

CO1: Effectively apply software engineering practice over the entire system lifecycle. This includes requirements engineering, analysis, prototyping, design, implementation, testing, maintenance activities and management of risks involved in software and embedded systems. (*Application*)

CO2: Know classical and evolving software engineering methods, can select and tailor appropriate methods for projects, and can apply them as both team members and managers to achieve project goals. (*Knowledge*)

CO3: Know the ethics, professionalism, and cultural diversity in the work environment. (*Knowledge*)

CO4: Apply basic software quality assurance practices to ensure that software designs, development, and maintenance meet or exceed applicable standards. (*Application*)

CO5: Obtain effective written and oral communication skills. Graduates will be able to prepare and publish the necessary documents required throughout the project lifecycle. (*Comprehension/Application*)

CO6: Effectively contribute to project discussions, presentations, and reviews. (*Synthesis /Evaluation/Application*)

Suggested Readings

1. Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, Tata McGraw-Hill seventh edition
2. Ian Sommerville, “Software Engineering”, Seventh Edition, Pearson Education Asia
3. Frank Buschmann,Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Pattern-Oriented Software Architecture - A System of Patterns”, Volume 1, Wiley
4. Mary Shaw, David Garlan, “Software architecture perspectives on an Emerging Discipline”, Prentice Hall

CSML0021: MACHINE LEARNING

(4 credits – 60 hours)

Objective*: The objective of this course is to familiarize the student of M Tech with all the important areas of Machine learning which helps the student to gain the knowledge necessary to build applications which involve the use of Artificial Intelligence.*

Module I (8 hours)
Introduction: Definition of learning systems. Goals, applications, aspects, Concept representation, Function approximation.Inductive Classification: The concept learning task. Concept learning as search through a hypothesis space.General-to-specific ordering of hypotheses.Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm.Learning conjunctive concepts.Inductive bias.

Module II (15 hours)
Decision Tree Learning: Entropy and information gain. Occam's razor.Overfitting, noisy data, and pruning.Ensemble Learning: Using committees of multiple hypotheses. Bagging, boosting, and DECORATE. Active learning with ensembles.Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.

Module III (10 hours)
Computational Learning Theory: Learning in the limit; probably approximately correct (PAC) learning. Sample complexity: quantifying the number of examples needed to PAC learn. kDNF, and kCNF. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension.Rule Learning: Propositional and First-Order: Translating decision trees into rules. Heuristic rule induction using separate and conquer and information gain. First-order Horn-clause induction (Inductive Logic Programming) and Foil.Inverse resolution, Golem, and Progol.

Module IV (15 hours)
Artificial Neural Networks: Neurons, Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation.Support Vector Machines: Maximum margin linear separators. Quadratic programming solution to finding maximum margin separators.Kernels for learning nonlinear functions.Bayesian Learning: Bayes rule. Naive Bayes learning algorithm.Parameter smoothing.Generative vs. discriminative training. Logistic regression.

Module V (12 hours)
Instance-Based Learning: k-Nearest-neighbor algorithm. Case-based learning.Text Classification: Bag of words representation. Vector space model and cosine similarity. Relevance feedback and Rocchio algorithm. Clustering and Unsupervised Learning: Clustering. Hierarchical Agglomerative Clustering.k-means partitional clustering. Expectation maximization (EM) for soft clustering.Semi-supervised learning with EM using labeled and unlabeled data.Language Learning: Hidden Markov models (HMM's). Viterbi algorithm for determining most-probable state sequences. Forward-backward EM algorithm for training the parameters of HMM's.

COURSE / LEARNING OUTCOMES

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

CO1: Understand basic terminologies like learning goals, concept representation, decision tree, computational learning, artificial neural network, classification; Know ways and means of dealing with specifies; Understand and learn different categories of machine learning, machine learning methodologies; Understand the universals and abstractions in a field; Understand the theory behind designing a learning model. (*Knowledge*)

CO2: Compare efficiency of different learning algorithms, classify supervised and unsupervised learning goals. (*Comprehension*)

CO3: Apply different learning algorithms for real life classification problem, sketch the structure of different learning model such as neural network, support vector machine, naive bayes etc. (*Application*)

CO4: Analyze decesion tree learning, computational learning, artificial neural network and instance based learning and how one learning overcomes the drawback in the other. (*Analysis*)

CO5: Create and design ensemble based learning, propose new learning for optimizing real life problems. (*Synthesis*)

CO6: Students would be able to judge in terms of different complexity which algorithms betters in what situation. (*Evaluation*).

Suggested Readings

1. Tom Mitchell, Machine Learning, McGraw-Hill.
2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 2004.
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
4. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern Classification, Wiley and Sons, 2001.
5. Trevor Hastie, Robert Tibshirani and Jerome Friedman, The Elements of Statistical Learning, Second Edition, Springer, 2009.
6. David J.C. MacKay, Information Theory, Inference and Learning Algorithms, Cambridge University Press, 2003.
7. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An introduction, MIT Press
8. S. Russel. and P. Norvig, Artifical Intelligence: A Modern Approach, Second Edition, New York: Prentice-Hall.

CSCV0022: COMPUTER VISION AND IMAGE ANALYSIS

(3 credits - 45 hours)

Objective: *This course deals with the Science and Engineering of Digital Image Analysis and Computer Vision, that is, mathematical, geometrical information processing aspects and analysis of patterns in visual images of 2D and 3D scenes. The intended outcome of this course is to create new and improved solutions for real-world application.*

Module I: Digital Image Fundamentals and Mathematical Preliminaries (6 hours)

a) Image Sampling and Quantization, Visual properties – brightness, acuity, texture, perception of Color;Scenes and Images; Steps in Image Processing; Components of Image Processing System.

b) Basic Relationships between pixels, distance measures, Linear and Nonlinear Operations, Orthogonal transforms - Fourier transformations, Discrete Cosine and Sine Transforms, Walsh-Hadamard ,Haar, Slant, Wavelet, KL, SVD.

Module II: Digital Image Processing and Analysis (15 hours)

a) Binary Images, Basic Gray Level Transformations, Geometric Transformations, Histogram Processing, Morphological Image Processing, Image enhancement using arithmetic/logic operations, Image Enhancement in the Spatial Domain and Image Enhancement in the Frequency Domain; Image Restoration .

b) Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection: Hough Transforms and other methods; Thresholding, Region Based Segmentation, Segmentation by Morphological Watersheds; Feature Extraction

c) Representation and Description

Module III: Computer vision and Image Understanding (16 hours)

a) Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, 3D Vision, Multi-view Geometry, Projective Reconstruction from multiple views, stereopsis, 3D information from radiometric measurements, 2D view-based representation of a 3D scene

b) Image understanding control strategies, Point distribution models, Active appearance models, Pattern recognition methods in image understanding

Module IV: Computer Vision Applications (8 hours)

Case Studies: Motion detection using static cameras and dynamic cameras, Visual Surveillance and Activity Monitoring, Medical Imaging, Face Recognition, Fingerprinting Authentication, Image Databases, Image-Based Rendering, Content-Based Image Retrieval System, and other related applications.

COURSE / LEARNING OUTCOMES

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

CO1: Demonstrate knowledge and understanding of Human and computer vision systems. (*Comprehension*)

CO2: Understand how images are formed and represented. (*Knowledge/Comprehension*)

CO3: Demonstrate knowledge and understanding of current approaches to image formation and image modelling. (*Application*)

CO4: Implement basic image analysis and computer vision algorithms in MATLAB/Python. (*Application*)

CO5: Understand the mathematical/computational techniques in typical steps for solution of image processing/vision problems: pre-processing, segmentation, description, and recognition. (*Analysis/Synthesis*)

CO6: Analyze and design a range of algorithms for image analysis and computer vision. (*Analysis/Evaluation*)

CO7: Develop and evaluate appropriate solutions to small-scale problems in computer vision and image analysis in MATLAB/Python. (*Application/Evaluation*)

Suggested Readings

1. Rafael C., Gonzalez and Woods R.E., Digital Image Processing, Addison Wesley.
2. Image Processing, Analysis, and Machine Vision. Sonka, Hlavec, and Boyle. Thomson.
3. David Forsyth and Jean Ponce, Computer Vision: a Modern Approach, Prentice Hall.
4. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer.
5. Horn, Berthold K. P. Robot Vision. Cambridge, MA: MIT Press/McGraw-Hill.

CSMC0023: MOBILE AND CELLULAR NETWORK SECURITY

(4 credits - 60 hours)

Objective*: The basic objective of this course is to provide introductory knowledge of mobile system architecture as well as cellular architecture with different application. Then it emphasizes on the vulnerabilities in cellular and mobile services. Then it includes wireless security, mobile IP security and discuss about 802.11 network structure. This course also gives idea on MANETs and some secure protocol of MANETs and their application in MANETs security.*

Module I: Introduction (10 Hours)

Mobile system Architectures, Overview of Mobile cellular systems, GSM and UMTS Security and Attacks(GSM security Features and GSM Security Mechanisms), Authentication and key Agreement, Radio Link Encryption, Temporary ID Management, Algorithm Implementation(A3,A5,A8), Network and Over-Air attack on GSM, Enhanced Authentication and keying, Vulnerabilities in 3G services.

Module II: Vulnerability in cellular Services and Mobile Security (15 Hours)

SMS and related Attacks, Cellular data services and attacks, VoIP services and attacks, Cellular Jamming Attacks, Control channel hiding and Control channel access, Resilience Metric, Identification of compromised users, SIP(session initiation Protocol), Cellular IP multimedia(IMS-IP Multimedia Subsystems), VoIP security, VoIP security vulnerabilities, Billing Attack, SSL, Multi-factor Authentication, Secure programming practices, Establishing a threat model.

Module III: Overview of Wireless Security, Mobile IP Security and 802.11 (15 Hours)
Cellular and WLAN systems, primary WLAN security issues, wireless access threats, wireless security services, NAC Architecture, Subscription-Based systems, Hotspots, Wifi and Wimax, Mobile IP entities and relationships, IP tunneling, Care-of Address, Insider Attacks on Mobile IP, Mobile Node DoS attack, Replay attack, Session-stealing attack, Firewalls, Attacks on 802.11(DoS), Greedy MAC behavior.

Module IV: Ad Hoc Network Security, Secure MANET Routing (20 Hours)
Ad Hoc network security, Security in MANET, PHY, MAC, NET, misbehavior, Cross-Layer Approaches, Role of location in MANET, Attacks on location, Trust and reputation in MANET, MANET routing challenges, Attacks on MANET routing, Secure Distance Vector Routing, SAODV, ARAN, Hybrid systems, Mesh security, Location security and privacy, Mitigating Traceability, Related case studies

COURSE / LEARNING OUTCOMES

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

CO1: Understand mobile and cellular network architecture, security issues, and vulnerabilities. (*Knowledge*)
CO2: Understand security issues and their remedies in mobile cellular communications. (*Comprehension*)
CO3: Recognize different wireless security flaws, creation of mobile hotspot, implementation of attack. (*Application*)
CO4: Compare and analysis of different security issues in mobile and cellular network. (*Synthesis/Analysis*)

Suggested Research papers
This course will be based primarily on research papers. Students are expected to read a number of research papers in the area of Mobile and cellular network security.
1. V.Bharghavan, "Secure Wireless LAN's" in Proceedings ACM Conference on Computer and Communications Security ,1994.
2. Y. Zhang and W.Lee, "Intrusion detection in wireless ad hoc networks" in IEEE/ACM MobiCom Proc, 2000.
3. C. Perkings ,"IP mobility support" IETF RFC 2002, Oct 1996 and revised in September 2002.
4. Lucio Fuentelsaz et al ," The evolution of mobile communications in Europe: The transition from the second to the third generation" in Elseiver, 2008.
5. Toshio Miki and Narumi Umeda,"The overview of the 4th Generation Mobile Communication System",in IEEE,2005.
6. Al-Sakib khan Pathan ,Hyung-Woo Lee and Choong Seon Hong ,"Security in Wireless Sensor Networks: Issues and Challenges" ,ISBN 89-5519-129-4.

Suggested Readings
The following suggested readings are recommended for background knowledge.
1. James D. Solomon, Mobile IP: The Internet Unplugged, Prentice Hall.
2. Frank Adelstein, Sandeep K.S. Gupta, Golden G. Richard III, and Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing
3. Noureddine Boudriga, Security of Mobile Communications
4. LeventeButtyán and Jean-Pierre Hubaux, Security and Cooperation in Wireless Networks, 2008. [Available Online]
5. Himanshu Dwivedi, Chris Clark, and David Thiel, Mobile Application Security
6. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication [Available Online]
7. David B. Johnson. Mobile IP in the Current and Future Internet, Tutorial for MobiCom

8. Charles Perkins, "Mobile Networking with Mobile IP", IEEE Internet Computing, 2(1):58-69, January/February 1998

CSNS0024: NETWORK SECURITY AND FORENSICS

(3 credits – 45 hours)

Objective: *The objective of this course is to familiarize the student with the different network security forensic techniques using tools and available data sets.*

Module I: Email security and Firewalls (10 Hours)
IPSec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPSec. Transport layer Security: SSL protocol, Cryptographic Computations – TLS Protocol.PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions

Module II: Introduction to Computer Forensics (10 Hours)
Computer Forensics Fundamentals – Types of Computer Forensics – Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition, Processing Crime and Incident Scenes – Validating Forensics Data, Email Investigations Cell Phone and Mobile Devices Forensics

Module III: Footprinting, Social Engineering and Data Security (10 Hours)
Web Tools for Footprinting, Conducting Competitive Intelligence, Google Hacking, Scanning, Enumeration, Steganography – Methods, Firewall and Honeypots, IDS AND IPS, Web Filtering, Vulnerability, Penetration Testing, Session Hijacking, Reverse Engineering, Incident Handling and Response, Bluetooth Hacking.

Module IV: Pervasive Computing(15 Hours)
Pervasive computing infrastructure-applications- Device Technology - Hardware, Human-machine Interfaces, Biometrics, and Operating systems– Device Connectivity –Protocols, Security, and Device Management- Pervasive Web Application architecture-Access from PCs and PDAs - Access via WAP

COURSE / LEARNING OUTCOMES

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

CO1: Identify and state the definition of network security protocols and requirements, computer forensics fundamentals. (*Knowledge*)
CO2: Describe the types of computer forensics technology (email forensic, mobile device forensic, case studies). (*Comprehension*)
CO3: Analyze various digital footprinting techniques and issues. (*Analysis*)
CO4: Illustrate the methods for intrusion detection and/or prevention systems. (*Application*)
CO5: Summarize the concepts and techniques of modern day pervasive computing and Biometric. (*Synthesize*)
CO6: Evaluate, assess the significance of pervasive computing techniques and mechanisms and their contribution to forensics. (*Evaluate*)

Suggested Readings

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications.
2. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition.
3. John R.Vacca, "Computer Forensics", Firewall Media, 2005.
4. Richard E.Smith, "Internet Cryptography", Pearson Education, 3rd Edition.
5. Marjie T.Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education

6. Michael T. Simpson, Kent Backman, James E. “Corley, Hands-On Ethical Hacking and Network Defense”, Second Edition, CENGAGE Learning
7. Steven DeFino, Barry Kaufman, Nick Valenteen, “Official Certified Ethical Hacker Review Guide”, CENGAGE Learning, 2009-11-01.
8. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”, Syngress Basics Series – Elsevier, August 4, 2011.
9. Whitaker and Newman, “ Penetration Testing and Network Defense” , Cisco Press, Indianapolis, IN, 2006.
10. Jochen Burkhardt, Pervasive Computing: Technology and Architecture of Mobile Internet Applications, Addison-Wesley Professional; 3rd edition, 2007

CSDS0025: DATA STRUCTURES USING C

(4 credits - 60 hours)

Objective*: The objective of the course is to learn how to create data structures to represent a collection of similar data and solve problems using C language. After completion of this course, a student will be able to*

- *Understand and use the process of abstraction using a C programming language*
- *Implement various data structures viz. Stacks, Queues, Linked Lists, Trees and Graphs*
- *Understand various searching and sorting techniques.*

Module I: Arrays and Lists (16 Hours)

a) Data Type, Abstract Data Type, Data Structure, Fundamental and Derived Data Types, Array as a data structure, Representation of arrays: single and multidimensional, Address calculation using column and row major ordering; insertion and deletion in arrays; use of arrays for matrix representation and manipulation (addition, multiplication).
b) Linked List as a data structure; operations on lists; singly linked list (with one or two external pointers), doubly linked list, circular list; use of linked lists for polynomial representation and manipulation (addition and multiplication), and sparse matrix representation and manipulation (inputting, adding, and displaying in matrix form) .

Module II: Stacks and Queues (14 Hours)

Stacks and Queues as data structures; implementation of stacks and queues using arrays and linked lists; Circular Queue, Priority Queue; Application of stacks: Conversion of infix (containing arithmetic operators including exponential operator, and parenthesis) to postfix and prefix expressions; evaluation of postfix expression.

Module III: Trees and Graphs (18 Hours)

a) Binary Trees and General Trees, Representation of trees using linked lists, Binary tree traversal methods, recursive and non-recursive algorithms for traversal methods, Binary search trees (creation, insertion and deletion of a node), Height balanced (AVL) binary trees (construct and traverse an AVL tree), multi-way search trees (construction and traversal); B-tree (construction and traversal of a B-tree of given order)
b) Introducing Graphs; Graph representation: Adjacency matrix, adjacency lists, incidence matrix; Traversal schemes: Depth first search, Breadth first search

Module IV: Searching and Sorting (12 Hours)

Linear and binary search, Indexed search; Hashing, Hash Functions (division method, mid square method, folding), Sorting algorithms: Insertion, Selection, Bubble, Quick, Merge, Radix.

COURSE / LEARNING OUTCOMES

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

CO1: Recall the basic C constructs and familiarize with basic C syntax, also define and outline the relationship between data and operations on these data using different data structures like arrays, linked list, stacks and queues, graph and trees. (*Knowledge*)

CO2: Define C constructs for explaining and generalizing these data structures and choosing appropriate algorithm for efficient program design using C syntax. (*Comprehension*)

CO3: Compute and demonstrate these data structures and algorithms in different real world problem domain. (*Application*)

CO4: Compare and analyse the performance of algorithms based on problem domain. (*Analysis*)

CO5: Design and create efficient algorithm for application development related to academia and industry. (*Synthesis*)

CO6: Review the choice of data structure and algorithms based on problem domain, also would be able to judge and assess the algorithm efficiency based on space and time complexity which forms the fundamental step in the design of an efficient program. (*Evaluation*)

Suggested Readings

1. Lipschutz, S., Theory and Problems of Data Structures (International Edition), Schaum's Outline Series, New Delhi: Tata McGraw-Hill.
2. Kanetkar, Y. P., Data Structures Through C Language, New Delhi: BPB Publications.
3. Chattopadhyay, S.; D. G. Dastidar; M. Chattopdhyay, Data Structures Through C Language, New Delhi: BPB Publications.

CSNW0026: COMPUTER NETWORK FUNDAMENTALS

(3 Credits - 45 Hours)

***Objective**: The objective of this course is to make the students understand basic terminologies of computer network along with their types, mode of communication, models, transmission media, connecting devices. It also emphasizes to make the students aware about network security and basic conception of World Wide Web.*

Module I (15 Hours)

Computer Network: Definition, Goals, Applications, Structure, Components, Topology, Types of Topology, Types of Networks (LAN, MAN, WAN, Internet), Broadcast and Point-To-Point Networks, Communications Types (Synchronous, Asynchronous), Modes of Communication, Topology, Client/Server architecture, Network Models, Design issues of the layer, Protocol Hierarchy, ISO-OSI Reference Model (Functions of each layer),Terminology, SAP, Connection Oriented and connectionless services, Peer Entities, TCP/IP model, Layers, Ports, Protocol Stack, Comparison of ISO-OSI and TCP/IP Model

Module II (10 Hours)

Transmission Media, Classes of Transmission Media, Guided Media: Coaxial Cable, Twisted Pair, Fiber Optics Cable, Connectors. Unguided Media (Wireless) Electromagnetic Spectrum for Wireless Communication, Propagation Methods (Ground, Sky, Line-of-Sight), Wireless Transmission, Radio Waves, Infrared, Microwave, Wireless LANs Architecture, MAC Sublayer, Frame Format, Frame Types, Bluetooth Architecture.

Module III (10 Hours)

Analog and Digital Signals, Data Encoding, Parallel and Serial Transmission, Network Connectivity Devices, Categories of Connectivity Devices, Passive and Active Hubs, Repeaters, Bridges, Switches (2-Layer Switch, 3-Layer Switch (Router)), Gateways, Network Interface Cards (NIC), Internetworking Principles.

Module IV (10 Hours)

Network Security : Definition, Network Security Requirements and Attacks, Network Security Devices (firewalls, Proxy Server), Encryption and Digital Signatures, Internet Basics, Concept of Intranet and Extranet, Web Server, World Wide Web (WWW) Architecture, Web Documents, Search Engines, Internet Service Providers (ISP).

COURSE / LEARNING OUTCOMES

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

CO1: Learn the basic concepts of Computer Networks, its goals and network related terminologies. (*Knowledge /Analysis*)
CO2: Get an awareness on various Networks concepts such as Types of networks, Topologies, Transmission media and can implement these concepts in setting up a lab in a real time scenario. (*Application*)
CO3: Gain information on Analog and Digital signals, Electromagnetic spectrum and related concepts on various architecture used in computer networks. (*Knowledge*)
CO4: Comprehend Network Security Devices, Digital Signature and Internet Basics. (*Comprehension*)
CO5: Evaluate the performance of the network based on the network criteria. (*Evaluation*)
CO6: Design the network with a suitable topology and network types. (*Synthesis*)

Suggested Readings

1. Andrew S. Tannenbaum, "Computer Networks", Tata McGraw-Hill Publishing Company Limited New Delhi.
2. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill Publishing Company Limited New Delhi.
3. William Stallings, "Data and Computer Communications", Pearson Education Asia.

CSWT0027: WEB TECHNOLOGIES

(4 credits-60 Hours)

Objective*: The course provides an introduction to the fundamentals and basic requirements of web technologies. After completion of this course, students should be able to design and implement a website on their own by including client-side and server-side technologies. Finally, the course also provides a basic knowledge of querying web databases to support a website having back-end information.*

Module I: Basic Internet-related Terms and Static Web Development (18 Hours)

a) Basic Terms: History of the Internet and the World Wide Web; W3C (World Wide Web Consortium); Levels of Internet Connectivity (Dial-up, Leased Line, DSL, VSAT); Requirements for Internet Connectivity; Search Engines, News-group, voice and video conferencing, E-mail and its Protocols; Web Portal; Different types of browsers (IE, Firefox, Chrome); URLs, Domain names

b) Static Web Development: Introduction to XHTML; HTML vs. XHTML, XHTML comments; Basic Tags-XHTML, HEAD, TITLE, BODY; Paragraph Tag, Horizontal Rule Tag, Headings Tags, Blockquote Tag, Lists, Linking, Images, Tables, FONT Tag, PRE, DIV and SPAN tags; other different formatting tags; Forms; Frames

Module II: CSS, DHTML and JavaScript (18 Hours)

a) Cascading Style Sheets: Types of Style Sheets-Inline, Embedded, and External; Conflicting Styles; Use of CSS for positioning elements, Background, and Text flow, CSS Box Model, CSS Borders and Outlines, Style class and Pseudo-class, CSS Image Gallery

b) DHTML: Introduction to DHTML and JavaScript, JavaScript vs. VBScript, Adding script to documents, Data types, operators, variables, input and output statements, Built in functions, Arrays, If statement, Switch statement, Looping statements, Loops, JavaScript Form Validation, Events in JavaScript

Module III: Website Design Considerations and XML (10 Hours)

a) Website Design Considerations: Planning to design a website, sitemaps, top-down vs. bottom up approach, Creating a Compatible web site for different color depths, resolutions, and browser considerations, validating a website

b) XML: Introduction to XML; Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Parser; Document Object Model; Extensible Stylesheet Language (XSL)

Module IV: Web Servers and PHP (14 Hours)

a) Web servers: Need of a web server; System Architecture of a Web server; HTTP Request Types; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Various web servers-Microsoft IIS, Apache, NGINX, LAMP, WAMP
b) PHP: Introduction to PHP; PHP Data Types; Control Structures; Functions; Strings; Arrays

COURSE / LEARNING OUTCOMES

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

CO1: Examine the growth of Internet and identify the history behind it. (*Knowledge*)
CO2: Identify and differentiate the various services provided by the internet. (*Comprehension*)
CO3: Experiment with various mark-up languages, style sheets and scripting languages. (*Application*)
CO4: Analyse and design a website of their own and can also identify the faults in the design. (*Analysis*)
CO5: Develop and create a website of their own. (*Synthesis*)
CO6: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (*Evaluation*)

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 4th Edition, Prentice Hall of India Pvt. Ltd. , New Delhi, 2009.
2. E. A. Meyer, CSS The Definite Guide, 3rd Edition, O'Reily.
3. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
4. R. Lerdorf, K. Tatroe, P. MacIntyre, Programming PHP, 3rd Edition, O'Reily.
5. T. McNavage, JavaScript for Absolute Beginners, Apress, 2010.

CSCD0028 : DIGITAL COMPUTER DESIGN

(3 credits – 45 hours)

Objective*: The objective of the course is to introduce the fundamental concepts of digital systems and basic tools used in the design and implementation of digital circuits.*

Module I: Data representation and arithmetic operations (5 Hours)

Introduction, numbering systems, decimal to binary conversion, binary coded decimal numbers, hamming code for error correction, alphanumeric codes.

Module II: Algebra for Digital systems (8 Hours)

Binary addition, binary subtraction, complement representation of numbers, addition/subtraction of numbers in 1's complement Notation, addition/subtraction of numbers in 2's complement Notation, binary multiplication, multiplication of signed numbers, binary division, arithmetic with binary coded decimal numbers, representation of integers, Floating point representation of numbers, Floating point arithmetic.

Module III: Logic gates and Boolean Algebra (7 Hours)

Introduction to Basic logic gates (AND, OR, NOT, NOR, NAND), Truth tables, simplification of truth tables, the K-map method, SOP and POS simplifications, Quine-McCluskey tabulation method.

Module IV: Combinational logic and Sequential logic (15 Hours)

a) Combinational logic: Introduction, Combinational circuits, Analysis procedure, design procedure Binary Adder-Subtractor, Decimal adder, binary multiplier, Magnitude comparator, decoders, encoders, multiplexers, HDL models and Combinational Circuits

b) Sequential logic: Introduction, Sequential circuits, Storage elements: Latches, Storage elements: Flip-flops, Analysis of clocked sequential circuits, State reduction and Assignment, Design procedure.

Module V: Digital integrated circuits (10 Hours)

Introduction, Special characteristics, Bipolar-Transistor characteristics, RTL and DTL circuits, Transistor- Transistor Logic, Emitter-Coupled logic, Metal-oxide semiconductor, complementary MOS, CMOS transmission gate circuits, Switch-level Modeling with HDL

Module VI: Memories (5 Hours)

Memory types and terminology, read only memory, Semiconductor RAMs, Non-volatile RAMs, Sequential memories, Programmable logic Devices, Magnetic memories, Optical disk memory, Charge coupled devices.

COURSE / LEARNING OUTCOMES

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

CO1: Define the fundamental concepts of digital systems and basic tools used in the design and implementation of digital circuits. *(Knowledge)*

CO2: Evaluate various Boolean algebra/ expressions derived from truth tables. *(Evaluation)*

CO3: Analyze the Boolean expressions and circuit diagrams. They will be able to provide the simplified expression to implement circuit diagrams with minimum number of logic gates. *(Analysis)*

CO4: Implement the Boolean expressions using Logic gates to design combinational and sequential circuits. *(Application)*

CO5: Propose and design simplified Boolean function to develop logic circuits. *(Synthesis)*

CO6: Understand the various concepts of Boolean algebra, Microprocessor, Digital Integrated Circuits and Memory unit. *(Comprehension)*

Suggested Readings

1. M.Morris Mano, Digital Logic and Computer Design, Pearson Education, 2009
2. V.Rajaraman, An Introduction to Digital Computer Design, 5th ed., PHI
3. R. P Jain,Modern Digital Electronics, 4th ed.,TMH
4. William Stallings, Computer Organization, PHI

CSOJ0029: OBJECT ORIENTED PROGRAMMING USING JAVA

(3 credits – 45 hours)

Objective*: The course is designed to impart the knowledge and skill required to solve real world problem using object-oriented approach utilizing Java language constructs. This course covers the two main parts of Java i.e. Java Language and Java Library (JDK 5). After completion of the course, a student is expected to be able to:*

- *Do object Oriented Programming using Java*
- *Implement Exception handling and create applets in Java.*
- *Create Java I/O Applications and Applets.*
- *Set up a GUI using Swing components.*

Module I: Core Java Programming (12 hours)

a) Java Overview: Genesis, Java Philosophy, Java and Internet, Object-Oriented Programming features, Java Applet and Application, Java Environment and Java Development Kit (JDK) and Java Standard Library (JSL)

b) Java language fundamentals: The scope and lifetime of variable, Type conversion and casting, Control statements, Arrays

c) Classes and objects: The this keyword, Garbage collection, Overloading constructor, Using object as parameters, Argument passing, Returning objects, Recursion, Introducing Access control (public, private and protected), static, final, nested classes, String class, Command-line argument.

Module II: Inheritance, Exception handling, and Applets (10 hours)

a) Inheritance: Member access and inheritance, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance, the Object class; Packages, Interface, classpath
b) Exception handling: Fundamentals, Exception types, Java's built-in exceptions, user defined exceptions.
c) I/O Basics: Streams, the stream classes, the predefined streams, Reading console input, writing console output.

Module III: String handling, Utility classes, java.lang and java.io (12 hours)

a) String handling: String constructors, methods for character extraction, string searching and comparison, data conversion using valueof(), StringBuffer
b) Exploring java.lang: Simple type wrappers, System class, class Class, Math functions
c) The utility classes: Vector, Stack, HashTable, StringTokenizer, Bitset, Date, Calendar, Gregorian Calendar, Random, Observable
d) Input/Output - Exploring java.io: The java.io classes and interface, File class and methods for creating, renaming, listing and deleting files and directories, I/O stream classes.

Module IV: Applet class and Swing (11 hours)

a) The Applet class: applet architecture, passing parameters to applets, getDocumentBase, getCodeBase, and showDocument, AppletContext and AudioClip interfaces, Graphics class and methods for drawing lines, rectangles, polygons and ovals
b) Swing: Component and Container classes, Layout managers (FlowLayout, GridLayout, BorderLayout), Handling events, Adapter classes, Anonymous inner classes
c) Swing GUI components : JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollBar, JScrollPane, JToolTip, JPanel, JFrame (f) Menus: JmenuBar, JMenu, JMenuItem, JSeparator.

COURSE / LEARNING OUTCOMES

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

CO1: Define and describe various terms and concepts of C programming language. *(Knowledge)*
CO2: Comprehend or interpret information based on their understanding of the concepts of C language's syntax, data types, control statements, functions, pointers, arrays, structures, pointers, files, graphics and hardware programing using C. *(Comprehension)*
CO3: Solve problems using standard algorithms and translate pseudo-codes into C programs and implement them. *(Application)*
CO4: Apply their analytical skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. *(Analysis)*
CO5: Combine the various concepts and ideas learnt in C to plan, propose and develop a product. *(Synthesis)*
CO6: Evaluate various algorithms used for searching, sorting etc. in terms of correctness and computation cost. *(Evaluation)*

Suggested Readings

1. Deitel, H. M.; P. J. Deitel, Java : How To Program (Sixth Edition), New Delhi: Prentice-Hall India
2. Schildt, H., The Complete Reference Java 2 (Fifth Edition), New Delhi: Tata McGraw-Hill
3. Russel, Java Programming for the absolute Beginner , New Delhi: Prentice-Hall India
4. Hanagan D., Java Examples in a Nutshell (Third Edition), New Delhi: O' Reilly

CSCG0030: COMPUTER GRAPHICS

(3 credits – 45 hours)

Objective*: Computer graphics is one of the most exciting and rapidly growing computer fields. It has got numerous areas of applications such as user interface, data visualization, television commercials, motion pictures, etc. This paper is meant to give the students knowledge of hardware, graphics concepts and algorithms to implement the concepts.*

Module I (7 Hours)

Overview of Graphics Systems : Video Display Devices, Refresh cathode-ray Tubes, Raster Scan Display, Random Scan Display Color CRT Monitor, Direct View Storage Tubes, Flat panel Display, Three Dimensional Viewing Devices, Stereoscopic and Virtual-Reality Systems, Raster Scan Systems Video Controller, Raster Scan Display Processor, Random-Scan Systems, Graphics Monitors and Workstations, Input Devices, Hard Copy Devices, Graphics Software, Coordinate Representations, Graphics Functions, Software Standards, PHIGS Workstations.

Module II (10 Hours)

Output Primitives: Points and Lines, Line Drawing Algorithms, Loading the Frame Buffer, Line Functions, Circle –generating Algorithms, Ellipse-generating Algorithms, Other Curves, Conic Sections, Polynomial and Spline Curves, Parallel Curve Algorithms, Curve Functions, Pixel Address and Object Geometry Screen Grid Coordinate, Maintaining Geometric Properties of Displayed Objects, Filled-Area Primitives, Scan-line polygon Fill Algorithm, Inside Outside Test, Scan –Line Fill of Curved Boundary Areas, Boundary Fill Algorithm, Flood Fill Algorithm, Fill-Area Functions, Cell Array, Character Generations.

Module III (10 Hours)

Two- Dimensional Geometric Transformations : Basic Transformations: Translations, Rotations, Scaling; Matrix Representations and Homogeneous Coordinates, Composite Transformations: Translations, Rotations, Scaling, General Pivot Point Rotations, General Fixed Point Scaling, General Scaling Directions, Concatenation Properties, General Composite Transformations and Computational Efficiency, Other Transformations: Reflections, Shear; Transformations Between Coordinate Systems, Affine Transformations, Transformation Functions, Raster Method for Transformations.

Module IV (10 Hours)

Two-Dimensional Viewing: The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-Viewport Coordinate Transformations. Two -Dimensional Viewing Functions, Clipping Operations, Point Clipping, Line Clipping: Cohen-Sutherland Line Clipping, Liang-Barsky Line Clipping, Nicholl-Lee-Nicholl Line Clipping; Polygon Clipping: Sutherland-Hodgeman Polygon Clipping, Weiler-Atherton Polygon Clipping; Curve Clipping, Text Clipping, Exterior Clipping.

Module V (8 Hours)

Three Dimensional Concept and Some Object Representation: Three-Dimensional Display Methods, Parallel Projections, Perspective Projections, Depth Cueing, Visible Line and Surface, Identification, Surface Rendering, Exploded and Cutway Views, Three-dimensional and Stereoscopic Views, Three Dimensional Graphic Packages, Polygon Surfaces, Polygon Tables, Place Equations, Polygon Meshes, Curved Line and Surfaces, Quadric Surfaces: Sphere, Ellipsoid, Torus, Superquadrics, Superellipse, Superellipsoid, Blobby Objects, Spline Representations, Interpolations and Approximations Splines, Parametric Continuity Conditions, Geometric Continuity Conditions, Spline Specifications, Cubic Spline Interpolation Methods, Natural Cubic Splines, Hermite Interpolations, Cardinal Splines, Kochanek-Bartels Splines, Bezier Curves, Properties of Bezier Curves, Design Technique Using Bezier Curves, Cubic Bezier Curves, Bezier Surfaces.

COURSE / LEARNING OUTCOMES

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

CO1: Understand various graphics systems, Graphics software and software standards. (*Knowledge*)

CO2: Comprehend the output primitives that will comprise of various algorithms. (*Comprehension*)

CO3: Design simple applications of computer graphics. (*Application*)

CO4: Examine the 2D transformations, 2 D viewing and concepts on 3D dimensional concepts and some object representation. (*Analysis*)

CO5: Draw lines, curves, circle using algorithms and implement many functions to fill colors; further they will be able to design animations using various transformations. (*Synthesis*)

CO6: Evaluate the performance of the algorithms that will be required to design the shapes and curves. (*Evaluation*)

Suggested Readings

1. Donald Hearn and M Pauline Baker, Computer Graphics, 2^{nd} Edition, PHI, India.
2. R Plastock and G Kalley, Theory and Problems of Computer Graphics, 2^{nd} Edition, Schaum's Series, Mc GrawHill.
3. J Foley and A Van Dam, S Feiner , J Huges., Computer Graphics : Principles and Practice, Addison – Wesley.
4. D Rogers and J Adams, Mathematical Elements for Computer Graphics, 2^{nd} Edition, McGraw Hill, International Edition.

CSDC0031: DATA COMMUNICATIONS AND NETWORKS I

(4 credits – 60 hours)

Objective*: Data communications and networking may be the fastest growing technologies in our culture today. One of the ramifications of that growth is a dramatic increase in the number of professionals where an understanding of these technologies is essential for success. This course deals with the introduction and the first two layers of the OSI model. The students, at the end of this course, will have a more than elementary idea about the technologies/protocols involved in the physical and data link layer, including the medium access control sublayer of the latter.*

Module I: Introduction to Computer Networks (6 Hours)

Uses of Computer Networks; Wired and wireless Networks; Types of networks – LAN, MAN, WAN; Network Topology; OSI Reference Model – Outline, Protocol hierarchies, Design considerations; TCP-IP Reference Model; ATM Reference Model; Comparison among these reference models; Examples- Internet, X.25, Frame Relay, ATM

Module II: Physical Layer (17 Hours)

Fourier Analysis (Qualitative), Maximum data rate of a Channel, Bit rate and Baud; Baseband and Broadband; Guided Transmission Media- Magnetic, Twisted pair, Coaxial cable, Fibre Optics; Wireless transmission – Electromagnetic Spectrum, Radio transmission, Microwave Transmission, Infrared transmission; Comparison among the different transmission media – guided and unguided; Communication Satellite – LEO, MEO and GEO Satellite; Amplitude, Phase and Frequency modulation – QPSK, QAM, Frequency Division and Time Division Multiplexing – PCM, Delta Modulation, SONET; Circuit, Message and Packet Switching; Outline of PSTN, ADSL, WLL, AMPS, D-AMPS, GSM, CDMA

Module III: Data Link Layer (17 Hours)

Design Issues - Services provided to the higher layer, Framing, Error Control, Flow Control; Error Detection and Correction – Error Correcting Codes, Error-Detecting Codes; Elementary Data Link Protocols – Unrestricted simplex protocol, Simplex stop-and-wait protocol, Protocol for Noisy Channel; Sliding Window protocols – One bit sliding window, Go Back n protocol,

Protocol using Selective Repeat; Examples – HDLC, Data Link Layer in the Internet, PPP

Module IV: Medium Access Control Sublayer (20 Hours)
Channel Allocation Problem – Static and Dynamic channel allocation; Multiple access – Aloha, Slotted Aloha, CSMA; Collision free protocols; Limited Contention Protocols; Wireless LAN protocols – MACA, MACAW; IEEE Standard 802.3 – Ethernet, Cabling, Encoding, MAC Sublayer, Switched Ethernet, Fast Ethernet Gigabit Ethernet; IEEE Standard 802.11 – Protocol Stack, Physical Layer, MAC Sublayer, Frame Structure; IEEE Standard 802.16 – Protocol Stack, Physical Layer, MAC Sublayer, Frame Structure; Bluetooth- Architecture, Application, Protocol Stack, Radio Layer, Baseband layer, Frame Structure; Bridges – Spanning tree bridges, Remote bridges

COURSE / LEARNING OUTCOMES

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

CO1: Understand and identify different networking terminologies such as TCP/OSI,protocols, routing , link errors etc.; Understand and learn different network typologies, Fourier analysis, data link layer design issues and channel allocation problem in network; Understand the theory behind designing a network model and its importance. (*Knowledge*)

CO2: Students would be able to distinguish TCP from OSI, different physical layer transmissions, modulation and demodulation techniques. (*Comprehension*)

CO3: Students would be able to apply the knowledge to solve different problems related to Fourier analysis of a signal, spectrum analysis, medium access protocols etc. (*Application*)

CO4: Students would be able to analyze the pros, cons and implementation of different modulation techniques, encoding and decoding techniques, IEEE standards. (*Analysis*)

CO5: Students would be able to create circuit design for Lan communication, signal modulation and demodulation. (*Synthesis*)

CO6: Students would be able to judge which protocols operates in which layer and why, which encoding is efficient than the other and for what reason etc. (*Evaluation*).

Suggested Readings

1. Andrew S. Tenenbaum, Computer Networks, Fourth Edition, Prentice Hall of India, 2002
2. Behrouz A Forouzan, Data Communication and Networking, Second Edition, Tata McGraw Hill, 2000
3. William Stallings, Data and Computer Communications, Sixth Edition, Prentice Hall of India, 2000
4. Fred Halsall, Data Communication, Computer Networks and Opens Systems, Fourth Edition, Pearson Education, 2000

CSOS0032: OPERATING SYSTEMS
(4 credits – 60 hours)

Objective*: The main objective of this course is to introduce the students to a layer of software called Operating Systems, whose job is to manage all the devices of a computer system and provide user programs with a simple interface to the hardware. This course will familiarize the students with the concepts of processes, memory management, file management, Input/Output management and the potential problem of deadlocks. The students will also learn about the Linux operating system, which is a full-blown Unix clone and is fast gaining popularity worldwide.*

Module I: Concepts, Processes and Threads (14 Hours)
Operating system as an Extended Machine and as a Resource Manager, Operating system concepts (Files, Deadlocks, Memory Management, Input/Output, Processes, The Shell, Security), The evolution of Operating Systems (Serial Processing, Simple Batch Systems, Multiprogrammed Batch Systems, Mainframe Operating Systems, Server Operating Systems, Time Sharing Systems, Multiprocessor Operating Systems, Real-Time Systems, Embedded Operating Systems, Smart Card Operating), System Calls (Process Management, File Management, Directory management), Introduction to Processes (The Process Model, Process Creation, Process Termination, Process Hierarchies, Process States, Implementation of Processes, Process Control Block), Threads (The Thread Model, Thread Usage, Implementing Threads(In User Space and Kernel), Scheduler Activation, Pop Up Threads, Interprocess Communication (Race conditions, Critical Sections, Mutual Exclusion with Busy Waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message Passing), Classical IPC problems (The Dining Philosophers Problem, The Sleeping Barber Problem), Process Scheduling (Scheduling in Batch Systems, Scheduling in Batch Systems, Scheduling in Interactive Systems, Scheduling in Real-Time Systems, Thread Scheduling)

Module II: Deadlocks and Memory Management (14 Hours)
a) Resources, Deadlock (Conditions for Deadlock, Deadlock modeling), Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention
b) Memory management without swapping or paging (Monoprogramming without swapping or paging, Multiprogramming with fixed partitions, Relocation and Protection), Swapping, Virtual Memory (Paging, Page Tables), Page Replacement Algorithms (Not-recently-used, First in first out, Second Chance page replacement algorithm, The Clock Page Replacement Algorithm, Least Recently used page replacement algorithm, The Working Set Page Replacement Algorithm, Modeling Paging Algorithms (Belady's Anomaly, Stack Algorithms, Predicting page fault rates), Design issues for Paging Systems, Implementation issues, Segmentation (Implementation of pure segmentation, Segmentation with Paging: MULTICS)

Module III: Input/output and File Systems (16 Hours)
a) Principles of I/O hardware (I/O devices, Device Controllers, Direct memory access), Principles of I/O software, I/O Software Layers, Disks (Disk hardware, disk formatting, disk arm scheduling algorithms, Error handling, Track-at-a-time caching, RAM disks) Clocks (Clock hardware, Clock software), Terminals (Terminal hardware, Input software, Output software)
b) Files (File Naming, File structure, File types, File access, File attributes, File operations, Memory mapped files), Directories, File System layout (Implementing files, Implementing directories, Shared files), Security (The security environment, Generic Security Attacks, Design Principles For Security, User Authentication), Protection mechanisms (Protection Domains, Access Control Lists, Capabilities, Multilevel Security, Covert Channels), Type of File Systems (FAT, VFAT, FAT32, NTFS)

Module IV: Introduction to Linux OS design – Case study (16 Hours)
Overview of Unix, Processes in Unix (Fundamental Concepts, Process Management System Calls in Unix, Implementation of Processes in Unix), Memory Management in Unix, Input/Output in Unix, The Unix File System, Security in Unix

COURSE / LEARNING OUTCOMES

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

CO1: Identify the different types of operating systems. (*Knowledge*)
CO2: Describe the different functions of operating systems. (*Comprehension*)
CO3: Interpret any tasks performed by computer in terms of system call. (*Application*)
CO4: Summarize the different threading models. (*Comprehension*)
CO5: Interpret the different page replacement algorithms. (*Application*)

CO6: Categorize the different types of memory in to different classes. (*Synthesis*)
CO7: Describe the different types of Input /Output mechanisms. (*Evaluation*)

Suggested Readings

1. Andrew S Tanenbaum, Modern Operating Systems , (Second Ed.), Prentice Hall of India, New Delhi, 2002
2. William Stallings, Operating Systems, Fourth Edition, Prentice Hall of India, New Delhi.
3. Silberschatz, Galvin, Operating System Concepts, Fifth Edition, John Wiley and Sons (Asia) Pte Ltd.
4. HM Deitel, Operating Systems, Second Edition, Pearson Education.
5. Pramod Chandra P. Bhatt, An Introduction to Operating Systems Concept, Prentice Hall of India.
6. Maurice J. Bach, The Design of the Unix Operating System, Prentice Hall of India, New Delhi.
7. Kernighan and Pike, The Unix Programming Environment, Prentice Hall of India, New Delhi.

CSDA0033: DESIGN AND ANALYSIS OF ALGORITHMS

(4 credits – 60 hours)

Objective*: The study of algorithms is at the heart of computer science. In recent years, a number of advances have been made in the field of designing of algorithms. This course is meant to give students an in-depth knowledge to analyze and design a better algorithm before its actual implementation.*

Module I (16 Hours)

a) Models 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 Hours)

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, Concatanable queues, Partitioning.

Module III (14 Hours)

a) Algorithms on Graphs: Minimum-cost spanning trees, Depth-first search, Biconnectivity, 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 (10 Hours)

a) NP-Complete Problems: Nondeterministic Turing machine, The classes P and NP, Languages and problems, NP-completeness of the satsifiability 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 (10 Hours)

a) Data Structures and Algorithms for External Storage: A model for External computation, External sorting, Storing information in files, External search trees.

b) 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.

COURSE / LEARNING OUTCOMES

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

CO1: Know the formal definition of algorithms, importance of analysis of an algorithm and their asymptotic bounds. Students would get familiar with different types of problem and their solutions. (*Knowledge*)

CO2: Understand different design strategies such as brute force, divide and conquer, dynamic programming, greedy and backtracking used for the design of algorithms. (*Comprehension*)

CO3: Design and analyse algorithms for given problems. (*Application*)

CO4: Compare and analyse different design strategies. (*Analysis*)

CO5: Design new algorithms for given problems by using most appropriate algorithmic strategy considering the problem domain. (*Synthesis*)

CO6: Assess various algorithms in terms of correctness, computation cost and memory space used. (*Evaluation*)

Suggested Readings

1. Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, The Design and Analysis of Computer Algorithms. Addision Wesley, 2001. (Modules I, II, III and IV)
2. Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, Data Structures and Algorithms.. Addision Wesley, 2000. (Modules I and V)
3. Thomas H Corman, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, 2_{nd} ed., PHI, 2004.
4. V Manbar, Introduction to Algorithms - A Creative Approach, Addision Wesley, 2000.
5. Ellis Harwitz, Sartaz Sahani, Fundamentals of Computer Algorithms.. ,Computer Science Press, 2000.
6. Peter Linz, An Introduction to Formal Languages and Automata. Narosa Publishing House 2001.

CSPJ0034: PROGRAMMING THROUGH JAVA

(4 credits–60 hours)

Objective*: The course is designed to impart the knowledge and skill required to solve real world problem using object-oriented approach utilizing Java language constructs. This course covers the two main parts of Java i.e. Java Language and Java Library (JDK 5). After completion of the course, a student is expected to be able to*

- *Do Object Oriented Programming using Java*
- *Implement Exception handling and Multithreading in Java.*
- *Create Java I/O Applications and Applets.*
- *Set up a GUI using Swing components*
- *Do Network Programming in Java.*
- *Access relational databases from Java program and use Java Beans and Servlets.*

Module I: Core Java Programming (14 Hours)

a) Java Overview: Genesis, Java Philosophy, Java and Internet, Object-Oriented Programming features, Java Applet and Application, Java Environment and Java Development Kit (JDK) and Java Standard Library (JSL),
b) Java language fundamentals: The scope and lifetime of variable, Type conversion and casting, Control statements, Arrays
c) Classes and objects: The this keyword, Garbage collection, Overloading constructor, Using object as parameters, Argument passing, Returning objects, Recursion, Introducing Access control (public, private and protected), static, final, nested classes, String class, Command-line argument

Module II: Inheritance, Exception handling, Multithread and Applets (12 Hours)

a) Inheritance: Member access and inheritance, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance, the Object class; Packages, Interface, classpath
b) Exception handling: Fundamentals, Exception types, Java's built-in exceptions, user defined exceptions.
c) Multithreaded Programming: The Java thread model (thread priorities, synchronization and inter-thread communication); Deadlock, Thread Group
d) I/O Basics : Streams, the stream classes, the predefined streams, Reading console input, writing console output, the transient and volatile modifiers, using instance of native methods

Module III String handling, Utility classes, java.lang and java.io (12 Hours)

a) String handling: String constructors, methods for character extraction, string searching and comparison, data conversion using valueof (), StringBuffer
b) Exploring java.lang: Simple type wrappers, System class, class Class, Math functions
c) The utility classes: Vector, Stack, HashTable, StringTokenizer, Bitset, Date, Calendar, GregorianCalendar, Random, Observable
d) Input/Output - Exploring java.io: The java.io classes and interface, File class and methods for creating, renaming, listing and deleting files and directories, I/O stream classes (FileInputSream, FileOutputStream, BufferedInputStream, BufferedOutputStream, PushBackInputStream, InputStreamReader, BufferedReader, BufferedWriter, PrintStream, RandomAccessFile)

Module IV: Networking, Images, Applet class and Swing (12 Hours)

a) Networking: Socket overview, Stream Sockets, Datagram sockets, Manipulating URLs, Establishing a simple Server/Client using Stream Sockets, Connectionless Client/Server Interaction with Datagrams
b) Images: File formats, image fundamentals, creating, loading and displaying images, ImageObserver, MediaTracker
c) The Applet class: applet architecture, passing parameters to applets, getDocumentBase, getCodeBase, and showDocument, AppletContext and AudioClip interfaces, Graphics class and methods for drawing lines, rectangles, polygons and ovals
i) Swing: Component and Container classes, Layout managers (FlowLayout, GridLayout, BorderLayout), Handling events, Adapter classes, Anonymous inner classes
ii) Swing GUI components : JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollBar, JScrollPane, JToolTip, JPanel, JFrame
iii) Menus: JmenuBar, JMenu, JMenuItem, JSeparator

Module V: Java Beans, JDBC, Java Servlets (10 Hours)

a) Java Beans: Introducing JavaBeans Concepts and Bean Development Kit (BDK), Using the Bean Box, Writing a simple Bean, Bean Properties (simple properties), Manipulating events in the Bean Box

b) Java database connectivity (JDBC): Introduction to JDBC, type of JDBC connectivity, Establishing database connections, Accessing relational database from Java programs

COURSE / LEARNING OUTCOMES

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

CO1: Describe the various features of Object Oriented programming by utilizing the JAVA language construct. (*Knowledge*)

CO2: Explain the standard library, scope and lifetime of a variable and various control statements used in JAVA program. (*Comprehension*)

CO3: Interpret the concept of classes and object in JAVA and apply exception handling to solve various exceptions. (*Application*)

CO4: Contrast the different type of inheritance and polymorphism and analyze it in resolving various problems. (*Analysis*)

CO5: Develop algorithms based on the knowledge they have gained to design cost effective and user friendly application. (*Synthesis*)

CO6: Select the appropriate GUI and will be able to justify their decision to use a particular GUI by evaluating the required parameters depending on the domain and requirement. (*Evaluation*)

Suggested Readings

1. Deitel, H. M.; P. J. Deitel, Java : How To Program (Sixth Edition), New Delhi: Prentice-Hall India, 2005
2. Schildt, H., The Complete Reference Java 2 (Fifth Edition), New Delhi: Tata McGraw-Hill, 2005
3. Moss, K., Java Servlets (Second Edition), New Delhi: Tata McGraw-Hill
4. Russel, Java Programming for the absolute Beginner , New Delhi: Prentice-Hall India
5. Hanagan D., Java Examples in a Nutshell (Third Edition), New Delhi: O' Reilly, 2001

CSOS0035: INTRODUCTION TO OPERATING SYSTEMS

(4 credits -60 hours)

Objective: *To provide the basic functionalities and services provided by an operating system. This subject provides an overview of process management, memory management, deadlock, file system, input-output systems and protection and security. It give knowledge on existing common operating system like UNIX, Linux and Windows.*

Module I: Introduction to Operating systems (8 Hours)

Definition of Operating Systems, Functions of Operating Systems, Types of Operating Systems: Batch, Multiprogrammed, Time sharing, Multi-Processor, Real-time and Distributed Operating Systems, Operating System Structures, Components and Services, System calls.

Module II: Process Management (10 Hours)

Process Concept-Definition, Process States, Process Control Block, Process Schedulers- Short term, Medium term and Long term schedulers, Scheduling Algorithms - Preemptive and Non-Preemptive, Co-operating process, Threads, Inter-process communication.

Module III: Process Synchronization and Deadlock (12 Hours)

Process Synchronization-the Critical Section Problem, Classical Problems of Synchronization, Semaphores. Deadlocks - Definition of a Deadlock, System model, Characterization, Deadlock Handling-Prevention, Avoidance, Detection and Recovery (Banker's Algorithms and Resource Request Algorithm

Module IV: Memory Management (10 Hours)
Memory Management- Logical and Physical Address Space, Address Mapping, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging. Virtual memory-Demand paging and its performance, Page replacement algorithms- FIFO and LRU, Thrashing.

Module V: File and I/O System Management (12 Hours)
a) File management (Systems, Secondary Storage Structure)-File Concepts, Access methods, Directory Structure, Protection and consistency, Recovery.
b) I/O System Management- Overview of I/O Systems, I/O Interface, Secondary Storage Structure-Disk Structure and Scheduling methods, Disk management, Swap – Space management.

Module VI: Protection and Security (8 Hours)
Goals of protection, Domain Protection, Access matrix, Security Problem, Authentication, Case Study of Windows and Linux Operating System.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO1: Understand the basic concepts of operating systems and terminology related to operating systems. (*Analysis*)
CO2: Understand various management concepts and can use process management techniques with respect to operating systems. (*Application*)
CO3: Apply the memory management techniques for operating systems. (*Application*)
CO4: Understand the File and I/O system management in operating systems. (*Comprehension*)

Suggested Readings
1. Abraham Silberschatz and Peter Baer Galvin, "Operating System Concepts", 7th Edition, Pearson Education, 2002.
2. Tannenbaum ,"Modern Operating Systems", PHI
3. William Stallings, "Operating Systems", 6th Edition, Pearson Education, 2010.
4. Harvey M. Deitel, Operating Systems, Second Edition, Pearson Education Pvt. Ltd.
5. Mandik and Donovan, Operating Systems, Mcgraw Hill.

CSSD0036: SYSTEM ANALYSIS AND DESIGN
(4 credits - 60 hours)

Objective*: To provide various concepts of systems analysis and design. It will impart the knowledge and skills required for analysis, design, and development of an information system. Upon completion, students should be able to analyze a problem and design an appropriate solution using a combination of tools and techniques.*

Module I : Introduction to Information Systems (15 hours)
Types of Information Systems, Architecture based Information systems - Centralized Systems, Distributed Systems. The concept of system analysis and design, the stakeholders and their role: Systems users, Systems owners, Systems designers, Systems builders, Systems analysts. Tools for system development - Analysis tools, Fact Finding Techniques, Design tools and Development tools. Determination of system requirement, Activities in requirement determination. Fact Finding Techniques - Interview, Questionnaire, Record review, Observation.

Module II: Structured analysis (18 hours)
a) Methods and tools, Role of prototyping in the analysis. Tools and techniques for Modeling, Data flow diagram, Data dictionary, documenting decisions and procedures - Decision trees and Decision tables, Structures English. System Flow Charts, Program Flow Charts.

b) System Development Life Cycle, Phases of SDLC, SDLC models - Waterfall Model, Iterative Model, Spiral Model, etc.

Module III: The design concept of a system (15 hours)
The Design phase, Elements of design- design of Input, the design of output, the design of files, the design of control and procedure, the design of database interactions. Top down and Bottom up design.

Module VI: Testing and Documentation (12 hours)
Testing strategies, types of testing. User training, System audits. Documentation, Program structured charts, Software design and documentation tools, structured flow charts. Selection of Hardware and Software, Categories of automated tools- Front-end tools, Back-end tools, integrated tools, Case Tools.

COURSE / LEARNING OUTCOMES

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

CO1: Define and describe the five phases of the system development life cycle. (*Knowledge*)
CO2: Gather data to analyze and specify the requirements of a system and design system components and environments. (*Comprehension*)
CO3: Build general and detailed models that assist programmers in implementing a system. (*Application*)
CO4: Analyze a problem and design an appropriate solution using a combination of tools and techniques. (*Analysis*)
CO5: Determine methods for evaluating the effectiveness and efficiency of a system. (*Synthesis*)
CO6: Design a database for storing data and a user interface for data input and output, as well as controls to protect the system and its data. (*Evaluation*)

Suggested Readings

1. System Analysis and design - Preeti Gupta, Firewall media
2. Systems Analysis and Design, 9th Edition Kenneth E. Kendall, Julie E. Kendall, Pearson
3. System Analysis and Design, Fifth Edition by Roberta M. Roth, Barbara Haley Wixom, Alan Dennis, John Wiley and Sons
4. System Analysis and Design **-** Hitesh Gupta, India Book House Ltd
5. System Analysis And Design – V. K. Jain, Dreamtech Press

CSCO0038: COMPUTER ORGANISATION AND ARCHITECTURE

(4 credits – 60 hours)

Objective*: This course covers the organization of modern computer systems. It helps in learning how to program computers at the assembly level as well as how to design the main components of a Von Neumann computer system, including its instruction set architecture, data path, control unit, memory system, input/output interfaces, and system buses.*

Module I: Introduction (10 hours)
Number representation; fixed and floating point number representation, IEEE standard for floating point representation. Error detection and correction codes: Hamming code. Digital computer generation, computer types and classifications, functional units and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer.

Module II: Central Processing Unit (10 hours)
Addition and subtraction of signed numbers, look ahead carry adders. Multiplication: Signed operand multiplication, Booth's Multiplication Algorithm; Division Algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Processor organization, general register organization, stack organization and addressing modes.

Module III: Control Unit (10 hours)
Instruction types, formats, instruction cycles and subcycles (fetch and execute etc), micro-operations, execution of a complete instruction. Hardware and microprogrammed control: microprogramme sequencing, wide branch addressing, and microinstruction with next address field, pre-fetching microinstructions, concept of horizontal and vertical microprogramming.

Module IV: Memory (10 hours)
Basic concept and hierarchy, semiconductor RAM memories, 2D and 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues (performance, address mapping and replacement) Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation.

Module V: Input / Output (10 hours)
Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous and asynchronous communication, standard communication interfaces.

Module VI: Pipelining (10 hours)
Basic Concepts, performance, floating point arithmetic, operations, instruction pipelining in RISC, pipelining in computer arithmetic, Data Hazard, Instruction hazard, Influence on Instruction set, datapath and controls consideration, Superscalar Operation.

COURSE / LEARNING OUTCOMES

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

CO1: Familiarize oneself with the architecture and organization major components of modern computer systems. (*Knowledge*)

CO2: Describe the functioning and interconnection of major components of computer systems. (*Comprehension*)

CO3: Understand different design issues associated with the design of any architecture. (*Comprehension*)

CO4: Apply their logic in designing simple control unit, instruction sets, instruction format, buses and register set etc. (*Application*)

CO5: Compare and analyse different styles, strategies and formats adopted for designing the instruction set, register set, memory organization etc. (*Analysis*)

CO6: Construct and organize a new architecture by considering various design issues in order to make it more efficient with less overhead. (*Synthesis*)

CO7: Assess various architectures and their design considerations. (*Evaluation*)

Suggested Readings

1. M. Morris Mano, Computer System Architecture, PHI
2. William Stallings, Computer Organization, PHI
3. Vrunesic, Hamacher and Zaky, Computer Organization, TMH
4. Patterson, Computer Organisation and Design, Elsevier Pub. 2009
5. John P Hayes, Computer Organization, McGraw Hill
6. K.K Tripathi, Rajesh K. Gangawar, Microprocessor and its Applications, Acme Learning, New Delhi, 2010
7. Brey, Barry B, INTEL Microprocessors, PHI

CSDB0039: RELATIONAL DATABASE MANAGEMENT SYSTEMS

(4 credits – 60 hours)

Objective*: The objectives for this course are to give students an in-depth understanding of the relational model for establishing fundamental skills with SQL and the operation of an RDBMS. The course also provides concept of data modelling, design and management for solving realistic problems.*

Module I (15 hours)

a) Database System Architecture - Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages.

b) Data models - Entity Relationship(ER), Enhanced Entity Relationship (EER): specialization, Aggregation, Mapping ER Model to Relational Model, Network. Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

Module II (22 hours)

Relation Query Languages, SQL queries fro retrieval and data changing commands, Relational Algebra, Tuple and Domain Relational Calculus, SQL and QBE. Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.

Module III (8 hours)

Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Join strategies, Query Optimization Algorithms.

Module IV (15 hours)

a) Storage Strategies: Indices, B-Trees, Hashing, Transaction processing: Recovery and Concurrency Control, Locking and Timestamp based Schedulers, Multiversion and Optimistic Concurrency Control Schemes.

b) Advanced topics: Object-Oriented and Object Relational databases. Logical Databases, Web Databases, Distributed Databases, Data Warehouse and Data Mining.

COURSE / LEARNING OUTCOMES

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

CO1: Describe the fundamental concepts necessary for designing, using and implementing database systems and applications. (*Knowledge*)

CO2: Explain the core terms, concepts, and tools of relational database management systems. (*Comprehension*)

CO3: Correctly use the techniques, components and tools of a typical database management system to build a comprehensive database information system. (*Application*)

CO4: Use relational algebra, TRC, and SQL to solve queries related to database tables. (*Application*)

CO5: Compare and contrast all the physical file storage techniques and various facilities provided by database management systems. (*Analysis*)

CO6: Design ER-diagrams and corresponding schema diagrams for handling database projects. (*Synthesis*)

CO7: Evaluate and justify the database-related design diagrams related to any database project. (*Evaluation*)

Suggested Readings

1. Ramez Elmasri and Shamkant B Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education

2. Abraham Silberschatz, Henry F Korth and S Sudarshan, Database System Concepts, 5th Edition, Mc-Graw Hill.

3. C.J. Date, Introduction to Database Systems, 8th ed., Pearson Education.
4. Bipin Desai, An introduction to Database System, Galgotia Publication.

CSSG0040: SYSTEM PROGRAMMING

(3 credits – 45 hours)

***Objective**: The course is aimed at presenting the programming concepts of several system software such as assembler, linker, loader, macro processor, and other software.*

Module I: Assemblers (12 hours)
Overview of the assembly process, Machine dependent assembler features, Machine independent assembler features, Design of two pass assembler, single pass assembler.

Module II: Loaders and linkers (13 hours)
Loader functions, program relocatability, absolute and bootstrap loader, Overview of linkage editing- linking loader-Dynamic linking, Design of the linkage editor, study of executable linkable file, DLL.

Module III: Macroprocessors (15 hours)
Macro definition and usage, two pass macro, one pass macro, Schematics for Macro expansion- Generation of unique labels, Conditional macro expansion, Recursive macro expansion, Macro with language interpreter.

Module IV: Software tools (5 hours)
Introduction to software tools, text editor, Interpreter, Program generator, Debug monitor.

COURSE / LEARNING OUTCOMES

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

CO1: List the data structures used in designing –assembler, macro preprocessor, linkers-loaders and will also be able to state their functions in a computer system. (*Knowledge*)
CO2: Recognize different types of assembly statements and thus will be able to label the statements of a given assembly program as one of the type. (*Knowledge*)
CO3: Differentiate between system programs and application programs and will also be able to discuss the role of system program in a computer system. (*Comprehension*)
CO4: Describe different types of editors and will also be able to illustrate their working principle. (*Comprehension*)
CO5: Construct the data structures required to construct different system programs like-for assembler: Symbol Table, Literal Table, Pool Table, IC-Variant-I, IC-Variant-II,for direct linking loader: GEST, LESA, PLA, IPLA,for macro preprocessor: ALU, MNT, MDT etc. (*Application*)
CO6: Produce the machine code for a given assembly code. (*Application*)
CO7: Compare different types of loaders, multipass assembler and single pass assembler, functions and macros. (*Analysis*)
CO8: Analyse the efficiency of IC Variant-I and IC Variant-II. (*Analysis*)
CO9: Develop elementary assembler and macro preprocessor. (*Synthesis*)
CO10: Write the pseudocode for two-pass assembler, macro preprocessor, linkers and loaders. (*Synthesis*)
CO11: Summarize the functionalities of debug monitor and user interface. (*Evaluation*)
CO12: Justify the requirement of multiple passes in designing assembler, macro preprocessor, loaders and linkers. (*Evaluation*)

Suggested Readings

1. John J. Donovan, Systems Programming, 1st ed., McGraw Hill.
2. Leland L. Beck, System Software - An Introduction to System Programming, 3rd ed., Pearson.
3. D.M.Dhamdhere, System Programming and Operating Systems, TMH.
4. P. Balakrishna Prasad, Operating Systems and system Programming, 2nd ed., Scitech.

CCSSE0041: SOFTWARE ENGINEERING

(4 credits–60 hours)

***Objective**: The field of software engineering aims to find answers to the many problems that software development project is likely to meet when constructing large software systems. The objective of this paper is to make students aware of the problems incurred by large-scale software development and the solutions proposed. It covers a framework for studying and evaluating software tools, and stresses the importance of theory in the development of software.*

Module I (10 Hours)

a) The Product and The Process: The Product - Evolving Role of Software, Software (Characteristics, Components and Applications;
b) The Process – Software Engineering A Layered Technology, The Software Process, Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Process Models (The Incremental Model, The Spiral Model, The Component Assembly Model, The Concurrent Development Model), The Formal Methods Model, Fourth Generation Techniques;
c) Project Management Concepts – The Management Spectrum (People, The Problem, The Process and The Project);
d) Software Process and Project Metrics – Measures, Metrics and Indicators, Metrics in the Process and Project Domains, Software Measurement, Reconciling Different Metrics Approaches, Metrics for Software Quality;
e) Software Project Planning – Observation on Estimating, Project Planning Objectives, Software Scope, Resources, Project Estimation Technique – Empirical estimation techniques (Expert Judgement Technique, Delphi Cost Estimation), Heuristic estimation techniques (COCOMO Model), Halstead Software Science (An Analytical Technique), The Make-Buy Decision;

Module II (10 Hours)

a) Project Scheduling and Tracking - Basic Concepts, The Relationship between People and Effort, Defining a Task set for the Software Project, Selecting Software Engineering Tasks, Defining a Task Network, Scheduling, The Project Plan;
b) Software Projects Risks, Quality Assurance and Configuration Management: Risk Management- Reactive Vs. Proactive Risk Strategies, Software Risk, Risk Identification, Risk Projection, Risk (Mitigation, Monitoring and Management), Safety Risks and Hazards, The RMMM Plan;
c) Software Quality Assurance - Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Statistical Quality Assurance, Software Reliability, The SQA Plan, The ISO 9000 Quality Standards;
d) Software Configuration Management - Software Configuration Management, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting;
e) System Engineering - Computer Based Systems, Product Engineering

Module III (20 Hours)

a) Analysis and Design: Analysis Concepts and Principles - Requirements Analysis, Communication Techniques, Analysis Principles, Software Prototyping, Specification, Specification Review;
b) Analysis Modeling- The Elements of the Analysis Model, Data Modeling, Functional Modeling and Information Flow, Behavioral Modeling, The Mechanics of Structured Analysis, The Data Dictionary;
c) Design Concepts and Principles - Software Design And Software Engineering, The Design Process, Design Principles, Design Concepts, Effective Modular Design, Design Heuristic for Effective Modularity, The Design Model, Design Documentation;
d) Design Methods - Data Design, Architectural Design, The Architectural Design Process, Architectural Design Optimization, Interface Design, Human-Computer Interface Design, Interface Design Guidelines, Procedural Design;
e) Design For Real Time systems - Real Time Systems;
f) Case studies on diagram - Use case, Class, Activity, Sequence

Module IV (10 Hours)

a) Software Testing: Software Testing Methods - Software Testing Fundamentals, Test Case Design, White Box Testing, Basis Path Testing, Control Structure Testing, Black Box Testing, Testing for Specialized Environments;
b) Software Testing Strategies - A Strategic Approach to Software Testing, Strategic Issues, Unit Testing, Integration Testing, Validation Testing, System Testing, The Art of Debugging;
c) Technical Metrics For Software - Software Quality, A Framework For Technical Software Metrics, Metrics for the Analysis Model, Metrics for the Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Maintenance

Module V (10 Hours)

a) Object Oriented Software Engineering: Object Oriented Concepts and Principles - The Object Oriented Paradigm, Object Oriented Concepts, Identifying the Elements of an Object Model, Management of Object Oriented Software Projects
b) Object Oriented Analysis - Object Oriented Analysis, Domain Analysis, Generic Components of the Object Oriented Analysis Model, The OOA Process, The Object Relationship Model, The Object Behavior Model
c) Object Oriented Design - Design for Object Oriented Systems, The Generic Components of the OO Design Model, The Systems Design Process, The Object Design Process, Design Patterns, Object Oriented Programming
d) Advanced Topics In Software Engineering: Cleanroom Software Engineering- The Cleanroom Approach, Functional Specification, Design Refinement and Verification, Cleanroom Testing
e) Software Reuse - Management Issues, The Reuse Process, Domain Engineering, Building Reusable Components, Classifying and Retrieving Components, Economics of Software Reuse
f) Reengineering - Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering, Economics of Reengineering
g) Computer Aided Software Engineering - Case Definition, Building Blocks of Case, Taxonomy of Case Tools, Integrated Case Environments, The Integration Architecture, The Case Repository

COURSE / LEARNING OUTCOMES

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

CO1: Examine the life cycle models of a software. (*Knowledge*)
CO2: Identify and differentiate various software life cycle models. (*Comprehension*)
CO3: Experiment with different software architectures and identify the best feasible one. (*Application*)

CO4: Analyze and design the software requirement specification. (*Analysis*)
CO5: Develop and create various design diagrams and find solutions to problems. (*Synthesis*)
CO6: Maintain the software project by using maintenance plan. (*Evaluation*)
CO7: Summarize and validate a practical solution towards a software application development and also deploy a product of their own. (*Evaluation*)

Suggested Readings

1. Roger S. Pressman, Software Engineering A Practitioner's Approach, Fourth Edition, Tata McGraw Hill.
2. Rajib Mall, Fundamentals of Software Engineering, Second Edition, Prentice Hall of India Private Limited.
3. Ian Sommerville, Software Engineering, Sixth Edition, Addison Wesley, Pearson Education.
4. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals Of Software Engineering, Second Edition, Prentice Hall of India Private Limited, New Delhi, 2002.
5. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, Modern Systems Analysis and Design, Second Edition, Pearson Education.
6. Richard E Fairley, Software Engineering Concepts, Tata McGraw Hill Publishing Company Limited, New Delhi, 1997.
7. Hans Van Vilet, Software Engineering Principles and Practice, Second Edition, John Wiley and Sons, Ltd.

CSDC0042: DATA COMMUNICATIONS and NETWORKS II AND NETWORK PROGRAMMING USING LINUX

(4 credits – 60 hours)

Objective*: This course, being a continuation of the course Data Communication and Networks I of the previous semester, builds on the concepts of data communications and computer network. It deals with the remaining three main layers – the Network layer, the Transport layer and the Application Layer. This paper also introduces the students to network security and cryptography. While the aforesaid topics are dealt for the theory part of this paper, the practical section deals with network programming.*

Module I (17 Hours)

Network Layer : Design Issues – Store and forward packet switching, Services provided to higher layer, Connection Oriented and Connectionless services, Virtual Circuits and Datagram subnets; Routing Algorithms – Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Adhoc networks; Congestion Control Algorithms – General Principles, Congestion Prevention Policies, Congestion control in Virtual Circuit and Datagram Subnets, Load shedding, Jitter control, QoS, Leaky Bucket Algorithm, Token Bucket Algorithm, RSVP; Internetworking – Tunneling, Fragmentation; Internet Protocol – IP addresses, Subnets, CIDR, Network address translation,; Internet Control Protocol – ICMP, ARP, RARP, BOOTP, DHCP; Mobile IP – Routing

Module II (17 hours)

Transport Layer : Design Issues, Services presented to higher layers; Transport Service Primitives; Berkeley Sockets; Transport protocols – Addressing, Connection Establishment and Release, Flow Control and Buffering, Multiplexing, Crash Recovery; Internet Transport Protocols: UDP – Remote Procedure Call, Real-time transport Protocol; TCP – Service Model, Protocol, Header, Connection Establishment and Release, Connection Management, Transmission Policy, Congestion Control, Timer Management

Module III (10 Hours)
Application Layer : Domain Name System – name space, resource records, name servers; Electronic Mail - architecture and services, user agent, Message formats – MIME, Message Transfer - SMTP, Message Delivery – POP3 and IMAP, Web mail

Module IV (16 Hours)
Network Security : Cryptography, Substitution Ciphers, Transposition Ciphers, One time pads, Quantum Cryptography, Cryptographic principles; Symmetric Key Algorithms – Data Encryption Standard, Advanced Encryption Standard, Cipher Modes; Public Key Algorithms – RSA; Digital Signatures – Symmetric Key, Public Key, Message Digest, Birthday Attack; Communication Security - IPSec, Firewalls, Virtual Private Networks; Wireless Security – 802.11 Security, WAP Security; Authentication Protocols – Based on shared secret key, Deffie-Hellman Key Exchange, Key Distribution Center, Kerberos, Public Key

COURSE / LEARNING OUTCOMES

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

CO1: Know the different protocols, their purpose and architectures used in Network, Transport and Application Layers. (*Knowledge*)

CO2: Explain the routing algorithms, congestion control mechanism and their policies used in Network Layer. They will further comprehend the design issues of each layers, examine the issues related to network security and learn the algorithms used to provide solutions to the related issues. (*Analysis/ Knowledge/ Comprehension*)

CO3: Apply their knowledge to solve problems where data need to be transmitted in a network using the shortest path algorithm. (*Application*)

CO4: Analyze the purpose of using different Cryptographic principles. (*Analysis*)

CO5: Depending on the purpose of data communication in a network, the students will be able to choose the appropriate algorithms to dispatch the packets and decide whether to opt for TCP or UDP client-server programming. They will be able to justify their decision to choose a particular scheme. (*Evaluation*)

Suggested Readings

1. Andrew S. Tenenbaum, Computer Networks (Fourth Ed.), Prentice Hall of India, 2002
2. W Richard Stevens, UNIX Network Programming – Volume I (2nd Ed.), Prentice Hall of India, 2002
3. William Stallings, Data and Computer Communications (Sixth Ed.), Prentice Hall of India, 2000
4. Fred Halsall, Data Communication, Computer Networks and Opens Systems, (4th Ed.), Pearson Education, 2000
5. William Stallings, Cryptography and Networking Security - Principles and Practice, Pearson Education, 2000

CSDM0043: DATABASE MANAGEMENT SYSTEM II

(4 credits – 60 hours)

Objective*: The objective of this paper is to present to the students some advanced database management concepts like query procession and transaction procession. Also, an introduction to some emerging database management technologies like data mining, data warehousing, multimedia databases etc, is also included.*

Module I: Query Processing and Optimization (10 Hours)
Query Processing: Overview of query processing, translation of SQL queries into relational algebra, Algorithms for SELECT, JOIN, PROJECT and SET operations, pipelining of operations, heuristics, selectivity and cost estimates in query optimization

Module II: Transaction Processing and Concurrency Control (25 Hours)

a) Transaction Processing: Transaction, ACID properties of transaction, transaction states, schedules, serializability, tests for serializability, recoverability, transaction definition in SQL.
b) Concurrency Control: Concurrent execution of transaction, Lock-based techniques for concurrency control, Graph-based protocol, Timestamp based protocol, Deadlock, Deadlock prevention methods, Deadlock detection Deadlock recovery

Module III: Recovery and Security (10 Hours)

a) Recovery system: Types of failure, types of storage, recovery and Atomicity, Log-based recovery, shadow paging, recovery with concurrent transactions, buffer management, logical undo logging, transaction rollback, checkpoints, restart recovery, fuzzy checkpointing
b) Security: Security and Integrity-security violations, authorization and views, granting of privileges, security specifications in SQL, encryption, and statistical databases.

Module IV: Database System Architectures and New Applications (Introduction)(15 Hours)

Centralized Systems, Client-Server Systems, Parallel Systems, Distributed Systems, Decision-Support Systems, Data Mining Concepts- Association Rules, Classification, Clustering, Applications of Data Mining, Commercial Data Mining Tools, Other Database Technologies (introduction)-Data Analysis, Data Warehousing, Spatial and Geographical Databases, Multimedia Databases, Mobility and Personal Database.

COURSE / LEARNING OUTCOMES

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

CO1: Identify the techniques used by a DBMS to process, optimize and execute high level queries. (*Knowledge*)
CO2: Describe fundamentals of transaction processing system, including ACID properties of a transaction. (*Comprehension*)
CO3: Understand concurrency control & analyze several concurrency control techniques for ensuring serializability, locking, timestamping. (*Analysis*)
CO4: Discuss some of the techniques that can be used for database recovery from failures. (*Comprehension*)
CO5: Classify security issues and threats to databases and summarize the control measure for securing databases against a variety of threats. (*Synthesis, Comprehension*)
CO6: Describe different computer system architecture and show the influence of underlying computer system on the database system. (*Application, Comprehension*)
CO7: Understand the concept of data warehouse and explain data mining to discover new information in terms of patterns or rules from vast amount of data. (*Evaluation*)

Suggested Readings

1. Silberschatz, HF Korth, S Sudarshan, Database System Concepts, Tata- McGraw Hill, 1997.
2. R Elmasri, SB Navathe, Fundamentals of Database Systems, Addisson, Wesley (Third Edition) 2000.
3. DM Kroenke, Database Processing: Fundamentals, Design and Implementation, Prentice-Hall of India, (Eighth Edition) 2002.
4. GW Hansen, JV Hansen, Database Management and Design, Prentice-Hall of India, (2nd Edition) 2001.
5. Thomas M Connolly, Carolyn E Begg, Database Systems, A Practical Approach to Design, Implementation and Management, Addison Wesley Longman Ltd. 1999.

CSIT0044: INTERNET TECHNOLOGY AND APPLICATIONS

(3 credits – 45 hours)

***Objective**: The objective of the course is to familiarize the students with a discussion on Internet and its growth. It also provides the students a study on the basic services provided by the Internet. A familiarization on the markup languages, scripting languages and web application development are also being discussed to make the student competent to design websites. It has been taken into consideration that this paper assumes that the students must know well in advance about the various protocols of the Internet and the knowledge of HTML and databases.*

Module I: Introduction to Internet (9 Hours)

History of the Internet; History of the World Wide Web; W3C (World Wide Web Consortium); Levels of Internet Connectivity (Dial-up, Leased Line, DSL, VSAT); Requirements for Internet connectivity; Use of Browsers; Different types of browsers (IE, Opera, Netscape, Firefox); Search engines; FTP; Electronic Mail; Instant Messaging; DHCP; DNS; HTTP; URL; Proxy Servers.

Module II: Internet Markup Languages (12 Hours)

a) XHTML: What is XHTML?; Components of XHTML; Elements of XHTML (Headers, Paragraphs,
b) Linking, Images, Special Characters, Lists, Tables, Forms, Framesets)
c) Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation Service; Use of CSS (Positioning Elements, Backgrounds, Text flow)
d) XML: What is XML? Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Vocabularies; Document Object Model (DOM and its methods); Extensible StyleSheet Language (XSL)

Module III: Web servers, Databases and Scripting Languages (12 Hours)

a) Web servers: What is a web server; HTTP Request Types; System Architecture of a Web server; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Apache Web Server.
b) Databases: Introduction to each one of the following: SQL, MYSQL, DBI
c) Scripting Languages: Javascript: Operators, Data Types, Control Structures, Functions, Arrays, String Manipulation. JQuery, ASP.NET. Introduction to Perl and CGI (Common Gateway Interface). JSP: Introduction; JSP Overview; Scripting; Standard Actions; Directives
d) Java Servlets: Servlet overview and architecture, Servlet Interface and Servlet life cycle, HttpServlet Class, HttpServletRequest Interface, HttpServletResponse Interface, Handling HTTP get Requests, Deploying a web application, Handling HTTP get requests containing data, Handling HTTP post requests

Module IV: Web Application Development Using PHP (12 Hours)

a) Web Site Design Considerations: Using Logical Design: Planning your website, drawing a map, using a top-down approach, flexibility, other web design metaphors. Creating templates. Creating a Compatible Design: Designing for different color depths, resolutions, different browser considerations, accommodating limited bandwith. Validating your work.
b) PHP: Introduction to PHP; Data Types; Control Structures; Functions; Strings; Arrays; Querying Web Databases using PHP; Writing to Web Databases; Errors, Debugging and Deployment; Reporting in PHP; Validation Techniques in PHP.

COURSE / LEARNING OUTCOMES

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

CO1: Examine the growth of Internet and identify the history behind it. (*Knowledge*)
CO2: Identify and differentiate the various services provided by the internet. (*Comprehension*)
CO3: Experiment with various mark-up languages and scripting languages. (*Application*)
CO4: Analyse and design a website of their own and can also identify the faults in the design. (*Analysis*)
CO5: Develop and create a website of their own. (*Synthesis*)
CO6: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (*Evaluation*)

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 2nd Edition, Prentice Hall of India Pvt. Ltd. , New Delhi
2. Hugh E. Williams and David Lane, PHP and MySQL, 2nd Edition, O'Reilly, Shroff Publishers and Distributors Pvt. Ltd.
3. Moss, K., Java Servlets (Second Edition), New Delhi: Tata McGraw-Hill
4. Internet Complete, 2nd Edition, BPB Publications., New Delhi
5. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

CSEP0045: ENTERPRISE RESOURCE PLANNING

(3 credits–45 hours)

Objective*: To help the student understand the conceptual elements of ERP and its theory and implementation. This is especially poignant in view of large number of organizations implementing ERP applications in recent years. The student will appreciate the impact that ERP brings into the daily operations of firms with respect to their productivity, integration, communication, etc.*

Module I: ERP Basics (15 hours)

a) Evolution and structure of ERP, ERP concepts, growth of the ERP market, conceptual model of ERP, 2-tier and 3-tier architecture, elements in ERP architecture, advantages/benefits of ERP, overview of an enterprise, integrated management information, business modeling, integrated data model
b) ERP and related technologies: Business Process Reengineering (BPR), Management Information Systems (MIS), Decision Support Systems (DSS), Data Warehousing, Data Mining, Online Analytical Processing (OLAP), Supply Chain Management.

Module II: ERP Modules (9 hours)

Item types in ERP, Manufacturing, distribution and Financial requirements, item control module in ERP, Finance module, Manufacturing and Production Planning module, Sales and Distribution module, Plant Maintenance module, Quality Management module, Materials Management module, Capital Requirement Planning module, Purchase Control module, Human Resources modules; concept of Bill of materials, concept of formula management.

Module III: Profiling ERP Vendors (8 hours)

a) SAP AG : R/3 –, overview of R/3 system, R/3 modules, R/3 and the internet
b) BAAN : Baan ERP modules, Baan ERP Tools
c) Oracle : Oracle modules – Financials, Human Resources, Projects, Manufacturing, Supply chain.
d) PeopleSoft : Accounting and control, Treasury Management, Performance Management, Sales and Logistics, Procurement.

Module IV: ERP Implementation Lifecycle (6 hours)
Elements of implementation methodology, Pre-evaluation Screening, Package evaluation, project planning phase, Gap Analysis, Business Process Re-engineering, configuration, Implementation team training, testing, product migration and support, Problems in ERP implementation, cost of ERP.

Module V Best Practices in ERP (7 hours)

a) Concept of Best Practices, concept of Customer Order Decoupling Point(CODP), Demand Management – Sales and Operations Planning, ERP scenario in India, future directions in ERP.
b) Case studies should also be introduced to highlight situations where ERP projects are implemented, and the success stories/benefits/difficulties of these implementations.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO1: Understand the conceptual elements of ERP. (*Knowledge*)
CO2: Know Influence of ERP in Large organization. (*Comprehension*)
CO3: Understand the impact of ERP into the daily operations of firms with respect to their productivity, integration, communication etc. (*Application*)
CO4: Develop clear idea of the practical side of ERP implementation with different vendors. (*Analysis*)
CO5: Compare the best practices of ERP with various case studies and real time examples. (*Synthesis*)

Suggested Readings

1. O'Leary, Daniel E, Enterprise Resource Planning Systems: systems, life cycle, electronic commerce and risk, Cambridge University Press.
2. Alexis Leon, Enterprise Resource Planning, 14th reprint, Tata McGraw Hill, New Delhi 2005
3. Rahul V Altekar, Enterprise Resource Planning (Theory and Practice), Prentice Hall India, New Delhi 2004
4. Alexis Leon, ERP Demystified, Tata McGraw Hill Pub. Co. Ltd, 2000
5. Kent Sandoe, Enterprise Integration, John Wiley and Sons
6. Garg and Venkitakrishnan, Enterprise Resource Planning : Concepts and Practice, 2nd edition, Prentice Hall India
7. Garg and Venkitakrishnan, ERPWARE : ERP Implementation Framework, Prentice Hall India
8. ERP – Concepts and Cases, ICFAI University Press, 2004

CSSE0046: BASIC SOFTWARE ENGINEERING

(4 credits - 60 hours)

Objective*: To provide ability analyze a scenario and produce a problem statement. The learners will be able to produce a conceptual solution which includes sample prototypes, domain models, and user stories. The learners will be able to describe the attributes and activities involved in software development process models and testing.*

Module I: Introduction (10 Hours)
Problems and solutions: Why software is developed. Problem and vision statements. Goals and objectives. Definitions and paradigms, A generic view of software engineering. Software development life cycle, Role of quality, metrics and measurement.

Module II: Requirements Analysis (15 Hours)
The feasibility study, Software Requirement Analysis and Specifications, work breakdown structure (WBS), Problem Analysis, Creating software requirement specification document (SRS).

Module III: Designing Software applications (15 Hours)
Process Models: How software is built. The fundamental design concept for data, architectural and procedural designs. Conceptual solutions. Agile concept and User stories. Domain modeling with UML diagrams-Class diagram, Use cases etc, Object oriented design paradigm; Creation of technical design document.

Module IV: Software Implementation (10 Hours)
The relationship between design and implementation, Implementation, Coding the procedural design, Good coding style and review of correctness and readability.

Module V: Software Testing and Maintenance (10 Hours)
Strategies of software testing. Types of testing, functional testing, validation and verifications. Test Case Design. Maintenance as part of software evaluation, techniques and procedures for maintenance. Introduction to configuration Management. The concept of CASE, green engineering.

COURSE / LEARNING OUTCOMES

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

CO1: Examine the life cycle models of a software. (*Knowledge*)
CO2: Identify and differentiate various software life cycle models. (*Comprehension*)
CO3: Experiment with different software architectures and identify the best feasible one. (*Application*)
CO4: Analyze and design the software requirement specification. (*Analysis*)
CO5: Develop and create various design diagrams and find solutions to problems. (*Synthesis*)
CO6: Maintain the software project by using maintenance plan. (*Evaluation*)

Suggested Readings

1. Sommerville, "Software Engineering", Addison Wesley.
2. Roger S.Pressman, "Software Engineering–A Practitioner's Approach", McGraw Hill Companies.
3. Rajib Mall, Fundamentals of Software Engineering, PHI.

CSMA0047: MICROPROCESSORS AND APPLICATIONS
(4 credits – 60 hours)

***Objective**: This course helps to develop an in-depth understanding of the operation of microprocessors, assembly language programming and microprocessor interfacing techniques. The students will be able to design and implement microprocessor- based systems in both hardware and software and can apply this knowledge to more advanced structures.*

Module I: Introduction (12 hours)
Microprocessor evolution and types, microprocessor architecture and operation of its components, addressing modes, interrupts, data transfer schemes, instruction and data flow, timer and timing diagram. Interfacing devices. Architectural advancement of microprocessor. Typical microprocessor development schemes.

Module II: 8-bit Microprocessors (13 hours)
8-bit Microprocessors: Pin diagram and internal architecture of 8085 microprocessor, registers, ALU, Control and status, interrupt and machine cycle. Instruction sets. Addressing modes. Instruction formats Instruction Classification: data transfer, arithmetic operations, logical operations, branching operations, machine control and assembler directives.

Module III: 16-bit Microprocessor (7 hours)
Architecture of 8086 microprocessor: register organization, bus interface unit, execution unit, memory addressing, and memory segmentation. Operating modes. Instruction sets, instruction format, Types of instructions. Interrupts: hardware and software interrupts.

Module IV: Programming (8 hours)
Assembly language programming based on Intel 8085/8086. Instructions, data transfer, arithmetic, logic, branch operations, looping, counting, indexing, programming techniques, counters and time delays, stacks and subroutines, conditional call and return instructions

Module V: Peripheral Interfacing (15 hours)
Peripheral Devices: 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254 programmable timer/counter, 8259 programmable interrupt controller, 8251 UART and RS232C.

Module VI: Pentium processor (Only features) (5 hours)
Introduction to Pentium Processors, Memory system, I/O system, Pipelining, Floating point module, Cache structure, superscalar architecture.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO1: List the parts of a microprocessor. (*Knowledge*)
CO2: Describe the architecture of 8085/8086 microprocessors. (*Comprehension*)
CO3: Evaluate given 8086/8085 assembly language programs in terms of time required to execute them. (*Evaluation*)
CO4: Construct 8086/8085 assembly language programs for tasks such as arithmetic operation, logic operation, looping, counting etc. (*Application*)
CO5: Synthesize the glue logic required to interface memory to a microprocessor for a given memory map. (*Synthesis*)
CO6: Determine the timing diagrams for different 8086/8085 instructions. (*Evaluation*)
CO7: Compare the interrupt structure of 8086 and 8085 microprocessor. (*Analysis*)
CO8: Interface peripherals such as 8255, 8253/8254, 8259, 8251, 8237 with 8086/8085 microprocessors. (*Application*)

Suggested Readings

1. Gaonkar, Ramesh S, Microprocessor Architecture, Programming and Applications with 8085, Penram International Publishing.
2. Ray A K, Bhurchandi K M, Advanced Microprocessors and Peripherals, TMH
3. Hall D V, Microprocessor Interfacing, TMH
4. Liu and Gibson G A, Microcomputer System: The 8086/8088 family, PHI
5. Aditya P Mathur, Introduction to Microprocessor, TMH
6. Brey, Barry B, INTEL Microprocessors, PHI
7. Renu Singh and B.P.Singh, Microprocessor, Interfacing and Applications
8. M Rafiqzzaman, Microprocessors, Theory and Applications

CSOC0048: OPERATING SYSTEMS AND CONCEPTS
(4 credits – 60 hours)

***Objective**: This course provides an overview of operating systems along with the concepts of process management, memory management, deadlocks, file systems and input-output systems. After completing this course, the student should be able to recognize the underlying concepts and principles of operating systems, understand the structure and components of traditional OSs and acquire skills to deal with common operating systems like UNIX, Linux and Windows.*

Module I (15 hours)
a) Introduction to operating systems, Simple batch system, Multiprogramming and time sharing systems, Personal computer systems, Parallel systems, Distributed systems and Real time systems.
b) Operating system structures: System components, protection system, OS services, System calls.

c) Process management: Process concept, Process scheduling, Operation on processes, Cooperating processes, Interprocess communication, Threads CPU scheduling: Basic concepts, scheduling criteria, scheduling algorithms.

Module II (15 hours)

a) Deadlocks: System model, Deadlock characterization methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, recovery from Deadlock.
b) Memory Management: Background, Logical versus physical address space, Swapping, Contiguous allocation, Paging, Segmentation.
c) Virtual Memory: Background, Demand paging, Performance of demand paging, Page replacement, Page replacement algorithms, Allocation of frames, Trashing.

Module III (15 hours)

File-system Interface: File concept, Access methods, Allocation methods, Directory implementation, Recovery.

Module IV (15 hours)

a) I/O Systems: Overview, I/O hardware, Application of I/O interface, Kernel I/O - subsystem, Transforming I/O requests to hardware operations.
b) Secondary storage structure: Disk structure, Disk scheduling, Disk management, Swap space management, Disk reliability, Case studies LINUX, WINDOW NT.

COURSE / LEARNING OUTCOMES

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

CO1: Explain what operating systems are, what they do and how they are designed and constructed. (*Synthesis*)
CO2: Describe process concept like process scheduling, interprocess communication, process synchronization and concurrency as the heart of modern operating systems. (*Knowledge*)
CO3: Explain different memory management schemes, reflecting various approaches to memory management and effectiveness of a particular algorithm. (*Comprehension*)
CO4: Use different page replacement algorithms to solve problems. (*Application*)
CO5: Describe how the file system, mass storage and I/O are handled in a modern computer system. (*Knowledge, Comprehension*)
CO6: Analyze the mechanisms necessary for the protection and security of computer systems. (*Analysis*)
CO7: Relate the concepts learned with case studies of Linux and Windows.

Suggested Readings

1. Abraham Silberschatz, Peter Bear Galvin, Operating system concepts, Addison Wesley.
2. Madnik and Donovan, Operating systems, McGraw Hill.
3. Andrew, S. Tannenbaum, Modern operating system, PHI.
4. Harvey M. Deitel, Operating Systems, Second Edition, Pearson Education Pvt. Ltd.
5. William Stallings, Operating Systems, Prentice Hall of India.
6. Pramod Chandra P. Bhatt – An Introduction to Operating Systems, Concepts and Practice, PHI.

CSFL0049: FORMAL LANGUAGE AND AUTOMATA THEORY

(4 credits – 60 hours)

Objective*: The purpose of this course is to understand the power and limitations of abstract computational devices and to study various models including finite automata, grammars, pushdown automata, and Turing machines. The course will help in study of methods for classifying computational devices according to their computational power, and tools which will allow ascertaining the capability of a device to solve a given computational problem.*

Module I: Theory of Automata (10 Hours)
Definition of an Automaton, Description of a Finite Automaton, Transition Systems, Properties of Transition Functions, Acceptability of a String by a Finite Automaton, Nondeterministic Finite State Machines, The Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata.

Module II: Formal Languages, Regular Sets and Regular Grammars (15 Hours)
Definition of formal languages, Chomsky Classification of Languages, Languages and Their Relation, Recursive and Recursively Enumerable Sets, Operations on Languages, Languages and Automata; Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma for Regular Sets, Application of Pumping Lemma, Regular Sets and Regular Grammars Exercises.

Module III: Context-free Languages (17 Hours)
Context-free Languages and Derivation tree, Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars, Pumping Lemma for Context-free Languages, Decision Algorithms for Context-free Languages Exercises

Module IV: Pushdown Automata Turing Machines and Linear Bounded Automata (18 Hours)
Basic Definitions, Acceptance by pda, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata; Turing machine Model, Representation of Turing Machine, Language Acceptability by Turing Machines, Design of Turing Machines, Universal Turing Machine and Other Modification, The Model of Linear Bounded Automaton, Turing Machines and Type 0 Grammars, Linear Bounded Automata and Languages, Halting Problem of Turing Machines, NP-Completeness.

COURSE / LEARNING OUTCOMES

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

CO1: Describe basic terminology like Deterministic and Non deterministic automata, Pushdown Automata, Parse Tree, Regular Languages, Turing Machines etc. (*Knowledge*)
CO2: Explain the concepts, core terms and tools used in automata theory (*Comprehension*)
CO3: Correctly use the techniques, components and tools of a typical automated machine and apply it in designing new machines (*Application*)
CO4: Learn which input pattern would be accepted by a Turing Machine, Pushdown Automata, Finite Automata etc. (*Application*)
CO5: Compare and contrast various types of machines in Automata theory and relate it to everyday appliances like washing machines, fans, etc (*Analysis*)
CO6: Design new automata for given problems by using most appropriate algorithmic strategy considering the problem domain. (*Synthesis*)
CO7: Design anautomata and evaluate it in terms of correctness, computation cost and complexity. (*Evaluation*)

Suggested Readings

1. K.L.P. Mishra, N. Chandrasekaran, Theory of Computer Science, BPB Publication, Prentice-Hall of India, Second Edition.
2. H.R. Lewis and C.H.Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall of India.
3. H.E. Hopcraft and J.D. Ullamn, Introduction to Automata Theory, Languages and Computation, Narosa Publications.
4. J.C. Martin, Introduction to Languages and the Theory of Automata, Tata McGraw-Hill International, 2003..
5. C.H. Papadimitriou, Computation Complexity, Addison-Wesley.

6. Linz Peter, An Introduction to Formal Languages and Automata,Narosa.
7. Kain, Theory of Automata and Formal Language, McGraw Hill.

CSDC0050: DATA COMMUNICATION

(4 credits – 60 hours)

Objective*: The main objective of this course is to make the students understand the characteristics of signals propagated through different transmission media, including concepts of attenuation and noise, error-detection, and error-correction techniques and interfacing and synchronization issues.*

Module I (16 hours)

a) Introduction to data communications: A communications model, Data communications, Networking, Protocols and Protocol architecture, Characteristics of data transmission: Concepts and Terminology, Analog and digital data transmission, Transmission impairments.
b) Transmission media: Guided transmission media, Wireless transmission data encoding, Digital data-Digital signals, Digital data- Analog signals, Analog data-Digital signals, and Analog data-Analog signals.

Module II (13 hours)

Data communication interface: Asynchronous and Synchronous transmission, Line configurations, Interfacing. Data link control, Flow control, Error detection, Error control, High-level data link control (HDLC), Other data link control protocols.

Module III (16 hours)

Data communications hardware: Terminals- Introduction, Basic terminal components, Enhanced terminal components, General-purpose terminals, Remote job entry terminals, Transaction terminals, Clustering of terminal devices. Communications processing hardware introduction, Switching processors, Multidrop lines, Multiplexers, Concentrators, Front-end processors.

Module IV (15 hours)

Modems: Network attachment and regulations, Line conditioning and leased lines, Modems and modem circuits. Multiplexing: Frequency-division multiplexing, Synchronous time-division multiplexing: Characteristics, TDM Link control, Digital carrier systems statistical time-division multiplexing: Characteristics.

COURSE / LEARNING OUTCOMES

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

CO1: Understand fundamentals of data communication and various technique of communications. They will also know about the different media of communications and the types of communications Protocols. They will also understand the layered structure of computer network. (*Knowledge*)

CO2: Explain about different network topology and the type of protocol required for different communication technique. (*Comprehension*)

CO3: Understand the requirements of various networking devices and establish network accordingly. (*Application*)

CO4: Compare different networking devices. They will also be able to analyse different network behaviour depending on performance parameters. (*Analysis*)

CO5: Depending on availability of hardware and software, students will be able to suggest a type of network required for an organisation. (*Synthesis*)

CO6: Students will be able to establish a computer network either Wired or Wireless. (*Evaluation*)

Suggested Readings

1. William Stallings , Data and Computer Communications, Sixth Edition, Pearson Education Asia.
2. Prakash C. Gupta , Data Communications and Computer Networks, PHI
3. B.A. Forouzan, Data Communications and Networking, TMH.
4. William L.Scweber, Data Communication, McGraw Hill.
5. Tenenbaum, A. S., Computer Networks (Fourth Edition), New Delhi: Prentice-Hall India
6. Larry L. Peterson and Bruce S. Davie, Computer Networks: A systems approach, 3rd Edition, Morgan Kaufmann Publishers.
7. Mary E.S. Loomis, Data Communications, PHI.

CSIS0051: INFORMATION SYSTEM DESIGN

(4 credits – 60 hours)

Objective*: The course is aimed at familiarizing the student with the techniques, applications and control of modern information systems. The course will also provide working knowledge of the types of information systems and`` their strengths and weaknesses in solving various business and organization problems. It also gives the fundamentals of Rational Rose and skills of designing using Rose tools.*

Module I (10 hours)

a) Introduction to Information systems development: overview of system analysis and design, Categories of Information systems, Systems development strategies, Implementation and evaluation, Tools for systems development, Information systems planning methodologies, Managing project- review and selection, Preliminary Investigation, Project feasibility, selecting the project development strategy;

b) Requirement analysis and determinations: Activities in requirements determination, Fact finding techniques: Interview, questionnaire, Record review, observation, tools for documenting procedures and decisions: Decision trees, Decision tables, Structured analysis, Dataflow analysis, Tools for dataflow strategy, Developing data flow diagrams, Leveling, Data dictionary.

Module II (10 hours)

Prototype development strategy: purpose of prototyping, steps in prototype method, use of prototypes, tools for prototyping, Prototyping strategies. Computer Aided System Tools: Benefits of computer Assisted Tools, Categories of computer assisted system Engineering (CASE) Tools.

Module III (15 hours)

System Design: Objectives, Features to be designed, managing the design process, managing end-user development system Design of output, Design of input and control, Design of online dialogue, Design of files and databases.

Module IV (15 hours)

Fundamentals of Rational rose, Object oriented design using UML, Design of software development diagram using rose, Functional Testing using rose

Module V (10 hours)

a) System Engineering and Quality assurance: Designing reliable and maintainable system, Program structure charts, Software Modules, Coupling and Cohesion.

b) Software design and documentation tools: Structured flowchart, HIPO, Warnier/Orr diagrams. Managing quality assurance, Assessing system Reliability, Testing strategies, Documentation. Managing system implementation: Training conversion methods, Data and file preparation, and post implementation review. Managing information system development: Estimation and management of development time, Personnel and Development management, structured walkthroughs.

c) Selection of hardware and software: Hardware selection, determining size and capacity requirements. Computer evaluation, Financial factors, Maintenance and support, Software selection.

COURSE / LEARNING OUTCOMES

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

CO1: Define and describe the phases of the system development life cycle. (*Knowledge*)

CO2: Explain the purpose of prototyping and also will be able to summarize the benefits of CASE tools. (*Comprehension*)

CO3: Construct design diagrams like use case, activity, sequence diagram etc. using rational Rose. (*Application*)

CO4: Solve realistic systems analysis problems by preparing technical documentations and also to make presentations on various aspects of a software development project, including the technical aspects as well as the managerial aspects. (*Application*)

CO5: Analyse the use of different types of design diagrams. (*Analysis*)

CO6: Develop data flow diagrams and data dictionary, decision tree, decision tables. (*Synthesis*)

CO7: Evaluate the performance of small project by applying software testing and quality assurance techniques at the module level, and understand these techniques at the system and organization level. (*Evaluation*)

Suggested Readings

1. James A. Senn, Analysis and Design of Information Systems, Tata McGraw Hill
2. Essentials of Visual Modeling with UML 2.0, IBM Manual
3. Essentials of Rational Software Architect, IBM Manual
4. Ram Bansal, Information Systems Analysis and Design A Modern Approach To Systems Development, New Age International.
5. Rajaraman, Analysis and Design of Information Systems, Prentice Hall
6. A.M. Langer, Analysis and Design of Information Systems, Springer.

CSPA0052: PRINCIPLES OF ARTIFICIAL INTELLIGENCE

(4 credits – 60 hours)

Objective: *Artificial Intelligence has embraced the larger scientific goal of constructing information-processing theory of intelligence. If such a science of intelligence could be developed, it could guide the design of intelligent machines as well as explicate intelligent behaviour as it occurs in humans and other animals. This paper describes the fundamental AI ideas that underlie many of the AI applications and provides a base for understanding natural intelligence.*

Module I: General Issues and Overview of AI (12 Hours)

Introduction to AI: The AI problems, the underlying assumption, AI techniques, the level of the model, criteria for success, AI applications. problem solving, search and control strategies: defining the problem as a state space search, production systems, control strategies, breadth-first search, depth-first search, problem characteristics, production system characteristics, issues in the design of search programs.

Module II: Search Strategies for AI Production Systems (16 Hours)

Heuristic search techniques: generate-and-test, hill climbing, simple hill climbing, steepest-ascent hill climbing simulated annealing, best-first search, OR-graphs, the A* algorithm, problem reduction, AND-OR graphs, the AO* algorithm, constraint satisfaction, means-end analysis. game playing: overview, the minimax search procedure, adding alpha-beta cutoffs, additional refinements, iterative deepening.

Module III: Knowledge Representation (16 Hours)

Knowledge representation issues: representations and mappings, representing simple facts in logic, knowledge representation attributes, computable functions and predicates, resolution, conversion to clause form, the basics of resolution, resolution in propositional logic, procedural vs. declarative knowledge, logic programming, forward vs. backward reasoning, matching, control knowledge. statistical reasoning: probability and Bayes' theorem, certainty factors and rule-based systems, Bayesian networks, Dempster-Shafer theory, basic notions and concepts of fuzzy sets, fuzzy set operations, information - based characterization of fuzzy sets, fuzzy relations and their calculus.

Module IV: Advanced AI (16 Hours)

Natural language processing: overview, morphological analysis, syntactic analysis, semantic analysis, discourse integration, pragmatic analysis, parsing techniques, top-down parsing, bottom-up parsing, augmented transition networks (ATN). Learning: rote learning, learning by taking advice, learning by induction, explanation-based learning. Expert system: representing and using domain knowledge, expert system shells, explanation, knowledge acquisition.

COURSE / LEARNING OUTCOMES

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

CO1: Identify the need of incorporating human intelligence into machine and define the basic terms related to the concept of knowledge and representation, learning and reasoning, communication and language processing. (*Knowledge*)

CO2: Define problem state space, design algorithms to solve problems, generalized schema for knowledge interpretation and planning and language processing. (*Comprehension*)

CO3: Compute and demonstrate the problem in terms of state space and apply different AI algorithms to solve problems and construct a logic to represent knowledge in computational domain and also to interpret the natural language. (*Application*)

CO4: Compare and analyse the performance of algorithms based on problem domain. (*Analysis*)

CO5: Design and create new intelligent algorithm for application development by integrating experience based learning. (*Synthesis*)

CO6: Judge and assess the algorithms based on completeness, optimality, space and time complexity for solving a problem in intelligent manner. (*Evaluation*)

Suggested Readings

1. Rich, E.; K. Knight, Artificial Intelligence, (Second Edition), New Delhi: Tata McGraw-Hill, 1997
2. Nilson, N. J., Principles of Artificial Intelligence, New Delhi: Narosa Publishing House, 2002
3. Pedrycz, W.; F. Gomide, An Introduction to Fuzzy Sets: Analysis and Design, New Delhi: Prentice-Hall India, 2004.
4. Winston, P. H., Artificial Intelligence, New Delhi: Pearson Education Asia, 2002
5. Charniak, E.; D. McDermott, Introduction to Artificial Intelligence, New Delhi: Pearson Education, 2002
6. Russell, S.; P. Norvig, Artificial Intelligence: A Modern Approach (Second Edition), New Jersey: Prentice-Hall, 2003

CSET0053: EMERGING TRENDS IN CLOUD COMPUTING

(4 credits – 60 hours)

Objective*: The purpose of this course is to make the student of Computer Applications aware of the trends of changes in technologies, applications and systems in the world of Information Technology specially in areas of cloud computing and related*

Module I: E-Commerce and CRM (10 Hours)

a) Model of E-Commerce, Application with respect to models, BPR and E-Commerce, Creation of E-Commerce sites (ethics): com/edu/org sites, Introduction to ERP Packages

b) CRM-Sales, Marketing and Service Management, What is BPO/BCP, Why it is required? Guidelines, Merits/De-Merits, Call Center – brief perspective technology wise, Functioning, Ethics, Disaster Recovery Management, Case Study

Module II: E-Banking Transactions, Content Management and Disseminations (10 Hours)

a) Inter Banking, Intra Banking, Electronic Payments, (Payment – Gateway Example, Securities in E-banking (SSL, Digital Signatures – Examples), Services Provided: ATM, Smart Card ECS(Electronic Clearing System),e.g. Telephone, Electricity Bills
b) E-learning – Models WBT, CBT, Virtual Campus, LMS and LCMS, Video Conferencing, Chatting Bulleting, Building Online Community, Asynchronous/ Synchronous Learning, Case Study

Module III: Introduction to cloud computing (16 hours)

a) Introduction to Cloud Computing, the Evolution of Cloud Computing, Hardware Evolution, Internet Software Evolution, Server Virtualization, Web Services Deliver from the Cloud, Communication-as-a-Service, Infrastructure-as-a-Service, Monitoring-as-a-Service, Platform- as- a-Service, Software-as-a-Service, Building Cloud Network
b) Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Map-reduce.

Module IV: Security in Cloud (14 hours)

Understanding Security Risks, Reducing Cloud Security Breaches, Implementing Identity Management, Benefits of identity management, Aspects of identity management, Playing Detective: Detection and Forensics, Activity logs, HIPS and NIPS, Data audit, Encrypting Data, Creating a Cloud Security Strategy

Module V: Virtualization (10 hours)

Virtualization and the Cloud: Visualizing Virtualization, Characteristics, Using a hypervisor in virtualization, Abstracting hardware assets, Managing Virtualization, Foundational issues, Abstraction layer, Provisioning software, Virtualizing storage, Hardware provisioning, Security issues, Taking Virtualization into the Cloud

COURSE / LEARNING OUTCOMES

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

CO1: Describe the models of E-Commerce and its application. (*Knowledge/ Evaluation*)
CO2: Explain and describe the working functionalities of BPO/BCP. (*Comprehension/ Evaluation*)
CO3: Paraphrase electronic payment gateways and securities in E-Banking. (*Comprehension*)
CO4: Demonstrate and explain the models of E-Learning modules. (*Application/Evaluate*)
CO5: Identify and memorize the various evolutionary steps of computation. (*Knowledge*)
CO6: Distinguish and define the web services delivered via cloud. (*Comprehension/ Knowledge*)
CO7: Deploy and construct a virtual private cloud using amazon web service as IaaS. (*Application*)
CO8: Define and analyze the concepts of Big data and Hadoop components. (*Knowledge/Analysis*)
CO9: Run an application using map reduce program. (*Application*)
CO10: Design a vulnerability assessment tool for cloud computation. (*Synthesis*)
CO11: Illustrate the use of management console for virtualization using hypervisors. (*Application/Analysis*)

CO12: Create and assess a real time application deployed on cloud platform (*Synthesis/Evaluation*)

Suggested Readings

1. Arpita Gopal, Chandrani Singh, Emerging Trends in Information Technology, First edition, Excel books, New Delhi
2. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kaufman, F.Halper, (Wiley India Edition)
3. Enterprise Cloud Computing by Gautam Shroff,Cambridge
4. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
5. Google Apps by Scott Granneman,Pearson
6. Cloud Security and Privacy by Tim Malhar, S.Kumaraswamy, S.Latif (SPD,O'REILLY)
7. Cloud Computing : A Practical Approach, Anthony T Velte, et.al McGraw Hill,
8. Cloud Computing Bible by Barrie Sosinsky, Wiley India

CSCL0054: CYBERLAW and IT SECURITY

(4 credits – 60 hours)

***Objective**: The objective of this course is to learn about IT security – threats, detection, laws and provisions.*

Module I (12 hours)

Object and Scope of the IT Act - Genesis, Object, Scope of the Act. Encryption -Symmetric Cryptography, Asymmetric Cryptography, RSA Algorithm, Public Key Encryption

Module II (14 hours)

Digital Signature- Technology behind Digital Signature, Creating a Digital Signature, Verifying a Digital Signature, Digital Signature and PKI, Digital Signature and the Law. E-Governance and IT Act 2000- Legal recognition of electronic records, Legal recognition of digital signature, Use of electronic records and digital signatures in Government and its agencies, Certifying Authorities. Need of Certifying Authority and Power. Appointment, function of Controller. Who can be a Certifying Authority? Digital Signature Certifications. Generation, Suspension and Revocation of Digital Signature Certificate.

Module III (12 hours)

Domain Name Disputes and Trademark Law: Concept of Domain Names, New Concepts in Trademark, Jurisprudence, Cyber squatting, Reverse Hijacking, Meta tags, Framing, Spamming, Jurisdiction in Trademark Dispute

Module IV (12 hours)

Cyber Regulations Appellate Tribunal: Establishment and Composition Of Appellate Tribunal, Powers of Adjudicating officer to Award Compensation, Powers of Adjudicating officer to impose Penalty.

Module V (10 hours)

The Cyber Crimes (S-65 to S-74): Tampering with Computer Source Documents(S-65), Hacking with Computer System(S-66), Publishing of Information Which is Obscene in Electronic Form(s-67), Offences: Breach of Confidentiality and Privacy (S-72), Offences : Related to Digital Signature Certificate(S-73 and S-74)

COURSE / LEARNING OUTCOMES

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

CO1: Identify the scopes of the IT ACT and their association with various aspects of cryptography. (*Knowledge*)

CO2: Demonstrate a value chain of an organization with their suppliers. (*Application/Analysis*)

CO3: Explain the need of digital signature and describe how a digital signature can be well recognised. (*Comprehension/Analysis/Synthesis*)

CO4: Describe and have a clear understanding of the domain name disputes and trademark law. (*Knowledge/Comprehension*)

CO5: Explain and compare symmetric and asymmetric cryptosystem implementations in IT Security. (*Synthesis/Evaluation*)

CO6: Generalize the concept of cyber regulations appellate tribunal. (*Comprehension*)

CO7: Develop the skill of identifying cyber crimes and judge whether a published information is obscene or not and also explain offence related to digital signature certificate. (*Synthesis/Evaluation*)

Suggested Readings

1. Farooq Ahmad, Cyber Law in India, Pioneer Books
2. Vakul Sharma, Information Technology Law and Practice, Universal Law Publishing Co. Pvt. Ltd.
3. Suresh T Vishwanathan, The Indian Cyber Law, Bharat Law house New Delhi.
4. P.M. Bakshi and R.K.Suri, Hand book of Cyber and E-commerce Laws, Bharat Law house New Delhi.
5. Rodney D. Ryder, Guide to Cyber Laws, Wadhwa and Company Nagpur.
6. The Information Technology Act, 2000, Bare Act, Professional Book Publishers, New Delhi.

CSEC0055: E-COMMERCE AND DATA SECURITY

(4 credits – 60 hours)

Objective: *The objective of the course is to introduce the main concepts related to electronic commerce (e-commerce), their forms common applications and the threat and vulnerabilities associated with them. The subject also introduces the security techniques that can be used to protect e-commerce transactions.*

Module I: Introduction to E-Commerce (15 hours)

Definition, Scope of E-Commerce, Hardware requirements, E- Commerce and Trade Cycle, Electronic Markets, Electronic Data Interchange and Internet Commerce. Business to Business E-Commerce: Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational E-commerce.

Module II: Legal issues (20 hours)

Risks - Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.Security Issues: Security Solutions- Symmetric and Asymmetric Cryptosystems, RSA, DES, AES and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic cash over internet, Internet Security.

Module III: Business to Consumer E-Commerce (10 hours)

Consumer trade transaction, Internet, Page on the Web, Elements of E-Commerce with VB, ASP, SQL.

Module IV: E-business (15 hours)

Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

COURSE / LEARNING OUTCOMES

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

CO1: Identify the scopes of e-commerce and their association with different trade cycles. (*Knowledge*)

CO2: Demonstrate a value chain of an organization with their suppliers. (*Application/Analysis*)

CO3: Explain and categorize the in-depth knowledge of EDI and its constituent elements. (*Comprehension/Analysis/Synthesis*)

CO4: Describe and have a clear understanding of the legal issues associated with electronic documents, jurisdiction issues, copyrights etc. (*Knowledge/Comprehension*)

CO5: Explain and compare symmetric and asymmetric cryptosystem implementations on e-commerce. (*Synthesis/Evaluation*)

CO6: Generalize the concept of business to consumer mode of transaction in e-commerce. (*Comprehension*)

CO7: Relate the above knowledge on certain case studies like internet bookshops, electronic newspapers, virtual auctions etc. (*Synthesis/Evaluation*)

Suggested Readings

1. D. Whitley, E-Commerce-Strategy, Technologies and Applications, TMH.
2. K.K.Bajaj, E-Commerce - The Cutting Edge of Business, TMH.
3. W. Clarke, E-Commerce through ASP, BPB.
4. M.Reynolds, Beginning E-Commerce with VB, ASP, SQL Server 7.0 and MTS, Wrox.

CSDW0056: DATA WAREHOUSING AND DATA MINING

(4 Credits – 60 hours)

Objective: *The main purpose of the course is to develop and gain an understanding of the principles, concepts, functions and uses of data warehouses, data modeling and data mining in business.*

Module I: Data warehousing (15 hours)

Definitions and characteristics, Multi-dimensional data model, Warehouse schema. Data Marts: Data marts, types of data marts, loading a data mart, metadata, data model, maintenance, nature of data, software components; external data, reference data, performance issues, monitoring requirements and security in a data mart. Online Analytical Processing: OLTP and OLAP systems, Data Modeling, LAP tools, State of the market, Arbor Essbase web, Microstrategy DSS web, Brio Technology, star schema for multi dimensional view, snowflake schema; OLAP tools.

Module II: Developing a Data Warehouse (15 hours)

Building of a Data Warehouse, Architectural strategies and organizational issues, design considerations, data content, distribution of data, Tools for Data Warehousing Data Mining: Definitions; KDD (Knowledge Discovery database) versus Data Mining; DBMS versus Data Mining, Data Mining Techniques; Issues and challenges; Applications of Data Warehousing and Data mining in Government.

Module III: Association Rules (20 hours)

A priori algorithm, Partition algorithm, Dynamic inset counting algorithm, FP – tree growth algorithm; Generalized association rule. Clustering Techniques: Clustering paradigm, Partition algorithms, CLARA, CLARANS; Hierarchical clustering, DBSCAN, BIRCH, CURE; Categorical clustering, STIRR, ROCK, CACTUS. Decision Trees: Tree construction principle, Best split, Splitting indices, Splitting criteria, Decision tree construction with presorting.

Module IV: Web Mining (10 hours)

Web content Mining, Web structure Mining, Web usage Mining, Text Mining. Temporal and Spatial Data Mining: Basic concepts of temporal data Mining, The GSP algorithm, SPADE, SPIRIT, WUM.

COURSE / LEARNING OUTCOMES

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

CO1: Understand the principles, concepts, functions and various applications of data warehouse. (*Knowledge*)

CO2: Have clear idea regarding various concepts related to Online Analytical Processing. (*Comprehension*)

CO3: Understand association rules and can implement various Data Mining algorithms. (*Application*)

CO4: Have a clear understanding of the various concepts of Web Mining. (*Synthesis*)

Suggested Readings

1. C.S.R.Prabhu, Data Warehousing- Concepts, Techniques, Products, Application, PHI.
2. AK Pujari, Data Mining Techniques, Universities Press.
3. Berson and S.J.Smith, Data Warehousing, Data Mining and OLAP, TMH.
4. M.H.Dunham, Data Mining Introductory and Advanced Topics, Pearson.

CSNS0057: COMPUTER NETWORKS

(4 credits – 60 hours)

Objective: *The course provides an understanding of the overriding principles of computer networking, including protocol design, protocol layering, algorithm design, and performance evaluation along with principles embodied in the protocols designed for the application layer, transport layer, network layer, and link layer of a networking stack.*

Module I (10 hours)

Review of OSI, TCP/IP models, Switching Techniques: Circuit Switching, Switching Techniques: Packet Switching, Multiple Accesses –RANDOM ACCESS-ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access, Channelization.

Module II (12 hours)

X.25, ATM, LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 – FDDI - SONET – Bridges.

Module III (15 hours)

Network Layer: IP addressing methods, Subnetting, ARP, RARP, BOOTP, DHCP – Routing – Distance Vector Routing – Link State Routing – Routers.

Module IV (12 hours)

Transport layer: Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

Module V (11 hours)

Application Layer: Domain Name Space (DNS), EMAIL, Network Security-PLAYFAIR CIPHER, AES, DES, Public key cryptosystem and RSA, Message authentication code using Hash Function, Introduction to Kerberos.

COURSE / LEARNING OUTCOMES

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

CO1: Gain the following characteristics: i. Understand and identify different networking terminologies such as TCP/OSI,protocols, routing , link errors etc. (*Knowledge*); ii. Understand and learn different network topologies, network, transport and application layer design issues, importance of QoS in a network. (*Knowledge*); iii. Understand the theory behind designing a network model and its importance, role of routing protocols in different network structure. (*Knowledge*)

CO2: Distinguish TCP from OSI, different layers protocols, subnetting, application layer security. (*Comprehension*)
CO3: Apply the knowledge to solve different problems related to subnetting, configuring working routing protocols in some model network topology, implement presentation layer security. (*Application*)
CO4: Analyze the pros ,cons and implementation of different routing protocols,IEEE standards, packet header value analysis under different circumstances. (*Analysis*)
CO5: Design topology implementing different routing protocols that best suits a real time demand, Application, network and transport layer. (*Synthesis*)
CO6: Judge which protocols operates in which layer and why. Proper address allocation in a network topology. (*Evaluation*).

Suggested Readings

1. Andrew S. Tanenbaum , Computer Networks, PHI
2. Larry L. Peterson and Bruce S. Davie, Computer Networks –A system approach.
3. Behrouz A. Forouzan, Data communication and Networking, Tata McGraw-Hill.
4. William Stallings, Data and Computer Communication, Pearson Education.
5. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Pearson Education.

CSSD0058: SOFTWARE ENGINEERING AND DESIGNING CONCEPTS

(3 credits – 45 hours)

Objective: *The objective of the course is to introduce the methodologies involved in the development and maintenance of software over its entire life cycle and make aware of different life cycle models, requirement dictation process, implementation and testing strategies and planning and management of software.*

Module I (12 hours)

a) Software Process: Introduction –S/W Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented), system engineering – computer based system – verification – validation – life cycle process – development process –system engineering hierarchy.
b) Software Requirements: Functional and non-functional - user – system –requirement engineering process, feasibility studies – requirements – elicitation – validation and management, software prototyping – prototyping in the software process – rapid prototyping techniques – user interface prototyping -S/W document. Analysis and modeling – data, functional and behavioral models – structured analysis and data dictionary.

Module II (5 hours)

Design Concepts and Principles: Design process and concepts, modular design, design heuristic, design model and document. Architectural design – software architecture

Module III (8 hours)

Data design – architectural design – transform and transaction mapping, user interface design – user interface design principles. Real time systems - Real time software design – system design, real time executives – data acquisition system - monitoring and control system. SCM – Need for SCM – Version control – Introduction to SCM process – Software configuration items. Introduction- Use case diagram, Class diagram, Activity diagram and Sequence diagram.

Module IV (10 hours)

Testing: Taxonomy of software testing, Levels, test activities, types of s/w test – black box testing –testing boundary conditions – structural testing – test coverage criteria based on data flow mechanisms, regression testing – testing in the large. S/W testing strategies–strategic approach and issues, unit testing, integration testing, validation testing, system testing and debugging.

Module V (10 hours)
Software Project Management: Measures and measurements – S/W complexity and science measure – size measure – data and logic structure measure – information flow measure. Software cost estimation – function point models – COCOMO model- Delphi method. Defining a Task Network – Scheduling – Earned Value Analysis – Error Tracking - Software changes – program evolution dynamics – software maintenance – Architectural evolution. Taxonomy of CASE tools.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO1: Identify the life cycle models of a software. (*Knowledge*)
CO2: Identify and differentiate various software complexities. (*Comprehension*)
CO3: Experiment with different software architectures and identify the best feasible one. (*Application*)
CO4: Analyze and design any software application or software product. (*Analysis*)
CO5: Develop and create various design diagrams and find solutions to problems. (*Synthesis*)
CO6: Summarize and validate a practical solution towards a software application development and also deploy a product of their own. (*Evaluation*)

Suggested Readings
1. Roger S.Pressman, Software Engineering- A practitioner's Approach, MGH.
2. Ian Sommerville, Software Engineering, Pearson Education.
3. Rajib Mall, Fundamentals of Software Engineering–, PHI.
4. Ali Behforooz and Frederick J Hudson, Software Engineering Fundamentals, Oxford University Press.
5. Pankaj Jalote, An Integrated Approach To Software Engineering, Narosa
6. Ghezzi, C.; M. Jazayeri; D. Mandrioli, Fundamentals Of Software Engineering (Second Edition), New Delhi: Prentice-Hall India, 2002
7. Fairley, R. E., Software Engineering Concepts, New Delhi: Tata McGraw-Hill, 1997
8. Vilet, H. V., Software Engineering Principles and Practice (Second Edition), New York: John Wiley and Sons

CSAA0059: ANALYSIS AND DESIGN OF ALGORITHMS

(4 credits – 60 hours)
Objective: *To create analytical skills, to enable the students to design algorithms for various applications and to analyze the algorithms with the objective to introduce mathematical aspects, design and analysis of algorithms.*

Module I (18 hours)
a) Basic Concepts of Algorithms: Introduction, Notion of Algorithm, Fundamentals of Algorithmic Solving, Important Problem types, Fundamentals of the Analysis Framework – Asymptotic Notations and Basic Efficiency Classes.
b) Mathematical Aspects and Analysis of Algorithms: Mathematical Analysis of Non-recursive Algorithm, Mathematical Analysis of Recursive Algorithm – Example: Fibonacci Numbers, Empirical Analysis of Algorithms, Algorithm Visualization. (12 hours)

Module II (15 hours)
Analysis of Sorting and Searching Algorithms: Brute Force – Selection Sort and Bubble Sort – Sequential Search and Brute-force string matching – Divide and conquer – Merge sort – Quick Sort – Binary Search – Binary tree- Traversal and Related Properties – Decrease and Conquer – Insertion Sort – Depth first Search and Breadth First Search.

Module III (15 hours)
Algorithmic Techniques: Transform and conquer – Presorting – Balanced Search trees – AVL Trees – Heaps and Heap sort – Dynamic Programming – Warshall's and Floyd's Algorithm – Optimal Binary Search trees – Greedy Techniques – Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman trees.

Module IV (12 hours)
Algorithm Design Methods: Backtracking – n-Queen's Problem – Hamiltonian Circuit problem – Subset-Sum problem – Branch and bound – Assignment problem – Knapsack problem – Traveling salesman problem.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO1: Know the formal definition of algorithms, importance of analysis of an algorithm and their asymptotic bounds. Students would get familiar with different types of problem and their solutions. (*Knowledge*)
CO2: Understand different design strategies such as brute force, divide and conquer, dynamic programming, greedy and backtracking used for the design of algorithms. (*Comprehension*)
CO3: Design and analyse algorithms for given problems. (*Application*)
CO4: Compare and analyse different design strategies. (*Analysis*)
CO5: Design new algorithms for given problems by using most appropriate algorithmic strategy considering the problem domain. (*Synthesis*)
CO6: Assess various algorithms in terms of correctness, computation cost and memory space used. (*Evaluation*)

Suggested Readings
1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Introduction to Algorithms, PHI.
2. A.V.Aho, J.E. Hopcroft and J.D.Ullman, The Design and Analysis Of Computer Algorithms, Pearson Education.
3. Anany Levitin, Introduction to the Design and Analysis of Algorithm, Pearson Education.
4. Sara Baase and Allen Van Gelder, Computer Algorithms - Introduction to Design and Analysis, Pearson Education.

CSCD0060: COMPILER DESIGN

(4 credits – 60 hours)
Objective: *The objectives of the course are to understand, design and implement a lexical analyzer, a parser, and generation schemes and to understand optimization of codes and runtime environment.*

Module I (12 hours)
Introduction to compiling: Compilers – Analysis of the source program – Phases of a compiler – Cousins of the Compiler – Grouping of Phases – Compiler construction tools – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens.

Module II (12 hours)
Syntax Analysis: Role of the parser –Writing Grammars –Context-Free Grammars – Top Down parsing – Recursive Descent Parsing – Predictive Parsing – Bottom-up parsing – Shift Reduce Parsing – Operator Precedent Parsing – LR Parsers – SLR Parser – Canonical LR Parser – LALR Parser. Syntax Directed translation: Syntax Directed definition, Construction of syntax trees, Bottom Up Evaluation of S-Attributed Definitions.

Module III (20 hours)
a) Intermediate Code Generation: Intermediate languages – Declarations – Assignment Statements – Boolean Expressions – Case Statements – Back patching – Procedure calls.
b) Code Generation: Issues in the design of code generator – The target machine – Runtime Storage management – Basic Blocks and Flow Graphs – Next-use Information –

A simple Code generator – DAG representation of Basic Blocks – Peephole Optimization.

Module IV (16 hours)
Code Optimization and Run time Environments: Introduction – Principal Sources of Optimization – Optimization of basic Blocks – Introduction to Global Data Flow Analysis – Runtime Environments – Source Language issues – Storage Organization – Storage Allocation strategies – Access to non-local names – Parameter Passing.

COURSE / LEARNING OUTCOMES

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

CO1: Understand the different phases of compiler design, their functionalities. They will also know about compiler design tools and techniques. (*Knowledge*)
CO2: Understand various types of parser and their merits and demerits. They also know about error handling technique in compiler construction. (*Comprehension*)
CO3: Implement different parsing technique to input string. (*Application*)
CO4: Compare and analysis different techniques of parsing. (*Analysis*)
CO5: Decide which parsing technique will be most suitable for any input given to them. They will also be able to know how to convert the given grammar to its respective non-left recursive grammar if it requires for certain type of parsing technique. (*Synthesis*)
CO6: Handle with code optimization, run time environment etc. during compilation. (*Evaluation*)

Suggested Readings

1. Cozmpilers Principles, Techniques and Tools- Alfred Aho, Ravi Sethi, Jeffrey D Ullman, Pearson Education.
2. Introduction to Compiler Techniques- J.P. Bennet, Tata McGraw-Hill.
3. Compiler Construction: Principles and Practice- Kenneth C. Louden, Thompson. Learning.
4. Practice and Principles of Compiler Building with C- Henk Alblas and Albert Nymeyer, PHI.

CSAI0061: ARTIFICIAL INTELLIGENCE
(4 credits – 60 hours)

***Objective:** The course objective is to make the students understand the principles of problem solving, search techniques and AI techniques for representation and manipulation of complex information and knowledge. The course also makes aware of several advanced AI applications and topics such as intelligent agents, planning and scheduling, machine learning and expert systems.*

Module I (15 hours)
Overview of Artificial intelligence: Problems of AI, AI technique, Tic -Tac-Toe problem. Intelligent Agents: Agents and environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problem Solving: Problems, Problem Space and search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs. Search techniques: Solving problems by searching: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Module II (18 hours)
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms and optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions and strategies in games,

the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening. Knowledge and reasoning: Knowledge representation issues, representation and mapping, approaches to knowledge representation, issues in knowledge representation. Using predicate logic: Representing simple fact in logic, representing instant and ISA relationship, computable functions and predicates, resolution, natural deduction.

Module III (15 hours)
Representing knowledge using rules: Procedural versus declarative knowledge, logic programming, forward versus backward reasoning, matching, control knowledge. Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets and fuzzy logics. Planning: Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. Natural Language processing: Introduction, Syntactic processing, semantic analysis, discourse and pragmatic processing.

Module IV (12 hours)
Learning: Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning and genetic learning. Expert Systems: Representing and using domain knowledge, expert system shells, knowledge acquisition. Basic knowledge of programming language like Prolog and Lisp.

COURSE / LEARNING OUTCOMES

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

CO1: Identify the need of incorporating human intelligence into machine and define the basic terms related to the concept of knowledge and representation, learning and reasoning, communication and language processing. (*Knowledge*)
CO2: Define problem state space, design algorithms to solve problems, generalized schema for knowledge interpretation and planning and language processing. (*Comprehension*)
CO3: Compute and demonstrate the problem in terms of state space and apply different AI algorithms to solve problems and construct logic to represent knowledge in computational domain and also to interpret the natural language. (*Application*)
CO4: Compare and analyse the performance of algorithms based on problem domain. (*Analysis*)
CO5: Design and create new intelligent algorithm for application development by integrating experience based learning. (*Synthesis*)
CO6: Judge and assess the algorithms based on completeness, optimality, space and time complexity for solving a problem in intelligent manner. (*Evaluation*)

Suggested Readings
1. Ritch and Knight, Artificial Intelligence, TMH.
2. S. Russel and P. Norvig, Artificial Intelligence A Modern Approach, Pearson.
3. Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI.
4. S. Kaushik, Logic and Prolog Programming, New Age International.

CSGM0062: COMPUTER GRAPHICS AND MULTIMEDIA

(3 credits – 45 hours)
Objective: *The objective of the course is to provide the understanding of the fundamental graphical operations and the implementation on computer, the mathematics behind computer graphics and to build a virtual environment and situation using animation and multimedia.*

Module I (10 hours)
Introduction to computer graphics and graphics systems: Overview of computer graphics, representing pictures, preparing, presenting and interacting with pictures for presentations; Visualization and image processing; RGB color model, direct coding, lookup table; storage

tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active and Passive graphics devices; Computer graphics software; Scan Conversion: Points and lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

Module II (12 hours)
2D transformation and viewing: Basic transformations: translation, rotation, scaling ; Matrix representations and homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons and ellipse. 3D transformation and viewing: 3D transformations: translation, rotation, scaling and other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, viewport clipping, 3D viewing.

Module III (10 hours)
Curves: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B- spline curves, rational B-spline curves. Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry. Color and shading models: Light and color model; interpolative shading model, Texture.

Module IV (13 hours)
Introduction to Multimedia: Concepts, uses of multimedia, hypertext and hypermedia. Image, video and audio standards. Audio: digital audio, MIDI, processing sound, sampling, compression. Video: MPEG compression standards, compression through spatial and temporal redundancy, inter-frame and intra-frame compression. Animation: types, techniques, key frame animation, utility, morphing. Virtual Reality concepts.

COURSE / LEARNING OUTCOMES

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

CO1: Recognize different graphics and multimedia systems comprising of software and hardware. (*Knowledge*)
CO2: Understand the fundamentals of graphical operations and the mathematics behind computer graphics. (*Comprehension*)
CO3: Write programmes to design various applications of computer graphics. (*Application*)
CO4: Compare and analyse different graphical systems and their application. (*Analysis*)
CO5: Synthesize methods to design computationally efficient multimedia and graphical application. (*Synthesis*)
CO6: Evaluate different techniques used to design various applications of computer graphics. (*Evaluation*)

Suggested Readings

1. Hearn and Baker, Computer Graphics (C version 2nd Ed.), Pearson.
2. Mukherjee, Fundamentals of Computer graphics and Multimedia, PHI.
3. D. F. Rogers, J. A. Adams, Mathematical Elements for Computer Graphics, TMH.
4. J. K. Buford, Multimedia Systems, Pearson Education

CSPM0063: PERSONAL AND MOBILE COMMUNICATION

(4 credits – 60 hours)

Objective: *The course on mobile communications introduces the principles of mobile systems and its technical aspects and services. The evolution of services related to technical aspects is emphasized for both public and professional mobile telephony standards (GSM, UMTS, etc.). Indoor access standards as Wireless LAN and ad hoc networks based on Bluetooth are also* *considered in the frame of the migration to wireless of wired applications. The course also emphasizes on cellular networks.*

Module I: Introduction to Personal Communications Services (PCS) (12 hours)
PCS Architecture, mobility management, Networks signaling, Global System for Mobile Communication (GSM) System overview: GSM Architecture, Mobile management, Network signaling. General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. W-CDMA, CDMA, 3G services

Module II: Wireless LANs (15 hours)
Characteristics, IEEE 802.11: Architecture, Physical Layer, MAC Layer, MAC Management, 802.11a and 802.1 1b. HIPERLAN: History, WATM, BRAN and HiperLAN2. Bluetooth: Architecture, Radio Layer, Baseband Layer, Link Management Protocol, L2CAP and Security.

Module III: Mobile Transport and Network Layer (18 hours)
Introduction, Traditional TCP: Congestion Control, Slow Start, Fast Retransmit and Implications of Mobility. Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP and Fast Retransmit. Mobile IP: Introduction, IP Packet Delivery, Agent Discovery, Registration, Tunneling and Encapsulation, Optimizations and Reverse Tunneling. Mobile Ad-hoc Networks: Routing, Destination Sequence Distance Vector, Dynamic Source Routing and Alternative Metrics.

Module IV: Cellular Networks (15 hours)
Cellular Concept, Frequency Reuse, Channel Allocation Management, Call Setup, Location Management, Cell Handoffs, Interference: Co-channel and Adjacent Interference. System Capacity, Improving Cell Capacity and Coverage: Cell Splitting, Sectoring, Repeaters and Microcell Zone Concept. Wireless Application Protocol: Introduction, Protocol Stack, Connections.

COURSE / LEARNING OUTCOMES

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

CO1: Understand and identify different mobile communication terminologies such as GSM, GPRS, CDMA, W-CDMA etc.; Gain knowledge of ways and means of dealing with specifies: Understand and learn different wireless LAN, Mobile transport and network layer and basics of cellular network; Gain knowledge of the universals and abstractions in a field: Understand the theory behind designing a GSM network, wireless LAN, building mobile communication protocols. (*Knowledge*)

CO2: Distinguish GSM from CDMA/W-CDMA, mobile communication from 802.11, mobile communication transport and network layer protocols from TCP/IP. (*Comprehension*)

CO3: Apply the knowledge to solve problems like but not specific to frequency reuse problems, DSDV etc. (*Application*)

CO4: Analyze the pro, cons and implementation of different routing protocols in Mobile communication, IEEE standards, for 802.11, distinguish the working principle of mobile communication from 802.11 (*Analysis*)

CO5: Students would be able to design and analysis theoretical mobile communication model, develop routing protocols for packet delivery. (*Synthesis*)

CO6: Students would be able to judge which protocols operates in which layer and the corresponding pros and cons. (*Evaluation*)

Suggested Readings

1. J. Schiller, Mobile Communications, Addison-Wesley.
2. T. S. Rappaport, Wireless Communications: Principle and Practices, Pearson.
3. R. Pandya, Mobile and Personal Communication Systems and Services, PHI.
4. J.Burkhardt, Pervasive Computing: Technology and Architecture, Pearson.

CSIR0064: IMAGE PROCESSING AND PATTERN RECOGNITION

(4 credits – 60 hours)

Objective: *The objective of the course is to be familiar with Image acquisition, digital image representation, various image processing operations for improving image quality through enhancement, segmentation and representation. The course also focuses on pattern recognition and extraction of image features.*

Module I (15 hours)

a) Introduction: Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.
b) Digital Image Formation: A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling and Quantization - Uniform and Non uniform.
c) Mathematical Preliminaries: Neighbour of pixels, Connectivity, Relations, Equivalence and Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine and Sine Transform.

Module II (20 hours)

a) Image Enhancement Techniques: Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters : Smoothing – Sharpening filters – Homomorphic filtering.
b) Image Segmentation and Representation: Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors- Texture

Module III (10 hours)

Basic Concepts, Pattern Recognition Systems, Fundamental Problems in pattern recognition system design, Design concepts and Methodologies – Character recognition – Speech recognition – Fingerprint Recognition – Pattern Recognition Model. Decision Functions – Linear Decision functions – Distance functions. Minimum distance classification, clustering concepts, Cluster seeking algorithms, Maximum distance, K- means Algorithms.

Module IV (10 hours)

Bayes classifier, decision function for Baye's classifier, Baye's Classifier for normal patterns. Trainable pattern classifiers - deterministic approach, perception approach reward-punishment concept. Gradient approach- Gradient Descent algorithms, LMSE Algorithms, Multi category classification. Introduction to statistical approach – stochastic approximation methods

Module V (5 hours)

Introduction to Image processing toolbox in MATLAB: MATLAB Basics, Image processing toolbox, Importing and displaying images, Converting between image types, Exporting images, Importing and playing video files, obtaining pixel intensity values, Extracting a region of interest, Computing pixel statistics on a region of interest, Measuring object sizes, Preprocessing Images, Adjusting image contrast, reducing noise in an image Using sliding neighborhood operations, Using block processing operations, Spatial Transformation and Image Registration, Geometric transformations, Edge and Line Detection, Segmenting object edges, Detecting straight lines, performing batch analysis over sets of images, Detecting circular objects, Color space transformation, Color Segmentation, Texture segmentation, Texture based image classification, using morphological operations.

COURSE / LEARNING OUTCOMES

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

CO1: Recognize fundamentals of digital image processing, mathematical modeling of digital images, various image enhancement filters, methods for image segmentation and representation, basic concepts of pattern recognition, design concepts and methodologies used for recognition of characters, speech etc., various clustering and classification techniques. (*Knowledge*)

CO2: Familiarize themselves with programming in MATLAB (syntax and semantics) and MATLAB library for processing images. (*Knowledge*)

CO3: Understand process of image acquisition, image enhancement, image segmentation and classification. Students would be able to understand and distinguish the need of various image processing filters and pattern recognition approaches depending on the application. (*Comprehension*)

CO4: Apply image processing filters and pattern recognition methods to images using MATLAB. (*Application*)

CO5: Analyse different available methods for performing image processing and pattern recognition operations. (*Analysis*)

CO6: Design new methods to perform image enhancement, image segmentation and pattern recognition. (*Synthesis*)

CO7: Evaluate the suitability of image processing filters and pattern recognition approaches depending on the image quality, expected outcome of the application and also considering the performance of the method/filter. (*Evaluation*)

Suggested Readings

1. R.C.Gonzalez and R.E.Wood, Digital Image Processing, Addison Wesley.
2. J.T. Tou, R.C. Gonzalez, Pattern Recognition Principles, Addison Wesley.
3. Anil Ku Jain, Fundamentals of Digital Image Processing, PHI.
4. B.Chanda and D.Dutta, Digital Image Processing and Analysis, Prentice Hall.

CSRE0065: REAL TIME AND EMBEDDED SYSTEMS

(4 credits – 60 hours)

Objective: *This course will discuss the design issues in an embedded system and the technologies needed to support such systems, with the focus on the software aspects. This course will discuss the design issues in an embedded system and technologies needed to support such systems.*

Module I (12 hours)

Embedded Architecture: Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, embedded system design process- Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design-Structural Description, Behavioral Description, Design Example: Model Train Controller.

Module II (18 hours)

Embedded Processor and Computing Platform: ARM processor, processor and memory organization, Data operations, Flow of Control, SHARC processor- Memory organization, Data operations, Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock.

Module III (10 hours)

Networks: Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I2C, CAN Bus, SHARC link ports, Ethernet, Myrinet, Internet, Network-Based design- Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

Module IV (10 hours)
Real-Time Characteristics: Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in priority driven systems, Off-line versus On- line scheduling.

Module V (10 hours)
System Design Techniques: Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design, Quality Assurance, Design Example: Telephone PBX- System Architecture, Ink jet printer- Hardware Design and Software Design, Personal Digital Assistants, Set-top Boxes.

COURSE / LEARNING OUTCOMES

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

CO1: Describe the theoretical concepts of embedded system, identify the design issues in real time embedded system and explain the architecture of distributed embedded systems. (*Knowledge*)

CO2: Comprehend the various aspects of embedded system used in real life ranging from home appliances to industrial applications, automotives etc. (*Comprehension*)

CO3: Apply the design methodologies, ideas and concepts learnt to design real time embedded system and write programs using ARM assembly language. (*Application*)

CO4: Compare and contrast the different design methodologies in developing real time embedded systems, scheduling algorithms and would also resolve various issues of I/O programming in ARM and SHARC processors. (*Analysis*)

CO5: Plan, design and develop software as well as assemble the hardware required to develop an embedded system taking into account the desired real-time characteristics. (*Synthesis*)

CO6: Assess the design principle and development process of real time embedded system and check whether it meets the functional as well as non-functional requirements of the system. (*Evaluation*)

Suggested Readings

1. Frank Vahid and Tony Givargis, Embedded System Design, John Wiley and sons, Inc.
2. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kauffman publishers, 2001
3. Alan C. Shaw, Real-Time Systems and software, John Wiley and Sons Inc
4. Daniel W. Lewis, Fundamentals of Embedded Software, Pearson
5. J. W. S. Liu, Real time Systems, Pearson
6. S. V. Iyer and P. Gupta, Embedded Real-time System Programming, TMH
7. David E. Simon, An Embedded System Primer, Addison-Wesley Publishers
8. Steve Heath, Embedded System Design, Butterworth-Heinemann Publishers
9. Graham Wilson, Embedded System Computer Architecture, Butterworth-Heinemann

CSAP0066: ADVANCED COMPUTER ARCHITECTURE AND PARALLEL PROCESSING

(3 credits – 45 hours)

Objective: *This course is intended to introduce the students to the field of modern computer architecture design stressing parallel processing techniques. The course is a comprehensive study of parallel processing techniques and their application from basic concepts to state-of-the-art parallel computer systems.*

Module I (12 hours)
Introduction to Parallel Processing: Shared Memory Multiprocessing, Distributed Memory, Parallel Processing Architectures- Introduction-Parallelism in sequential Machines, Abstract Model of Parallel Computer, Multiprocessor Architecture, Array Processors.

Module II (10 hours)
Pipelining and Super Scalar Techniques, Linear Pipeline Processors, Non-Linear Pipeline processors, Instruction pipeline design, Arithmetic pipeline Design, Super Scalar and Super pipeline Design.

Module III (11 hours)
Programmability Issues - An Overview, Operating system support, Types of Operating Systems, Parallel Programming models, Software Tools-Data Dependency Analysis- Types of Dependencies, Program Transformations, Shared Memory Programming.

Module IV (12 hours)
Thread-based Implementation, thread Management, Attributes of Threads, Mutual Exclusion with Threads, Mutex Usage of Threads, Thread implementation, Events and Conditions variables, Deviation Computation with Threads, Java Threads, Distributed Computing: Message Passing Model, General Model, Programming Model, PVM-Algorithms for Parallel Machines, Debugging Parallel programming, Other Parallelism Paradigms.Analysis of parallel algorithm, Matrix operations

COURSE / LEARNING OUTCOMES

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

- CO1: Identify the classes of computers and new trends and developments in computer architecture. (*Knowledge*)
- CO2: Explain different processor architectures and system-level design processes. (*Comprehension*)
- CO3: Categorize pipelining, instruction set architectures, memory addressing. (*Synthesize*)
- CO4: Analyze the performance metrics of microprocessors, memory, networks, and disks. (*Analysis*)
- CO5: Apply various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges. (*Application*)
- CO6: Interpret multithreading by using ILP and supporting thread-level parallelism (TLP). (*Analysis*)
- CO7: Describe symmetric shared-memory architectures and their performance. (*Knowledge*)
- CO8: Summarize multiprocessor cache coherence using the directory based and snooping class of protocols. (*Comprehension*.
- CO9: Illustrate the various memory models to achieve memory consistency. (*Application*)
- CO10: Develop systems programming skills in the content of computer system design and organization. (*Synthesis*).
- CO11: Critique storage systems, RAID, I/O performance, and reliability measures. (*Evaluation*)
- CO12: Analyze of various parallel algorithms. (*Analysis*)

Suggested Readings

1. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw Hill.
2. M. Sasikumar, D. Sikhare and P. Ravi Prakash, Introduction to Parallel Processing, PHI.
3. W. Stallings, Computer Organization and Architecture, PHI.
4. K. Parthasarathy, Advanced Computer Architecture, Thomson Business Information.

CSET0067: EMERGING TRENDS IN COMPUTING- CLOUD COMPUTING

(3 credits – 45 hours)

Module I (10 hours)

Introduction to Cloud Computing, the Evolution of Cloud Computing, Hardware Evolution, Internet Software Evolution, Server Virtualization, Web Services Deliver from the Cloud, Communication- as-a-Service, Infrastructure-as-a-Service, Monitoring-as-a-Service, Platform-as-a-Service, Software- as- a-Service, Building Cloud Network

Module II (13 hours)

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Map-reduce.

Module III (14 hours)

Putting Security on the Spot with Questions: Understanding Security Risks, Reducing Cloud Security Breaches, Implementing Identity Management, Benefits of identity management, Aspects of identity management, Playing Detective: Detection and Forensics, Activity logs, HIPS and NIPS, Data audit, Encrypting Data, Creating a Cloud Security Strategy

Module IV (8 hours)

Virtualization and the Cloud: Visualizing Virtualization, Characteristics, Using a hypervisor in virtualization, Abstracting hardware assets, Managing Virtualization, Foundational issues, Abstraction layer, Provisioning software, Virtualizing storage, Hardware provisioning, Security issues, Taking Virtualization into the Cloud

COURSE / LEARNING OUTCOMES

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

CO1: Identify and memorize the various evolutionary steps of computation. (*Knowledge*)

CO2: Distinguish and define the web services delivered via cloud. (*Comprehension/ Knowledge*)

CO3: Deploy and construct a virtual private cloud using amazon web service as IaaS. (*Application*)

CO4: Define and analyze the concepts of Big data and Hadoop components. (*Knowledge/Analysis*)

CO5: Run an application using map reduce program. (*Application*)

CO6: Design a vulnerability assessment tool for cloud computation. (*Synthesis*)

CO7: Illustrate the use of management console for virtualization using hypervisors. (*Application/Analysis*)

CO8: Create and assess a real time application deployed on cloud platform. (*Synthesis/Evaluation*)

Suggested Readings

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kaufman, F.Halper, (Wiley India Edition)
2. Enterprise Cloud Computing by Gautam Shroff,Cambridge
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
4. Google Apps by Scott Granneman,Pearson
5. Cloud Security and Privacy by Tim Malhar, S.Kumaraswamy, S.Latif (SPD,O'REILLY)
6. Cloud Computing : A Practical Approach, Anthony T Velte, et.al McGraw Hill,
7. Cloud Computing Bible by Barrie Sosinsky, Wiley India

CSDG0068: DISTRIBUTED COMPUTING

(3 credits – 45 hours)

Objective: *This course provides an introduction to the fundamentals and structure of distributed computer systems including distributed memory, distributed file systems, distributed databases, security, protection and process management.*

Module I (10 hours)

Fundamentals: Introduction, Models and Features, Concept of distributed operating system, Issues in design of a distributed operating system. Message Passing: Good message passing system, IPC, Synchronization, Buffering, Multi-datagram messages, Encoding and decoding techniques, Process addressing, Failure handling, Group communication; Remote procedure calls (RPC) - Models, Communication protocols, RPC, Lightweight RPC.

Module II (12 hours)

Distributed Shared Memory: Architecture, Thrashing, Granularity, Advantages. Synchronization: Introduction, Clock Synchronization, Event handling, Mutual Exclusion; Deadlock – Conditions, Avoidance, Prevention, Recovery.

Module III (11 hours)

Resource and Process Management: Features of a good scheduling algorithm, Task assignment approach, Load balancing and load sharing approach, Introduction to process management, Process migration, Threads. Distributed File Systems: Introduction, Features, Models, Accessing models; sharing Semantics and caching schemes, replication, Fault Tolerance, Atomic transactions.

Module IV (12 hours)

Naming: Introduction, Features, Fundamental Terminologies and concepts, System oriented names, Human oriented names, Name caches. Security: Potential attacks to computer system, Cryptography, Authentication, digital signatures, Access Control.

COURSE / LEARNING OUTCOMES

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

CO1: Identify and memorize the various evolutionary steps of distributed computing. (*Knowledge*)

CO2: Distinguish and define the various distributed computing system models. (*Comprehension*/ *Knowledge*)

CO3: Demonstrate the purpose of using message passing mechanisms and illustrate the various synchronization techniques used in distributed computing. (*Application*)

CO4: Define and analyze the concepts of Big data and Hadoop components. (*Knowledge/Analysis*)

CO5: Run an application using map reduce program. (*Application*)

CO6: Categorize distributed computing systems based on load balancing and load sharing approaches. (*Synthesis*)

CO7: Illustrate the use of replication and fault tolerance to analyze the efficiency of a distributed computing system. (*Application/Analysis*)

CO8: Describe the necessity of having a global naming system and explain why security is such an essential component in designing a trustable distributed system. (*Synthesis/Evaluation*)

Suggested Readings

1. P.K.Sinha, Distributed Operating Systems: Concepts and Design, PHI.
2. A.S. Tanenbaum, Distributed Operating Systems, Pearson.
3. G. Coulouris, J. Dollimore and T. Kindberg, Distributed Systems: Concepts and Design, Pearson.
4. A. Silberschatz and P. Galvin, Operating System Concepts, John Wiley.

CSNC0069: NETWORK SECURITY AND CRYPTOGRAPHY

(3 credits – 45 hours)

Objective: *The course is intended to understand network security threats and countermeasures, fundamentals of cryptography and techniques of key encryption, authentication, IP security, network security and web security.*

Module I (8 hours)

Introduction to the concepts of Security: Introduction, The Need for Security, Security approaches, Principles of Security, Types of Attacks. Cryptographic Techniques: Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Possible Types of attacks.

Module II (15 hours)

Computer Based Symmetric Key Cryptographic Algorithms: Introduction, Algorithm Types and modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC5, Blowfish, Advanced Encryption Standard (AES).Computer Based Asymmetric Key Cryptographic Algorithms: Introduction, Brief history of Asymmetric Key Cryptography, An Overview of Asymmetric Key Cryptography, the RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm.

Module III (12 hours)

Public Key Infrastructure: Introduction, Digital Certificates,the PKIX, Public Key Cryptography Standards (PKCS) XML, PKI and Security. Internet Security Protocols: Basic Concepts, Secure Socket Layer (SSL), Secure Hyper Text Transfer Protocols (SHTTP), Time Stamping Protocol (TSP), Secure Electronic Transaction (SET), PGP, IPSec, 3-D Secure Protocol, Email Security, Security in GSM.

Module IV (10 hours)

User Authentication Mechanisms: Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based Authentication, Biometric Authentication, Kerberos, Single Sign On (SSO) Approaches. Network and System Security: Brief Introduction to TCP/IP, Vulnerability, Monitoring/Sniffing, Spoofing, Firewalls, Intrusion Detection, others (DNS, DoS etc). Wireless Application Protocol (WAP), Security in UMTS. Introduction to Operating System security: Computer systems overview, Buffer overflow. Introduction to Securing UNIX.

COURSE / LEARNING OUTCOMES

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

CO1: Identify the concept and significance of network security, types of attacks and also recognize the different encryption techniques adopted in both traditional modern cryptographic mechanisms. (*Knowledge*)

CO2: Infer the logic adopted in different cryptographic algorithms, and their countermeasures. (*Comprehension*)

CO3: Employ the concepts gathered from the fundamentals of cryptographic and security approaches in solving related problems. (*Application*)

CO4: Compare and contrast the need and working of different network security protocols, services and mechanisms. (*Analysis*)

CO5: Hypothesize and may be generate techniques, algorithms related to IP security, network security and web security. (*Synthesize*)

CO6: Assess and critique references to computer security appearing in any other academic or non-academic curriculum. (*Evaluation*)

Suggested Readings

1. A. Kahate, Cryptography and Network Security, PHI.

2. W. Stallings, Cryptography and Network Security, PHI.
3. B. A. Forouzan, Cryptography and Network Security, McGraw Hill.
4. W. Stallings, Network Security Essentials: Applications and Standards, Pearson.

CSAO0070: CONCEPTS OF ADVANCED OPERATING SYSTEMS

(3 credits – 45 hours)

Objective: *The objective of the course is to expose students to advanced concepts and design issues of operating systems which will give a basic understanding of the industry's leading advanced operating systems. Students should be able to identify each system and know the operational and administrative requirements of them.*

Module I (10 hours)

Concepts of processes, Concurrent processes, Threads, Overview of different classical synchronization problems, Monitors, Communicating Sequential processes (CSP), Process deadlocks: Introduction, causes of deadlocks, Deadlock handling strategies, Models of deadlock.

Module II (11 hours)

Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lampert's global state recording algorithm,Basic concepts of Distributed Mutual Exclusion, Lamport's Algorithm, Ricart -AgrawalaAlgorithm;Basic concepts of Distributed deadlock detection, Distributed File system, Architecture, Design issues, SUN Network File system, Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing

Module III (12 hours)

Multiprocessor System: Motivation, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions and requirements; Design and Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization. Performance, Coprocessors, RISC and data flow: Introduction, Necessity, Measures, Techniques, Bottlenecks and Saturation, Feedback loops, Coprocessors, RISC.

Module IV (12 hours)

Analytic Modeling: Introductions, Queuing Theory, Markov Process. Security and Protection: Security-threats and goals, Penetration attempts, Security Policies and mechanisms, Authentication, Protections and access control Formal models of protection, Cryptography, worms and viruses.

COURSE / LEARNING OUTCOMES

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

CO1: Describe the concept of concurrent processes, deadlock, process synchronization and must be able to list the various conditions for identifying these scenarios. They will also be able to define the advanced terms like distributed deadlock, distributed mutual exclusion, distributed file system etc. (*Knowledge*)

CO2: Explain the concept of Lamport's logical clock, global state and give example of consistent, transit and inconsistent global state. They will also be able illustrate the Chandy-Lampert's algorithm for consistent global state recording. (*Comprehension*)

CO3: Apply various algorithms like Lamport's algorithm and Ricart- Agarwala algorithm to solve the problem of distributed mutual exclusion. They will also be able to detect distributed deadlock using various algorithm. (*Application*)

CO4: Compare techniques of implementing distributed file system, distributed shared memory, different load scheduling algorithms like- load balancing and load sharing. (*Analysis*)

CO5: Summarize the design and implementation issues of multiprocessor operating system. (*Syntheis*)

CO6: Judge the requirement of security and protection for a computer system and will also be able to estimate the efficiency of different security models. (*Evaluation*)

Suggested Readings

1. Milan Milenkovic, Operating Systems Concepts and Design, TMH.
2. H.M. Deitel, Operating System, Pearson.
3. M. Singhal and N. G. Shivaratri, Advanced Concepts in Operating Systems, TMH.
4. A. Silberschatz, P. B. Galvin and G. Gagne, Operating System Concepts, John Wiley and Sons.

CSIJ0071: INTRODUCTION TO JAVA PROGRAMMING

(4 Credits–60 hours)

Objective: *The course is designed to impart the knowledge and skill required to solve real world problem using object-oriented approach utilizing Java language constructs. This course covers the two main parts of Java i.e. Java Language and Java Library (JDK 5). After completion of the course, a student is expected to be able to*

- *Do Object Oriented Programming using Java*
- *Implement Exception handling and Multithreading in Java.*
- *Create Java Applets.*
- *Set up a GUI using Swing components*
- *Do Network Programming in Java.*

Module I: Java Fundamentals (16 hours)

Genesis, Java Philosophy, Java & Internet, Object-Oriented Programming features, Java Applet and Application, Java Environment and Java Development Kit (JDK) and Java Standard Library (JSL),Tokens, Expressions, Using Data Types, Declarations, Control Flow

Module II: Java Classes, Packages and Interfaces, Java Streams (14 hours)

a) Introduction, Classes, Working with Objects, Packages, Inheritance, Interfaces
b) Data Flow with Java Streams, Input Streams, Output Streams

Module III: Exception Handling in Java and Java threads (10 hours)

a) Introduction, Exception Methods, java.lang Exceptions
b) Introduction, Creating Threads, The Life Cycle of a Thread, Thread Methods, Using Threads, Synchronization of Threads

Module IV: Java Applets (10 hours)

Introduction, Applet Examples, The java.applet.Applet Class, The Five Stages of an Applet's Life Cycle, Methods for Adding UI Components, Methods for Drawing and Event Handling

Module V: Java AWT (10 hours)

Introduction, Swing Component and Container classes, Layout managers (FlowLayout, GridLayout, BorderLayout), Handling events, Adapter classes, Anonymous inner classes, Swing GUI components :JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollBar, JScrollPane, JToolTip, JPanel, JFrame, introduction to database connectivity with JDBC.

COURSE / LEARNING OUTCOMES

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

CO1: Describe the structure and model of the Java programming language. (*Knowledge*)

CO2: Use the Java programming language for various programming technologies. (*Application*)

CO3: Develop software in the Java programming language. (*Application*)

CO4: Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements. (*Analysis*)

CO5: Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem. (*Synthesis*)

CO6: Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (*Evaluation*)

Suggested Readings

1. Deitel, H. M.; P. J. Deitel, Java : How To Program, New Delhi: Prentice Hall India
2. Schildt, H., The Complete Reference Java 2 , New Delhi: Tata McGrawHill
3. Moss, K., Java Servlets , New Delhi Tata McGraw-Hill
4. Russell, Java Programming for the absolute Beginner , New Delhi: Prentice-Hall India
5. Hanagan D., Java Examples in a Nutshell ,New Delhi: O' Reilly

CSCL0072: CLOUD COMPUTING

(4 Credits–60 hours)

Objective: This course is designed to enable students

- *To get acquaint with the latest computational model, i.e. cloud computing*
- *To understand the basic foundational elements of cloud computing*
- *To study details of Data storage in cloud, big data file handling and parallel computing basics*
- *To get familiarized with popular cloud platforms and applications*

Module I (15 hours)

Introduction to cloud computing, the evolution of cloud computing, hardware evolution, internet software evolution, server virtualization, web services deliver from the cloud, communication-as-a-service, infrastructure-as-a-service,monitoring-as-a-service, platform-as-a- service, software-as-a-service, building cloud network

Module II (18 hours)

Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Map-reduce.

Module III (15 hours)

Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud, Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Cloud computing security challenges: Virtualization security management virtual threats, VM Security Recommendations, Secure Execution Environments and Communications in cloud.

Module IV (12 hours)

Issues in cloud computing, implementing real time application over cloud platform, Issues in Inter cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment.

COURSE / LEARNING OUTCOMES

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

CO1: Recognize the differences in cloud services and deployment models. (*Knowledge*)

CO2: Describe the behaviour of Big Data and the components of Hadoop. (*Knowledge*)

CO3: Describe and compute MapReduce programs. (*Comprehension/ Application*)

CO4: Illustrate the security principles in cloud computing and predict the vulnerabilities. (*Application/ Analysis*)

CO5: Demonstrate the application of HDFS by transferring a file from local file system to HDFS or vice versa and justify the transactions using HDFS commands. (*Application/ Evaluation*)

CO6: Demonstrate the hosting of real time application on cloud platform. (*Analysis*)

CO7: Design and build a cloud network using OpenStack. (*Synthesis*)

Suggested Readings

1. Enterprise Cloud Computing by Gautam Shroff,Cambridge
2. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
3. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, (Wiley India Edition)
4. Google Apps by Scott Granneman, Pearson
5. Cloud Security and Privacy by Tim Malhar, S. Kumaraswamy, S.Latif (SPD,O'REILLY)
6. Cloud Computing : A Practical Approach, Anthony T Velte, et.al McGraw Hill
7. Cloud Computing Bible by Barrie Sosinsky, Wiley India

CSNW0073: NETWORK SECURITY

(4 Credits–60 hours)

Objective: *This course provides a beginners approach to understanding the basic security concepts in a Network along with different mitigation techniques of several attacks. After the completion of the course students will be able to understand security measures to be adopted in different devices and network applications used to interface with inter network.*

Module I (18 hours)

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

Module II (18 hours)

Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC, Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management Kerberos, X.509 Directory Authentication Service.

Module III (12 hours)

Email privacy: Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Module IV (12 hours)

Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. Intruders, Viruses and related threats. Firewall Design principles, Trusted Systems, Intrusion Detection Systems, Ransomware and different types of Ransomware, Methodology of execution of Ransomware.

COURSE / LEARNING OUTCOMES

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

CO1: Identify the different security attacks, requirements, mechanisms and services in the practical field. (*Knowledge*)

CO2: Recognize and summarize the core principles of cryptography and cryptanalysis available today, including symmetric and asymmetric encryption, hashing, and digital signatures. (*Comprehension*)

C03: Discover and relate themselves with the different vulnerabilities, a system in a network can have. (*Application*)

CO4: Interpret and predict the issues of securing computer and information systems. (*Analysis*)

CO5: Reconstruct how malicious code functions, relate the vulnerabilities that make proliferation possible and rewrite methods and practices are available for alleviation. (*Synthesis*)

CO6: Assess and critique references to computer security appearing in other academic and non-academic curriculum. (*Evaluation*)

Suggested Readings

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech.
3. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.
4. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
5. Cryptography and network Security, Third edition, Stallings, PHI/Pearson
6. Principles of Information Security, Whitman, Cengage Learning.
7. Cryptography and Network Security, S.Bose , Pearson

CSMC0074: MOBILE COMMUNICATION

(4 Credits–60 hours)

Objective: *The course on mobile communications introduces the principles of mobile systems and its technical aspects and services. The evolution of services related to technical aspects is emphasized for both public and professional mobile telephony standards. Indoor access standards as Wireless LAN and adhoc networks based on Bluetooth are also considered in the frame of the migration to wireless of wired applications. The course also emphasizes on cellular networks.*

Module I: Introduction to Personal Communications Services (PCS) (12 hours)

Personal Communications Services (PCS): Architecture, Cellular Telephony, Coreless Telephony; Overview of AMPS, GSM, DAMPS, CDMA; 3G Wireless Systems

Module II: Wireless LANs (15 hours)

Infra-red vs. Radio Transmission, Infrastructure and Ad-hoc Network; IEEE 802.11: Architecture, Medium Access Control Layer, MAC Management, 802.11a, 802.11b; HIPERLAN: HIPERLAN 1, WATM, BRAN, HIPERLAN 2; Bluetooth

Module III: Mobile Transport and Network Layer (18 hours)

a) Mobile Transport Layer: Traditional TCP: Congestion Control, Slow Start, Fast Retransmission, Fast Recovery; Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmission, Fast Recovery
b) Mobile Network Layer: Mobile IP, Dynamic Host Configuration Protocol, Mobile ad-hoc networks

Module IV: Cellular Networks (15 hours)

Cellular Concept: Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Improving Capacity in Cellular Systems, Cell Splitting, Sectoring, Microcell Zone Concept

COURSE / LEARNING OUTCOMES

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

CO1: Know about different mobile communication technology including AMPS, GSM, GPRS, #G, $G etc. (*Knowledge*)
CO2: Understand wireless communication, relevant protocols, layer structure, function of different layers etc. (*Comprehension*)
CO3: Work in mobile environment, creation of mobile network and understanding their functions. (*Application*)
CO4: Analyse packet structure and functions of packet header with respect to different fields. (*Analysis*)
CO5: Synthesise mobile protocols, data communications and variation with respect to different network parameters. (*Synthesis*)
CO6: Evaluate network performance and also be able to know how to get mobile communication in best possible way. (*Evaluation*)

Suggested Readings

1. J. Schiller, Mobile Communications, Addison-Wesley.
2. T. S. Rappaport, Wireless Communications: Principle and Practices, Pearson.
3. R. Pandya, Mobile and Personal Communication Systems and Services, PHI.
4. J.Burkhardt, Pervasive Computing: Technology and Architecture, Pearson.

CSAD0075: ANDROID APPLICATION DEVELOPMENT FUNDAMENTALS

(4 credits - 60 hours)

Objective: This course is designed to enable students to get complete understanding of the android applications development. On completion of this course, students will be able to design, develop, debug and deploy various real-time applications.

Module I: Get started (2 hours Theory and 8 hours Lab)

a) Get started: Build your first app, Introduction to Android, Create Your First Android App, Layouts, Views and Resources, Text and Scrolling Views.
b) Activities: Understanding Activities and Intents, the Activity Lifecycle and Managing State, Activities and Implicit Intents.
c) Testing, debugging, and using support libraries: The Android Studio Debugger, Testing your App, The Android Support Library

Module II: User experience (3 hours Theory and 10 hours Lab)

a) User interaction: User Input Controls, Menus, Screen Navigation, RecyclerView,
b) Delightful user experience: Drawables, Styles, and Themes, Material Design, Providing Resources for Adaptive Layouts
c) Testing your UI: Testing the User Interface

Module III: Working in the background (2 hours Theory and 8 hours Lab)

a) Background Tasks: AsyncTask and AsyncTaskLoader, Connect to the Internet, Broadcast Receivers, Services
b) Triggering, scheduling and optimizing background tasks: Notifications, Scheduling Alarms, Transferring Data Efficiently

Module IV: All about data (4 hours Theory and 16 hours Lab)

a) Preferences and Settings: Storing Data, Shared Preferences, App Settings
b) Storing data using SQLite: SQLite Primer, SQLite Database,
c) Sharing data with content providers: Share Data Through Content Providers
d) Loading data using loaders: Loaders

Module V: What's Next? (1 hour Theory and 6 hours Lab)

a) Permissions, Performance and Security

b) Firebase and AdMob
c) Publish

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:
CO1: Understand the evolution of the Android operating system. (*Knowledge*)
CO2: Understand the functionalities of the Android development framework. (*Comprehension*)
CO3: Create applications for different requirements. (*Application*)
CO4: Understand the basics of commercializing an application. (*Analysis*)
CO5: Analyse the working of Android Applications. (*Synthesis*)
CO6: Synthesise real time product for real time problems. (*Evaluation*)

Suggested Readings

1. Android Developer Fundamentals Course – E-book by the Google Developer Training team.
2. The practical workbook: Android Developer Fundamentals Course—Practical's E-book.
3. Slide decks & Videos of lectures for reference provided by Google.

CSRM0076: INTRODUCTION TO RESEARCH METHODOLOGY AND STATISTICAL TOOLS

(3 credits – 45 hours)

Objective: *Research is a tool which helps the student to identify, understand and solve management problems. Research improves one's decision making ability. The objective of this course is to create a scientific attitude towards understanding and solving a problem and to impart knowledge about tools available for carrying out research.*

Module I: Research Methodology (20 Hours)

a) Meaning, Objectives and Motivation in Research, types of Research, Research Approaches, Research Process, Validity and Reliability in Research, Obstacles in accepting research. Problem Formulation, Hypothesis Formulation, types of Hypothesis, characteristics of Good Hypothesis .Meaning and Significance of Research Designs, Features of a good research design, types of research design, contents of research design
b) Census Vs. Sample - Steps in Sample Design, Determining the size of Sample. Sampling methods - Simple Random Sampling, Stratified Sampling, Systematic Sampling, Cluster Sampling, Selective Sampling.
c) Data, Measurement and Scaling Techniques -Types of Data, Sources of Data – Primary and Secondary Data. Methods of collecting the data. Testing the validity of the data. Measurement and scaling techniques, errors in measurement, tests of sound measurement, scaling and scale construction techniques
d) Questionnaire, Presentation and Report writing: Steps in Questionnaire design, characteristics of a good questionnaire .Presentation, Processing and Analysis and Interpretation of Data. Report Writing – layout of a Research Report, Characteristics of a good research report.

Module II: Statistical Tools (25 Hours)

a) Measures of Central Tendencies and Dispersions – Simple Numerical calculations for understanding the characteristic values
b) Linear Correlation and Linear Regression – 2 Variables
c) Association of Attributes – 2 Attributes Only 2
d) Testing of Hypothesis, Large Sample Tests, Small Sample Tests – t, F tests. χ2tests.
e) Simulation Techniques

COURSE / LEARNING OUTCOMES

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

CO1: Systematically state the several methods of conducting research including research designs, data collection and analysis. (*Knowledge*)
CO2: Develop a scientific attitude towards understanding and solving a research problem. (*Comprehension*)
CO3: Use tools and techniques available for carrying out research. (*Application*)
CO4: Compare and contrast the various data collection, sampling, and scaling techniques available for carrying out research. (*Analysis*)
CO5: Integrate existing research work and write a survey research paper. (*Synthesis*)
CO6: Summarize the existing research work of a particular research topic for judging and assessing the given outcome and results. (*Evaluation*)

Suggested Readings

1. C.R. Kothari, Research Methodology Methods and Techniques, New Age International
2. S.P. Gupta, Statistical Methods, Sultan Chand, New Delhi
3. William G. Zikmund, Business Research Methods, Thomson South-Western
4. Mark Balnaves and Peter Caputi, Introduction to Quantitative Research Methods, Sage Publications

CSCP0077: COMPUTER PROGRAMMING IN C LANGUAGE

(3 credits – 45 hours)

Objectives: This first course in Computer Programming aims to develop the analytical skills of the students for creative problem solving using computers. Specifically, this course will

- *Discuss basic concepts of algorithms and programs*
- *Enable the student to develop solutions for common problems.*
- *Familiarize the student with the syntax of C language and teach him/her to translate pseudo-code into C programs, understanding the steps involved in the execution of a C program.*
- *Make the student well conversant with managing functions.*
- *Get introduced to pointers, arrays, structures and files in C.*

Module I: Introduction to Algorithms and Programming Languages (11 hours)

Introduction to structured programming and problem solving methods: Algorithms, key features of algorithms, flowcharts, pseudocode, generation of programming languages, structured programming languages.

Overview of C: Introduction to C, basic structure of a C program, compiling and executing C programs, comments, characteristics of a good program, character set, identifiers, keywords, data types, constants and variables, I/O statements, operators and expressions, precedence and associativity of operators, type conversion and typecasting.

Module II: Decision Control Statements, Loops and Functions (12 hours)

Decision Control Statements and Loops: Introduction to decision control statements, conditional branching statements, goto statements, while loop, do-while loop, for loop, nested loops, break and continue statements.

C Functions: Need for functions, function declaration and definition, user defined and library functions, passing parameters to function, return statement, scope of variables, storage classes, recursive functions.

Module III: Arrays, Strings and Pointers (12 hours)

Arrays and Strings: One-dimensional arrays, passing array to function, multidimensional arrays and their applications, character arrays and string operations.

Pointers: Introduction to pointers, pointer expressions, null pointers, generic pointers, pointers and arrays, dynamic memory allocation.

Module IV: Structures, Files and Preprocessor Directives (10 hours)
Structures and Unions: Declaration of structures and simple implementation of structures, unions, enumerated data types.
Files: Introduction to files, file management – open, close, input/output operations, Command line arguments.
Preprocessor Directives: Introduction to preprocessor directives, macros and file inclusion.

Suggested Readings
1. Thareja, R., Computer Fundamentals and Programming in C, Oxford University Press, New Delhi.
2. Balagurusamy, E., Computer Fundamentals and C Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Gottfried, Byron S., Programming with C (Schaum's Outlines Series), Tata McGraw Hill Publishing Company Limited, New Delhi.
4. Kanetkar, Y., Let us C, BPB Publication, New Delhi.
5. Kernighan, B.W., and Ritchie, Dennis M., The C Programming Language, Prentice Hall Pvt. Ltd, New Jersey.

CSIG0078: INTRODUCTION TO COMPUTER GRAPHICS
(2 credits - 30 hours)
***Objective**: This course aims to give an overview of Computer Graphics System and to give the understanding the mathematics behind computers graphics and their implementation on computer.*

Module I (6 Hours)
Introduction to computer Graphics - Video display devices- Raster scan Systems -Random Scan Systems - Interactive input devices - Hard copy devices - Graphics software - Output primitives. Shadow Mask CRT.

Module II (10 Hours)
Line drawing algorithms-DDA, Bresenham, circle generating algorithms. Boundary Fill Algorithm, Flood Fill Algorithm. Two dimensional transformation-translation, scaling, rotation, reflection, shear. Viewing Pipeline.

Module III (14 Hours)
Window to viewport co-ordinate transformation, clipping operations: point clipping, line clipping. 3D transformation and viewing: 3D transformations: translation, rotation, scaling and other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; Projection-parallel, perspective.

Suggested Readings
1. Hearn, Baker, " Computer Graphics (C version 2 nd Ed.)" – Pearson education
2. Mukherjee Arup, Introduction to Computer Graphics,PHI
3. D. F. Rogers, J. A. Adams, " Mathematical Elements for Computer Graphics – TMH
4. Buford J. K., "Multimedia Systems" – Pearson Education

CSPS0079: PROGRAMMING FOR PROBLEM SOLVING
(3 credits-45 Hours) (L-T-P:3-0-0)
Objectives: This first course in Programming for Problem solving aims to develop the analytical skills of the students for creative problem solving using computers. Specifically, this course will
- *Discuss simple algorithms and flowcharts for arithmetic and logical problems*
- *Familiarize the student with the grammar and syntax of C language*
- *To translate algorithm/pseudo-code into C programs and understanding the steps involved in the execution of a C program.*
- *Enable the student to use C program to find solutions for common problems.*

- *Get introduced to functions, pointers, arrays, structures and files in C.*

Module I (8 Hours)
Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), and Idea of Algorithm: steps to solve logical and numerical problems. Types of Algorithm: Sequentially executed, Conditional Based, repetitive structure, Representation of Algorithm: Flowchart/Pseudocode with examples, from algorithms to programs; source code, variables (with data types) variables and memory, locations, Syntax and Logical Errors in compilation, object and executable code.

Module II (12 Hours)
Operators, precedence of operators, Arithmetic expressions, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Module III (5 Hours)
Arrays, Arrays (1-D, 2-D), Character arrays and Strings

Module IV (5 Hours)
Basic Algorithm Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module V (8 Hours)
Functions (including built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion.

Module VI (7 Hours)
Structures, Defining structures and Array of Structures, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), File handling.

Suggested Readings
1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

CSCP6001: PROGRAMMING IN C LAB

(2 credits)

1. Introduction to OS: Linux/Unix, vi editor, file handling, directory structures, creating and editing simple C programs.
2. C programming using variables, assignment and simple arithmetic expressions
3. If else
4. Switch-case statements
5. Break, continue
6. Loops
7. Single and multidimensional arrays
8. Functions and recursion
9. Pointers, address operator, declaring pointers and operations on pointers
10. File handling in C.
11. Basic programming using C++ using concepts of Classes and Objects, data members and member functions
12. Demonstration of Data hiding, Data encapsulation, Inheritance, Polymorphism.

COURSE / LEARNING OUTCOMES

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

CO1: List various data structures and thus will be able to select the suitable data structure to resolve a given problem. (*Knowledge*)

CO2: Convert a given mathematical expression to various forms like – infix to postfix or prefix. (*Comprehension*)

CO3: Apply their knowledge to solve practical problems like- expression conversion using stack, tower of hanoi using stack and recursion, process management using queue and memory management using linked list and B tree. (*Application*)

CO4: Analyse the efficiency of various programs with respect to time and space complexity. They will also be able to modify a weak program into a more efficient one. (*Analysis*)

CO5: Design code for simulating the working of various data structures like- stack, queue, linked list, tree, graph etc. and based on their practical knowledge will be able to develop cost effective and user friendly applications. (*Synthesis*)

CO6: Depending on the problem domain, input pattern and size of the input, students will be able to evaluate the performance of various sorting and searching techniques and will also be able to justify their decision by doing complexity analysis. (*Evaluation*)

E-resource for learning

C, www.spoken-tutorial.org

CSPC6002: PROGRAMMING AND PROBLEM SOLVING THROUGH C LAB

(2 credits)

1. C Fundamentals
2. Functions, arrays and pointers
3. Structure and Union, Data files
4. VDU and Keyboard Basics
5. Graphics and Mouse programming

CSDL6003: DIGITAL LOGIC DESIGN LAB

(2 credits)

1. Study of the Truth tables of logic gates
2. Realization of half/full adder and half/full adder subtractor
3. Binary number to Gray code conversion and vice versa
4. Verify truth table of multiplexer and demultiplexer
5. Verify truth table of one bit and four bit comparators
6. Verify truth table of flip-flops
7. Realization of 3-bit asynchronous counter and Mod-N counters
8. Realization of 3-bit synchronous counter
9. Realization of 2:4 decoder and 4:2 encoder
10. Simulation with VDHL
    a. Adders
    b. Subtractors
    c. Logic gates
    d. MUX and DEMUX

CSCF6006: COMPUTER FUNDAMENTALS LAB

(2 credits)

Module I: Word Processing

a) Word Processing Basics: introduction to office software; introduction to word processing software; features and area of use; menus and commands; toolbars and buttons; shortcut menus, wizards and templates; creating a new document; different page views and layouts; applying various text enhancements; working with styles, text attributes; paragraph and page formatting; text editing using various features ; bullets, numbering, auto formatting, printing and various print options

b) Advanced word processing features: spell check, thesaurus, find and replace; headers and footers; inserting – page numbers, pictures, files, auto texts, symbols etc.; working with columns, tabs and indents; creation and working with tables including conversion to and from text; margins and space management in document; adding references and graphics; mail merge, envelopes and mailing labels. importing and exporting to and from various formats.

Module II: Spreadsheet

Introduction and area of use; concepts of workbook and worksheets; using wizards; various dta types; using different features with data, cell and texts; inserting, removing and resizing of columns and rows; working with data and ranges; different views of worksheets; column freezing, labels, hiding, splitting etc.; using different features with data and text; use of formulas, calculations and functions; cell formatting including borders and shading; working with different chart types; printing of workbook and worksheets with various options.

Module III: Presentation

Introduction and area of use; creating a new presentation; working with presentation; using wizards; slides and it's different views; inserting, deleting and copying of slides; working with notes, handouts, columns and lists; adding graphics, sounds and movies to a slide; working with objects; designing and presentation of a slide show; printing presentations, notes, handouts with print options.

Module IV: UNIX Commands

Basic unix commands (log in, create/delete files/directories, listing files/directories, changing permission of files/directories etc), file related commands, process related commands, i/o redirection and piping, vi editor, gedit

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify hardware commonly found in or attached to computing devices and identify software commonly installed on computing devices. (*Knowledge*)

CO2: Work with files, folders, and applications. (*Comprehension*)

CO3: Learn the basics of word processing. They can create a document, format it, and make changes to it. They explore the use of graphics and different fonts that add more to documents. (*Application*)

CO4: Learn how to do basic troubleshooting, what tool or application works best for the situation, and how to ask for help when they need it. (*Analysis*)

CO5: Learn the tips and tricks to make presentations and documents more professional. (*Synthesis*)

CO6: Use practical concepts to ensure that a document or presentation is ready for publication. (*Evaluation*)

Suggested Readings

1. Manuals of the Office Software
2. A. Mansoor, I.T. Tools and Applications, Pragya Publications, Matura
3. Yashwant Kanetkar, UNIX Shell Programming

CSDS6007: ADVANCED C AND DATA STRUCTURE LAB

(2 credits)

Solution of problems on

1. Dynamic memory allocation

2. Structures and pointers to structures
3. Arrays
4. Stacks and Stack application, Queues
5. Linked Lists, Circular and Doubly Linked Lists.
6. Binary Trees
7. Searching and data modification: Linear Search, Binary Search, Hashing.
8. Sorting Techniques: Selection, Insertion, Bubble, Merge, Heap, Quick, Radix, and Merge-Sort.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: List different data structures and define the purpose of using data structure. (*Knowledge*)
CO2: Explain the concept of various data structure like stack, queue, linked list, tree, graph etc. and describe their working mechanism. (*Comprehension*)
CO3: Apply their knowledge to solve practical problems like- expression conversion using stack, process management using queue and memory management using linked list and B tree. (*Application*)
CO4: Compare the efficiency of various data structure related algorithms with respect to time and space complexity. They will also be able to modify a weak algorithm into a more efficient one. (*Analysis*)
CO5: Develop algorithms based on the knowledge they have gained to design cost effective and user friendly application. (*Synthesis*)
CO6: Depending on the problem domain and input pattern students will be able to choose the appropriate data structure and will be able to justify their decision to use a particular data structure by evaluating the required parameters. (*Evaluation*)

CSDS6008: DATA STRUCTURES USING C++ LAB

(2 credits)

Programs on

1. Arrays and Lists
2. Stacks and Queues
3. Linked Lists, Circular and Doubly Linked Lists.
4. Trees and Graphs
5. Searching and Sorting techniques

CSOP6009: OBJECT ORIENTED PROGRAMMING AND DESIGN LAB

(2 credits)

Programs on

1. Concept of classes and objects, constructors and destructors
2. Use of memory management.
3. Inheritance
4. Virtual functions
5. Using polymorphism – i) operator overloading ii) dynamic binding
6. Use of operator overloading.
7. Exception handling and use of templates.
8. File handling in C++.

CSDM6010: DATABASE MANAGEMENT SYSTEMS I LAB

(2 credits)

Module I: Query handling with SQL in Oracle

1. Creation, altering and droping of tables and inserting rows into a table (use of constraints while creating tables) examples using SELECT command.Queries using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT, Constraints.
2. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.Queries implementing various joins (left,right,full). Implemention of complex queries: nested queries,sub queries.
3. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions

Module II: PL/SQL Programming

1. Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date
2. i) Creation of simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)

   ii) Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.
3. Develop a program that includes the features NESTED IF, CASE and CASE expression.
4. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT-IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
5. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
6. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
7. Program development using creation of package specification, package bodies, private objects, package variables and cursors and calling stored packages.
8. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
9. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

E-resource for learning

PHPMySQL, www.spoken-tutorial.org

CSOA6011: COMPUTER ORGANISATION AND ARCHITECTURE LAB

(2 credits)

1. Some experiments using hardware trainer kits for floppy drive, dot matrix printer etc.
2. Dismantling and assembling a PC along with study of connections, ports, chipsets, SMPS etc.
3. Assembly language programming using IA32(gcc)
   I. Introduction gcc assembly programming
   II. Verification of Instruction Set.
   III. Arithmetic operations
4. Addition, Subtraction, Multiplication and Division of two 8-bit numbers.
5. Multi byte Addition and Subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.
6. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.

7. By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.
8. DOS/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

CSDS6014: DATA STRUCTURES USING C LAB

(2 Credits)

Solution of problems on

1. Arrays
2. Stacks and Stack Application, Queues
3. Linked Lists, Circular and Doubly Linked Lists
4. Binary Trees
5. Searching and data modification: Linear search, Binary search, Hashing
6. Sorting Techniques: Selection, Insertion, Bubble, Merge, Quick and Merge sort.

CSNW6015: COMPUTER NETWORK FUNDAMENTALS LAB

(2 Credits)

1. Basic Networking Commands and troubleshooting.
2. Introduction and implementation of LAN Trainer for various topologies and protocols simulation.
3. Programs using TCP Sockets (like date and time server and client, echo server and client, file transfer, etc.)
4. Programs using UDP Sockets (like simple DNS, file transfer, etc.)
5. Program to implement Remote Command Execution.
6. Create HTTP socket for web page upload and download.
7. Perform a case study on the following routing algorithms to select the optimum network path for data transfer.
   i. Shortest path routing
   ii. Flooding
   iii. Distance vector

Suggested Readings

1. Behrouz A. Forouzan, "TCP/IP Protocol Suite", Tata McGraw Hill.
2. Laboratory Manual

CSWT6016: WEB TECHNOLOGIES LAB

(2 credits)

1. Creating static websites involving various XHTML elements.
2. Designing web pages that use CSS for standard formatting.
3. Designing websites that use JavaScript for creating interactive web pages.
4. Designing web pages that use PHP for handling loops, strings and arrays.

CSOJ6017: OBJECT-ORIENTED PROGRAMMING USING JAVA LAB

(2 credits)

1. Implement simple programs for core Java programming language constructs.
2. Implement a simple calculator in java using remote method invocation.
3. Find the shortest path using Breadth First Search Algorithm using Java.
4. Create a new text editor like the notepad.
5. The reservation system code which register a passenger for different categories.
6. Implement code that can find a file Located anywhere in your computer (Hard Drive).
7. Implement calculator with both Standard and Scientific Mode.
8. Implement code to make a Ball move around in the window.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: List various GUI and thus will be able to select the suitable GUI to resolve a given problem. *(Knowledge)*
CO2: Distinguish among the various utility class like vector, stack, Hash Table, String Tokenizer, etc. *(Comprehension)*
CO3: Apply their knowledge to solve practical problems like reading from a dataset, writing into a file and develop games using JAVA program. *(Application)*
CO4: Analyze the efficiency of various programs with respect to time and space complexity. They will also be able to modify a weak program into a more efficient one. *(Analysis)*
CO5: Design various methods for drawing lines, rectangles, polygons and ovals and based on their practical knowledge will be able to develop cost effective and user friendly applications. *(Synthesis)*
CO6: Depending on the problem domain students will be able to evaluate the performance of various swing GUI components and design various applications using Swings. *(Evaluation)*

E-resource for learning
C++, Java, www.spoken-tutorial.org

CSOS6018: OPERATING SYSTEMS LAB

(2 credits)

1. Introduction to Linux
2. File System (Types of file, Filename, parent-child relationship, absolute and relative pathname, file and directory permissions) Introduction to vi editor (start vi, the three modes, create, save and open a text file, positioning by character, positioning by line, positioning by word, positioning in the word, positioning on a numbered line, inserting text, deleting text), Simple Linux commands, Shell Programming
3. Semaphores, Shared Memory and Message Queues: Semaphore (Binary semaphore, Linux Semaphore Facilities, Using Semaphores), Shared Memory, Message Queues
4. Processes and Signals : Process Structure, Starting a new Process, Replacing a Process Image, Duplicating a Process Image, Waiting for a process, Zombie Processes, Terminating a Process, Signals (Signal handling, Sending signals, Signal interface, Signals sets).
5. POSIX Threads: Creating threads, Simultaneous execution of threads, Synchronization and Critical sections, Synchronization with Semaphores, Synchronization with Mutexes, Thread Attributes, Cancelling a thread.
6. Inter-Process Communication: Pipes, Process Pipes, and The Pipe Call, Parent and Child processes, FIFOs (Accessing a FIFO, Opening a FIFO, Reading and Writing FIFO).

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recall the basic commands used in LINUX. (*Knowledge*)
CO2: Define the LINUX shall. (*Comprehension*)
CO3: Solve problems using shall script. (*Application*)
CO4: Interpret different filters used in shall script. (*Analysis*)
CO5: Develop programs in shall script related to pipe command. (*Application*)
CO6: Contrast different pipe commands. (*Evaluation*)
CO7: Develop page replacement algorithms in C Programming. (*Synthesis*)
CO8: Develop semaphore program in C programming language. (*Synthesis*)

E-resource for learning
Linux-Ubuntu, www.spoken-tutorial.org

CSDA6019: DESIGN AND ANALYSIS OF ALGORITHMS LAB

(2 credits)

1. Prove that bubble sort algorithm has time complexity (n_2) by showing the graph notation.
2. Implement the Dynamic programming technique and analyze the algorithm showing the graph notation.
3. Implement the Greedy programming technique and analyze the algorithm showing the graph notation.
4. Implement the Divide and Conquer technique and analyze the algorithm showing the graph notation.
5. Design a small file compressor and de-compressor by using Huffman coding technique

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recognize existing algorithms and how to analyse them using graph notation. (*Knowledge*)
CO2: Implement the existing algorithms. (*Comprehension*)
CO3: Apply existing algorithms in developing different applications. (*Application*)
CO4: Analyse the time complexity of standard algorithms. (*Analysis*)
CO5: Create efficient applications by using right algorithm depending on input pattern and size. (*Synthesis*)
CO6: Evaluate an algorithm in terms of time and space efficiency. (*Evaluation*)

CSPJ6020: PROGRAMMING THROUGH JAVA LAB

(2 credits)

1. Implement a simple calculator in java using remote method invocation
2. To find the shortest path using Breadth First Search Algorithm
3. To create a new text editor like the notepad
4. The reservation system code which register a passenger for different categories.
5. This Code can find a file Located anywhere in your computer (Hard Drive).
6. Calculator with both Standard and Scientific Mode
7. Program for Student Management
8. Calling Windows Runtime Commands.
9. A Ball Moving round the window.
10. Travel agent
11. Hundred Year Calendar(2001-2100)
12. Program to create GUI for Bank Account Simulation.
13. Write the java source code for "the 8 Puzzle" program and the html Java applet to execute interactive content on the World Wide Web.

COURSE / LEARNING OUTCOMES

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

CO1: List various GUI and thus will be able to select the suitable GUI to resolve a given problem. (*Knowledge*)
CO2: Distinguish among the various utility class like vector, stack, Hash Table, String Tokenizer, etc. (*Comprehension*)
CO3: Apply their knowledge to solve practical problems like reading from a dataset, writing into a file and develop games using JAVA program. (*Application*)
CO4: Analyze the efficiency of various programs with respect to time and space complexity. They will also be able to modify a weak program into a more efficient one. (*Analysis*)
CO5: Design various methods for drawing lines, rectangles, polygons and ovals and based on their practical knowledge will be able to develop cost effective and user friendly applications. (*Synthesis*)

CO6: Evaluate the performance of various swing GUI components and design various applications using Swings depending on the domain and requirement. (*Evaluation*)

E-resource for learning
Java, www.spoken-tutorial.org

CSCG6021: COMPUTER GRAPHICS

(2 credits)

1. Algorithms discussed in the theory should be implemented using C/C++.
2. Graphics using OPEN GL: Introduction to OPEN GL, Drawing lines, Drawing polylines, Drawing polygons, Drawing aligned rectangles, clipping a line, Drawing arcs, Drawing circles, Drawing 3D curves, Circles rolling around a circle.
3. GUI using X-Windows: X Windows, Xaw-an X Toolkit, Introduction to Motif.

COURSE / LEARNING OUTCOMES

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

CO1: Recognize various inbuilt functions of graphics packages. (*Knowledge*)
CO2: Comprehend the task of each inbuilt functions used in graphics programming. (*Comprehension*)
CO3: Implement various graphics related algorithms to draw various shapes such as line, curve, circle etc. (*Application*)
CO4: Analyze the graphics packages. (*Analysis*)
CO5: Design simple animations, draw shapes, fill colors using mathematical logics and transformations. (*Synthesis*)
CO6: Evaluate the performance and complexity of the program written for designing the shapes and curves. (*Evaluation*)

CSRS6022: RESEARCH SEMINAR - MTECH

(4 credits)

Objective of the research Seminar is to conduct a research literature survey on a topic chosen. 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

1. Literature survey on the chosen topic
2. Presentation on the chosen topic, comprising the following three components:
    a. Presentation
    b. Report
    c. Viva Voce examination

COURSE / LEARNING OUTCOMES

At the end of the Research Seminar students will be able to:

CO1: Survey literature on a chosen topic. (*Application*)
CO2: Familiarize themselves with the current literature on recent trends in the chosen area. (*Knowledge*)

CSMP6023: PROJECT PHASE I - MTECH

(12 credits)

Objective: *During this phase the student will start a research project applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation* *and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester*

COURSE / LEARNING OUTCOMES

At the end of Project Phase I students will be able to:

CO1: Identify the basic research areas which could be undertaken. (*Knowledge*)
CO2: Able to explain the research gap within the topic that he / she undertakes. (*Comprehension*)
CO3: Write algorithm to solve the problem in hand. (*Application*)
CO4: Categorize the data to be collected to carry on with the research. (*Analysis*)
CO5: Summarize the outcome which is expected from the research. (*Synthesis*)
CO6: Justify the methodology used in the project. (*Evaluation*)

E-resource for learning:
LaTeX, www.spokentutorial.org

CSOS6024: INTRODUCTION TO OPERATING SYSTEMS LAB

(2 credits)

1. Simple Unix-C programs: Programs using system calls, library function calls to display and write strings on standard output device and files.
2. Programs using fork system call.
3. Programs for error reporting using errno, perror() functions.
4. Programs using pipes.
5. Shell programming.
6. Programs to simulate process scheduling- FCFS, SJF and Round Robin.
7. Programs to simulate page replacement algorithms-FIFO, LRU.
8. Programs to simulate free space management.
9. Programs to simulate deadlock detection.
10. Study of file system-UNIX/FAT/NTFS

E-resource for learning:
Linux-Ubuntu, www.spoken-tutorial.org

CSCD6026: DIGITAL COMPUTER DESIGN LAB

(2 credits)

1. To study the Truth tables of logic gates
2. To realize half/full adder and half/full adder subtractor
3. Simulation with VDHL
   i. Adders
   ii. Subtractors
   iii. Logic gates
   iv. MUX and DEMUX

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify the various logic gates used in the digital circuits. (*Knowledge*)
CO2: Relate and illustrate the Truth tables of logic gates. (*Knowledge/ Comprehension/ Application*)
CO3: Demonstrate half/full adder and half/full subtractor. (*Application/Analysis*)
CO4: Design circuits using Analog Digital Trainer kits. (*Synthesis*)
CO5: Construct and justify the truth table of MUX and DEMUX. (*Application/Evaluation*)
CO6: Design, illustrate and evaluate counters, registers, encoders and decoders. (*Application/ Analysis/ Evaluation*)

CO7: Simulate and deploy complex circuits with VDHL. (*Application*)

CSCO6027: COMPUTER ORGANISATION AND ARCHITECTURE LAB

(2 credits)

(10 classes for 10 different Programs along with some hardware exposure)

1. Some experiments using hardware trainer kits for floppy drive, dot matrix printer etc.
2. Dismantling and assembling a PC along with study of connections, ports, chipsets, SMPS etc.
3. Assembly language programming using IA32(gcc)
   i. Introduction gcc assembly programming
   ii. Verification of Instruction Set.
   iii. Arithmetic operations

a) Addition, Subtraction, Multiplication and Division of two 8-bit numbers.
b) Multi byte Addition and Subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmetic operation.

   iv. Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.
   v. By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.
   vi. DOS/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Get introduced to 8086 instruction set and the overview of its architecture. (*Knowledge*)
CO2: Know how to write 8086 assembly programmes in TASM. (*Knowledge*)
CO3: Understand the meaning of each 8086 assembly instruction and also will be able to understand the use of assembler directives. (*Comprehension*)
CO4: Write and execute 8086 assembly programs. (*Application*)
CO5: Analyse different instructions based on number of clock cycle it takes in order to write an efficient program. (*Analysis*)
CO6. Write efficient programs by using minimal number of instruction as well as using relatively faster and simple instructions. (*Synthesis*)
CO7: Evaluate the output of 8086 assembly programmes. (*Evaluation*)

CSSG6028: SYSTEM PROGRAMMING LAB

(3 credits)

1. Design of a small Assembler
2. Design of loader.
3. Design of linker.
4. Design and implementation of Macro-processor.
5. Study of Debugger (GDB)

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: List the various Java functions for file processing and string processing. (*Knowledge*)
CO2: Recognize the different tokens in a given program file and hence will be able to classify them in various categories (for example AD, DS, IS, Macro Name, Macro end tagline, arguments, Extern variables, Entry variables etc.) (*Comprehension*)
CO3: Construct a mini assembler, macro pre-processor and direct linking loader. (*Application*)

CO4: Use the various java functions for file processing and string processing and by applying these functions will be able to demonstrate practically the working of various system programs. (*Analysis*)

CO5: Design the various data structures used in an assembler (and macro preprocessor) and then to combine them to develop a complete working assembler (macro preprocessor). (*Synthesis*)

CO6: Judge the effectiveness of using breakpoints and debugging to check for errors in a program. (*Evaluation*)

CSDB6029: RDBMS LAB

(2 credits)

a) Programs to be created and executed on the following areas

1. Use of SQL Syntax: Insertion, Deletion Join), Updating using SQL.
2. Program segments in embedded SQL using C as host language to find average grade point of a student, etc.
3. Program for Log based data recovery technique.
4. Program on data recovery using check point technique.
5. Concurrency control problem using lock operations.
6. Use of package (ORACLE) for programming approaches.
7. Programs on JDBC/ODBC.

b) PL/SQL Programming Language fundamentals

1. PL/SQL block structure, character set, identifiers, literals, delimiters, comments, data types in Pl/SQL
2. Program structure- Conditional constructs, iterative constructs, exception handling
3. SQL in PL/SQL - DML and Transaction Management (Commit and Rollback), Data Retrieval, Cursors (Explicit and Implicit), Error handling with cursors, Procedures, Function, Triggers- creating and managing functions, procedures.

c) PHP, MYSQL

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Get introduced to various types of SQL commands and structure of PL/SQL programming. (*Knowledge*)

CO2: Explain and identify which command would be used for a given query. (*Comprehension*)

CO3: Correctly use the techniques, components and tools of a typical database management system to build a comprehensive database information system. (*Application*)

CO4: Write SQL commands and PL/SQL programs to solve problems related to database tables. (*Application*)

CO5: Compare and contrast the various ways of solving a query for optimization. (*Analysis*)

CO6: Students should be able to design schema diagrams for handling database projects. (*Synthesis*)

CO7: Evaluate and justify the database designed for any database project. (*Evaluation*)

CSDC6030: DATA COMMUNICATION and NETWORKS II and NETWORK PROGRAMMING USING LINUX LAB

(2 credits)

Objective: *Network programming involves writing programs that communicate with other programs across a computer network. Most operating systems provide pre-compiled programs that communicate across a network. This course envisages providing an introduction to such networking programming, whereby students will learn to write their own* *network programs. At the end of this course in network programming, the students are expected to have elementary ideas about the Barkeley sockets and their usage in setting up TCP and UDP communications.*

Module I

a) Introduction to Network Programming : Introduction to Sockets; Address Structure – IPv4, IPv6; Value-Result Arguments; Byte Order Functions; Byte Manipulation Functions; inet_aton, inet_addr, inet_ntoa, inet_pton, inet_ntop, readn, written, readline, isfdtype functions

b) Elementary TCP Sockets : Introduction; socket, connect, bind, listen, accept, fork, exec, close, getsockname, getpeername functions; TCP Client Server example; signal, sigaction, wait, waitpid functions; Connection Termination; SIGPIPE signal

c) I/O Multiplexing : I/O models; select function; Batch input; shutdown, pselect, poll functions; Example – TCP Echo Server.

d) Socket Options : getsockopt, setsockopt, fcult, ioclt functions; Socket status – generic socket options

e) Elementary UDP Sockets : Introduction; recvfrom, sendto functions; UDP Examples; connect function with UDP; UDP socket receive buffer; Example – UDP Echo Server

Module II

a) Elementary Name and Address Conversion : Introduction; gethostbyname function; RES_USE_INET6 resolver option; gethostbyaddr, uname, gethostname, getservbyname, getservbyport functions.

b) IPv4 and IPv6 Interoperability : Introduction; IPv4 Client - IPv6 Server, IPv6 Client – IPv4 Server; IPv6 Address Testing Macros, IPV6_ADDRFORM.

c) Advanced Name and Address Conversions : Introduction; getaddrinfo, gai_strerror, freeaddrinfo, getnameinfo functions; Reentrant functions.

d) Daemon Processes : Introduction; syslogd daemon; syslog, daemon_init functions; inetd daemon; daemon_inetd function.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: List various network related commands. They will get introduced to socket programming in TCP and UDP environment. (*Knowledge*)

CO2: Comprehend the functions used in TCP and UDP client server communication. (*Comprehension*)

CO3: Apply their knowledge of socket programming to perform various types of communications, address conversions and so on. (*Application*)

CO4: Analyze the efficiency of TCP and UDP client –server communication. (*Analysis*)

CO5: Design code for conducting chat or communication between client and server in UDP environment. (*Synthesis*)

Suggested Readings

1. W Richard Stevens, UNIX Network Programming – Volume I , Second Edition, Prentice Hall of India Pvt. Ltd., 2002
2. Douglas E Comer, Internetworking with TCP/IP: Principles, Protocols, and Architectures – Volume I, Fourth Edition, Prentice Hall of India Pvt. Ltd.
3. Douglas E Comer, David L Stevens, Internetworking with TCP/IP: Design, Implementation, and Internals – Volume II,Third Edition, Prentice Hall of India Pvt. Ltd.
4. Douglas E Comer, David L Stevens, Internetworking with TCP/IP: Client Server Programming and Applications – Volume III, Second Edition, Prentice Hall of India Pvt. Ltd.

CCSIT6031: INTERNET TECHNOLOGY AND APPLICATIONS LAB
(2 credits)

Module I

a) XHTML:Components of XHTML; Elements of XHTML (Headers, Linking, Images, Special Characters, Lists, Tables, Forms, Framesets)
b) Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation Service; Use of CSS (Positioning Elements, Backgrounds, Text flow)
c) XML: XML Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Vocabularies; Document Object Model (DOM and its methods); Extensible StyleSheet Language (XSL)

Module II

a) Web servers: HTTP Request Types; System Architecture of a Web server; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Apache Web Server.
b) Databases: Introduction to each one of the following: SQL, MYSQL, DBI
c) Scripting Languages: Javascript: Operators, Data Types, Control Structures, Functions, Arrays, String Manipulation. VBScript Introduction to Perl and CGI (Common Gateway Interface). JSP: Introduction; JSP Overview; Scripting; Standard Actions; Directives
d) Web Site Design Considerations: Using Logical Design: Planning your website, drawing a map, using a top-down approach, flexibility, other web design metaphors. Creating templates. Creating a Compatible Design: Designing for different color depths, resolutions, different browser considerations, accommodating limited bandwith. Validating your work.
e) PHP: Introduction to PHP; Data Types; Control Structures; Functions; Strings; Arrays; Querying Web Databases using PHP; Writing to Web Databases; Errors, Debugging and Deployment; Reporting in

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Experiment with various mark-up languages and scripting languages. (*Application*)
CO2: Analyse and design a website of their own and can also identify the faults in the design. (*Application*)
CO3: Develop and create a website of their own. (*Application*)
CO4: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (*Application / Syntesis*)

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 2nd Edition, Prentice Hall of India Pvt. Ltd. , New Delhi
2. Hugh E. Williams and David Lane, PHP and MySQL, 2nd Edition, O'Reilly, Shroff Publishers and Distributors Pvt. Ltd.
3. Internet Complete, 2nd Edition, BPB Publications. , New Delhi
4. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

CSDM6032: DATABASE MANAGEMENT SYSTEM II LAB
(2 credits)

Module I: PL/SQL Programming

a) Language fundamentals - PL/SQL block structure, character set, identifiers, literals, delimiters, comments, data types in PL/SQL
b) Program Structure - Conditional constructs, Iterative constructs, Exception handling

c) SQL in PL/SQL- DML and Transaction Management (Commit and Rollback), Data Retrieval, Cursors (Explicit and Implicit), error handling with Cursors
d) Procedures, Functions, packages, Triggers- creating and managing functions, procedures, packages and triggers
e) Built-in functions - String functions (ascii, chr, concat, greatest, instr, least, length, lower, lpad, ltrim, replace, rpad, rtrim, substr, trim, upper) Numeric functions (bitand, ceil, exp, floor, ln, mod, power, round, sign, sqrt, trunk) , Date and time functions (add_months, current_date, current_timestamp, last_day, months_between, next_day, round, sysdate, systimestamp, trunk) Conversion functions (to_number, to_char, cast, to_date, to_timestamp)

Module II: Forms Builder
Components of application development in Oracle Forms (Form modules, menus, PL/SQL libraries, Object libraries, Database objects), components of a form module, creating single table forms, creating tabular forms, changing attributes of form objects, validations, triggers, adding PL/SQL codes to triggers, creating master-details form, PL/SQL libraries, creating and adding library to modules, creating multi-canvas forms, error handling, creating multi-form applications, creating menus, adding PL/SQL code to menu items, adding libraries to a menu module, attaching menu to a form, properties of menus, creating iconic toolbar, creating master-details iconic toolbar menu

Module III: Reports Builder and Graphics Builder
Features of the Report Builder, defining a data model for a report, specifying the layout of the report, specifying a runtime parameter form for a report, using the Oracle reports interface, using the Reports Wizard, changing report attributes, creating manual reports, creating master-detail reports, creating parameterized reports, running a report from a form, working with charts, tools available in the Graphics Builder, creating Graphs, embedding charts in forms and reports

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Define the PL/SQL language fundamentals. (*Knowledge*)
CO2: Describe PL/SQL program structure like conditional constructs, iterative construct, exception handling. (*Comprehension*)
CO3: Use different program structure and apply them to solve problems. (*Applications*)
CO4: Students will be able to apply PL/SQL procedures, functions, packages, triggers to practice assignments. (*Analysis*)
CO5: Create applications in ORACLE forms. (*Synthesis*)
CO6: Describe data model for a report and summarize using report builder and graphics builder. (*Evaluation*)

Suggested Readings

1. Ivan Bayross, Commercial Application Development Using Oracle Developer 2000 Forms 6i, BPB Publications, 2nd Revised Edition, 2005
2. John Day, Craig Van Slyke, Starting out with Oracle, Dreamtech Press, 2004
3. Steven Feuerstein, Oracle PL/SQL Programming, O'Reilly Publications, 3rd Edition.

CSMP6033: PROJECT PHASE II - MTECH CS

(16 credits)

Objective: *During this phase the student will start a research project applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester*

COURSE / LEARNING OUTCOMES

At the end of Project Phase II students will be able to:

CO1: Identify the basic research areas which could be undertaken. (*Knowledge*)
CO2: Explain the research gap within the topic that he / she undertakes. (*Comprehension*)
CO3: Write algorithm to solve the problem in hand. (*Application*)
CO4: Categorize the data to be collected to carry on with the research. (*Analysis*)
CO5: Summarize the outcome which is expected from the research. (*Synthesis*)
CO6: Justify the methodology used in the project. (*Evaluation*)

E-resource for learning:
LaTeX, www.spokentutorial.org

CSSE6034: BASIC SOFTWARE ENGINEERING LAB

(2 credits)

A. Lab using IBM RSA tools
B. Virtual lab
Weblink: http://iitkgp.vlab.co.in/?sub=38andamp;brch=204

Contents

1. Identifying the requirements from problem statements
2. Estimation of project metrics
3. Modeling Data Flow Diagrams
4. Development of User stories
5. Identifying domain classes from the problem statements
6. Modeling UML use case diagram & capturing use case scenarios
7. Class diagram, Activity diagram etc
8. Designing test suite and testing

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Implement the software engineering process to develop any software project. (*Knowledge*)
CO2: Formulate an effort estimation plan. (*Comprehension*)
CO3: Understand and apply software design patterns. (*Application*)
CO4: Employ the knowledge and also capable of understanding ISO, CMM level for the software project. (*Analysis*)
C05: Maintain the software project by using maintenance plan. (*Synthesis*)
CO6: Test the software project through various testing approaches. (*Evaluation*)

CSAI6036: ARTIFICIAL INTELLIGENCE I LAB

(2 credits)

Tools: Common LISP and PROLOG

Practical Assignments

1. DFS and BFS implementation
2. Game playing: Single and two players (Using Heuristic functions)
3. A* algorithm
4. Syntax checking for English sentences
5. Develop an Expert system

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify the need of two basic programming language very specific to AI viz., LISP and Prolog, learning and search algorithm like (A*, DFS, BFS), knowledge representation using Propositional and predicate logic. (*Knowledge*)

CO2: Define problem state space, design algorithms to solve problems, generalized schema for knowledge interpretation and planning and language processing using the syntax and semantics of Prolog and LISP. (*Comprehension*)

CO3: Compute and demonstrate the problem in terms of state space and apply different AI search algorithms(A*, DFS, BFS) to solve problems and construct a logic(Propositional and Predicate) to represent knowledge and interpret the natural language in computational domain by developing expert system using Prolog and LISP. (*Application*)

CO4: Compare and analyse the performance of algorithms based on problem domain. (*Analysis*)

CO5: Design and create new intelligent algorithm for application development by integrating experience based learning. (*Synthesis*)

CO6: Judge and assess the algorithms based on completeness, optimality, space and time complexity for solving a problem in intelligent manner. (*Evaluation*)

CSCN6037: COMPUTER NETWORKS AND INFORMATION SECURITY I: ADVANCED COMPUTER NETWORKS LAB

(2 credits)

Tools: NS2, MATLAB, Router, Switches etc

Practical Assignments:

1. Network signal modulation using MATLAB
2. Routing protocol simulation using NS2
3. TCP congestion control analysis
4. Creation and simulation of Ad hoc networks using NS2
5. Case study on application layer attacks
6. Routing and WAN simulation
7. VLAN creation and link aggregation

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Know various network simulators and other related tools. (*Knowledge*)

CO2: Define the network topology with different device required to function the structure. (*Comprehension*)

CO3: Implement the network architecture using tools. (*Application*)

CO4: Compare and analysis the different architecture. (*Analysis*)

CO5: Check network topology for any attack or error using some tools. (*Synthesis*)

CO6: Form both wired and wireless network using networking tools as well as network simulator. (*Evaluate*)

CSAI6039: ARTIFICIAL INTELLIGENCE II LAB
CSCN6040: COMPUTER NETWORKS AND INFORMATION SECURITY II LAB

(2 credits)

Objective: *Lab assignments are assigned to students individually or in groups by the concerned faculty according to the chosen specialization subjects . The objective of the mini project is to train the students to design, simulate the system which will give them hands on* *experience in re-creating principals they have studied in their classes.*

The suggested tools or software to use during this project are (Specializations - Software /Tools):

1. Artificial Intelligence (Natural Language Processing) - NLTK, WORDNET, Prolog, LISP.
2. Computer Networks and Information Security: (Number Theory and Cryptography) - Snort 2.8, Engage Packet Builder, TcpDump, Honeynet Security Console, Kismet
3. MUX and DEMUX

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: List the functions provided by NLTK for natural language processing. (*Knowledge*)
CO2: Explain of the various NLTK functions available for natural language processing. (*Comprehension*)
CO3: Implement NLTK programs for part of speech tagging, syntax analysis, semantic analysis etc. (*Application*)
CO4: Evaluate the performance of classifiers used for text classification. (*Evaluation*)
CO5: Compare the performance of classifiers used for text classification, part of speech tagging etc. (*Analysis*)
CO6: Combine different NLTK functions to complex NLP applications. (*Synthesis*)

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CO1: Identify the underlying mathematical principles related to the cryptography. (*Knowledge*)
C02: Understand the importance of integral theorems and postulates in building up a secure cipher. (*Comprehension*)
CO3: Use the knowledge of number theory in formulating or testing new and existing ciphers. (*Application*)
CO4: Analyse the significance of number theory towards the security of cryptographic algorithms. (*Analysis*)
CO5: Summarize the results of their formulated and/or tested ciphers. (*Synthesis*)
CO6: Evaluate and assess the results to develop and improve existing algorithms. (*Evaluation*)

CSAI6042: ARTIFICIAL INTELLIGENCE III LAB
CSCN6043: COMPUTER NETWORKS AND INFORMATION SECURITY III LAB
(2 credits)

Assignments are assigned to students individually or in groups by the concerned faculty as per the chosen specialization subjects. The objective of the mini project is to train the students to design, simulate the system which will give them hands on experience in re-creating principals they have studied in their classes.

The suggested tools or software to use during this project are (Specializations - Software/ Tools):

a) Artificial Intelligence (Computer Vision And Image Analysis) - MATLAB, OpenCV, JIPT, etc.
b) Computer Networks and Information Security (Network Security and Forensics) - NS2, GloMoSim, Packet tracer, OMNeT++, OPNE, etc.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Develop competency in the design and implementation of computer vision/image analysis software. (*Synthesis*)
CO2: Understand the fundamental mathematical/statistical concepts in image analysis and computer vision. (*Comprehension/Knowledge*)

CO3: Implement basic image analysis and computer vision algorithms in MATLAB/Python. (*Application*)
CO4: Analyze and design a range of algorithms for image analysis, image representation and other computer vision applications. (*Analysis/Evaluation*)
CO5: Develop and evaluate appropriate solutions to small-scale problems in computer vision and image analysis in MATLAB/Python. (*Application/Evaluation*)

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CO1: Identify the tools adhered to computer forensic technology and also simulations to network topology and protocol setup. (*Knowledge*)
C02: Understand the principles and underlying methodologies adhered to computer/network forensic technology. (*Comprehension*)
CO3: Apply the methodologies in testing some case scenarios related to simulation of network structure/topology. (*Application*)
CO4: Analyse and practice similar programs and instances related to network simulation. (*Analysis*)
CO5: Summarize the logics learnt in designing or developing new prototypes. (*Synthesis*)
CO6: Assess and critique the simulations and/or prototype designs appearing in academic/non-academic curriculum. (*Evaluation*)

CSDE6044: DATA ENGINEERING IV LAB
CSAI6045: ARTIFICIAL INTELLIGENCE IV LAB
CSCN6046: COMPUTER NETWORKS AND INFORMATION SECURITY IV LAB
(2 credits)

This lab will be treated as a Mini project and assigned to students individually by the Department under the supervision of the designated faculty member. The objective of this mini project is to train students to develop a model in the chosen specialized subject using the related tools learned in previous semesters.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Understand and identify different machine learning tools such as scipy, numpy , scikit etc. (*Knowledge*)
CO2: Design basics learning model and understand how in fact learning takes place. (*Comprehension*)
CO3: Apply different learning algorithms for real life classification problem, sketch the structure of different learning model such as neural network, support vector machine, naive bayes etc. using different machine learning tools (*Application*)
CO4: Implement and analyze decision tree learning, computational learning, artificial neural network and instance based learning and how one learning overcomes the drawback in the other. (*Analysis*)
CO5: Create and design ensemble based learning, propose new learning for optimizing real life problems. (*Synthesis*)
CO6: Judge in terms of different complexity which algorithms better in what situation. (*Evaluation*)

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CO1: Understand various network security issues and causes. They also understand about mobile IP management. (*Knowledge*)
CO2: Know different ways to analyses wireless communication system. (*Synthesize*)
CO3: Write program for testbed network to evaluate various performance parameters. Students also write socket programing for testbed network. (*Application*)
CO4: Compare and analysis different network architecture for several problem domain. (*Analysis*)
CO5: Write own logic to analyse mobile cellular network. (*Application*)

CSMA6047: MICROPROCESSORS AND APPLICATIONS LAB
(2 credits)

Laboratory course will be based on 8051 microcontroller.

1. Study of 8051 microcontroller architecture
2. Study of assembly language and embedded C for 8051
3. To perform interfacing of LED.
4. To perform interfacing of LCD
5. To perform interfacing of stepper motor
6. To perform interfacing of speaker.
7. To perform serial transfer of data from PC and microcontroller board.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recall the names of the 8051 registers, instructions set etc. (*Knowledge*)
CO2: Explain the working of LCD, keypad, motors, interrupts etc. of 8051 microcontroller. (*Comprehension*)
CO3: Implement 8051 programs to add numbers, compare numbers, delay loops etc. (*Application*)
CO4: Evaluate the performance of 8051 programs in terms of time requirement. (*Evaluation*)
CO5: Compare the performance of interrupt driven and polling based programs. (*Analysis*)
CO6: Combine different 8051 instructions to write complex 8051 programs such as rotating motors, displaying characters in LCD, reading characters from keypad etc. (*Synthesis*)

Suggested Readings

1. Kenneth Ayala, The 8051 Microcontroller, 3rd edition

CSOC6048: OPERATING SYSTEMS AND CONCEPTS LAB
(2 credits)

1. Simple Unix-C programs: Programs using system calls, library function calls to display and write strings on standard output device and files.
2. Programs using fork system calls.
3. Programs for error reporting using errno, perror( ) function.
4. Programs using pipes.
5. Shell programming.
6. Programs to simulate process scheduling like FCFS, Shortest Job First and Round Robin.
7. Programs to simulate page replacement algorithms like FIFO, Optimal and LRU.
8. Programs to simulate free space management.
9. Programs to simulate virtual memory.
10. Programs to simulate deadlock detection.
11. Study of file systems: UNIX/FAT/NTFS.
12. Study of Windows registry.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify and name the basic commands in Linux. (*Knowledge*)
CO2: Describe system calls, library functions calls to write on standard output device. (*Comprehension*)
CO3: Write shell programs. (*Application*)
CO4: Analyse and compare between different file systems like ext4/FAT/NTFS. (*Analysis*)

CO5: Students will be able to write programs on process scheduling, page replacement algorithms. (*Synthesis*)

CO6: Evaluate free space management using programs. (*Evaluation*)

E-resource for learning

Linux-Ubuntu, www.spoken-tutorial.org

CSDC6049: DATA COMMUNICATION LAB

(2 credits)

1. PC-to-PC communications under WinXP/Win98 direct cable connection with null modem
   a) Using serial ports and RS-232 C cable connection, and
   b) Using parallel ports and direct parallel cable connection.
2. PC-to-PC communications under WinXP/Win98 dial-up networking with modem and 4-line exchange.
3. PC-to-PC communications under WinXP/Win98 hyper terminal with modem and 4-line exchange.
4. Simple file transfer between two systems (without protocols): By opening socket connection to a server on one system and sending a file from one system to another.
5. Writing a Chat application:
   a) One-One: By opening socket connection and displaying what is written by one party to the other.
   b) Many-Many (Broad cast): Each client opens a socket connection to the chat server and writes to the socket. Whatever is written by one party can be seen by all other parties.
6. Introduction to Packet Tracer
7. Simulation of Telnet: Provide a user interface to contact well-known ports, so that client-server interaction can be seen by the user.
8. TFTP- Client: To develop a TFTP client for file transfer.
9. HTTP-Server: Develop a HTTP server to implement the commands – GET, POST, HEAD, DELETE.The server must handle multiple clients.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: List various packet tracing tools and thus will be able to select the suitable simulation tool to resolve a given problem. (*Knowledge*)

CO2: Classify different incoming packets based on the protocol using sniffing tools like Snort. (*Comprehension*)

CO3: Apply their knowledge to solve practical problems like finding whether a packet is coming from a particular IP address or calculating the frequency count of a particular protocol. (*Application*)

CO4: Analyse the efficiency of TCP and UDP packets using python programming. (*Analysis*)

CO5: Design code for simulating the working of various types of network topology using Packet Cisco Tracer. (*Synthesis*)

CO6: Depending on the problem domain, students will be able to evaluate the performance of various network topology and will also be able to justify their decision by studying the network traffic that is created. (*Evaluation*)

Suggested Reading

1. Networking and Data Communications Laboratory manual, Frances S. Grodzinsky, PH, 1999.

BTCSMI6050: MINI PROJECT I

(2 credits)

Mini projects are assigned to students individually or in groups by the Department under the supervision of the designated faculty member. The objective of the mini project is to train the students to create Industry oriented software or hardware applications in his/her field of interest.

CSPA6051: PRINCIPLES OF ARTIFICIAL INTELLIGENCE LAB

(2 credits)

List of Experiments

1. Write a LISP Program to solve the water-jug problem using heuristic function.
2. Create a compound object using Turbo Prolog.
3. Write a Prolog Program to show the advantage and disadvantage of green and red cuts.
4. Write a prolog program to use of BEST-FIRST SEARCH applied to the eight puzzle problem.
5. Implementation of the problem solving strategies: Forward Chaining, Backward Chaining, Problem Reduction.
6. Write a LISP Program to implement the STEEPEST-ASCENT HILL CLIMBING.
7. Write a PROLOG Program to implement COUNTE PROPAGATION NETWORK.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify the problem state and solve the problem with AI technique (SEARCH TECHNIQUE). (*Knowledge*)
CO2: Explain the various search techniques (Uninformed). (*Comprehension*)
CO3: Apply the performance of the search algorithm with complexity analysis. (*Application*)
CO4: Analyze the concept of machine learning with reference to neural network, expert system. (*Analysis*)
CO5: Develop in Prolog and Lisp environment for interpreting knowledge and complex information and representing using the prolog interpreter. (*Synthesis*)
CO6: Evaluate the various search techniques (Informed). (*Evaluation*)

CSRM6052: INTRODUCTION TO RESEARCH METHODOLOGY AND STATISTICAL TOOLS LAB

(2 credits)

1. To conduct a small research project in group and apply the knowledge about research methodology
2. Use of SPSS, SCILAB/ MATLAB -Statistical Tool Box, etc. for Data Analysis is recommended.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:
CO1: Recall and recognize the structure of a LaTex document. (*knowledge*)
CO2: Student will be able to recall and recognize the functions and syntaxes of SCILAB scripts. (*knowledge*)
CO3: Develop a scientific attitude towards understanding and solving a research problem. (*Comprehension*)
CO4: Use tools and techniques available for practically carrying out research. (*Application*)
CO5: Compare and analyse the various sections of a standard research paper. (*Analysis*)
CO6: Construct a coherent research proposal that includes an abstract, introduction, literature review, research questions, ethical considerations, and methodology. (*Synthesis*)

CO7: Summarize the existing research work of a particular research topic for judging and assessing the given outcome and results. (*Evaluation*)

CSMN6053: MINOR PROJECT - MCA

(4 credits)

Objective: *The objective of the Minor project is to consolidate the concepts and practices that were learned during the course and to serve as a record of competence. It should enable a student to apply concretely in a small package the concepts gained from Software Engineering.*

COURSE / LEARNING OUTCOMES

At the end of this Minor Project students will be able to:

CO1: Understand and identify different API and development environment tools for building the project, research terminologies for research based project; Understand and learn different programming languages needed to meet different objectives. (*Knowledge*)

CO2: Distinguish client end programming from a server end programming, web based application from a smart phone based application, approach to an application based project from a research based project. (*Comprehension*)

CO3: Apply the knowledge of programming to develop application specific but not limited to Web, Android, IoT etc. For research based project the different algorithm design techniques. (*Application*)

CO4: Analyze the advantage and limitation of different development languages, APIs, platforms, algorithms (research). (*Analysis*)

CO5: Create applications to meet real time needs. (*Synthesis*)

CO6: Judge the efficiency of the project using various evaluation parameters and testing methodologies, efficiency of the algorithm for research based [complexity measure]. (*Evaluation*)

E-resource for learning

LaTeX, www.spoken-tutorial.org

CSNS6054: COMPUTER NETWORKS LAB

(2 credits)

1. Introduction to
    a) Network Components such as GATEWAYS, ROUTER, Switches, etc.
    b) Various Network Software, service and application
    c) Network Trouble shooting.
2. LAN with bus/star (switch or hub) topology with a minimum of two systems
3. Performance Evaluation of Error and Flow control protocol using LAN trainer.
4. Socket Programming (java or c).
    a) Implementation of Protocol- ALOHA, CSMA/CD, CSMA/CA
    b) Implementation of Applications using socket
        i. Telnet Client
        ii. FTP Client
        iii. HTTP Client
5. Introduction to Network Simulator (NS)
    a) Implementation and Analysis of protocol
6. Modeling of Network Architecture for an Organization (Project)

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Understand and identify different basic networking commands and utilities and learn different network topologies and associated network terminologies such as routing table, arp table etc. (*Knowledge*)
CO2: Distinguish different header values of different layer protocols in a packet by using tools such as wireshark, tcpdump etc. (*Comprehension*)
CO3: Apply the knowledge to view fragmentation, segmentation behavior of packets in a network. They would also able to identify and implement dynamic routing such as RIPv1. Create different network topology using ns3. (*Application*)
CO4: Apply the knowledge to analyze fragmentation, segmentation behavior of packets in a normal network and hybrid network demanding special flag value set. They would also able to identify and analyze problems related to some dynamic routing protocols such as RIPV1. (*Analysis*)
CO5: Design network topology implementing different routing protocols that best suits a real time demand. They should also be able to synthesize a hybrid network implementing different IEEE 802.x behavior using NS3. (*Synthesis*)
CO6: Judge which protocols operates in which layer and why by analyzing and observing network traces. (*Evaluation*).

CSCD6055: COMPILER DESIGN LAB

(2 credits)

1. Introduction to LEX and YACC. Preferable on UNIX but any other version is also acceptable.
2. Writing simple scanner for accepting and validating floating point numbers and fixed point numbers
3. Writing simple scanners for tokenizing C or BASIC programs. The Program will output the list of token to a file and classify them by type of token
4. Writing a program to pick out comments in a C ++ program or a JAVA Program
5. Developing a rudimentary C Preprocessor capable of handling the “define, ifdef, ifndef, include” directives. More ambitious students can implement substitution of Macros with arguments.
6. Converting simple finite Automata into program.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Know about different syntax of compiler construction tools like LEX and YACC. (*Knowledge*)
CO2: Form regular expression to match the pattern. (*Comprehension*)
CO3: Implement various problem using LEX and YACC. (*Application*)
CO4: Understand the techniques of parsing practically. (*Analysis*)
CO5: Know how to represents different rules using standard parser generator YACC. (*Synthesis*)
CO6: Solve problems using both LEX and YACC together. (*Evaluation*)

CSAA6056: ANALYSIS AND DESIGN OF ALGORITHMS LAB

(2 credits)

1. Using Graph notation to prove that bubble sort algorithm has time complexity (n^2)
2. Implement the Dynamic programming technique and analyze the algorithm using the graph notation.

3. Implement the Greedy programming technique and analyze the algorithm using the graph notation.
4. Implement the Divide and Conquer technique and analyze the algorithm using the graph notation.
5. Design a small file compressor and de-compressor by using Huffman coding technique

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recognize existing algorithms and how to analyse them using graph notation. (*Knowledge*)
CO2: Implement the existing algorithms. (*Comprehension*)
CO3: Apply existing algorithms in designing different applications. (*Application*)
CO4: Analyse execution time of standard algorithms. (*Analysis*)
CO5: Create efficient applications by using right algorithm depending on input pattern and size. (*Synthesis*)
CO6: Evaluate an algorithm in terms of time and space efficiency. (*Evaluation*)

CSMI6057: MINI PROJECT II

(2 credits)

Mini projects are assigned to students individually or in groups by the Department under the supervision of the designated faculty member. The objective of the mini project is to train the students to create Industry oriented software or hardware applications in his/her field of interest. The mini projects taken up by the students in the sixth semester are expected to be more advanced than the projects taken up in the fifth semester.

COURSE / LEARNING OUTCOMES

At the end of Mini Project II students will be able to:

CO1: Recognize the fundamental phases of a system/application/software design. (*Knowledge*)
CO2: Understand how to carry out a project work. (*Comprehension*)
CO3: Understand the importance of different phases of a system design. (*Comprehension*)
CO4: Design and implement a system. (*Application*)
CO5: Analyse the feasibility of a project in terms of time, effort and money. (*Analysis*)
CO6: Design applications by critically examining and scientifically designing each phase of a project work. (*Synthesis*)
CO7: Evaluate a project based on its efficiency, applicability, robustness, user friendliness etc. (*Evaluation*)

CSMP6058: MAJOR PROJECT - MCA

(12 credits)

***Objective**: The primary objective of the Major Project is to enable students to have a thorough understanding of the theoretical principles learnt in earlier five semesters through a prolonged practical experience. The major project is oriented towards developing requisite skills, knowledge of latest technologies and an entrepreneurial attitude in a student which are needed to make an effective start as a computer/IT professional.*

COURSE / LEARNING OUTCOMES

At the end of Major Project students will be able to:

CO1: Understand and identify different API and development environment tools for building the project, research terminologies such as scaling,sampling,information gathering etc., for research based project; Understand and learn different programming languages/research tools needed to meet different objectives of the project based on the company/institutional requirements. (*Knowledge*)

CO2: Distinguish web based application from smart phone based applications, IoT applications, translate proposed research algorithm into implementation. (*Comprehension*)

CO3: Apply the knowledge of programming to develop application specific but not limited to Web, Android,IoT etc. For research based project, the different algorithm design techniques, classification & clustering techniques, etc. will be applied. (*Application*)

CO4: Analyze the advantages and limitations of different development languages , APIs , platforms , algorithms (for research). (*Analysis*)

CO5: Create applications to meet real time needs. For research-based projects, students will be able to design novel or hybrid research techniques to meet the problem statement objectives. (*Synthesis*)

CO6: Judge the efficiency of the project using various evaluation parameters and testing methodologies, efficiency of the algorithm for research based [complexity measure]. (*Evaluation*)

CSAI6059: ARTIFICIAL INTELLIGENCE LAB

(2 Credits)

List of Experiments

1. Write a LISP Program to solve the water-jug problem using heuristic function.
2. Create a compound object using Turbo Prolog.
3. Write a Prolog Program to show the advantage and disadvantage of green and red cuts.
4. Write a prolog program to use of BEST-FIRST SEARCH applied to the eight puzzle problem.
5. Implementation of the problem solving strategies: Forward Chaining, Backward Chaining, Problem Reduction.
6. Write a Lisp Program to implement the STEEPEST-ASCENT HILL CLIMBING.
7. Write a Prolog Program to implement COUNTE PROPAGATION NETWORK.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify the need of two basic programming language very specific to AI viz., LISP and Prolog, learning and search algorithm like (A*, DFS, BFS), knowledge representation using Propositional and predicate logic. (*Knowledge*)

CO2: Define problem state space, design algorithms to solve problems, generalized schema for knowledge interpretation and planning and language processing using the syntax and semantics of Prolog and LISP. (*Comprehension*)

CO3: Compute and demonstrate the problem in terms of state space and apply different AI search algorithms(A*, DFS, BFS) to solve problems and construct a logic (Propositional and Predicate) to represent knowledge and interpret the natural language in computational domain by developing expert system using Prolog and LISP. (*Application*)

CO4: Compare and analyse the performance of algorithms based on problem domain. (*Analysis*)

CO5: Design and create new intelligent algorithm for application development by integrating experience based learning. (*Synthesis*)

CO6: Judge and assess the algorithms based on completeness, optimality, space and time complexity for solving a problem in intelligent manner. (*Evaluation*).

CSGM6060: COMPUTER GRAPHICS AND MULTIMEDIA LAB

(2 Credits)

COMPUTER GRAPHICS

Mandatory exercises

1. Learning graphics functions in C, C++.
2. Bresenham's line drawing algorithm.
3. DDA line drawing algorithm.
4. Polygon filling algorithm (FLOODFILL / SEEDFILL)
5. Cohen-Sutherland clipping algorithm.
6. 3D Transformations such as translation, rotation and scaling.

Any One exercise from the following

7. Reflection of a given point about a given axis.
8. Polygon clipping using Sutherland Hodgeman algorithm.

Any One exercise from the following

9. A straight line, rotating about the perimeter of a given circle.
10. Z-buffer algorithm for hidden surface elimination.

MULTIMEDIA

1. To visualize projections of 3D images.
2. To convert between color models.
3. To implement text compression algorithm.
4. To implement image compression algorithm.
5. To perform animation using any Animation software.
6. To perform basic operations on image using any image editing software.
7. Multimedia Sound: Create 2 soundtracks and 2 EFX sounds for a project.
8. Digital Video: Use video capture to digitize video shoot or another video source to create short production (15-45 seconds).

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recognize programming with graphics packages. (*Knowledge*)
CO2: Understand the functioning of inbuilt functions of graphics packages. (*Comprehension*)
CO3: Design and implement computer graphics algorithms using graphics packages. (*Application*)
CO4: Aalyse various graphics packages and their applicability. (*Analysis*)
CO5: Create animation, drawing using mathematical logics and transformations. (*Synthesis*)
CO6: Evaluate mathematical logics used to design graphics applications. (*Evaluation*)

E-resource for learning

Blender, GIMP, www.spoken-tutorial.org

CSTS6061: TRAINING SEMINAR

(2 credits)

Objective*: During the semester break at the end of the third year, students are required to undergo an Industrial Training. The purpose of the Industrial Training is to expose students to real-life industry situations, so that they may be able to apply the engineering knowledge and skills that they have gained through class-room teaching and lab activities, in an on-the-job situation. After the period of training, students are to present their experience in the form of reports and seminar presentations. Students will be evaluated on the seminar, viva voce examination and written reports.*

COURSE / LEARNING OUTCOMES

At the end of Training Seminar students will be able to:

CO1: Identify various real world problems. (*Knowledge*)
CO2: Develop and enhance leadership skills. (*Comprehension*)
CO3: Get the opportunity to work with live projects. (*Application*)
CO4: Increase exposure to industries. (*Analysis*)
CO5: Be accustomed with working environment in industries. (*Synthesis*)
CO6: Improve communication skills, presentation skills and other soft skills. (*Evaluation*)

CSMP6062: MAJOR PROJECT (PHASE I)

(4 credits)
During the last year of their study, B. Tech. students are required to take up a major project. This may be an individual project or a group project. The Major Project is an integral learning experience that encourages students to break away from the compartmentalization of the different courses they have studied during the three years of their study and aims to provide opportunities to explore the inter-relationships and inter-connectedness of the various courses and gather them together into a single learning experience.
The major project focuses upon the following:

- Interdisciplinary: The major project provides a platform for students to apply the knowledge and skills acquired from different courses.
- Collaboration: It encourages students to work in groups over an extended period of time. They clarify the task, plan their work, share the responsibilities and work towards the successful completion of the project.
- Process and Product: Project work focuses on both process and product. The process would include collaboration, gathering and processing of information. The product may take the form of a working model, a complete software package, etc.
- Written and Oral presentation: Project work provides students with opportunities to present their findings as a written thesis in a prescribed format and orally with an intended audience and purpose in mind.

During the first phase in the seventh semester, students are expected to choose the project, prepare a synopsis under the guidance of a project supervisor appointed by the department, present the synopsis to the committee set up for the purpose, get approval for the synopsis and start the project work. Students are expected to submit weekly activity reports and present a progress seminar during this phase. They will also undergo a viva voce examination, in which they will be examined on all the basic areas of the discipline in which they have chosen their project.

COURSE / LEARNING OUTCOMES

At the end of Major Project I students will be able to:

CO1: Familiarize themselves with the Software Development Life Cycle and fundamental phases of system/application/software design and research. (*Knowledge*)
CO2: Understand how to carry out a project work. Students would be able to understand the importance of different phases of a system design, workflow and time estimation with research outlook. (*Comprehension*)
CO3: Design and implement a system and how to perform research for real time application. (*Application*)
CO4: Analyse the feasibility of a project in terms of time, effort and money. (*Analysis*)
CO5: Design applications by critically examining and scientifically designing each phase of a project work. (*Synthesis*)
CO6: Evaluate a project based on its efficiency, applicability, robustness, user friendliness etc with socioeconomic impact. (*Evaluation*)

E-resource for learning
LaTeX, www.spoken-tutorial.org

CSMP6063: MAJOR PROJECT (PHASE II) AND VIVA VOCE

(8 credits)
During the second phase students are expected to focus on the process and completion of the projects and prepare project reports under the guidance of the Supervisors. Internal assessment shall be done by the DPEC and the external assessment shall be done by the external examiner(s) assisted by the DPEC and the supervisor. The modality and components of the internal assessment and their weightages shall be notified at the beginning of each semester. The External assessment shall have the following components:

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

COURSE / LEARNING OUTCOMES

At the end of Major Project II students will be able to:

CO1: Students would get familiar with the Software Development Life Cycle and fundamental phases of system/application/software design and research. (*Knowledge*)
CO2: Student would be able to understand how to carry out a project work. Students would be able to understand the importance of different phases of a system design, workflow and time estimation with research outlook. (*Comprehension*)
CO3: Students will be able to design and implement a system and how to perform research for real time application. (*Application*)
CO4: Students will be able to analyse the feasibility of a project in terms of time, effort and money. (*Analysis*)
CO5: Student would be capable of designing applications by critically examining and scientifically designing each phase of a project work. (*Synthesis*)
CO6: Students will be able evaluate a project based on its efficiency, applicability, robustness, user friendliness etc with socioeconomic impact. (*Evaluation*)

CSIJ6064: INTRODUCTION TO JAVA PROGRAMMING LAB

(2 Credits)
1. Java Fundamentals using Data Types, Declarations, Control Flow
2. Java Classes and Java Packages
3. Java Interfaces and Java Streams
4. Java Exception Handling
5. Java Threads
6. Java Applets
7. Java AWT

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify classes, objects, members of a class and relationships among them needed for a specific problem. (*Knowledge/Evaluation*)
CO2: Write Java application programs using OOP principles and proper Program structuring. (*Application/Comprehension*)
CO3: Demonstrate the concepts of polymorphism and inheritance. (*Application*)
CO4: Write Java programs to implement error handling techniques using exception handling. (*Application*)

CO5: Analyze the real world problems and solve using Java programming. (*Analysis/ Application*)

E-resource for learning
Java, www.spoken-tutorial.org

CSMI6065: MINI PROJECT - BCA

(4 credits)
Mini projects are assigned to students in groups by the Department under the supervision of the designated faculty member. The objective of the mini project is to train the students to create Industry oriented software or hardware applications in his/her field of interest.

COURSE / LEARNING OUTCOMES

At the end of this Mini Project students will be able to:

CO1: Identify and recognize the available project domains and its related requirements for project development. (*Knowledge*)
CO2: Locate the domain, illustrate and explain the requirements and modules to be included in designing the system. (*Comprehension*)
CO3: Estimate and predict the feasibility of the system/application/project to be developed. (*Comprehension*)
CO4: Apply the knowledge of various tools and techniques in designing the system. (*Application*)
CO5: Develop the system, by applying the knowledge they hold or (learn during or before the project phase). (*Application*)
CO6: Analyse and modify (if needed) the system based on the requirements. (*Analysis*)
CO7: Summarize their learning in the form of a final system/application/product. (*Synthesis*)
CO8: Evaluate, assess their work based on the certain defined metrics such as robustness, optimality, scalability, etc. (*Evaluation*)

CSMP6066: MAJOR PROJECT - BCA

(16 credits)
Objective: The primary objective of the Major Project is to enable students to have a thorough understanding of the theoretical principles learnt in earlier five semesters through a prolonged practical experience. The major project is oriented towards developing requisite skills, knowledge of latest technologies and an entrepreneurial attitude in a student which are needed to make an effective start as a computer/IT professional.

COURSE / LEARNING OUTCOMES

At the end of Major Project students will be able to:

CO1: Identify and recognize the available project domains and its related requirements for project development. (*Knowledge*)
CO2: Locate the domain, illustrate and explain the requirements and modules to be included in designing the system. (*Comprehension*)
CO3: Estimate and predict the feasibility of the system/application/project to be developed. (*Comprehension*)
CO4: Apply the knowledge of various tools and techniques in designing the system. (*Application*)
CO5: Develop the system, by applying the knowledge they hold or (learn during or before the project phase). (*Application*)
CO6: Analyse and modify (if needed) the system based on the requirements. (*Analysis*)
CO7: Summarize their learning in the form of a final system/application/product. (*Synthesis*)
CO8: Evaluate, assess their work based on the certain defined metrics such as robustness, optimality, scalability, etc. (*Evaluation*)

CSCP6067: COMPUTER PROGRAMMING IN C LANGUAGE LAB

(2 credits)

1. Introduction to OS: Linux/Unix, Vi editor, file handling, directory structures, creating and editing simple C programs.
2. C programming using variables, assignment and simple arithmetic expressions
3. If else
4. Switch-case statements
5. Break, continue
6. Loops
7. Single and multidimensional arrays
8. Functions and recursion
9. Pointers, address operator, declaring pointers and operations on pointers
10. File handling in C.

E-resource for learning

C, www.spoken-tutorial.org

CSIG6068: INTRODUCTION TO COMPUTER GRAPHICS LAB

(2 credits)

1. Learning graphics functions in C,C++
2. Digital Differential Analyzer line drawing algorithm.
3. Bresenham’s line drawing algorithm.
4. Bresenham’s circle drawing algorithm.
5. Polygon filling algorithm (Flood Fill, Boundary Fill)
6. Cohen Sutherland clipping algorithm.
7. 2D Transformations such as translation, rotation, scaling and shear.

CSPL6069: PROGRAMMING FOR PROBLEM SOLVING LAB

(2 Credits) (L-T-P:0-0-4)

(The laboratory is preceded by a teaching to explain the approach or algorithm to be implemented for the problem given)

1. Lab 1: (Teaching on Problem solving using computers) Familiarization with programming environment
2. Lab 2: (Teaching on Variable types and type conversions) Simple computational problems using arithmetic expressions
3. Lab 3: (Teaching on Branching and logical expressions) Problems involving if-then-else structures
4. Lab 4: (Teaching on Loops, while and for loops) Iterative problems e.g., sum of series
5. Lab 5: (Teaching on 1D Arrays: searching, sorting) 1D Array manipulation
6. Lab 6: (Teaching on 2D arrays and Strings) Matrix problems, String operations
7. Lab 7: (Teaching on Functions, call by value) Simple functions
8. Lab 8 and 9: (Teaching on Numerical methods-Root finding, numerical differentiation, numerical integration) Programming for solving Numerical methods problems
9. Lab 10: (Teaching on Recursion, structure of recursive calls) Recursive functions
10. Lab 11: (Teaching on Pointers, structures and dynamic memory allocation) Pointers and structures
11. Lab 12: (Teaching on File handling) File operations

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Our vision:
To cultivate nation builders, with scientific and engineering expertise and moral integrity, committed to the upliftment of society.

Our Mission:
To provide young and enthusiastic minds with sound theoretical and practical knowledge in electronics and communication technologies, so that they grow into competent individuals, capable of

- Converting ideas into reality
- Standing up to challenges to lead from the front and provide progressive solutions
- Contributing towards the growth and development of new technologies
- Creating a positive impact on global society, contributing towards the welfare of mankind

Program Educational Objectives, Department of ECE,

1. To create highly professional graduates with sound knowledge in the field of Electronics and Communication engineering through quality education.
2. To cater to global technological needs and to contribute to the industry by delivering the expertise acquired, through problem solving and working on need based projects.
3. To groom young minds with a strong sense of commitment towards the betterment of society and the environment.

DETAILED SYLLABUS

ECBE0001: BASIC ELECTRONICS

(4 credits – 60 hours)

Objectives: *As a first course in Electronics, this course is intended to give a preliminary understanding of the world of Electronics - Semiconducting materials and basic devices, simple circuits and systems. It will also serve to create a better appreciation of going digital and to generate continued interest in the course.*

Module I: Introduction to circuit elements (4 hours)

Voltage and Current sources- Independent and dependent sources, resistors, capacitors and inductors

Module II: Semiconductor Diodes (12 hours)

a) Semiconductor Concepts: Intrinsic semiconductor materials, energy levels, mobility, conductivity, N and P-type, concept of hole, majority and minority carriers, mechanism of current flow;
b) Semiconductor Diode: PN junction, forward bias condition, reverse bias condition, V-I characteristics, diode equation, Silicon vs Germanium, DC resistance levels, AC resistance, simplified equivalent circuit of a diode, application of diode as rectifier, clipper and clamper; Special purpose diode characteristics and applications: Zener diode, photo diode, varactor diode, Light Emitting Diode, Schottky diode, tunnel diode.

Module III: Transistors (20 hours)

a) Bipolar Junction Transistors: Transistor – construction, operation and configuration, V-I characteristics, Biasing, DC load line analysis, analysis of CE amplifier and emitter follower;
b) Field-Effect Transistors: FET – construction, operation and configuration, V-I characteristics; types of MOSFET, V-I characteristics, DC-biasing, DC load line analysis; basic configuration of MOS amplifier.

Module IV: Operational Amplifiers (6 hours)

Operational Amplifiers: The ideal OpAmp and its parameters, inverting and non-inverting configurations, equivalent circuit model, OpAmp application in integration, differentiation and summing circuits, OpAmp as differential amplifier

Module V: Digital Electronics (7 hours)

Digital Electronics: Number system representation and conversion, binary arithmetic, Boolean algebra. Logic gates – AND, OR, NAND, NOR, EX-OR, realization of Boolean expressions using gates, general idea about half adder and full adder; flip-flops.

Module VI: Introduction to Communication and Electronic Measurements (11 hours)

a) Principle of Communication: Introduction to signals, block diagram of communication system; modulation– AM, FM and PM and de-modulation of AM signal, effect of noise;
b) Fibre Optics Communication: a simplified fibre optic communication system, principle of operation, advantages.
c) Electronic Instruments: oscilloscope, time base, displaying a waveform in oscilloscope

COURSE / LEARNING OUTCOMES

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

CO1: Identify, recognize & describe the basic electronic components and devices. (*Knowledge*)

CO2: Define the various terminologies related to semiconducting materials, basic electronic devices, simple electronic circuits and systems, digital logic circuits and communication systems. (*Knowledge*)

CO3: State the basic laws and axioms of digital logics. (*Knowledge*)
CO4: Explain and illustrate the basic working principle and operation of various electronic components and circuits. (*Comprehension*)
CO5: Classify & compare the different types of Signals. (*Analysis*)
CO6: Explain & compare the fundamentals of basic communication types. (*Analysis*)
CO7: Compute the important parameters related to basic electronic components/Semiconductor circuits (BJT, FET, etc)/communication types. (*Application*)
CO7: Apply the laws and axioms to solve/simplify basic digital logic circuits/expressions. (*Application*)
CO8: Analyse the characteristics/working principle/operation of semiconductors /transistors /op-amps/logic gates/ communication types. (*Analysis*)
CO9: Design and develop different types of electronic circuits (Analog/Digital). (*Application*)
CO10: Evaluate the performance & characteristics of different types of electronic circuits (*Evaluation*)

Suggested Readings

1. Chattopadhyay and Rakshit, Electronics Fundamentals and Applications, 10th Edition, New Age International (P) Ltd., New Delhi, 2007.
2. Boylestead and Nashelsky, Electronic Devices and Circuits Theory, 9th Edition, Prentice Hall India, 2007.
3. Salivahanan et al., Electronic Devices and Circuits, 2nd Edition, Tata McGraw Hill, New Delhi, 2008.
4. Sedra and Smith, Microelectronic Circuits, 5th Edition, Oxford University Press, New Delhi, 2007
5. R. P. Jain, Modern Digital Electronics, Tata McGraw Hill, New Delhi, 2008.
6. Donald P Leach, Albert Paul Malvino and Goutam Saha, Digital Principles and Applications, 6th Edition, Tata McGraw Hill, New Delhi, 2006.

ECDP0002: DIGITAL SIGNAL PROCESSING

(4 credits - 60 hours)

Objectives: *This course is intended to make the students learn the essential advanced topics in digital signal processing that are necessary for successful post graduate-level research. The course includes a review of the linear constant-coefficient system properties covered in an undergraduate DSP course, and then examines a variety of filter structures, time-varying and adaptive systems, fast algorithms, and other topics relevant to the research areas of the students.*

Module I: Review of Digital Signal and Systems (15 hours)

a) Discrete time signals and its classification, discrete time systems and its classification.
b) The Z-transform, Properties of Z-transform, Inverse Z-transform, application of Z-transform.
c) Analysis and response of Discrete LTI system, Recursive and non Recursive LTI system, Constant coefficient difference equations and their solution, impulse response of LTI system and structure of LTI system.
d) Fast Fourier Transform: Discrete Time Fourier Transform, Discrete Fourier Transform, Radix-2 FFT algorithm-Decimation in time (DIT) and Decimation in frequency (DIF) algorithm.

Module II: Filters and Classifiers (16 hours)

a) Design of FIR and IIR filters, Implementation of discrete time system structure to realize FIR and IIR filters.
b) Introduction to adaptive signal processing, FIR adaptive filters, steepest descent adaptive filter, LMS algorithm, convergence of LMS algorithms, Application: noise

cancellation, channel equalization, adaptive recursive filters , recursive least squares.

c) Multirate system – decimation and interpolation, quadrature – mirror filters.

Module III: Effects of finite word length in digital systems (14 hours)

Introduction; Representation of numbers- fixed point, floating point; Rounding and Truncation Errors; Quantization Effects in ADC and DAC processes; Noise power from a digital system; Coefficient quantization effects in direct form realization of IIR and FIR systems; Roundoff effects in Digital filter structures.

Module IV: Wavelet Transforms (15 hours)

Fourier Transform : Its power and Limitations, Short Time Fourier Transform, The Gabor Transform, Discrete Time Fourier Transform and filter banks, Continuous Wavelet Transform, Wavelet Transform Ideal Case, Perfect Reconstruction Filter Banks and wavelets, Recursive multi-resolution decomposition, Haar Wavelet, Daubechies Wavelet.

COURSE / LEARNING OUTCOMES

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

CO1: Define and outline the fundamental concepts of signals and system.(*Knowledge*)
CO2: List and recognize the different mathematical tools like Z-transform, DFT, and Wavelet transform etc., used in digital signal processing. (*Knowledge*)
CO3: Define various classifications of digital filters. (*Knowledge*)
CO4: Cite various algorithms for adaptive filter design. (*Knowledge*)
CO5: Define various techniques such as decimation, interpolation, and resampling for handling the multirate signal processing. (*Knowledge*)
CO6: Recall different effects related to quantization and representation of numbers in terms digital system. (*Knowledge*)
CO7: Define various types of Wavelets. (*Knowledge*)
CO8: Classify the different types of signals and discrete time system. (*Comprehension*)
CO9: Classify the different types of digital filters and different methods of designing digital filters. (*Comprehension*)
CO10: Describe the issues related adaptive filter design. (*Comprehension*)
CO11: Interpret the various effects of finite word length in digital systems. (*Comprehension*)
CO12: Illustrate how advanced algorithms like LMS, MMSE etc., can be utilized to design adaptive filters. (*Comprehension*)
CO13: Explain the different methods of multirate signal processing (*Comprehension*)
CO14: Illustrate the use various wavelets for high end signal processing. (*Comprehension*)
CO15: Compute the time domain and frequency domain responses of various discrete time systems. (*Application*)
CO16: Design and analyze digital filters for different specifications. (*Application*)
CO17: Use the digital signal processing concepts to practical DSP system. (*Application)*
CO18: Solve multirate signal processing problems. (*Application*)
CO19: Implement fast algorithms in DSP processors. (*Application*)
CO19: Classify and analyze various methods of IIR and FIR filter design. (*Analyze*)
CO20: Should determine the appropriate design procedure for adaptive filter. (*Analyze*)
CO21: Point out different pros and cons of multirate signal processing (*Analyze*)
CO22: Design different IIR and FIR systems (*Synthesis*)
CO23: Recognize the different effects related finite word length in digital system. (*Synthesis*)
CO24: Evaluate the performance of different algorithms related to adaptive filters. (*Evaluation*)
CO25: Compare the various types of digital filters *(Evaluation)*

Suggested Readings

1. Proakis and Manolakis, Digital Signal Processing, 4th Edition, Prentice Hall, 2007
2. Monson H. Hayes Statistical Digital Signal Processing and Modeling, Wiley, 2002
3. B. Yegnanarayana, Artificial Neural Networks, Prentice Hall of India, 1999
4. S. Haykin, Neural Networks – A Comprehensive Foundation, Prentice Hall, 1998.
5. S. Salivahanan, Digital Signal Processing, TMH.

ECFT0003: MICROELECTRONICS FABRICATION TECHNOLOGY

(3 credits - 45 hours)

Objectives: *This course serves as an introduction to basic processes used in the fabrication of semiconductor devices and integrated circuits. The objective is to develop the background knowledge necessary to understand the state-of-the-art semiconductor technology related to device fabrication processes.*

Module I: Semiconductor Processing Technology (8 hours)

An Introduction to Microelectronic Fabrication, Roadmap of semiconductor manufacturing, Semiconductor Materials and Process Chemicals, Crystal Growth and Wafer Preparation, Contamination Control

Module II: Overview of Wafer Fabrication (12 hours)

Phase Diagrams and Solid Solubility, Basic Wafer Fabrication Operations, Hot Processing and Ion Implantation, Construction of a Semiconductor Circuit, Chip Terminology, Process Yields

Module III: Principles of Microelectronics Fabrication (7 hours)

Oxidation, Rapid Thermal Processing, Photolithography

Module IV: Photolithographic Processes (6 hours)

Optical Lithography, Photo resists, Non optical Lithographic Techniques

Module V: Processing of thin films (8 hours)

Vacuum Science and Plasmas, Etching, Physical Deposition: Evaporation and Sputtering, Chemical Vapor Deposition, Epitaxial Growth, Device Isolation, Contacts, and Metallization, Fundamentals of MEMS and NEMS

Module VI: Overview of Wafer Fabrication (4 hours)

The Business of Wafer Fabrication, Semiconductor Devices and IC Formation, Integrated Circuit Types, Chip Packaging

COURSE / LEARNING OUTCOMES

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

CO1: Reproduce how silicon wafers are made starting from sand, the various processes and techniques involved in making integrated circuits on silicon wafer, the roadmap for silicon technology. *(Knowledge)*

CO2: Infer how semiconductor properties could be related to fabrication of integrated circuits *(Comprehension)*

CO3: Demonstrate how semiconductors are used for fabrication of integrated circuits (ICs) *(Application)*

CO4: Relate basic theories underlying the various processes that are used in fabricating electronic devices and ICs and how it affects the environment. *(Analysis)*

CO5: Construct problems related to IC fabrication processes. *(Synthesis)*

CO6: Evaluate process parameters for minimizing defects and reducing power consumption in fabrication of ICs. *(Evaluation)*

Suggested Readings
1. S. A. Campbell, The Science and Engineering of Microelectronics Fabrication, Oxford University Press, Second Edition, 2001
2. Stephen A. Campbell, Fabrication Engineering at the Micro and Nanoscale, Oxford University press, 2007
3. R.C. Jaeger, Introduction To Microelectronics Fabrication, 2nd Edition (ISBN: 0201444941), 2001
4. P. V. Zant, Microchip Fabrication: A Practical Guide to Semiconductor Processing, 3rd Edition, Semiconductor Services, 2000 (ISBN: 0071356363)
5. Marc J. Madou, Fundamentals of Microfabrication: The Science of Miniaturization, 2nd Edition (ISBN: 0849308267), 2002

Journals and Magazines
1. IEEE Circuits and Devices Magazine
2. IEE Electronics Letters
3. IEEE Transactions on Circuits and Systems

ECCI0004: DIGITAL COMMUNICATION AND INFORMATION SYSTEMS
(3 credits - 45 hours)

Objectives: *This course is aimed at introducing to the student the advanced theory of Digital Communication. The course will provide in-depth knowledge of communication fundamentals, which include different digital modulation techniques, linear filtering techniques, spread spectrum modulation and information theory.*

Module I (17 hours)

Digital Modulation Techniques: ASK, FSK, BPSK, QPSK, DPSK, FQPSK, QAM, M-QAM, OFDM, Optimum Receiver for Signals Corrupted by AWGN, Performance of the Optimum Receiver for Memory-less Modulation, Optimum Receiver for CPM Signals, Optimum Receiver for Signals with Random Phase in AWGN Channel.

Module II (6 hours)

Communication through band limited linear filter channels: Optimum receiver for channels with ISI and AWGN, Linear equalization, Decision-feedback equalization, reduced complexity ML detectors, Iterative equalization and decoding-Turbo equalization.

Module III (5 hours)

Spread Spectrum Signals for Digital Communication: Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals, Frequency-Hopped Spread Spectrum Signals, CDMA, time-hopping SS, Synchronization of SS systems.

Module IV (17 hours)

Information Theory and Coding: Entropy, Source coding theorem, Huffman coding, mutual Information, channel models, channel capacity and bounds on communication, differential entropy, Coding and decoding of Linear Block code, cyclic code, convolution code, BCH codes, Reed-Solomon codes, Trellis and Turbo codes.

COURSE / LEARNING OUTCOMES

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

CO1: Define and outline the fundamental concepts of digital communication system. *(Knowledge)*
CO2: List and recognize the different digital modulation techniques. *(Knowledge)*
CO3: Define the various technical terms such as BER, SNR, CNR etc., to analyze the performance of digital modulation techniques. *(Knowledge)*
CO4: Cite different linear and adaptive filter for digital communication. *(Knowledge)*

CO5: Define various techniques such as equalization, diversity, coding etc. for handling the multipath fading scenarios. *(Knowledge)*

CO6: Define various terms related to the measurement of information to be sent through a digital communication system. *(Knowledge)*

CO7: Should recall different form of source and channel coding techniques.

CO8: Define the various parameters to determine the efficiency and redundancy of a particular source or channel coding techniques. (*Knowledge*)

CO9: Define different spread spectrum communication system. (*Knowledge*)

CO10: Classify the different types of digital modulation schemes. (*Comprehension*)

CO11: Classify the different correlative coding techniques to handle ISI. (*Comprehension*)

CO12: Describe the issues related to different spread spectrum communication systems. (*Comprehension*)

CO13: Interpret the relationship among the average code length, entropy, efficiency, redundancy etc., of a particular coding schem. (*Comprehension*)

CO14: Illustrate the solution of ISI problem in baseband transmission. *Comprehension*)

CO15: Explain the different equalization techniques. (*Comprehension*)

CO16: Illustrate the various coding techniques to improve the communication system. (*Comprehension*)

CO17: Describe the probabilistic model of the communication channel. (*Comprehension*) CO18: Compute the performance of a digital modulation scheme for a particular communication system. (*Application*)

CO19: Compute and analyze the different properties of PN sequence for spread spectrum communication. (*Application*)

CO20: Implement and analyze different source and channel codes. (*Application*)

CO21: Classify and analyze the bit error performance of various digital modulation techniques.

CO22: Point out different pros and cons of match filter in digital communication system. (*Analysis*)

CO23: Determine the appropriate coding scheme for a particular scenario. (*Analysis*)

CO24: Simulate different modulation schemes. (Synthesis)

CO25: Find out the best modulation for particular communication system. (Synthesis)

CO26: Recognize the bit error rate for particular case system. (Synthesis)

CO27: Evaluate the performance of different modulation schemes based on the nature and performance characteristics and assess their importance in design cellular communication system. (*Evaluation*)

CO28: Compare the various types of source and channel coding schemes. (*Evaluation*)

Suggested Readings

1. John G. Proakis, Digital Communications, 4th edition, McGraw Hill, 2001.
2. Stephen G. Wilson, Digital Modulation and Coding, Pearson Education (Asia) Pte. Ltd, 2003.
3. Simon Haykin, Digital Communications, John Wiley and sons.
4. Wayne Tomasi, Advanced Electronic Communication Systems, 4th Edition Pearson Education Asia.
5. B.P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press.

ECOE0005: OPTICAL ELECTRONICS

(3 credits - 45 hours)

Objectives: *The course gives the fundamentals of Optical Electronics which includes modulation of light, Lasers, photodetectors and Holography. This course will from the basic for optical devices and optical communication.*

Module I (10 hours)

Modulation of light: elliptical polarization, birefringence, optical activity, electrooptic effect, Kerr modulators, magneto-optic effect, acousto-optic effect and non-linear optics, Mach-Zehnder interferometer modulator and switch, optical directional coupler

Module II (15 hours)

a) Lasers I: Emission and absorption of radiation, Einstein relations, population inversion, threshold conditions, pumping threshold conditions, Laser modes Classes of Laser.
b) Lasers II: Single mode operation, Frequency stabilization, Mode locking, Q switching, Laser application, Laser induced nuclear fusion.

Module III (12 hours)

Photodetectors: Photon devices; photoemissive devices vacuum photodiode, photomultipliers, noise in photomultipliers, photoconductive detectors, noise in photoconductive detectors, Characteristics of particular photoconductive materials, junction detectors, detector arrays, Detector performance parameters.

Module IV (8 hours)

Holography: Introduction, basic principle, , applications of holography , coherence requirement, resolution.

Display devices: LED materials, construction response times of LED, LED drive circuitry plasma displays, Liquid Crystal Displays, Numeric displays.

COURSE / LEARNING OUTCOMES

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

CO1: Describe modulation of light, holography and different display devices. *(Knowledge)*
CO2: Identify and describe the various types of optical sources and detectors. *(Knowledge)*
CO3: Explain the electro-optic effect, acousto-optic effect and magneto-optic effect and describe the various modulators based on these effects. *(Comprehension)*
CO4: Establish the need for coherent optical source and describe its fundamental working principles, structure, types and characteristics. *(Comprehension)*
CO5: Explain the nature and performance of various types of photo detectors. *(Comprehension)*
CO6: Compute the performance parameters of different photo detectors. *(Application)*
CO7: Classify the different optoelectronic sources, detectors and display devices. *(Analyze)*
CO8: Summarize and compare the coherent and non-coherent optical sources. *(Synthesis)*
CO9: Evaluate the performance characteristics of optical sources, detectors, and other optoelectronics devices. *(Evaluation)*

Suggested Readings

1. J. Wilson and J.F.B. Hawkes, Optoelectronics, an Introduction, Prentice Hall of India Private Ltd.
2. Ajoy Ghatak and K. Thyagarajan, Optical Electronics, Cambridge University Press.
3. B.P Pal (ed), Fiber Optics - Fundamentals of Fibre Optics in Telecommunications and Sensor Systems, New Age International (P) Ltd. New Delhi.
4. Yariv, Optical Electronics, Oxford University Press.

ECES0006: EMBEDDED SYSTEMS AND APPLICATIONS

(3 credits – 45 hours)

Objectives: *The course helps to develop an in-depth understanding of the operation of microcontrollers, assembly language programming and microcontroller interfacing techniques. The students will be able to design and implement microcontroller based systems in both hardware and software and can apply this knowledge to more advanced structures.*

Module I (7 hours)

Introduction: History of Microcontrollers and Microprocessors. Differences between Microcontrollers and Microprocessors, Introduction to MPU of different categories- such as Microcontroller-8051, AVR, PIC, etc., their specific features, advantages.

Module II (10 hours)

Microcontroller 8051: Introduction, MCS-51 Architecture, Registers, I/O Ports, Memory organization.

Module III (12 hours)

Assembly / C Programming of Microcontroller 8051: Instructions, Addressing modes, Arithmetical, Logical, Jumps, Loops and Call etc., Interrupts Timers/ Counters and Serial Communications.

Module IV (8 hours)

Application of MCS-51: Interfacing 7-segment display, LCD, Key board, ADC etc. Development of instrumentation system such as temperature, pressure, flow, frequency, pulse width, voltage, rpm, pH etc. monitoring. Generation of PWM wave. Data- logger, alarm enunciators, PID controller, programmable controller and interlock control.

Module V (8 hours)

Introduction to PIC microcontrollers: Architecture, Mid-Range instruction Set, Power Input and Decoupling, Reset, Watchdog Timer, System Clock/Oscillators.

COURSE / LEARNING OUTCOMES

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

CO1: Define various terminologies related to microprocessors and microcontrollers *(Knowledge)*
CO2: Differentiate between microprocessor and microcontroller *(Comprehension)*
CO3: Explain the internal organization of 8051 and PIC16C61 microcontroller *(Comprehension)*
CO4: Apply 8051 microcontroller programming to solve real life problems. *(Application)*
CO5: Analyze the performance of 8051 microcontroller *(Analyze)*
CO6: To design and develop microcontroller based systems/models for real life application *(Synthesis)*
CO7: To summarize the various applications of 8051 microcontroller. *(Synthesis)*
CO8: Able to evaluate 8051 microcontroller based system *(Evaluation)*

Suggested Readings

1. Mazidi and J. G. Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson
2. A V Deshmukh, Microcontrollers : Theory and Applications, Pearson
3. Subrata Ghosal, 8051 Microcontroller-Internals, Instructions, Programming and Interfacing, Pearson
4. Md Ali Mazidi, Rolin D. Mc-Kindly and Janice Gillistie The 8051 Microcontroller and Embedded System Using Assembly and C
5. Lyla B. Das, Embedded Systems-An Integrated Approach, Pearson
6. Relevant Data Sheets

ECSP0007: STATISTICAL SIGNAL PROCESSING

(3 credits - 45 hours)

Objectives: *The main objective of this course is to provide the platform for the research in the field of signal processing specially in the field of machine learning, speech and pattern recognition etc. The course contains random variable, random process, nonparametric and parametric Spectral Estimation, Estimation principle and its application, adaptive filter and Spectral analysis.*

Module I (10 Hours)

Review of random variables and Random process: Discrete and Continuous Random Variables, Distribution and density functions, moments; Vector-space representation of Random variables, Central Limit theorem, stationary processes, autocorrelation and auto covariance functions, Spectral representation of random signals, Wiener Khinchin theorem, Properties of power spectral density, Gaussian Process and White noise process, Linear System with random input, Spectral factorization theorem and its importance, innovation process and whitening filter, Random signal modeling: MA(q), AR(q), ARMA(q) models.

Module II (5 Hours)

Optimal linear filtering: Overview of Non Parametric Spectral estimation Techniques; Parametric Spectral Estimation with emphasis on AR process Modeling; Yule Walker Equation and Levison Durbin Algorithm, Lattice filter (Derived from Levison Durbin Algorithm)

Module III (15 Hours)

a) Estimation Theory: Principle of estimation and applications, Properties of estimates, unbiased and consistent estimators, Minimum Variance Unbiased Estimates (MVUE), Maximum likelihood estimation; Bayes cost method Bayes estimation criterion -Mean square error criterion; Uniform cost function; absolute value cost function; MMSE, Mean Absolute error, MAP estimation.
b) Properties of estimators: Bias, Efficiency, Cramer Rao bound Asymptotic properties; Sensitivity and error analysis.
c) Estimation of signal in presence of White Gaussian Noise (WGN) Linear Minimum Mean-Square Error (LMMSE) Filtering: Wiener Hoff Equation FIR Wiener filter, IIR Wiener filter Linear Prediction of Signals, Forward and Backward Predictions.

Module IV (6 Hours)

a) Adaptive filters: Adaptive systems - definitions and characteristics - applications - properties and examples. Steepest Descent Algorithm Convergence characteristics; LMS algorithm, convergence, RLS algorithm.
b) Kalman filtering: State-space model and the optimal state estimation problem, discrete Kalman filter, continuous-time Kalman filter, extended Kalman filter.

Module V (9 Hours)

Spectral analysis: Estimated autocorrelation function, periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Blackman and Tukey method of smoothing periodogram, Parametric method, AR(p) spectral estimation and detection of Harmonic signals, MUSIC algorithm.

COURSE / LEARNING OUTCOMES

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

CO1: Define scalar and multiple random variables using theory of probability. *(Knowledge)*
CO2: Define power spectral density of stationary random process. *(Knowledge)*
CO3: Define basic properties of estimators *(Knowledge).*
CO4: Explain the notion of characterizing random variables using moments. *(Comprehension)*
CO5: Explain the notion of random process and statistical time series. *(Comprehension)*
CO6: Explain the notion of parametric signal models. *(Comprehension)*
CO7: Describe common regression-based signal models in terms of its statistical characteristics and in terms of its effect in random signals. *(Comprehension)*
CO8: Discuss the principles of Estimation theory. *(Comprehension)*

CO9: Calculate the properties of a given estimator. *(Application)*

CO10: Apply least squares, maximum-likelihood and Baseyian estimators to model signal processing problems. *(Application)*

CO11: Analyze and manipulate power spectral densities. *(Analyze)*

CO12: Analyze in both time and frequency the effect of transformations and linear systems on random processes, both in terms of the density functions and statistical moments *(Analyze)*

CO13: Realize FIR, IIR and Whitening filter. *(Synthesis)*

CO14: Design and estimate the power spectral density of AR, MA and ARMA model. *(Synthesis)*

CO15: Characterize random processes in terms of its statistical properties. (*Analysis*)

CO16: Evaluate the performance of AR, MA and ARMA process with respect to power spectral density. (*Evaluation*)

Suggested Readings

1. M. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons.
2. Steven Kay, Fundamentals of Statistical Signal Processing, Vol I: Estimation Theory, Vol II: Detection Theory, Prentice Hall.
3. M.D. Srinath, P.K. Rajasekaran and R. Viswanathan: Statistical Signal Processing with Applications, PHI.
4. D.G. Manolakis, V.K. Ingle and S.M. Kogon: Statistical and Adaptive Signal Processing, McGraw Hill.
5. Simon Haykin, Adaptive Filter Theory, Prentice Hall.

ECWC0008: WIRELESS COMMUNICATION SYSTEM

(4 credits - 60 hours)

Objectives: *This course is intended to make the students learn the essential advanced topics in wireless communication that are necessary for successful post graduate-level research. The course includes an introduction of wireless communication and cellular concepts, and then examines a variety of phenomenon related to mobile radio propagation, modulations and diversity techniques and other advanced topics relevant to the research areas of the students.*

Module I: Introduction to Wireless Mobile Communication System and Cellular Concepts (11 Hours)

a) History and evolution of mobile radio systems; Types of mobile wireless services/systems, Paging, Satellite systems, Standards, Future trends in personal wireless systems, Second generation (2G) Cellular Network, Introduction to third generation (3G) Wireless Network.

b) Cellular concept and frequency reuse, Channel assignment and Handoff Strategies,Interference and system capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems.

Module II: Mobile Radio Propagation (15 Hours)

a) Free space propagation model, basic propagation mechanisms, reflection, ground reflection model, diffraction, and scattering, Practical link budget design, outdoor and indoor propagation models.

b) Small scale multipath propagation: Impulse response model of a multipath channel, small scale multipath measurements, parameters of mobile multipath channels, types of small scale fading, Fading effect due to Doppler Spread, Statistical models for multipath fading channels.

Module III: Performance of digital modulation over wireless channels and signal processing (20 Hours)

a) Overview of analog and digital modulation techniques. Performance of various modulation techniques-Spectral efficiency, mobile radio interference: co-channel and adjacent-channel interference, intermodulation, inter-symbol and simulcast interference; frequency plans: channelized schemes and frequency reuse, spread spectrum and frequency hopping, Error-rate, Power Amplification.
b) Linear and nonlinear Equalization, Realization of Independent Fading Paths: Receiver Diversity, Selection Combining, Threshold Combining, Maximal-Ratio Combining, Equal Gain Combining, Transmitter Diversity-Channel known at Transmitter, Channel unknown at Transmitter; The Alamouti Scheme; basic concepts of RAKE receivers, Coding techniques for mobile communications.

Module IV: Wireless System Examples and Design Issues (14 Hours)

a) Multiple Access Techniques: Frequency division multiple access, time division multiple access, code division multiple access, space division multiple access. Operational systems, Wireless networking, design issues in personal wireless systems; Cellular CDMA: narrow band and wide band signal propagation, spread spectrum techniques, capacities of multiple access schemes; micro cell systems: conventional cellular system, micro cell system design, capacity analysis.
b) MIMO and multicarrier modulation: Narrowband MIMO model, parallel decomposition of MIMO channel, MIMO channel capacity, MIMO diversity gain, data transmission using multiple carriers, multicarrier modulation with overlapping sub channels, mitigation of subcarrier fading, basic concepts of OFDM.

COURSE / LEARNING OUTCOMES

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

CO1: Define and outline the fundamental concepts of wireless communication system. *(Knowledge)*
CO2: List and recognize the different wireless communication standards and types with respective specifications. *(Knowledge)*
CO3: Define the various technical terms related to mobile cellular communication system. *(Knowledge)*
CO4: Cite various propagation models for cellular communication. *(Knowledge)*
CO5: Define various techniques such as equalization, diversity, coding etc. for handling the multipath fading scenarios. *(Knowledge)*
CO6: Recall different advanced technology like CDMA, MIMO etc. for mobile communication system. *(Knowledge)*
CO7: Classify the different types of wireless communication system. *(Comprehension)*
CO8: Classify the different generation of cellular communication system. *(Comprehension)*
CO9: Describe the issues related to geometry, capacity, interference etc. of cellular communication system. *(Comprehension)*
CO10: Interpret the tradeoff between capacity and interference of cellular communication system. *(Comprehension)*
CO11: Illustrate how advanced technique like cell splitting, sectoring and zoning can improve the capacity of a cellular system. *(Comprehension)*
CO12: Explain the different radio wave propagation mechanism like refection, diffraction and scattering. *(Comprehension)*
CO13: Illustrate the various techniques to improve the received signal quality in mobile communication system *(Comprehension)*
CO14: Describe the various multiple access techniques *(Comprehension)*
CO15: Compute the various parameters related to cellular system link budget design. *(Application)*

CO16: Compute and analyze path loss of various path loss models for radio wave propagation in cellular communication system. *(Application)*
CO17: Apply the concepts to practical cellular system. *(Application)*
CO18: Classify and analyze various capacity improvement techniques. *(Analyze)*
CO19: Determine the appropriate propagation model of radio wave propagation for different geographical location. *(Analyze)*
CO20: Point out different pros and cons of the signal quality improvement techniques based on present scenarios. *(Analyze)*
CO21: Simulate different propagation models *(Synthesis)*
CO22: Find out the best path-loss model for a given scenario. *(Synthesis)*
CO23: Recognize the large scale path-loss and small scale path loss for particular case system. *(Synthesis)*
CO24: Evaluate the performance of different modulation schemes based on the nature and performance characteristics and assess their importance in design cellular communication system *(Evaluation)*
CO25: Compare the various types of multiple access techniques and assess their importance in mobile communication *(Evaluation)*

Suggested Readings

1. K.Feher, Wireless digital communications, PHI
2. T. S. Rappaport, Wireless Digital Communications Principles and Practice, Pearson Education
3. W. C. Y. Lee, Mobile Communications Engineering: Theory And Applications, McGraw Hill
4. J Schiller, Mobile Communications, Pearson Education
5. W Stallings, Wireless Communications and Networks, Pearson Education
6. X Wang, H V Poor,Wireless Communication Systems, Pearson Education
7. A Goldsmith, Wireless Communications, Cambridge University Press, 2005
8. R Pandya, Mobile and Personal Communication Systems and Services, Prentice Hall of India, 2002

ECNE0009: NANOTECHNOLOGY AND NANOELECTRONICS

(3 Credits - 45 hours)

Objectives: *This course will introduce the students to Nanotechnology. The course is designed to build up a basic understanding of the nano concepts. It will provide the students the knowledge of synthesis of nanomaterials, their characterization techniques as well as touch upon some applications of nanotechnology. This course will also introduce the students to nano and molecular electronics.*

Module I (8 Hours)

Basics of Nanotechnology: History, Properties of Nanomaterials, Difference between Bulk and Nanomaterial, Molecular building blocks for nanostructure systems, Forces between atoms and molecules - Particles and grain boundaries – strong Intermolecular forces – Electrostatic and Vander Waals forces between surfaces, Properties of nanomaterials.

Module II (8 Hours)

Physics of nanomaterials: Atomic scale structure of nanoparticles, nanotubes, nanowires, nanodots etc.; electronic and optical characteristic properties of quantum dots, quantum wires and quantum wells; concept of quantum confinement: 0D, 1D and 2D nanostructures; Size effects – Fraction of Surface Atoms, specific Surface Energy and Surface Stress. Nanofluidics, Nanophotonics, Nanothermodynamics, Plasmonics – plasmons and surface plasmons, SPR, Core-shell quantum dots and quantum- dot-quantum wells.

Module III (10 Hours)

Synthesis and Characterization of nanomaterials: Top down approach, Lithography – electron beam and ion beam techniques, Etching – wet and dry etching, Bottom up approach - Solvent based and template based synthesis, other important synthesis methods like CVD, PVD etc.; Doping, Nucleation, Growth and Stability of colloidal nanoparticles, concept of self-assembly. Characterization methods: Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), X-ray diffraction spectroscopy (XRD), Optical characterization.

Module IV (12 Hours)

Fundamentals of Nanoelectronics: Quantum particles, Quantum mechanics of electrons, Free and confined electrons, Band theory of solids, Single electron/few electron devices, Coulomb blockade, Semiconductor quantum wells, quantum wires and quantum dots, Nanosensors, Photonic crystals, Nanopiezotronics.

Module V (7 Hours)

Molecular Electronics: Electronic and optoelectronic properties of molecular materials, Electrodes and contacts, functions, molecular electronic devices, elementary circuits using organic molecules, Organic materials based rectifying diode switches, TFTs, OLEDs, OTFTs, logic switches.

COURSE / LEARNING OUTCOMES

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

CO1: Recognize the principles underlying the field of Nanotechnology. *(Knowledge)*

CO2: Discuss the concepts underlying this disruptive field of new technology. *(Comprehension)*

CO3: Apply this knowledge for fabricating new materials and devices in the nanoscale. *(Application)*

CO4: Analyze new materials and devices in the nanoscale using various characterization tools. *(Analysis)*

CO5: Synthesize new Nano structured materials through various synthesis methods. *(Synthesis)*

CO6: Evaluate synthesized materials for their various properties. *(Evaluation)*

Suggested Readings

1. G. L. Hornyak, J. Dutta, H. F. Tibbals, A. Rao Introduction to nanoscience, CRC Press
2. G. L. Hornyak, J. Dutta, H. F. Tibbals, A.Rao Introduction to nanotechnology CRC Press
3. T. Pradeep, Nano: The Essentials McGraw Hill
4. G. W. Hanson, Fundamentals of Nanoelectronics, Pearson
5. D. Maclurcan and N. Radywyl (Eds.) Nanotechnology and Global Sustainability CRC Press
6. E. Lichtfouse, J. Shwarzbauer, D. Robert, Environmental Chemistry for a Sustainable World, Vol.2 Springer Verlag

ECOC0010: OPTICAL FIBRE COMMUNICATION AND NETWORKS

(4 credits - 60 hours)

Objectives: *The content of the course is designed to introduce the students to fiber-optic communication technology while considering the latest development in the field of fiber optics communication and networking. Technical concepts which are at the core of design, implementation and research will be discussed during this course in a manner that is conducive to understanding general concepts as well as latest development.*

Module I (12 hours)

Introduction, Ray theory transmission, Total internal reflection, Acceptance angle, Numerical aperture, Skew rays, Electromagnetic mode theory of optical propagation, EM waves, modes in planar guide, phase and group velocity, cylindrical fibers, SM fibers. Mode volume, single and multimode fibre, cut off wavelength, mode field diameter. Graded Index fiber. Different types of polarization maintaining fiber, high birefringent fibers, single polarization single mode fibres, applications. Fabrication techniques of optical fibers, multi component technology and vapour deposition Methods.

Module II (10 hours)

Transmission characteristics of optical fibers: Attenuation, Material absorption losses in silica glass fibers, Linear and Nonlinear Scattering losses, Fiber Bend losses, Midband and farband infra red transmission, Intra and inter Modal Dispersion, Over all Fiber Dispersion Polarization, nonlinear Phenomena. Optical fiber connectors, Fiber alignment and Joint Losses Fiber Splices, Fiber connectors, Expanded Beam Connectors, Fiber Couplers.

Module III (8 hours)

Fiber Optics Receiver and Measurements: Fundamental receiver operation, Pre amplifiers, Error sources, Receiver Configuration, Probability of Error, Quantum limit. Characterization of multimode fiber and single mode fiber, measurement techniques of RIP, geometrical measurement, numerical aperture, attenuation.

Module IV (10 hours)

An overview of fiber Nonlinearities. Optical Networking Components: First and second generation optical networks. Components: couplers, isolators, circulators, multiplexers, filters, amplifiers, switches and wavelength converters.

Module V (8 hours)

Sonet and SDH Networks: Integration of TDM signals, Layers, Framing, Transport overhead, Alarms, Multiplexing, Network elements, Topologies, Protection architectures, Ring architectures, Network Management; Introduction to Network topologies and wavelength routing networks.

Module VI (12 hours)

High Capacity Networks: SDM, TDM, and WDM approaches, Application areas, Optical TDM Networks: Multiplexing and Demultiplexing, Synchronization, Broadcast networks, Switch-based networks, OTDM test beds.

COURSE / LEARNING OUTCOMES

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

CO1: Define and outline the fundamental concepts of light transmission through an dielectric media *(Knowledge)*

CO2: Identify and recognize the different types of optical fibers and other components of Fiber Optic Communication such as optical sources, detectors, optical amplifiers and connectors, etc. *(Knowledge)*

CO3: Define the fundamental concepts, terminologies and other important parameters of an optical network. *(Knowledge)*

CO4: Explain the mechanism and contributing factors of fiber attenuation/ dispersion and other transmission characteristics. *(Comprehension)*

CO5: Describe the major building blocks and components of an optical network. *(Comprehension)*

CO6: Describe various fiber nonlinearities. *(Comprehension)*

CO7: Explain SONET/SDH architecture. *(Comprehension)*

CO8: Compute the various parameters related to optical fiber and fiber optics link design, optical Network. *(Application)*

CO9: Classify and analyze optical fibers in terms of their operating characteristics, material composition and fabrication techniques. *(Analysis)*

CO10: Analyze the effects of fiber non-linearities on WDM system. *(Analysis)*

CO11: Analyze the various high capacity optical networks and topologies. *(Analysis)*

CO12: Design a fiber optic Communication link and an optical Network for a given scenario *(Synthesis)*

CO13: Evaluate the performance of Fiber optic link based on the nature and performance characteristics and assess their importance in design of optical receivers. *(Evaluation)*

CO14: Compare and asses the performance and fault managements of various high capacity networks & topologies. *(Evaluation)*

Suggested Readings

1. B.P Pal (ed), Fundamentals of Fibre Optics in Telecommunications and Sensor System, New Age international (P) Ltd., New Delhi.
2. K. Thyagarajan and A. Ghatak, Fiber Optics Essentials, Wiley Survival Guide in Engineering and Science, John Wiley and Sons.
3. John A. Buck, Fundamentals of Optical Fiber, Wiley Series in Pure and Applied Optics (Volume 1), Wiley and Sons.
4. Rajiv Ramaswami and Kumar Sivarajan, Optical Networks: A practical perspective, Morgan Kaufmann.
5. Vivek Alwayn, Optical Network Design and Implementation, Pearson Education.
6. Hussein T. Mouftah and Pin-Han Ho, Optical Networks: Architecture and Survivability, Kluwer Academic Publishers.
7. Biswanath Mukherjee, Optical Communication Networks, McGraw Hill.
8. G Keiser, Optical Fiber Communication,McGraw Hill.
9. J.M.S Senior, Optical Fiber Communication, PHI
10. G.P. Agarwal, Fiber optic communication systems, John Wiley and Sons, New York.

ECOI0011: OPTOELECTRONIC INSTRUMENTATION

(3 credits - 45 hours)

Objectives*: This course in optoelectronic instrumentation is an advanced course which guides the M Tech student into the world of optical fibres and the use of fibre optic sensors in instrumentation. It also introduces the student to instrumentation using lasers in a variety of areas, including medicine.*

Module I: Optical Sources and Detectors (17 Hours)

a) Optical Sources: Blackbody radiation, Kirchhoff' law, emittance, thermal radiation from metals, dielectrics and gasses, natural sources, energy balance, incandescent sources, Source polarization, selection of sources, Luminescent radiation, LEDs : LED materials, construction, structure, characteristics, response times of LED, efficiency, Injection Laser diode structure and working, comparison between LED and ILD.

b) Optical Detectors: Introduction, definitions, basic detection mechanisms. Noise: Definitions and calculations, Noise sources, combinations. Photon detectors - quantum detection mechanisms, photo-emissive, photovoltaic and photoconductive, Performance limits of detectors.

Module II: Fiber Optic Sensors in Measurement (15 Hours)

Intensity modulated Optical fiber sensors: reflective fiber optic sensors, Evanescent-wave Fiber sensors, Fiber optic refractometers, distributed sensing with fiber optics. Interferometric Optical fiber Sensors: basic principle, application, components for interferometric sensor Fiber optic instrumentation system, Fiber optic sensors Different types of modulators, Application in instrumentation, Interferometric method of measurement of length, Measurement of pressure, temperature, current, voltage, liquid level and strain.

Module III: Lasers in Measurements and Testing (10 Hours)

Laser for measurement of distance, length, velocity, acceleration, current, voltage and atmospheric effect, material processing, laser heating, welding, melting and trimming of materials, removal and vaporization. Medical applications of lasers: laser and tissue interaction - Laser instruments for surgery.

Module IV: Applications of Holography in measurement and testing (3 Hours)

Holography: Basic principle, Holographic interferometry and applications; Holography for non- destructive testing, Holographic components

COURSE / LEARNING OUTCOMES

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

CO1: Define different types of radiation and state the laws related to these radiations. *(Knowledge)*
CO2: Identify and describe the various types of optical sources and detectors. *(Comprehension)*
CO3: Explain the different types of fiber optic sensors used in measurement. *(Comprehension)*
CO4: Describe different types of radiation and explain the laws related to these radiations *(Comprehension)*
CO5: Explain the electro-luminescent based optical source and describe its fundamental working principles, structure, types and characteristics. *(Comprehension)*
CO6: Explain the nature and performance of various types of photo detectors. *(Comprehension)*
CO7: Compute the performance parameters of LED and different photo detectors. *(Application)*
CO8: Apply LASER and holography for different measurement and testing purpose. *(Application)*
CO9: Distinguish and analyze the characteristics of different optoelectronic sources and detectors. *(Analyze)*
CO10: Identify, distinguish and analyze different fiber optic sensors. *(Analyze)*
CO11: Summarize and compare the different optical measurement and testing techniques. *(Synthesis)*
CO12: Evaluate the performance characteristics of optical sources and detectors. *(Evaluation)*

Suggested Readings

1. B.P. Pal, Fundamentals of Fiber optics in Telecommunication and Sensor systems, New Age International Pvt. Ltd
2. John F Ready, Industrial applications of lasers, Academic press.
3. Jasprit Singh, Semi-conductor Optoelectronics, McGraw Hill.
4. Silvano Donati, Electro-optical Instrumentation Sensing and Measurement with Laser, Prentice Hall.
5. I A. Ghatak and K. Thyagarajan, Introduction to Fiber Optics, Cambridge Univ. Press

ECES0012: EMBEDDED SYSTEMS AND APPLICATIONS II

(4 credits - 60 hours)

Objectives: *The objective of this course is to expose the students to the features of advanced microcontrollers such as PIC and AVR. In this course students are introduced to the architecture, programming and interfacing of all these microcontrollers. Industrial applications of these microcontrollers are also introduced in this course.*

Module I: PIC Microcontroller (10 Hours)

Overview of PIC Microcontrollers, PIC16CXX Series: Architecture, Memory Organization, Registers, Oscillator Connections, Reset Actions, I/O ports, Interrupt, Timers, ADC, Watch Dog timer, Instruction Set

Module II: PIC16F8XX Series (15 Hours)

a) Architecture, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, ADC, Instruction Set, Capture/Compare/PWM Module, MSSP Module, USART, Watch Dog Timer.
b) Assembly Language Programming using PIC16CXX and PIC16F8XX

Module III: PIC24FXX Family Microcontroller (15 Hours)

Architecture, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, Watch Dog timer, ADC, PWM, Serial Communications, Programming using Embedded C.

Module IV: AVR Microcontroller (20 Hours)

a) Introduction, History, Importance of AVR, Naming Convention of AVR, Mega AVR Series.
b) ATMega8 Microcontroller: Architecture, Pin Diagram, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, ADC, Watch Dog timer.
c) ATMega16 Microcontroller: Architecture, Pin Diagram, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, ADC, Watch Dog timer.
d) Programming using ATMega8 and ATMega16.

COURSE / LEARNING OUTCOMES

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

CO1: Define various terminologies related to embedded system. *(Knowledge)*
CO2: Explain the internal organization of PIC and AVR microcontroller. *(Comprehension)*
CO3: Apply PIC and AVR microcontrollers to solve real life problems. *(Application)*
CO4: Analyze the performance of PIC and AVR microcontrollers *(Analyze)*
CO5: Summarize the application of PIC and AVR microcontrollers *(Synthesis)*
CO6: Able to evaluate various embedded systems used for industry applications *(Evaluation)*

Suggested Readings

1. A. V. Deshmukh, Microcontroller: Theory and Applications, TMG, 1^{st} Edition
2. Md. Ali Mazidi, Rolin D. Mckinlay, Danny Causey, PIC Microcontroller and Embedded Systems: Using Assembly and C, Pearson, 1^{st} Edition
3. Md. Ali Mazidi, Sarmad Naimi, Sepehr Naimi, The AVR Microcontroller and Embedded Systems: Using Assembly and C, Pearson, 1^{st} Edition
4. Relevant Data Sheets

ECDP0013: DIGITAL SIGNAL PROCESSOR

(3 credits - 45 hours)

Objectives: *This course aims at providing a framework to understand the hardware implementation of the digital signal processing algorithm. It will help to develop in depth knowledge of VLSI design for DSP algorithm and their various trade off in speed, power etc.*

Module I: Introduction (10 Hours)

a) Basic features, requirements, Introduction to DSP systems: Representation of DSP algorithms;
b) Computational characteristics of DSP algorithms and applications; Influence of Digital Signal processing in defining generic instruction-set architecture for DSPs.

Module II: Design requirement of DSPs (12 Hours)

Multiplier, MAC, ALU, Shifters. High throughput, Data address generator, Program sequencer, Memory Issue, low cost, low power, small code size, embedded applications. Techniques for enhancing computational throughput: parallelism and pipelining.

Module III: Basic Architecture of DSP Processors (10 Hours)

a) Data-path of DSPs- Multiple on-chip memories and buses, dedicated address generator units, specialized processing units and on-chip peripherals for communication and control;

b) Control-unit of DSPs- pipelined instruction execution, specialized hardware for zero-overhead looping, interrupts; Introduction to software development for the DSP system

Module IV: DSP Processor families (8 Hours)

a) Architecture of Texas Instruments fixed-point and floating-point DSPs: brief description of TMS320 C5x /C54x/C3x DSPs; Programmer's model.
b) Architecture of Analog Devices fixed-point and floating-point DSPs: brief description of ADSP 218x / 2106x DSPs; Programmer's model.
c) Advanced DSPs: TI's TMS 320C6x, ADI's Tiger-SHARC, Lucent Technologies' DSP 16000 VLIW processors.

Module V: Applications (5 Hours)

Application of DSPs for signal processing, communication and multimedia.

COURSE / LEARNING OUTCOMES

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

CO1: Define basic features of DSP system, fixed point and floating point data representation. *(Knowledge)*
CO2: Identify and define fundamental blocks in a DSP processor. *(Knowledge)*
CO3: Explain the fundamental blocks of a DSP system. *(Comprehension)*
CO4: Explain the type of architecture used in DSP system. *(Comprehension)*
CO5: Comprehend the computational characteristics of Digital Signal Processor algorithms. *(Comprehension)*
CO6: Explain the architecture details of Fixed and Floating point Processors. (*Comprehension*)
CO7: Explain the features of on-chip peripheral devices and its interfacing along with its programming details. (*Comprehension*)
CO8: Demonstrate an understanding of working principles of a fixed point processor and Floating point processor. (*Application*)
CO9: Demonstrate an understanding of peripheral devices and its interfacing with Digital signal processors. (*Application*)
CO10: Analyze the working of a fixed point and floating point processors. (*Analyze*)
CO11: Design signal processing modules in Digital Signal Processors using Code Composer Studio (CCS). (*Synthesis*)
CO12: Compare and evaluate the performance of fixed point and floating point processors. (*Evaluation*)

Suggested Readings

1. Kuo and Gan, Digital Signal Processors, Pearson Education
2. P. Pirsch, Architectures for Digital Signal Processing, John Wiley
3. R. J. Higgins, Digital Signal Processing in VLSI, Prentice-Hall
4. Texas Instruments TMSC5x, C54x and C6x Users Manuals.
5. Analog Devices ADSP 2100-family and 2106x-family Users Manuals.

ECIS0014: DIGITAL IMAGE AND SIGNAL PROCESSING

(4 credits - 60 hours)

Objectives: *The objectives of the course are to introduce the fundamentals of digital image and speech processing, analyze operations on images such as image enhancement, image restoration, edge detection, image compression, and analyze the basic subject related to speech processing such as discrete time and continuous time signals, linear time-invariant systems, convolution, Z-transform etc. and linear predictive speech coding.*

Module I (10 hours)

Different stages of Image processing and Analysis Scheme, Components of Image Processing System. A Review of various Mathematical Transforms; Image Digitization: A review of Sampling and quantization processes. A digital image, Some basic relationship between pixels: Neighbour of pixels, Adjacency, Connectivity, Regions, Boundaries, Distance Measures. Intensity Transforms: Image Negatives, Log Transform, Power Law Transformation, Piecewise linear Transformation function.

Module II (10 hours)

Histogram Processing, Fundamentals of Spatial Filtering: Mechanics of spatial Filtering, Spatial Correlation and Convolution, Spatial Filter Mask, Smoothing Filtering Mask, Sharpening Filtering Mask, Median Filtering, Filtering in Frequency domain.

Module III (20 hours)

Image Restoration: A model of image degradation, Estimation of degradation function, Inverse Filtering, Minimum Mean – Square Error Restoration, Image Compression: Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Schematic diagram of Data Compression Procedure, Lossless and Lossy compression, Morphological Image Processing: Dilation, Erosion, Combining Dilation and Erosion, The Hit or Miss Transformation, Image Segmentation: Point Detection, Line Detection, Edge Detection, Thresholding and Region Growing based Segmentation, Introduction to Multi-resolution image processing.

Module IV (10 hours)

The Fundamentals of Digital Speech Processing. A Review of Discrete-Time Signal and Systems, the Z-transform. Time–Domain Methods for Speech Processing. Time-Dependent Processing of speech, short-time energy and Average Magnitude, Short time Average Zero-crossing Rate.

Module V (10 hours)

Block diagram of Simplified Model for Speech Production. Basic Principles of Linear Predictive Analysis- The Autocorrelation Method, Cepstral Analysis, MFCC, Digital Speech Processing for Man-Machine Communication by voice. Speaker Recognition Systems, speaker verification and speaker Identification Systems.

COURSE / LEARNING OUTCOMES

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

CO1: Define and outline the fundamental concepts of digital signal processing. (*Knowledge*)

CO2: Review of various mathematical transforms and sampling and quantization processes related to digital image and speech processing. (*Knowledge*)

CO3: Explain the fundamentals of digital image and speech processing.(*Comprehension*)

CO4: Improve the quality of image by performing various operations such as image enhancement, image restoration etc. (*Application*)

CO6: Analyze operations on images such as image enhancement, image restoration, edge detection, image compression etc. (*Analyze*)

CO7: Analyze speech signals, models for speech production, feature extraction systems etc. (*Analyze*)

CO8: Design speaker recognition systems, and speaker verification and speaker identification systems. (*Synthesis*)

CO9: Design a simple model for speech production. (*Synthesis*)

CO10: Evaluate the different operations such as image enhancement, image restoration, image compression etc. performed on an image. (*Evaluation*)

CO11: Evaluate a speech signal, speech production system, and speaker verification and speaker identification system. (*Evaluation*)

Suggested Readings

1. R.C.Gonzalez and R.E.Woods, Digital Image Processing, Pearson.
2. Anil K. Jain, Fundamentals of Digital Image Processing, PHI.
3. B.Chanda and D.Dutt Majumdar, Digital Image Processing and Analysis, PHI.
4. L.R.Rabinu and R.W Schafer, Digital Processing of Speech Signals, Pearson.
5. L.Rabiner and B-H Juang, Fundamentals of Speech Recognition, Pearson.
6. M Nixon and A S Aguado, Feature Extraction and Image Processing for Computer Vision, Elsevier.
7. J. R. Parker, Algorithms for Image Processing and Computer Vision, Wiley.
8. L.R.Rabinu and R.W Schafer, Theory and Applications of Digital Speech Processing, Pearson.
9. B Gold, N Morgan and D Ellis, Speech and Audio Signal Processing: Processing and Perception of Speech and Music, Wiley.

ECDC0015: ELECTRONIC DEVICES AND CIRCUITS

(5 credits – 75 hours)

Objectives: *This course will provide an introduction to the basic principles of electronic circuit design and electronic devices. The student will develop the ability to apply basic engineering sciences to the design, analyses and operation of electronics devices and circuits and problem solving skills of electronic circuits. The course will also help in understanding the operation of simple devices such as p-n junctions. More complex devices such as Field Effect Transistors (FETs), Bipolar Junction Transistors (BJTs) and Optoelectronic devices will also be covered.*

Module I (16 hours)

Semiconductors: Semiconductor Physics, Crystal Lattice, Energy band theory of Solids, Conductors, Semiconductors and Insulators, Direct and Indirect bandgap semiconductor. Intrinsic and Extrinsic semiconductor Fermi Dirac Equations, Density of states in an energy band. Fermi factor and Fermi level. Degenerate and Non-degenerate Semiconductor, Compensated semiconductor, variation of carrier concentration at different temperature: Complete Ionization and Freeze out. Effect of temperature on Fermi level. Carrier Transport phenomenon: Carrier drift: electron and hole mobility, drift current density, Conductivity, Carrier diffusion, diffusion current, total current density, Einstein Equation, Continuity Equation, Hall Effect, Work function of a metal, metal–metal junction contact potential. Semiconductor junction with no bias, forward bias and reverse bias conditions. Depletion width, Junction capacitance, junction breakdown.

Module II (20 hours)

a) PN Junction diodes: PN junction as a diode, Energy Band in PN junction diode, drift and diffusion currents in PN junction diode, V-I characteristics, Diode equation. Diode resistance, Transition capacitance and diffusion capacitance, loadline analysis. Applications of Diode: Half-wave and full-wave rectifiers, voltage multipliers, clipper, clamper; zero crossing detector.

b) Special purpose diodes: Construction, Principle of operation, application and characteristics of Zener diode, Schottky diode, Varactor diode, Tunnel diode, PIN diode, LED, photo diode, Avalanche Photo diode.

Module III (17 hours)

Bipolar Junction Transistor: Transistor introduction with applications, Transistor Inverter and Transistor Switch, Early Effect, Thermal runaway. Eber's Moll model, Characteristics of current flow across base region of transistor. BJT as an amplifier: Graphical analysis (DC and AC load line), Q- point. Biasing and Stabilization: Fixed bias, Potential-divider bias. Collector feedback Bias etc. Bias Stabilization and stability factor. Classes of amplifiers, Small signal modeling and analysis: Hybrid model and analysis. Parameter conversion for three transistor configurations. Compound configurations: Darlington pair, cascade and cascode connection; Frequency Response of an amplifier Miller Effect; phototransistors.

Module IV (7 hours)

Feedback amplifiers: Concept of feedback, advantages of negative feedback; Topological classification (Voltage series; Voltage shunt, Current series, Current shunt), Effect of feedback on input and output resistances, Bandwidth of amplifier.

Module V (15 hours)

Field Effect Transistors(FET): JFET, MOSFET, CMOS. Biasing and Stabilization of Q-point, Small signal modeling and analysis of FETs. CMOS inverter; square wave testing of amplifiers.

COURSE / LEARNING OUTCOMES

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

CO1: Define the basic principles and terminologies associated with electronic devices and circuits. (*Knowledge*)
CO2: Illustrate the working principles guiding the operation of electronic devices and circuits. (*Comprehension*)
CO3: Apply the knowledge and concepts of electronic devices and their operation principles to making electronic circuits.(*Application*)
CO4: Analyze and troubleshoot complex electronic circuits. (*Analysis*)
CO5: Design electronic circuits using different devices and components to perform certain operations. (*Synthesis*)
CO6: Compare performances of different electronic circuits for various applications. (*Evaluation*)

Suggested Readings

1. Robert L. Boylestad and Lowis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, New Delhi
2. Jacob Millman, Christos C Halkias and Satyabrata Jit, Millman's Electronic Devices and Circuits, 2nd Edition,Tata McGraw Hill, New Delhi.
3. S Salivahanan, N Suresh Kumar and A Vallavaraj, Electronic Devices and Circuits, 2 ed., Tata McGraw-Hill, 2008
4. Streetman and Banerjee, Solid State Electronic Devices, Prentice Hall, New Delhi
5. David A. Bell, Electronic Devices and Circuits, 4th Edition, Oxford University Press
6. Jacob Millman, Christos C Halkias, Integrated Electronics, McGraw Hill Int. students Edition.
7. R.S.Sedha, Applied Electronics, Multicolor Illustrative Edition, SChand, New Delhi.
8. Donald A. Neamen, Semiconductor Physics and Devices, 3rd Edition, Tata McGraw Hill
9. P. Ramesh Babu, Electronic Devices and Circuits, Scitech Publications Pvt. Ltd.

ECSS0016: SIGNALS AND SYSTEMS

(3 credits – 45 hours)

Objectives: *The objective of this course on Signals and Systems is to acquaint the student with the various types of signals which form the basis electronic communication and to provide the theoretical background necessary to understand the working of any electronic communication system.*

Module I (6 hours)

Introduction to Signals and Systems: Signals- basic definitions. Classification of signals - Continuous time(CT) signals ,Discrete time(DT)signals - Impulse, Step, Ramp, Exponential, Gate, Signum and Rectangular. Classification of CT and DT signals – Periodic and Aperiodic, random and deterministic, Energy and power, even and odd signals. Operations: time shifting, time scaling, time reversal, and their combinations. Systems and their classification. System Properties.

Module II (7 hours)

Linear Time Invariant(LTI) Systems: Linearity, time invariance, causality and stability. LTI-CT SYSTEMS-Differential equation, Block diagram representation, Impulse response, Convolution integral. LTI-DT SYSTEMS– Difference equations, Block diagram representation, Impulse response, Convolution sum, Properties of LTI systems and Frequency response.

Module III (19 hours)

a) Fourier analysis: Continuous Time Fourier analysis – Representation of periodic signals by Fourier series. Representation of aperiodic signals by Fourier transform. Properties of Fourier Transform and Frequency domain analysis of CT LTI system . Discrete Time Fourier analysis – DT Fourier series and DT Fourier transform. Frequency domain analysis of DT LTI systems
b) Probability and Random process, Random variables, distribution and density functions. Statistical averages.
c) Sampling : Sampling theorem. Aliasing, relation between CT and DT Fourier transforms.

Module IV (13 hours)

a) Laplace transform: Definition and properties. Methods of inversion. Analysis of CT LTI system using Laplace transform.
b) Z-transform: Definition and properties. The region of convergence. Inversion of Z-transforms. Analysis of DT LTI system using z-transform.

COURSE / LEARNING OUTCOMES

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

CO1: Identify different types of signals and systems(*Knowledge*)
CO2: Define the fundamentals of LTI system and its properties (*Knowledge*)
CO3: Explain different transforms like Fourier transform, Laplace transform and Z-transform **(***Comprehension***)**
CO4: Measure diffraction patterns using a Laser. (*Application*)
CO5: Analyze properties of continuous-time systems in the frequency domain and Laplace domain using Fourier and Laplace transforms.(*Analysis*)
CO6: Analyze properties of discrete-time systems in the frequency domain and Z- domain using Fourier and Z transform.(*Analysis*)
CO7: Aummarize and synthesize the concept of sampling, ESD, PSD, auto-correlation and cross-correlation to different signals(*Synthesis*)
CO8: Evaluate characteristics of different systems to implement in communication systems (*Evaluation*)

Suggested Readings

1. V. Oppenheim, A. S. Willsky, with S. H. Nawab, Signals and Systems, PHI Learning Pvt. Ltd., New Delhi
2. P Ramesh Babu, R AnandaNatarajan, Signals and Systems, SciTech Publications, 2006
3. T. Rawat, Signals and Systems, Oxford University Press, 1st Edition, 2010
4. B.P. Lathi, Signals Processing and Linear Systems, Oxford University Press, 1st Indian Edition, 2006.
5. A.Nagoor Kani, Signals and Systems,Tata Mc Graw Hill.

ECAE0017: ANALOG ELECTRONIC CIRCUITS

(4 credits – 60 hours)

Objectives: *The course provides basic analog electronic circuit design techniques and analytical skills using diodes, op-amps, FETs and BJTs. The student will develop ability to apply basic engineering sciences to the design, analysis and operation of electronics devices and circuits and problem solving skills of electronic circuits.*

Module I (10 hours)

a) PN junction: PN junction as a diode, drift and diffusion currents in PN junction diode, V-I characteristics, Diode resistance, Transition, capacitance and diffusion capacitance; Application in rectifier with filter
b) Special purpose diodes and applications: Zener diodes, LED, Photo diode, Schottky diode, Opto-coupler, regulator.

Module II (20 hours)

a) Bipolar Junction Transistor: PNP and NPN transistors. Characteristics of current flow across base region of transistor, BJT as an amplifier: Graphical analysis (DC and AC load line), Q- point, Biasing and stabilization, small signal analysis, h-parameter model and analysis of CE configuration
b) Field Effect Transistors: JFET, MOSFET, CMOS. Biasing and Stabilization of Q-point, small signal analysis JFET amplifiers, Enhancement Mode MOSFET amplifier, Depletion mode MOSFET amplifiers, CMOS inverter.

Module III (20 hours)

a) Thyristors: Four layer diode, SCR, Photo SCR, Gate controlled switch, Silicon controlled switch, Diac, Triac, UJT;
b) Op-Amp: Ideal operational Amplifiers: Differential and common mode operation, Op-Amp basics, Equivalent circuit analysis of Inverting and Non-inverting Op-Amp circuits, Input impedance. Op-Amp specifications, DC offset parameters, frequency parameters, gain-bandwidth, Op-Amp applications in constant gain multiplier, Voltage summing, Integrator, Differentiator and Controlled sources. Instrumentation Amplifier,Active filters: Low, High and bandpass;
c) 555 Timer: Block diagram, Monostable operation, Astable operation, Voltage controlled oscillator, Ramp generator.

Module IV (10 hours)

a) Regulated Power supply: Voltage feedback regulation, Current limiting characteristics, Power supply characteristics, 3 terminal IC regulators, Current boosters, Switching regulators
b) Digital Instruments: Digital Voltmeter, Digital storage oscilloscope.

COURSE / LEARNING OUTCOMES

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

CO1: Define and outline the preliminary understanding of semiconducting materials, basic devices and simple circuits (*Knowledge*)

CO2: Explain the basic concepts used in the design of analog electronic circuit design. (*Comprehension*)
CO3: Describe about the working principle of the different types of diodes, transistors, thyristors, operational amplifiers etc. (*Comprehension*)
CO4: Design of different basic electronic circuits using diodes, BJTs, FETs, op-amps etc.(*Application*)
CO5: Problem solving skills of electronic circuits.(*Application*)
CO6: Analyze and operate different electronic devices and circuits
CO7: Design of circuits which make use of diodes, BJTs, FETs, thyristor, op-amps, 555 timer. (*Synthesis*)
CO8: Operate digital voltmeter and digital oscilloscope. (*Synthesis*)
CO9: Evaluate the performance of basic electronic circuits. (*Evaluation*)

Suggested Readings

1. Robert L. Boylestad and Lowis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, New Delhi
2. Jacob Millman, Christos C Halkias and Satyabrata Jit, Millman's Electronic Devices and Circuits, 2nd Edition,Tata McGraw Hill, New Delhi.
3. S Salivahanan, N Suresh Kumar and A Vallavaraj, Electronic Devices and Circuits, 2 ed., Tata McGraw-Hill, 2008
4. Streetman and Banerjee, Solid State Electronic Devices, Prentice Hall, New Delhi
5. David A. Bell, Electronic Devices and Circuits, 4th Edition, Prentice Hall of India, New Delhi,
6. Jacob Millman, Christos C Halkias, Integrated Electronics, McGraw Hill Int. students Edition.

ECDL0018: DIGITAL ELECTRONICS AND LOGIC DESIGN

(4 credits – 60 hours)

Objectives: *The objectives of this course are to introduce the concept of digital and binary systems and give students the concept of digital electronics. The course also provides fundamental concepts used in the design of digital systems, the basic tools for the design and implementation of digital circuits, modules and subsystems.*

Module I: Number System and codes (12 hours)

a) Decimal, Binary, Octal, Hexa-decimal number system, Conversion of numbers from a number system to another, complement method of subtraction, 9's and 10's complement method, 1's and 2's complement method, Floating point numbers. Weighted and Non-weighted code, Self complementing course, cyclic course, 8421 BCD code, XS-3 code, Gray code, Binary to Gray conversion, Gray to Binary conversion, Parity bit and its importance in error detecting.
b) Logic Gates and Boolean Algebra : AND, OR, NOR, NOT, NAND, X-OR, Inhibit circuits, Axioms and laws of Boolean algebra, D'Morgans theorem, Duality, Reduction of boolean expression, converting AND/OR/INVERT logic to NAND/NOR logic

Module II: Simplification of Boolean expressions (20 hours)

a) Expansion of a Boolean expression to SOP and POS form, Minimization of POS and SOP expressions for 2 to 6 variables, Don't care conditions, Combinational logic, Quine-McClusky methods.
b) Combinational Logic : The Half-adder, The Full-adder, The Half-subtractor, The Full-Subtractor, Parallel Binary Adders, The Look-Ahead Carry Adder, IC Parallel Adders, Two's Complement Addition And Subtraction Using Parallel Adders, Serial Adders, BCD adder, Binary Multipliers, Code converters, Parity bit Generators/Checkers, Comparators, IC comparators, Decoders, BCD to 7- Segment Decoders, Encoders, Priority Encoders, Multiplexers, Applications of Multiplexer, Demultiplexers

Module III: Sequential Logic (20 hours)

a) S-R Flip-flop, JK Flip-flop, D Flip-flop, T Flip-flop, Edge-Triggered Flip-flop, Master-slave Flip-flop, Applications of Flip-flops. Serial-in Serial-out Shift register, Serial-in Parallel-out Shift register, Parallel-in Serial-out Shift register, Parallel-in Parallel-out Shift register, Bidirectional shift register, Universal shift register, Dynamic shift register, Applications of shift registers.
b) Asynchronous counter, Design of Asynchronous counter, Decoding of Ripple counters, Synchronous counters, Design of Synchronous counter.
c) Logic Families: Digital IC specification terminology, Logic families, TTL, Open collector gate, TTL subfamilies, IIL, ECL, MOS, CMOS, Dynamic MOS Logic.

Module IV: Memories (8 hours)

Memory types and terminology, Read Only memory, Semiconductor RAMs, Non-volatile RAMs, Sequential memories, Programmable logic Devices, Magnetic memories, Optical Disk memory, Charge Coupled Devices.

COURSE / LEARNING OUTCOMES

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

CO1: Define the basic terminologies related to digital electronics and logic design (*Knowledge*)
CO2: State the need and advantages of digital systems. (*Knowledge*)
CO3: Explain the fundamentals of logic gates and Boolean algebra (*Comprehension*)
CO4: Apply Boolean formulas, K-map and Quine-Mc Clusky methods for minimizing logic functions (*Application*)
CO5: Differentiate between combinational and sequential circuits and analyse their behavior(*Analysis*)
CO6: Design and develop various combinational circuits like adders, subtractors, comparators, encoders, decoders, multiplexers and demultiplexers, etc.(*Synthesis*)
CO7: Design and develop various sequential circuits like registers, counters, etc. (*Synthesis*)
CO8: Evaluate the performance of various types of digital logic circuits. (*Evaluation*)
CO9: Evaluate the performance of memory elements like RAM, ROM, PROM, EPROM, magnetic and optical memory. (*Evaluation*)
CO10: Examine and analyse digital circuits in the laboratory. (*Evaluation*)

Suggested Readings

1. M. Morris Mano, Digital Logic and Computer Design, Pearson Education,2009
2. A. Anand Kumar, Fundamentals of Digital Circuits, 2nd Ed., PHI
3. B. Somanathan Nair, Digital Electronics and Logic Design, 1st Ed., PHI.
4. R.P. Jain, Modern Digital Electronics, 4th Ed., TMH.

ECAC0019: ANALOG INTEGRATED CIRCUITS

(4 credits – 60 hours)

Objectives: *To understand the basic concepts in the design of electronic circuits using Linear Integrated Circuits and their application in the processing of analog signals. The course also helps in learning the linear and non-linear applications of operational amplifiers (OpAmps), the theory and applications of analog multipliers, ADC and DAC and a few special function integrated circuits.*

Module I (15 Hours)

a) Power Amplifiers: Introduction and classification, Class A, Class B, Complementary Symmetry Push Pull amplifier, Class C, distortion in amplifiers.
b) Tuned Amplifiers: Introduction and classification, Capacitance Coupled tuned amplifier, Stagger tuned amplifier.
c) Oscillators: Introduction and classification, General form of LC oscillator, e.g. Hartley

oscillator, Colpitts oscillator, RC phase shift oscillator, Wein Bridge oscillator, Crystal oscillator.

Module II (10 Hours)

a) Differential amplifier: Dual input balanced output and unbalanced output with AC and DC analysis.
b) Operational amplifier (OpAmp): Introduction, Basic building blocks of op-amp, Ideal OpAmp equivalent circuits, transfer curve, open loop Opamp configuration, open loop inverting, non-inverting and differential amplifiers, closed loop configuration, virtual ground concept.
c) Practical OpAmp: 741 IC, Input resistance, input capacitance, input bias current, input offset voltage, input offset current, CMRR, SVRR, Slew rate, frequency response, offset voltage adjustment, output voltage swing, power consumption, gain bandwidth product, 741 data sheet.

Module III (8 Hours)

OpAmp with different Feedback configurations: Negative feedback Concept, Amplifiers: Voltage Series, Voltage Shunt, Current Series, Current Shunt, Derivation of Parameters: Voltage gain with feedback, Input impedance and output impedance with feedback, Non linear distortion, Bandwidth, output offset voltage with feedback.

Module IV (12 Hours)

Opamp applications(Linear and Non-linear): Inverting, Non-inverting and Differential amplifier, Adder - Subtractor, Integrator - Differentiator, Instrumentation Amplifier, Log - Antilog amplifier, Comparator – Zero crossing detector, Schmitt trigger and its application, Astable and Monostable multivibrator, Triangular and Saw tooth wave generator, Sample and Hold circuit, Precision rectifiers. Fixed voltage regulators using opamp, 317.

Module V (15 Hours)

a) Active Filters: Transfer functions – LPF, HPF, BPF, BRF and All Pass Filter. Approximation methods – Butterworth, Chebyshev Filter. Filter orders Ist and IInd order, Switched Capacitive Filters.
b) Specialized ICs: 555 Timer architecture and applications (Monostable and Astable multivibrator) linear time base generator, VCO architecture and applications, PLL-architecture and applications.
c) A/D and D/A Converter: DAC (Weighted-R, R-2R Networks), ADCs (Dual slope, counter type, successive approximation and flash type).

COURSE / LEARNING OUTCOMES

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

CO1: Elucidate the linear and non-linear applications of an opamp and special application ICs. (*Knowledge*)
CO2: Classify and comprehend the working principle of different circuits based on op-amp and specialized ICs (*Comprehension*)
CO3: Apply the methods learned in the class to design and implement practical projects (*Application*)
CO4: Design, layout, and testing of Analog circuits. (*Application*)
CO5: Analysis of modern analog circuits using integrated circuits (*Analysis*)
CO6: Demonstrate the use of analog circuit analysis techniques to analyze the operation and behavior of various analog integrated circuits. (*Evaluation*)

Suggested Readings

1. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, 4th Edition, PHI.
2. Jacob Millman, Christos C Halkias and Satyabrata Jit, Millman’s Electronic Devices and Circuits, 2nd Edition,Tata McGraw Hill, New Delhi.

3. S. Salivahanan, V.S.K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill.
4. K.Lal Kishore, Operational Amplifiers and Linear Integrated Circuits, Pearson Education.
5. R.F. Coughlin, Op-amps and Linear Integrated Circuits, 6th ed., Pearson Education.
6. Sargio Franko, Design with operational Amplifiers Analog ICs, McGraw Hill.

ECCT0020: COMMUNICATION TECHNIQUES

(3 credits – 45 hours)

Objectives: *This course which deals with signals and different techniques of electronic communication of signals serves as an introductory course in communication to the Computer Science student. The purpose is to enable such a student to use this knowledge in designing digital communication techniques.*

Module I (8 hours)

Introduction to signals – signal and its classification, generalized Fourier series and its properties, Fourier Transform and its properties, Inverse Fourier Transform, transmission of signals through linear system, distortion-less transmission and signal distortion or channel, power spectral density, energy spectral density, correlation and convolution.

Module II (17 hours)

Modulation, need for modulation and its types, amplitude modulation, generation and detection, AM, DSB-SC and VSB, introduction to AM receivers and transmitters. Angle modulation – Frequency and phase modulation, relationship between FM and PM waves, generation and detection of FM – NBFM and WBFM, introduction to FM transmitters.

Module III (8 hours)

Pulse modulation – sampling of analog signal, sampling theorem, PAM - generation and detection, PPM and PDM and its generation, PCM, quantization, PCM systems, Encoder-decoder, TDM and FDM.

Module IV (12 hours)

Digital modulation – binary communication, on-off keying, frequency shift keying (FSK), phase shift keying (PSK), introduction to microwave communication, satellite communication and RADAR.

COURSE / LEARNING OUTCOMES

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

CO1: Define electronic signals and their properties. (*Knowledge*)
CO2: Differentiate the different techniques of communication. (*Comprehension*)
CO3: Describe the interdisciplinary nature of the subject. (*Comprehension*)
CO4: Determine and demonstrate the role of computer science engineering and communication engineering in modern communication. (*Application*)
CO5: Compute the various parameters related to different modulation techniques. (*Application*)
CO6: Compare and analyze the performance of various modulation techniques. (*Analyze*)
CO7: Summarize the specific applications of various modulation techniques. (*Synthesis*)
CO8: Evaluate and assess the performance of various modulation techniques/types. (*Evaluation*)

Suggested Readings

1. George Kennedy, Electronic Communication Systems, McGraw Hill
2. Taub and Schilling, Principles of Communication Systems, TMH
3. BP Lathi, Modern Digital and Analog Communication Systems, Oxford University Press.
4. Roddy Coolen, Communication Systems, PHI
5. R Singh, S Sapre, Communication Systems : Analog and Digital, TMH

ECMM0021: MICROPROCESSORS AND MICROCONTROLLERS

(4 credits – 60 hours)

Objectives: *The course helps the student to develop an in-depth understanding of the operation of microprocessors and basics of microcontrollers, assembly language programming and microprocessor interfacing techniques. The students will be able to design and implement microprocessor-based systems in both hardware and software and can apply this knowledge to more advanced structures.*

Module I (20 hours)

a) Microprocessor Architecture: History and evolution, types of microprocessors, introduction to microprocessor and microcomputer architecture, block diagram of 8085, Register organization, ALU, control unit, Timing and control module, Pins and signals, Memory Organization, Memory and I/O Addressing

b) Instruction set and assembly language programming of 8085: Instruction cycle, machine cycles,Instruction set of 8085, Assembly language programming using 8085 instruction set, use of stack and subroutine.

Module II (13 hours)

Interrupts: Interrupt in 8085, RST Instructions, Issues in implementing interrupt, multiple interrupts and priorities, Daisy Chaining, Interrupt handling in 8085, Enabling, Disabling and masking of interrupts, Programming interrupt controller: 8259

Module III (15 hours)

Data Transfer Techniques: Data transfer techniques, Serial I/O using SID, SOD, Parallel Data transfer using 8155, Asynchronous and synchronous data transfer using 8251A, Programming peripheral interface: 8255, Programming DMA controller: 8257; Microprocessor Interfacing techniques: Interfacing memory and I/O devices, interfacing a LED and seven segment displays, interfacing A/D converter, D/A converter, Interfacing and refreshing dynamic RAMs, Interfacing a keyboard

Module IV (12 hours)

Microcontroller (Architecture and Programming): Introduction to 8051 Microcontrollers (Architecture, Pin description), 8051 addressing modes instruction set of 8051, 8051 Assembly level language programming

COURSE / LEARNING OUTCOMES

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

CO1: Define various terminologies related to microprocessors and microcontrollers (*Knowledge*)
CO2: State the internal organization of 8085 and 8051. (*Knowledge*)
CO3: List the various instructions related to assembly language programing. (*Knowledge*)
CO4: Explain internal architecture of 8085 microprocessor and 8051 microcontroller and other peripheral devices.(*Comprehension*)
CO5: Explain the instruction sets used in Assembly language programming. (*Comprehension*)
CO6: Apply the knowledge of Assembly language Programming in problem-solving (*Application*)
CO7: Illustrate the application of microprocessor and microcontroller in solving real life problems (*Application*)
CO8: Analyse interfacing of microprocessor with IO devices (*Analyse*)
CO9: Design and develop microprocessor-based systems in both hardware and software (*Synthesis*)
CO10: Evaluate various microprocessor based system (*Evaluation*)

Suggested Readings

1. R.S. Gaonkar, Microprocessor Architecture, Programming and Application with 8085, Pengram
2. Mazidi J Gillispie and Mazidi M Ali, The 8051 Microcontroller and Embedded Systems, Pearson
3. P.K. Ghosh and P.R. Sridhar, 0000 to 8085 - Introduction to Microprocessor for Scientists and Engineers, PHI
4. A.V. Deshmukh, Microcontroller, TMH
5. YU-Cheng Liu and Glenn A Gibson, Microprocessor System, Architecture, Programming and Design
6. Barry B Brey, The Intel Microprocessor, Architecture, Programming and interfacing

ECDP0022: DIGITAL SIGNAL PROCESSING

(3 credits – 45 hours)

Objectives: *The course aims at providing a framework to understand various aspects of digital signal processing and will deal with the design methodology of digital FIR and IIR filters along with various signals, discrete time systems and transforms.*

Module I (12 hours)

a) Discrete time signals: Elementary examples, classification- periodic and aperiodic Signals energy and power signals, Even and odd signals.
b) Discrete time system : Block diagram representation of discrete time systems, classification of discrete time systems –static and dynamic, time variant and time-invariant, linear and non-linear, casual and anti-casual, stable and unstable.
c) Analysis and response (convolution sum) of discrete - time linear LTI system, Recursive and non-recursive discrete time system. Constant coefficient differences equations and their solutions, impulse response of LTI system, Structures of LTI systems, Recursive and non-recursive realization of FIR system, Correlation of discrete time Signal.

Module II (11 hours)

a) The Z-transform and one-sided Z-transform, Properties of Z-transform, inverse of the Z-transform, Solution of difference equations.
b) The Discrete Fourier Transform- The DFT and IDFT, relationship, DFT with Z-transform, the DFT as a linear transformation, Relationship of DFT with Z-transform, Properties of DFT: periodicity, linearity, summery and time reversal of a sequence.
c) Circular convolution, Circular correlation, Circular correction by convolution method, Linear convolution by overlap save methods and by overlap add method, Circular convolution and correlation by DFT method, Overlap add and save filtering by DFT method.

Module III (11 hours)

a) Fast Fourier Transform: Operation counts by direct copulation of DFT, Radix-2 FFT algorithm- Decimation –in-time (DIT) and Decimation In Frequency (DIF) algorithm, Efficient computation DFT of two real sequences, Efficient computation of DFT of a 2 N-pt real sequences.
b) Design of Digital Filters: Casually and its implication, Design of linear phase FIR filters using different windows. Design of IIR filters- Impulse Invariance method and bilinear transformation method.

Module IV (11 hours)

a) Implementation of discrete time system structure of FIR systems – Direct form, cascaded form. Structure IIR Systems - Direct form I and II realizations.
b) Introduction to Digital Signal Processor – characteristics of digital signal processor.

COURSE / LEARNING OUTCOMES

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

CO1: Define and outline the fundamental concepts of Digital Signal Processing (*Knowledge*)
CO2: Define the different types of digital signals and digital systems (*Knowledge*)
CO3: Define and outline the fundamental concepts related to different transform technique for digital signals and systems (*Knowledge*)
CO4: Describe and classify the different types of Digital signal and systems (*Comprehension*)
CO5: Explain the different types of digitals filters and their mathematical models (*Comprehension*)
CO6: Design various digital systems such as digital filters, etc. and applying the same in fields like Communication, VLSI etc.(*Application*)
CO7: Classify and analyze various digital signal transform and filtering techniques.(*Analyse*)
CO8: Simulate different digital signals and LTIC digital systems (*Synthesis*)
CO9: Evaluate the performance of different transform schemes for digital signals (*Evaluation*)
CO10: Evaluate the various types of filtering techniques and compare their performances for various types of applications (*Evaluation*)

Suggested Readings

1. J. G. Proakis and D. G. Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, Pearson.
2. SK Mitra, Digital Signal Processing, Pearson
3. P Ramesh Babu, Digital Signal Processing, SciTech
4. S. Salivahanan, Digital Signal Processing, TMH
5. J. R. Johnson, Introduction of Digital Signal Processing, PHI.
6. Emmanuel C Ifeachor and Barrie W. Jervis, Digital Signal Processing: A Practical Approach, Pearson Education.

ECAC0023: ANALOG COMMUNICATION TECHNIQUES

(4 credits – 60 hours)

Objectives: *This course is intended to make the student understand the basic concepts of analog communication systems covering basic Fourier techniques and the use of these techniques in the analysis and design of communication systems. The subject covers time domain and frequency domain analysis of amplitude modulation (AM), frequency modulation (FM) and concept of noise.*

Module I (7 hours)

a) Introduction - Communication process, sources of information, communication channels; Modulation- types and need, block diagram of communication system
b) Energy and power signals Parseval’s Theorem: Power spectral density and Energy spectral density, correlation between waveforms: Auto and cross correlation

Module II (25 hours)

a) Amplitude modulation:Introduction, Double side band suppressed carrier modulation (DSB-SC): Introduction, Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves.
b) Double side band with carrier modulation (DSB-AM):Introduction Time-Domain description, Frequency – Domain description. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector; Quadrature Amplitude Modulation (QAM)

c) Single Side band suppressed carrier modulation (SSB-SC): Introduction, Hilbert transform, properties of Hilbert transform, Convolution, Time-Domain description, Frequency-Domain representation, Generation of SSBSC waves: Phase discrimination method, Frequency discrimination method; Detection of SSB-SC waves: Coherent detection, carrier re-insertion method
d) Vestigle Side Band modulation (VSB): Introduction, Time-Domain description, Frequency-Domain representation, Generation of VSB waves: Phase discrimination method; Detection of VSB waves: Coherent detection.
e) AM transmitters: Low level and high level modulation, AM receivers: TRF receivers, Superheterodyne receivers

Module III (15 hours)

a) Angle modulation: General form of angle modulation, types of angle modulation, Frequency Modulation, Single and multi-tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Bessel's function, Wide band FM, Transmission bandwidth of FM wave, Generation of FM Waves: Direct and Indirect methods, pre-emphasis and de-emphasis Filters, Demodulation of FM waves using PLL-FM demodulator, Comparison of AM and FM, Frequency Division Multiplexing.
b) Introduction to Pulse modulation

Module IV (13 hours)

Noise: Internal and External Noise and their different types, noise in cascaded amplifiers, Signal to Noise ratio, Noise figure, Noise figure from equivalent noise resistance, Noise Temperature, Noise figure for cascaded amplifiers, Equivalent circuit of a noisy resistor, Power of a thermal noise voltage, Noise power density in RLC circuit. Noise in AM and FM systems.

COURSE / LEARNING OUTCOMES

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

CO1: Define the basic concepts & terminologies related to analog modulation schemes. (*Knowledge*)
CO2: Identify the components of analog communication system (*Knowledge*)
CO3: Explain the different characteristics of transmitter and receiver (*Comprehension*)
CO4: Describe the working and operation of the various components of analog communication system (*Comprehension*)
CO5: Compute the bandwidth, power requirements and other vital parameters related to analog communication systems. (*Application*)
CO6: Analyze various methods of baseband & band-pass analog transmission and detection related to AM, FM and PM. (*Analyze*)
CO7: Analyze different characteristics of transmitter and receiver in analog communication. (*Analyze*)
CO8: Analyze energy and power spectral density of the signal. (*Analyze*)
CO9: Develop understanding about designing of analog communication systems (*Synthesis*)
CO10: Evaluate the performance of analog modulated waveforms in time /frequency domain and find modulation index (*Evaluation*)

Suggested Readings

1. R.P. Singh and S.D. Sapre, Communication Systems Analog and Digital, Tata McGraw Hill
2. P. Chakrabarti, Analog Communication Systems, Dhanpat Rai and Co.
3. Chandra Sekar, Analog Communication, Oxford.
4. B.P. Lathi, Modern Digital and Analogue Communication Systems, Oxford University Press.
5. Taub and Schilling, Principles of Communication Systems, TMH.

6. Simon Haykin, Communication Systems, John Wiley and Sons.
7. Leon W. Couch, Digital and Analog Communication Systems, Pearson Education Pvt. Ltd.

ECME0024: MICROWAVE ENGINEERING

(3 credits – 45 hours)

Objectives: *The course provides an introduction to microwave theory and techniques, including network theory, transmission lines, passive devices and active devices. The course also describes the microwave sources, propagation and measurement.*

Module I (13 hours)

High Frequency Transmission lines and Wave guides: The Distributed Circuit model for a Transmission line. Wave propagation. The lossless line. Field Analysis of Co-ax Transmission Lines. R, L. C. G parameters of Co-ax and Two wire Transmission Lines. Terminated lossless transmission line. Transmission line as circuit element. The Smith Chart. Solution of Transmission line problems using Smith Chart. Single Stub and Double Stub matching. Lowloss line.

Module II (10 hours)

Wave guides: Rectangular waveguide, Field solution for TE and TM modes, Field patterns power flow through waveguide. Attenuation due to conductor and dielectric losses. Design of Rectangular waveguide to support Dominant TE_{10} mode Cylindrical waveguide - Dominant Mode. Design of Cylindrical Waveguide to support Dominant TE_{11} mode. TEM mode in Co-ax line.

Module III (8 hours)

a) Microwave Resonator: Rectangular Waveguide Cavities. Resonant frequencies and of Cavity Supporting. Dominant mode only. Excitation of waveguide and Resonators.
b) Waveguide Components: Introduction and basic Properties of Power Dividers(All types of Tee junctions), N–port microwave network, scattering parameters (S – parameters), Directional Couplers, Isolators and Circulators

Module IV (14 hours)

Microwave Sources: Transferred Electron Devices: Introduction and principle of operation of Gunn Diode, Gunn Oscillator Principle and performance Simple Analysis Electron – field interaction. Avalanche Transit Time Devices: Introduction and principle of operation of IMPATT and TRAPATT Diodes. Reflex Klystron oscillator: Velocity Modulation. Electronic Admittance. Power Output and Frequency vs Reflector Voltage. Square-wave modulation; Multicavity Magnetron: Principle of Operation, Rotating Field. II-mode of Operation, Frequency of Oscillation. The Ordinary type (O-Type) Traveling wave Tube - Constructional features, Principle of Operation as an amplifier; Mixer: Linear Mixer Operation.

COURSE / LEARNING OUTCOMES

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

CO1: Define the basics of microwave engineering; the different frequency bands, advantages and applications (*Knowledge*)
CO2: Explain the fundamentals of transmission line theory and waveguide theory (*Comprehension*)

CO3: Explain the different measurement parameters and performance of waveguides and resonators (*Comprehension*)
CO4: Apply the knowledge of transmission line and waveguide theory to compute measurement parameters and solve related problems. (*Application*)
CO5: Analyse different parameters like standing wave, reflection coefficient, and impedance, etc. using Smith chart. (*Analyse*)

CO6: Analyse microwave circuits using scattering matrix (*Analyse*)

CO7: Relate the basic theories in understanding the working of both passive and active microwave components and devices (*Synthesis*)

CO8: Interpret and examine the components/parameters/ behavior of a microwave system in Laboratory (*Evaluation*)

Suggested Readings

1. D. M. Pozor, Microwave Engineering, John Willy and Sons.
2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, Principles of Microwave Engineering, CBS.
3. Samuel Y., Liao, Microwave Device and Circuit, 3rd Edition, Perason
4. R.E. Collin, Foundations for Microwave Engineering, IEEE Press, John Wiley.

ECSP0025: SIGNAL PROCESSING

(4 credits – 60 hours)

Objectives: *The course aims at providing a framework to understand various aspects of signal processing. The course introduces the student to signals and system and deals with the design methodology of digital FIR and IIR filters along with various signals, discrete time systems and transforms.*

Module I (16 Hours)

a) Introduction to signals and system, Continuous time and Discrete time signal, different classification of continuous and discrete time signals, different operations on signals.

b) System - introduction, classification of system based on system properties for both continuous and discrete time system, LTI system, impulse response and unit step response, convolution integral and convolution sum, properties of LTI system, block diagram representation of system.

Module II (20 Hours)

a) Laplace transforms and its properties, Inverse Laplace transform, Laplace transform in system analysis, Z-transform and its properties, R.O.C, relation between s plane and z plane, inverse z transform, Z-transform in system analysis, transfer function, poles and zeroes, linear phase system.

b) Fourier analysis, continuous time Fourier series and continuous time Fourier transform, properties, inverse Fourier transform, cross correlation, auto-correlation, energy spectral density, power spectral density, relation between Fourier transform and Laplace transform.

Module II (10 Hours)

a) Fourier analysis of discrete time signal-Discrete Fourier series and its properties, Discrete Time Fourier transform (DTFT) and its properties, DFT and its properties, Circular convolution and Circular correlation, FFT- DIT and DIF Algorithm.

b) Sampling theorem, aliasing, and spectrum of sampled signal.

Module IV (14 Hours)

a) FIR and IIR system, realization of discrete time FIR and IIR system-structure of FIR systems – Direct form, cascaded form, parallel form and transpose form.

b) Design of linear phase FIR filters using different windows. Design of IIR filters- Impulse Invariance method, bilinear transformation method, matched Z-transform method and backward difference technique.

COURSE / LEARNING OUTCOMES

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

CO1: Define tools like Fourier transform, Laplace transform, Z-transform etc. (*Knowledge*)

CO2: Define various signals and systems as well as various algorithms for fast Fourier transform. (*Knowledge*)

CO3: Define various operations used in digital systems as well as various digital filters (*Knowledge*)

CO4: Discuss and explain various signals and systems, and tools like Fourier transform, Laplace transform, Z-transform etc. (*Comprehension*)

CO5: Explain various algorithms for fast Fourier transform and various operations used in digital systems and various digital filters. (*Comprehension*)

CO6: Generate various signals using software tools like MATLAB and to calculate the output of various operations used in signal and systems, Fourier transform and Laplace transform of a signal along with Z-transform of a signal (*Application*)

CO7: Analyze various signals and systems and the tools like Fourier transform, Laplace transform, Z-transform etc. (*Analyze*)

CO8: Analyze various algorithms for fast Fourier transform as well as various operations used in digital systems and also analyse the performance of various digital filters. (*Analyze*)

CO9: Categorize tools like Fourier transform, Laplace transform, Z-transform etc., and review the performance characteristics of various algorithms used for fast Fourier transform and various operations used in digital systems. (*Synthesis*)

CO10: Compare and assess the various signals and systems and justify the use of a particular tool to analyze a signal in a specific domain. (*Evaluation*)

CO11: Interpret and choose an appropriate algorithm for fast Fourier transform for a specific condition also determine and justify operations to be used in a given digital system. (*Evaluation*)

CO12: Select a digital filter for a specific condition. (*Evaluation*)

Suggested Readings

1. Proakis and Manolakis, Digital signal Processing, PHI.
2. S.K.Mitra, Digital signal Processing, Pearson.
3. Poornachandra and Sashikala, Digital signal Processing, TMH.
4. P. Rameshbabu, Digital signal Processing, SCITECH.

ECAP0026: ANTENNA AND WAVE PROPAGATION

(3 credits – 45 hours)

Objectives: *This subject is aimed at providing basic knowledge on the theory of radiation of antenna, types of antenna and propagation characteristics and their applications in communication engineering.*

Module I (11 hours)

a) Physical concept of radiation in single wire, two wire, and dipole, Current distribution on a thin wire antenna.
b) Fundamental Parameters of Antenna: Radiation pattern, Radiation Power Density, Radiation intensity, Directivity, Gain, Antenna efficiency, Beamwidth, Bandwidth, Polarisation, Antenna Input Impedance, Elementary idea about self and mutual impedance, Radiation efficiency, Effective aperture, Antenna Temperature.
c) Linear Wire Antennas: Retarded potential, Infinitesimal dipole, Current distribution of short dipole and half wave dipole, Far-field, Radiating near-field and reactive near-field region, Monopole and Half wave dipole.

Module II (15 hours)

a) Antenna Arrays: Array of two point sources, Array factor, n-element linear array with uniform amplitude and spacing, Analysis of Broadside array, Ordinary end-fire array, n-element linear array with non-uniform spacing, Analysis of Binomial and Dolph-Tschebyscheff array, Scanning Array, Superdirective array; Yagi Uda antenna, Loop antenna.

b) Aperture Antennas: Field Equivalence principle, Rectangular and circular aperture antennas, Slot Antenna, Horn antenna, Paraboloid Reflector antenna – Simple Analysis, Types, Radiation Pattern, Gain and Bandwidth measurement of the given antennas.
c) Microwave Measurement: Measurement of Admittance. Measurement of Gain of a Horn Antenna

Module III (10 hours)

Radiation Mechanism from patch; Excitation techniques; Microstrip dipole; Rectangular patch, Circular patch, input impedance of rectangular and circular patch antenna. Microstrip array and feed network; Application of microstrip array antennas. Smart Antennas: Concept and benefits; Fixed weight beamforming basics, Adaptive beamforming. Basics of UWB antennas.

Module IV (9 hours)

Ground wave Propagation: Friis Free space equation, Reflection from earth's surface, Surface and Space wave propagation for vertical and horizontal dipole, Field strength of Space wave, Range of space wave propagation, Effective earth's radius. Ionospheric Propagation: Structure of ionosphere, propagation of radio waves through ionosphere , Critical frequency, Maximum usable frequency, Optimum working frequency, lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field. Microwave Propagation: Line of sight propagation. Attenuation of Microwaves by Atmospheric gases, Water Vapour and Precipitates.

COURSE / LEARNING OUTCOMES

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

CO1: Define the basic functions of an antenna and its parameters (*Knowledge*)
CO2: Classify and explain the different antenna types and arrays. (*Comprehension*)
CO3: Describe the physical and mathematical concept of radiation from different antennas and arrays (*Comprehension*)
CO4: Apply the mathematical knowledge to compute and sketch radiation characteristics of different antennas and arrays. (*Application*)
CO5: Analyze behavior of different wire antennas, aperture antennas and linear antenna arrays. (*Analyze*)
CO6: Formulate mathematical relations and design linear arrays (*Synthesis*)
CO7: Evaluate the behavior of nature on radio wave propagation (*Evaluation*)

Suggested Readings

1. C.A. Balanis, Antenna Theory, John Wiley and sons.
2. J.D. Krauss, Antenna Theory, McGraw Hill.
3. K.D.Prasad, Antenna and Wave Propagation, Satya Prakashan.
4. E.C. Jordan, Electromagnetics and radiating systems, PHI.
5. R.E. Collins, Antenna and radio wave propagation, McGraw Hill.
6. M Sachidananda, AR Harish, Antennas and Wave Propagation, Oxford University Press, 2007.

ECVD0027: VLSI DESIGN

(4 Credits – 60 hours)

Objectives: *The objective of this course is to deal with the study of the technology and building blocks of integrated circuits including salient features of digital circuits, structured systems and design automation in the field of VLSI. The scope of this course includes an introduction to practical considerations and design of integrated circuits.*

Module I (15 hours)

Introduction, Historical perspective, Introduction to IC Fabrication Techniques, VLSI design methodologies, VLSI design flow, Design hierarchy, Design Style. Introduction to CAD technology. The Bipolar Technology, Fabrication of BJT. Fabrication of MOSFETS, NMOS fabrication, CMOS n-well process. MOS Transistor, MOS transistor under external bias, Structure and Operation of MOSFET (Threshold Voltage), MOSFET V-I Characteristics (Gradual Channel Approximation, Channel Length Modulation, Substrate bias effect and Measurement of Parameters), MOSFET scaling and small geometry effects. MOSFET capacitances (Oxide Related Capacitance and Junction Capacitance). Modeling of MOS Transistors- Basic concept the SPICE level-1 models, the level –2 and level –3 model equations.

Module II (15 hours)

MOS Inverters: Static characteristics- voltage transfer characteristics, Noise Immunity and Noise Margins, Power and Area Considerations, Speed of operation, Inverters with resistive load and with n-type MOSFET load, CMOS inverter and characteristics. Switching characteristics and interconnect effects: Delay time definitions and calculation, inverter design with delay constraints, estimation of parasitic switching power dissipation of CMOS inverters.

Module III (15 hours)

a) Combinational MOS logic circuits, CMOS logic circuits, state style, Complex logic circuits, pass transistor logic, Sequential logic circuit – introduction, SR latch, clocked latch and flip-flop circuits, CMOS D latch and edge triggered flip-flop. Design considerations (Layer Representation), Design Style (Stick Diagrams), Design Rules.
b) Dynamics logic circuits: Dynamic logic, basic principles, high performance dynamics CMOS circuits, Dynamic RAM, SRAM, flash memory.

Module IV (15 hours)

a) Systems design method, Design strategies, combinational and Sequential module, ROM implementation, PLDs, PLA, PAL, Sequential System design, State Machines (Mealy Circuit and Moore Circuit) Concept of FPGA, Standard cell based design, Design capture tools, Hardware definition languages such as VHDL and packages. Xilinx (introduction),
b) Introduction to IRSIM and GOSPL (open source packages), Design verification and testing, Simulation at various levels including timing verification, Faults models. Design strategies for testing chip level and system level test techniques.

COURSE / LEARNING OUTCOMES

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

CO1: Define VLSI design Methodologies. (*Knowledge*)
CO2: Identify and recognize Fabrication steps of transistors (BJT and MOSFET), Stick Diagram, Static and Switching characteristics of inverters. (*Knowledge*)
CO3: Define Digital circuits and building blocks of integrated circuits. (*Knowledge*)
CO4: Understand the static and dynamic behavior of MOSFETs and the secondary effects of the MOS transistor model. (*Comprehension*)
CO5: Explain the concepts of MOS Technology and its operation in depletion and enhancement modes. (*Comprehension*)
CO6: Explain the basic concepts of combinational MOS logic circuits and Dynamic logic circuits. (*Comprehension*)
CO7: Explain the concepts of programmable logic devices, state machines and Field Programmable Gate Array (FPGA). (*Comprehension*)
CO8: Learn to design digital circuits using hardware description languages (VHDL, Verilog). (*Application*)
CO9: Demonstrate a clear understanding of CMOS fabrication flow and technology scaling. (*Application*)

CO10: Design MOSFET based logic circuit. (*Application*)
CO11: Demonstrate an understanding of working principles of clocking, power reduction and distribution. (Application)
CO12: *Analyze* and model the MOS transistor circuit, down to physical level. (*Analysis*)
CO13: Analyze various CMOS subsystems at gate level and transistor level. (*Analysis*)
CO14: Design MOS inverter for different loads. (*Synthesis*)
CO15: Implement designs using various programmable devices.(*Synthesis*)
CO16: Evaluate the performance of MOSFET for different designs. *(Evaluation)*
CO17: Compare the design methodologies of various type of PLDs. (*Analysis*)

Suggested Readings

1. S.M. Kang and Y. Leblebici, CMOS Digital integrated Circuits: Analysis and Design, TMH.
2. Perry, VHDL Programming by Example, TMH.
3. Rabeyet. al, Digital Integrated Circuits: A Design Perspective, Pearson.
4. R.A. Geiger, P.E. Allen et al, VLSI Design Techniques for Analog and Digital Circuits, McGraw Hill.

ECCT0028: DIGITAL COMMUNICATION TECHNIQUES

(4 credits – 60 hours)

Objectives: *This course is aimed at introducing to the student the fundamentals of the theory of Communication, in particular of Digital Communication. The course will provide in-depth knowledge of communication fundamentals, which include probability, random variables, stochastic processes, digital signals and their characteristics, baseband and bandpass digital communications, performance of digital transmission in the presence of noise and optimum detection of digital signals and performance measures.*

Module I (14 hours)

a) Sampling theorem, Signal reconstruction, Practical difficulties. The treachery of aliasing, The antialiasing filter, Discrete Fourier Transform, Application of sampling theorem: PAM, PWM and PPM signals.
b) Pulse Code Modulation: Quantization of Signals, Quantization error. Non-uniform quantization. The Compander, The encoder, Transmission bandwidth and output SNR, ATI carrier system:
c) Synchronizing and Signaling, Differential PCM, Delta modulation, Adaptive Delta modulation, Output SNR, Comparison with PCM.

Module II (14 hours)

a) Digital modulation techniques: Generation, Transmission, Reception, Spectrum and Geometrical representation in the signal space of BPSK, DPSK, Differentially-encoded PSK, QPSK, $\pi/4$ QPSK, M-ary PSK, BFSK, M-ary FSK, and Minimum Shifting Keying (MSK).
b) Introduction to BOC modulation
c) Noise in PCM and DM: Calculation of quantization noise power, Output signal power, and the thermal noise power.
d) Output SNR of PCM using different modulation techniques. Output SNR of DM.

Module III (16 hours)

a) Principles of digital data transmission: A digital communication system. Line coding- Various line codes. Polar signaling ON-OFF. Signaling, Bipolar signaling. Pulse shaping; Scrambling. Regenerative repeater – Preamplifier, Equalizer. Eye diagram. A baseband signal receiver. Peak signal to RMS Noise output voltage ratio, Probability of error. The optimum filter.
b) White Noise: The matched filter- probability of error of the matched filter coherent reception. Application to phase shift keying Quadrature Phase PSK (QPSK). Use of signal space to calculate P_e. Error probability calculation for BPSK and BFSK.

Module IV (16 hours)

The concept of amount of information, Average information, Entropy- Shanon-Fano algorithm, Shanon's Theoerm- channel capacity, Bandwidth - S/ N trade-off, Use of orthogonal signals to attain Shannon's limit, Efficiency of orthogonal signal transmission, Coding- Parity Checkbit coding for error detection, Hamming distance, Upper bounds of probability of error with coding, Block codes - Coding and decoding algebraic codes: Hadamard code, Hamming code, Convolutional coding, Reed Solomon coding , Turbo Coding - Code generation and Decoding. Concept of Low power communication (Green Communication), Spread spectrum modulation, Definition, PN sequence – Generation and Detection, Concept of Low power communication (Green Communication).

COURSE / LEARNING OUTCOMES

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

CO1: Define various techniques to convert an analog signal into digital signal along with various digital modulation techniques. (*Knowledge*)

CO2: Define transmitters and receivers of various digital communication techniques. (*Knowledge*)

CO3: Define optimum filter as well as various source and channel coding techniques used in signal transmission. (*Knowledge*)

CO4: Explain various techniques to convert an analog signal into digital signal with mathematical justifications. (*Comprehension*)

CO5: Discuss various digital modulation techniques as well as transmitters and receivers of various digital communication systems and their pros and cons. (*Comprehension*)

CO6: Design optimum filter used in signal transmission. (*Comprehension*)

CO7: Discuss various source and channel coding techniques used in digital communication systems. (*Comprehension*)

CO8: Simulate various techniques to convert an analog signal into digital signal using software tools like MATLAB. (*Application*)

CO9: Simulate various digital modulation techniques using software tools like MATLAB. (*Application*)

CO10: Analyze the difference between various techniques to convert an analog signal into digital signal with mathematical justifications. (*Analysis*)

CO11: Distinguish between various digital modulation techniques and their pros and cons. (*Analysis*)

CO12: Model the optimum filter used in signal transmission. (*Analysis*)

CO13: Analyze the difference between various source and channel coding techniques used in digital communication systems. (*Analysis*)

CO14: Summarize various techniques to convert an analog signal into digital signal. (*Synthesis*)

CO15: Categorize and summarize various digital modulation techniques. (*Synthesis*)

CO16: Review transmitters and receivers of various digital communication techniques. (*Synthesis*)

CO17: Categorize various source and channel coding techniques. (*Synthesis*)

CO18: Select a suitable technique to convert an analog signal into digital signal. (*Evaluation*)

CO19: Decide on digital modulation technique to be performed for a given situation. (*Evaluation*)

CO20: Determine a necessary source and channel coding technique for a specific condition. (*Evaluation*)

Suggested Readings

1. Simon Haykin, Communication Systems, John Wiley and Sons.
2. Taub and Schilling, Principles of Communication Systems, Tata Mc Graw Hill.
3. Leon W. Couch-II, Digital and Analogue Communication System, Pearson.

4. B.P. Lathi, Modern Digital and Analogue Communication Systems, OUP.

ECAM0029: ADVANCED MICROPROCESSORS AND EMBEDDED SYSTEMS

(3 credits – 45 hours)

Objectives: *The objective of the course is to expose the students to the features of advanced microprocessors like 8086, 80386, and Pentium processors and to introduce the architecture, programming, and interfacing of the microcontroller 8051.*

Module I (11 hours)

a) Some general concept related to higher level processor: pipelining, memory management(physical memory ,virtual memory), mode of operation(real and protected),descriptor tables, memory segmentation, paging, super scalar technology

b) Intel 8086(16 bit): Introduction: pins and signal description, Architecture, Bus timing, minimum mode 8086, maximum mode 8086. Multiprocessor: parallel processing; Instruction sets of 8086: Instruction formats, Addressing modes, Instruction set: Data transfer Instruction, Arithmetic and logic instruction and program control instructions. Assembly language program, iterative procedure, recursive procedure, parameter passing, 8086-memory interface. Memory management; 8086 Interrupts, 8087 Math coprocessor.

Module II (13 hours)

Intel 80286 Microprocessor: pins and signal description, Architecture, memory management and protection, memory and I/O device Interface; The 80386 and 80486 Microprocessor (32 bits): Introduction to 80386 Microprocessor, 80386 Registers, Memory management, protected mode of operation, paging technique, virtual 8086 mode, Brief introduction to 80387 co processor, Introduction to 80486 Microprocessor.

Module III (11 hours)

The Pentium Microprocessor (64 bit): Introduction to Pentium processor, system architecture, memory system, I/O system, branch prediction logic, Floating-point module, cache structure, super scalar architecture, Introduction to Pentium II processor, Pentium III and Pentium 4.

Module IV (10 hours)

Embedded systems: 8051 interrupt, I/O port programming, interfacing to 8255, 8051 Interfacing with 8255, 8051 Interfacing with External ROM, Interfacing ADC and DAC to 8051, Interfacing a stepper motor with 8051, Introduction to 16- bit microcontroller

COURSE / LEARNING OUTCOMES

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

CO1: State the internal organization of some popular microprocessors (8086, 80286, 80386, 80486, 80586) and microcontrollers (8051 and 8096) (*Knowledge*)

CO2: Explain features and architecture of different microprocessors (8086, 80286, 80386, 80486, 80586) and microcontrollers (8051 and 8096) (*Comprehension*)

CO3: Apply the knowledge of programming in 8086 and 8051, to solve various problems. (*Application*)

CO4: Compare the performance of pipe-lining (8086) and non-pipe-lining (8085) architecture microprocessor (*Analysis*)

CO5: Design and develop microcontroller based systems/models for real life application. (*Synthesis*) microcontrollers (*Synthesis*)

CO6: Summarize the evolution of microprocessors and microcontrollers (*Synthesis*)

CO7: Evaluate the performance various microprocessors and microcontrollers (*Evaluation*)

Suggested Readings

1. Barry B. Brey, The Intel Microprocessor (Architecture, programming and interfacing), Pearson.
2. Douglas V. Hall, Microprocessor and Interfacing, TMH.
3. M. A. Mazidi, J. Mazidi J. G. Mazidi, The 8051 Micro controller and Embedded systems, Pearson.
4. A.K.Roy and K.M. Bhurchandi, Advanced Microprocessor and peripherals (Architecture, programming and interfacing), TMH.

ECBC0030: BASIC COMMUNICATION SYSTEMS

(3 credits – 45 hours)

Objectives: *This course is intended as a base course to introduce the student to core areas other than Electronic communication, to basic communication systems. It introduces a student to Signals and different types of modulation. On completion of the course a student should be able to undertake other courses which have elements of Communication Techniques included in them.*

Module I (6 hours)

a) Review of signals and systems and Fourier analysis.
b) Introduction to Probability and Random process, Random variables, distribution and density functions. Statistical averages, Power spectral density, Energy spectral density, Correlation and convolution, Review of signals and systems and Fourier analysis.

Module II (17 hours)

a) Modulation, need for modulation and its types, Amplitude modulation, generation and detection of AM, DSB-SC, SSB-SC and VSB, Introduction to AM receivers and transmitters, super heterodyne receiver.
b) Angle modulation- Frequency and phase modulation, Relationship between FM and PM waves, Generation and detection of FM – NBFM and WBFM, Introduction to FM transmitters. Noise in AM and FM.

Module III (10 hours)

a) Pulse Modulation- Sampling of analog signal, Sampling theorem, PAM-generation and detection, PPM and PDM and its generation, quantization, PCM, PCM systems, Encoder-decoder, DPCM, DM and ADM, TDM and FDM.
b) Baseband binary PAM systems. Intersymbol interference (ISI). Nyquists's criterion for distortionless baseband binary transmission. Nyquist and Raised Cosine Pulses. Square-root Splitting of the Nyquist Pulse. Baseband M-ary, PAM systems. Optimum detection. Matched filters, correlation receivers.

Module IV (12 hours)

a) Digital Modulation- Binary communication, On-Off Keying and ASK, Frequency Shift Keying (FSK), Phase shift keying (PSK) and QPSK.
b) Detection of binary signals, Multi symbol signaling, Quadrature Amplitude Modulation (QAM). Introduction to Information theory and coding

COURSE / LEARNING OUTCOMES

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

CO1: Define analog and digital communication systems. (*Knowledge*)
CO2: Identify the need for digital and analog communication systems. (*Knowledge*)
CO3: Identify different types of noise in communication system. (*Knowledge*)
CO4: Explain the fundamental blocks of communication system. (*Comprehension*)
CO5: Explain the statistical properties of noise. (*Comprehension*)
CO6: Explain the steps for conversion of analog signal to digital signal. (*Comprehension*)

CO7: Explain the concept of analog and digital modulations. (*Comprehension*)
CO8: Demonstrate an understanding of working principles of analog and digital communication system. (*Application*)
CO9: Apply the statistical properties of random signal to understand impact of noise in communication system. (*Application*)
CO10: Demonstrate an understanding of modulation for long distance communication. (*Application*)
CO11: Compare the performance of various analog and digital modulation techniques. (*Analysis*)
CO12: Analyze and compare analog and digital communication systems. (*Analysis*)
CO13: Design an analog communication link and a digital Communication link. (*Synthesis*)
CO14: Evaluate the performance of AM, FM and PM in analog communication system and the performance of ASK, PSK and FSK in digital communication system. (*Evaluation*)

Suggested Readings

1. George Kennedy, Electronic Communication Systems, McGraw Hill.
2. Taub and Schilling, Principles of Communication Systems, TMH.
3. B.P.Lathi, Modern Digital and Analog Communication Systems, Oxford University Press.
4. Roddy Coolen, Communication Systems, PHI.

ECFS0031: FIBER OPTIC AND SATELLITE COMMUNICATION

(4 credits – 60 hours)

Objectives: *This course aims at providing a comprehensive introduction to communication systems which include fiber-optic communication technology, satellite communication and multiple access. The course is designed for the students to develop a good understanding of the physical aspect of the technology necessary for them to evaluate and design communication systems.*

Module I: Introduction (20 hours)

Block diagram of optical fiber communication system, Advantages of optical fiber communication; Optical fiber waveguides: structure of optical wave guide, light propagation in optical fiber using ray theory, acceptance angle, numerical aperture, skew rays, wave theory for optical propagation, modes in a planar and cylindrical guide, mode volume, single mode fibers, cutoff wavelength, mode field diameter, effective refractive index and group and mode delay factor for single mode fiber. Transmission Characteristics of Optical fiber, Attenuation in optical fibers, intrinsic and extrinsic absorption, linear and nonlinear scattering losses, fiber bend losses; Dispersion and pulse broadening, intramodal and intermodal dispersion for step and graded index fibers, modal noise, over all fiber dispersion for multimode and monomode fiber, dispersion shifted fibers, modal birefringence and polarization maintaining fibers

Module II: Optical Sources (22 hours)

LED, Typical GaAIAs p-n junction double hetrostructure, Fabrication of LEDs; Typical Spectral pattern, Modulation of an LED, Laser diodes: Principle of Operation, Typical Constructional features Radiation Pattern, Modulation Laser diode, Typical Manufactures specifications of LED and LASER, Power Lunching and Coupling; Source to fiber power launching, Coupling Power Calculation, Lensing Scheme for improvement of coupling. Fiber-to-fiber Connectors loss. Techniques of Splicing, Splicing loss; Photo Detectors: p-n, PIN and ADP Photodetectors, Responsivity and Bandwidth of diodes. Noise in PDs. Equivalent Circuits. SNR. Optical amplifiers; Optical Receiver: Receiver Configuration Sensitivity and Bandwidth of Receiver Bit Error Rate. Optical fiber communication systems: Principal components of an optical fiber communication system, source laminations, optical transmitter circuits, LED and laser drive circuits, optical receiver block diagram, Direct intercity and sub-carrier intensity modulation using AM, FM and PM.

Module III: Orbital Mechanics (10 hours)

Determination of Orbital Parameters, look angle of a geostationary Satellite from Earth. Launches and Launch Vehicle, Placing Satellite into Geo-stationary Orbit; Satellite Subsystems: A brief Description of AOCS, TTC and M and Power System. Description of Communication System – Transponders; Satellite Antennas: Basic Antennas Types and Relationship; Satellite Link: Basic Transmission Theory, System Noise Temperature and G/T Ratio; G/T Ratio for Earth station.

Module IV: Impactor Satellite: Earth Links (8 hours)

Attenuation, Depolarization, Ionospheric and Troposhric effects; multiple access: Comprehensive study on FDMA, TDMA and CDMA, Spread Spectrum Transmission and Reception. Introduction to BOC modulation.

COURSE / LEARNING OUTCOMES

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

CO1: Define and outline the fundamental concepts of light transmission through a dielectric media. (*Knowledge*)

CO2: Identify and recognize the different types of optical fibers and other components of Fiber Optic Communication such as optical sources, detectors, optical amplifiers and connectors, etc. (*Knowledge*)

CO3: Define the basics laws, terminologies and orbital parameters related to satellite communication (*Knowledge*)

CO4: Explain the mechanism and contributing factors of fiber attenuation/dispersion and other transmission characteristics. (*Comprehension*)

CO5: Describe the photoemission, detection and amplification process (*Comprehension*)

CO6: Explain the elements of satellite communication, describe the types of satellite, satellite orbits, orbital parameters and the process of launching them in orbits. (*Comprehension*)

CO7: Illustrate the propagation effects of atmosphere on performance of typical satellite communication. (*Comprehension*)

CO8: Explain the subsystems of a satellite communication(*Comprehension*)

CO9: Describe the various multiple access techniques (*Comprehension*)

CO10: Compute the various parameters related to optical fiber and fiber optics link design. (*Application*)

CO11: Compute and analyze parameters of satellite link design(*Application*)

CO12: Classify and analyze optical fibers in terms of their operating characteristics and material composition. (*Analyze*)

CO13: Design a fiber optic Communication link and Satellite Communication link (*Synthesis*)

CO15: Evaluate the performance of Fiber optic link based on the nature and performance characteristics and assess their importance in design of optical receivers (*Evaluation*)

CO16: Compare the various types of multiple access techniques and asses their importance in satellite communication (*Evaluation*)

Suggested Readings

1. Djafar K. Mynbaev, Fibre-Optics Communications Technology, Pearson Education.
2. J.M.S. Senior, Optical fiber Communication, PHI.
3. G. Keiser, Optical Fiber Communication, McGraw Hill.
4. R.N. Mutagi, Satellite Communications- Principles and Applications., Oxford University Press
5. T. Pratt, C. Bostian and J. Allnutt, Satellite Communication, John Wiley Co.
6. H. Kolimbins, Digital Communication with Satellite and Fiber optic Application, PHI.
7. W. Tomasi, Advanced Electronic Communication System, Pearson Education.

ECTS0032: TELECOMMUNICATION SWITCHING AND SYSTEMS

(4 credits – 60 hours)

Objectives: *The objective of the course is to provide modern evaluation and implementation procedures in the area of telecommunication services and networks which will help the students to model and design telecommunication/data networks using up-to-date techniques. Various telecommunication and data networking concepts including signaling techniques, public switched data networks, ISDN and DSL are introduced.*

Module I: Telecommunication switching systems (20 hours)

Introduction, Elements of switching systems, switching network configuration, principles of cross bar switching. Electronic space division switching, Time division switching, Combination switching.

Module II: Telephone networks (15 hours)

Subscriber loop systems, switching hierarchy and routing, transmission plan, numbering plan, charging plans. Signaling techniques: In channel signaling, common channel signaling. Network traffic load and parameters, grade of service and blocking probability.

Module III: Data communication networks (15 hours)

Introduction, network architecture, layered network architecture, protocols, data communications hardware, data communication circuits. Public switched data networks, connection oriented and connectionless service, Circuit Switching, packet switching and virtual circuit switching concepts, OSI reference model, LAN, WAN, MAN and Internet. Repeaters, Bridges, Routers and gateways.

Module IV: Integrated services digital network (ISDN) (10 hours)

Introduction, motivation, ISDN architecture, ISDN interfaces, functional grouping, reference points, protocol architecture, signaling, numbering, addressing, BISDN. DSL Technology: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM and CMTS and DOCSIS. SONET: Devices, Frame, Frame Transmission, Synchronous Transport Signals, STS I, Virtual Tributaries and Higher rate of service.

COURSE / LEARNING OUTCOMES

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

CO1: Define different switching systems and switching network configuration. (*Knowledge*)

CO2: Identify and recognize the signaling techniques involved in telephone networks. (*Knowledge*)

CO3: Recognize different data network components like repeaters, bridges, routers and gateways. (*Knowledge*)

CO4: Explain and distinguish between telephone, data communication and integrated services digital network. (*Comprehension*)

CO5: Describe the concepts of circuit and packet switching techniques. (*Comprehension*)

CO6: Explain different network topologies (*Comprehension*)

CO7: Choose appropriate elements for telephone and data communication networks. (Application)

CO8: Illustrate the signaling, numbering and addressing schemes involved in telephone and ISDN networks. (*Application*)

CO9: Compare and contrast the data communication network architecture and ISDN architecture (*Analyze*)

CO10: Relate and summarize the different components involved in telephone, data communication and ISDN networks (*Synthesis*)

CO11: Evaluate and assess the performance of telephone networks (*Evaluation*)

Suggested Readings

1. T. Viswanath, Tele communication switching system and networks, PHI.
2. W. Tomasi, Advanced electronic communications systems, PHI.
3. J E Flood, Telecommunication switching, Traffic and Networks, Pearson Education.
4. B.A. Forouzan, Data Communication and Networking, TMH.

ECIP0033: DIGITAL IMAGE PROCESSING

(4 credits – 60 hours)

Objectives: *This course's objectives are to introduce the students to the fundamentals of digital image processing, analyze operations on images such as image enhancement, image restoration, Image Segmentation, image compression, colour Image Processing etc. The students would be encouraged to develop the image processing tools from scratch, rather than using any image processing library functions.*

Module I (17 hours)

Different stages of Image processing, Components of Image Processing System. Elements of visual perception, 2D Fourier Transform and properties; Image Digitization: A review of Sampling and quantization processes, Image transforms: Unitary and orthogonal transforms, 2D DFT, Discrete cosine transform (DCT) and properties, 2D DCT, Discrete Wavelet Transform, KL transform.

Module II (15 hours)

Some basic relationship between pixels: Neighbour of pixels, Adjacency, Connectivity, Regions, Boundaries, and Distance Measures. Intensity Transforms: Image Negatives, Log Transform, Power Law Transformation, Piecewise linear Transformation function, Histogram Processing, Fundamentals of Spatial Filtering: Mechanics of spatial Filtering, 2D linear systems, Spatial Correlation and Convolution, Spatial Filter Mask, Smoothing Filtering Mask, Sharpening Filtering Mask. Salt and pepper noise and median filters; Filtering in Frequency domain.

Module III (13 hours)

Image Restoration: A model of image degradation, Estimation of degradation function, Inverse Filtering, Minimum Mean – Square Error Restoration, Image Compression: Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Schematic diagram of Data Compression Procedure, Lossless and Lossy compression, Hufman coding, transform coding; Morphological Image Processing: Dilation, Erosion, Combining Dilation and Erosion, The Hit or Miss Transformation.

Module IV (15 hours)

Image Segmentation: Point Detection, Line Detection, Edge Detection, Thresholding and Region Growing based Segmentation.

Colour Image Processing: Colour Fundamentals, RGB, HSV, CMY colour model, Basic of Colour Image Processing, Intensity Colour Slicing. Intensity to colour Transformation.

Multi-resolution Image Processing.

COURSE / LEARNING OUTCOMES

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

CO1: Define various types of images, various image operations such as image filtering, image segmentation, image enhancement, image restoration, image compression etc. (*Knowledge*)

CO2: Define various 2D mathematical operations as well as define basic relationship between pixels. (*Knowledge*)

CO3: Define various operations of morphological image processing as well as various color image processing techniques.(*Knowledge*)

CO4: Explain various types of images, various image operations such as image filtering, image segmentation, image enhancement, image restoration, image compression etc. (*Comprehension*)

CO5: Discuss various 2D mathematical operations as well as basic relationship between pixels. (*Comprehension*)

CO6: Discuss various operations of morphological image processing. (*Comprehension*)

CO7: Explain various color image processing techniques. (*Comprehension*)

CO8: Perform various types of images, various image operations such as image filtering, image segmentation, image enhancement, etc. and various 2D mathematical operations using MATLAB. (*Application*)

CO9: Obtain basic relationship between pixels and perform various operations of morphological image processing using MATLAB. (*Application*)

CO10: Analyze various types of images, various image operations such as image filtering, image segmentation, image enhancement, image restoration, image compression etc. (*Analysis*)

CO11: Analyze various 2D mathematical operations and basic relationship between pixels. (*Analysis*)

CO12: Analyze various operations of morphological image processing. (*Analysis*)

CO13: Analyze various colour image processing techniques. (*Analysis*)

CO14: Summarize various types of images, various image operations such as image filtering, image segmentation, image enhancement, image restoration, image compression etc. (*Synthesis*)

CO15: Review various 2D mathematical operations as well as basic relationship between pixels. (*Synthesis*)

CO16: Summarize various operations of morphological image processing. (*Synthesis*)

CO17: Review various color image processing techniques. (*Synthesis*)

CO18: Select a suitable operation for image filtering, image segmentation, image enhancement, image restoration, image compression etc. (*Evaluation*)

CO19: Pick a 2D mathematical operation or select a basic relationship between pixels suitable for specific condition. (*Evaluation*)

CO20: Select an operation of morphological image processing for a given situation.(*Evaluation*)

Suggested Readings

1. R.C.Gonzalez and R.E.Woods, Digital Image Processing, Pearson.
2. K. Jain, Fundamentals of Digital Image Processing, Pearson.
3. B.Chanda and D.Dutt Majumdar, Digital Image Processing and Analysis, PHI.

ECME0034: MICROELECTRONICS

(4 credits – 60 hours)

Objectives: *This course introduces basic semiconductor material and semiconductor junction properties. It also introduces basic processes used in fabricating semiconductor devices and integrated circuits. The objective is to develop the background knowledge necessary to understand semiconductor physics and state-of-the-art semiconductor technology related to device fabrication processes. Knowledge on semiconductor devices is a pre-requisite.*

Module I: Semiconductor Crystals (7 hours)

Semiconductor material types – crystalline, amorphous and polycrystalline; Crystal structure – lattice and unit cells, Cubic lattices – SCC, BCC, FCC structures, lattice constants, Planes and directions, Miller indices.

Module II: Quantum Theory (8 hours)

The photoelectric effect, Atomic spectra, Probability and uncertainty principle Schrodinger wave equation, potential well problem, quantum effect and quantum tunneling; Pauli exclusion principle.

Module III: Band Theory (15 hours)

Energy bands in solids, electron wave function, wave vector, (E, k) diagram, direct and indirect semiconductors, Effective mass, density of states, Fermi-Dirac distribution, carrier concentration; optical absorption, photoluminescence, cathodoluminescence, electroluminescence; Direct and indirect recombination, trapping, quasi-fermi levels, Diffusion and drift in carriers, diffusion length, contact potential, junction space charge, minority and majority carrier currents, Stored charges and time variation, reverse recovery, Junction capacitance, graded junctions, metal-semiconductor junctions, hetero-junctions.

Module IV: Semiconductor Processing Technology (10 Hours)

An Introduction to Microelectronic Fabrication, Roadmap of semiconductor manufacturing, Semiconductor Materials and Process Chemicals, Crystal Structure, Crystal Growth and Wafer Preparation, Contamination Control; Overview of Wafer Fabrication - Basic Wafer Fabrication Operations, Hot Processing and Ion Implantation, Construction of a Semiconductor Circuit, Chip Terminology, Process Yields.

Module V: Principles of Microelectronics Fabrication (10 Hours)

Oxidation, Rapid Thermal Processing, Photolithography; Photolithographic Processes - Optical Lithography, Photoresists, Non-optical Lithographic Techniques.

Module VI: Processing of Thin Films (10 Hours)

Vacuum Science and Plasmas, Etching, Physical Deposition: Evaporation and Sputtering, Chemical Vapor Deposition, Epitaxial Growth, Device Isolation, Contacts, and Metallization; Overview of Wafer Fabrication - The Business of Wafer Fabrication, Semiconductor Devices and IC Formation, Integrated Circuit Types, Chip Packaging.

COURSE / LEARNING OUTCOMES

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

CO1: Reproduce intricate semiconductor properties. (*Knowledge*)
CO2: Infer how semiconductor properties could be related to fabrication of integrated circuits (*Comprehension*)
CO3: Demonstrate how semiconductors are used for fabrication of integrated circuits (ICs) (*Application*)
CO4: Relate basic theories underlying the various processes that are used in fabricating electronic devices and Ics (*Analysis*)
CO5: Construct problems related to IC fabrication processes. (*Synthesis*)
C06: Evaluate process parameters for minimizing defects in fabrication of ICs. (*Evaluation*)

Suggested Readings

1. Adel S. Sedra, Kenneth C. Smith, Microelectronic Circuits, sixth edition, 2010.
2. Stephen A. Campbell, The Science and Engineering of Microelectronics Fabrication, Oxford University Press, Second Edition, 2001
3. Ben G. Streetman, Solid State Electronic Devices, Prentice Hall, 1980.
4. Stephen A. Campbell, Fabrication Engineering at the Micro and Nanoscale, Oxford University press, 2007
5. R.C. Jaeger, Introduction to Microelectronics Fabrication, 2nd Edition (ISBN: 0201444941), 2001
6. PV Zant, Microchip Fabrication: A Practical Guide to Semiconductor Processing, 3rd Edition, Semiconductor Services, 2000 (ISBN: 0071356363)

7. Marc J. Madou, Fundamentals of Microfabrication: The Science of Miniaturization, 2nd Edition (ISBN: 0849308267), 2002

ECES0035: EMBEDDED SYSTEMS AND APPLICATIONS

(4 credits – 60 hours)

Objectives: *The course helps to develop an in-depth understanding of the operation of different types of microcontrollers . It also covers assembly language programming and interfacing techniques using different types of microcontrollers. The students will be able to design and implement microcontroller-based systems in both hardware and software and can apply this knowledge to more advanced structures.*

Module I (15 hours)

Overview and practical aspects of embedded systems, Hardware description of 8051, Programming of 8051, Serial port programming, Interrupt programming, Timer and Counter, RTOS for 8051, Keypad Interfacing, DIP switch interfacing, Design of a traffic light controller system using 8051

Module II (12 hours)

Pin diagram and architecture of 8096, Memory Organization, Addressing mode and interrupts, instruction set of 8096, programming of 8096, design of a numeric machine using 8096

Module III (8 hours)

Introduction to PIC microcontrollers: Architecture, Architecture Differences, Mid-Range instruction Set, Power Input and Decoupling, Reset, Watchdog Timer, System Clock/Oscillators

Module IV (15 hours)

Registers, Parallel Input Output, Interrupts, Prescaler , Mid-Range Built-In EEPROM Flash Access,TMR1 and TMR2 Serial I/0, Analog I/0, Parallel Slave Port (PSP), External Memory Connections ,In-Circuit Serial Programming (ISCP), Assembly Language Programming, Hex File Format, Code-Protect,Features,INTERFACING TO LEDs, LCDs

Module V (10 hours)

ARM Processor Fundamentals: Processor architecture and organization, 3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, Instruction set design, The ARM coprocessor interface. The Reduced Instruction Set Computer. The Acorn RISC Machine, Architecture, Instruction set of ARM

COURSE / LEARNING OUTCOMES

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

CO1: Define various terminologies related to embedded system (*Knowledge*)
CO2: Explain the architecture of advanced microcontrollers such as 8096, PIC and ARM (*Comprehension*)
CO3: Apply the knowledge of timers, interrupt and serial communication of different microcontrollers (*Application*)
CO4: Analyze the internal organization and instruction set of 8096, PIC and ARM (*Analysis*)
CO5: Summarize advantage, disadvantage and applications of different microcontrollers (*Synthesis*)
CO6: Able to examine microcontroller-based systems (*Evaluation*)

Suggested Readings

1. M. A. Mazidi, J.G. Mazidi, R.D. McKinlay, The 8051 Microcontroller and Embedded systems, Prentice Hall, 2nd Edition.
2. Myke Predko, Programming and Customizing the 8051 Microcontroller, McGraw Hill.

3. Schultz Thomas W.C and 8051
4. David Calcutt Fred Cowan Parchizadeh, 8051 Microcontrollers an Applications-Based Introduction, Elsevier.
5. H.W Huang, Delmar, PIC Microcontroller, CENGAGE Learning, 2007.
6. J B Peatman, Design with PIC Microcontrollers, Prentice Hall.
7. Andrew N. Sloss, Dominic Symes, Chris Wright ARM system developers guide designing and optimizing system software
8. ARM system onchip architecture, Steve Ferber

ECLV0036: LOW POWER VLSI DESIGN

(4 credits – 60 hours)

Objectives: *The objective of the course is to learn basic ideas, concepts, theory and methods of low power VLSI design and also to gain experience with techniques and tools.*

Module I (17 hours)

Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices: MIS structure, long channel MOSFET, Leakage current in deep submicrometer transistors, weak inversion, punchthrough, Device and Technology Impact on Low Power: Dynamic dissipation in CMOS, Load Capacitance, Transistor sizing and gate oxide thickness, Impact of technology Scaling, Technology and Device innovation.

Module II (15 hours)

Power estimation, Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation; Probabilistic power analysis: Random logic signals, probability and frequency, probabilistic power analysis techniques, signal entropy. Low Power Design; Circuit level: Power consumption in circuits. Flip Flops and Latches design, high capacitance nodes, low power digital cells library

Module III (15 hours)

Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic; Low power Architecture and Systems: Power and performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power static RAM architecture, 4T SRAM, 6T SRAM, Banked organization of SRAM.

Module IV (13 hours)

Low power Clock Distribution: Power dissipation in clock distribution, power reduction in clock networks, clock gating reduced clock swing, oscillator circuit for clock generation, Frequency division and multiplication, CMOS floating, low power bus, Variable-threshold-voltage CMOS (VTCMOS) approach, Multi-threshold-voltage CMOS (MTCMOS) approach, Adiabatic Switching Circuits, Battery-aware Synthesis, Variation tolerant design, power efficiency of adiabatic logic, pass transistor synthesis.

COURSE / LEARNING OUTCOMES

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

CO1: Outline the need for low power VLSI chips (*Knowledge*)
CO2: Explain the sources of power dissipation in CMOS devices (*Comprehension*)
CO3: Compute the total power dissipation in VLSI chips(*Application*)
CO4: Analyze dynamic and static power dissipation (*Analyze*)
CO5: Summarize the techniques used to reduce power dissipation in VLSI chips (*Synthesis*)

CO6: Able to evaluate different techniques used to reduce the power dissipation (*Evaluation*)

Suggested Readings

1. G.K. Yeap and F.N. Najm, Practical Low Power Digital VLSI Design, World Scientific.
2. K. Roy and S. Prasad, Low-Power CMOS VLSI Circuit Design, Wiley.
3. J.M. Rabaey and M. Pedram, Low Power Design Methodologies, Kluwer Academic Publishers.
4. W. Nebel and J. Mermet, Low Power Design in Deep Sub-micron Electronics, Kluwer Academic Publishers.

ECCC0037: COMPUTER COMMUNICATION

(4 credits - 60 hours)

Objectives: *The course is intended at understanding the principles and practice of designing, building, and operating computer networks, particularly the Internet.*

Module I (15 hours)

Overview of Data Communications and Networking: Protocols and Architecture: ISO-OSI, TCP/IP, Data Transmission, Transmission Media: Guided Media, Unguided media (wireless); Data encoding schemes (in brief), Brief idea about spread spectrum technique; Multiplexing-FDM, TDM, ADSL.

Module II (20 hours)

Data Link Layer: Flow Control, Error detection and Error Control HDLC, Point-to- Point Protocol: PPP Multiple Access Techniques: Random Access, Controlled Access, Channelization. Switching Techniques: Circuit switching, Packet Switching, Routing and routing algorithms Message Switching; Wired LAN: IEEE standard, LAN, MAN and WAN Technology, LAN system – Ethernet; ATM, Wireless LANs: IEEE 802.11, Bluetooth virtual circuits, Brief Idea about Switches and Routers.

Module III (15 hours)

Network Layer: Addressing, IPv4, IPv6, Address mapping, ICMP and Routing; Transport Layer: UDP, TCP, Congestion control.

Module IV (10 hours)

Application Layer: Client Server Model, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW. Network management (SNMP), VOIP and Brief idea about ISDN.

COURSE / LEARNING OUTCOMES

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

CO1: Reproduce the working of different architectures and protocols involved in data communication. (*Knowledge*)

CO2: Identify and describe the various types of transmission media and network topologies.(*Knowledge*)

CO3: Describe the functionalities of different layers of the network architecture. (*Comprehension*)

CO4: Discuss different data access and switching techniques. (*Comprehension*)

CO5: Explain switches, routers, ISDN, VOIP etc. (*Comprehension*)

CO6: Distinguish between different network topologies, network architecture and transmission media. (*Comprehension*)

CO7: Choose appropriate transmission medium, switching and access technique for a given data communication network.(*Application*)

CO8: Examine and compare the performance of different data communication network. (*Analyze*)

CO9: Relate and summarize the different components involved in the designing of computer networks.(*Synthesis*)

CO10: Choose and justify the proper computer network component. (*Evaluation*)

Suggested Readings

1. W. Stallings, Principles of Data Communication and Networking, PHI.
2. B. A. Forouzan, Data Communications and Networking, TMH.
3. L.L. Peterson and B.S.Davis, Computer Networks: A System Approach, Elsevier.
4. A.S. Tannenbaum, Computer Networks, PHI.

ECMC0038: MOBILE COMMUNICATION

(4 Credits - 60 hours)

Objectives: *The course introduces the principles of mobile systems and its most important technical aspects and services and emphasizes on both public and professional mobile telephony standards, spread spectrum technology, wireless networks while migrating from wired to wireless applications.*

Module I: The Cellular Concept (15 hours)

A brief introduction to Mobile Telephony, Technologies and Choices; Cellular Concept-System Design: Fundamentals- Frequency reuse, Channel Assignment, Handoff Strategies, Interferences and System Capacity, Trunking and Grade of Service; Improving coverage and capacity in Cellular Systems – Cell Splitting, Sectoring, Repeaters and Range Extension, Microcell and Picocell Zone Concept. Antennas for Base Station and hand held Cellular phone.

Module II: Mobile Radio Propagation: Large-Scale path loss (15 hours)

Free space propagation model, Ground Reflection Model, Diffraction, Scattering. Outdoor propagation Model – Okumura Model; Indoor Propagation Model: Partition loses, Long distance Path loss Model; Small Scale Fading and Multipath fading, Doppler Shift. Types of Small Scale Fading and their effect on received signal; Modulation Techniques: FM for Analogue. FM Detection Techniques- PLL and Quadrature Detection. Digital Modulation: π /4 QPSK and MSK, GMSK.

Module III: Modulation Techniques for Mobile Radio (20 hours)

Spread Spectrum Techniques: DS-SS and FH-SS. Performances of FM, π /4 QPSK and MSK in Fading and Interference; fundamentals of Equalization, Adaptive Equalizer. Diversity Techniques-Space, frequency Polarization and Time Diversity; Access Techniques: Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread; Spectrum Multiple Access-Frequency Hopped Multiple Access (FHMA), Code Division Multiple Access (CDMA). Frequency and Channel specification for CDMA Digital Cellular Standard (IS-95).

Module IV: Wireless Systems and Standards (10 hours)

Wireless Networking: Various Generations of Wireless Networks, Fixed Network Transmission Hierarchy, Traffic Routing in Wireless Networks- Circuit Switching, Packet Switching. The X. 25 Protocol; Global System for Mobile (GSM): features, architecture, channel types, Frame Structure in GSM. Signal processing in GSM.

COURSE / LEARNING OUTCOMES

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

CO1: Recognize the different components of mobile communication system (*Knowledge*)

CO2: Explain the concept of cellular communication and frequency reuse (*Comprehension*)

CO3: Compute out the capacity of a cellular system (*Application*)

CO4: Analyze GSM mobile communication standard, its architecture, logical channels, advantages and limitations. (*Analyze*)

CO5: Summarize the different techniques used to improve the received signal quality (*Synthesis*)

CO6: Examine the different propagation models used to predict the received signal strength (*Evaluation*)

Suggested Readings

1. T.S. Rappaport, Wireless Communication, Pearson.
2. W.Y. Lee, Mobile Communication Engineering, McGraw Hill.
3. J.Schiller, Mobile Communication, Pearson.
4. W.Y. Lee, Mobile Cellular Communications, McGraw Hill.

ECOD0039: OPTOELECTRONIC DEVICES

(3 credits - 45 hours)

Objectives: *The course is intended to give the students an exposure to the design criteria for semiconductor optical sources including light emitting diodes and laser diodes, optical detectors, amplifiers and connectors for a variety of applications.*

Module I (15 hours)

Sources: Light Emitting Diodes (LEDs), LED Structures, LED types, Fabrication of LED, Light Source Materials, Internal Quantum Efficiency, Modulation Capacity, Transient Response, Power – Bandwidth Product, Laser Diodes, Laser Diode Modes and Threshold Conditions, Single mode operation, Mode locking, Q-switching, Holography, Resonant Frequencies, Laser Diode Structures and Radiation Patterns, Single Mode Lasers, Modulation of Laser Diodes, Temperature Effects, Light Source Linearity, Modal Partitionand Reflection Noise.

Module II (10 hours)

Detectors: PIN Photo-Detector, Avalanche Photodiodes, Photo-Detector Noise, Noise Sources, Signal-to-Noise Ratio, Depletion Layer Photocurrent, Response Time, Avalanche Multiplication Noise, Temperature Effects on Avalanche Gain, Photodiode Materials.

Module III (10 hours)

Amplifiers and Switches: Optical Amplifiers, Semiconductor Laser Amplifiers, Fiber Amplifiers, Rare Erbium Doped Fiber Amplifiers, Raman Fiber Amplifiers, Brillion Fiber Amplifiers, Amplifier Gain, Noise Figure, Bandwidth, Photonic Switching, Integrated Optical Switches.

Module IV (10 hours)

Connectors and Couplers: Cylindrical Ferrule Connector, Bi-Conical Ferrule Connectors, Double Eccentric Connectors, Duplex Fiber Connectors, Expanded Beam Connectors, Beam Splitter, Three Port Couplers, Four Port Couplers, Directional Couplers, Star Couplers, Lenses for Coupling Improvement.

COURSE / LEARNING OUTCOMES

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

CO1: Define and explain the working of basic optoelectronics devices such as optical sources, detectors, optical amplifiers and connectors, etc. (*Knowledge*)

CO2: Identify and describe the various types of connectors and couplers employed for fiber optic link design for efficient coupling of light from source to fibre/detector (*Knowledge*)

CO3: Establish the need for semiconductor optical sources & detectors and describe their fundamental principles, structure, types and characteristics(*Comprehension*)

CO4: Describe the photo-emission and photo-detection process(*Comprehension*)

CO5: Explain the nature and performance of various types of optical sources, photodetectors and amplifiers (*Comprehension*)

CO6: Describe the various types of connectors and couplers employed for fiber optic link design for efficient coupling of light from source to fibre/detector. (*Comprehension*)

CO7: Compute the efficiencies and other parameters related to optoelectronic sources, detectors and amplifiers. (*Application*)

CO8: Classify the different optoelectronic components and analyze their performances. (*Analysis*)

CO9: Summarize and compare the use of various optoelectronic components in a Fiber optic link design.(*Synthesis*)

CO10: Evaluate the performance characteristics of optical sources, detectors, optical amplifiers and other optoelectronics components. (*Evaluation*)

Suggested Readings

1. J. Wilson, J.F.B. Hawkes, Optoelectronics - An Introduction, Prentice Hall of India Private Limited.
2. G. Keiser, Optical Fiber Communications, McGraw Hill.
3. D.K. Mynbaev and L.L.Scheiner, Fiber Optic Communications Technology, Pearson.
4. S.K. Sarkar, Optical Fibers and Fiber Optic communication system, S.Chand and Co.
5. J.C. Palais, Fiber Optic Communications, Pearson.

ECSP0040: SPEECH PROCESSING

(3 credits – 45 hours)

Objectives: *The objectives of this course are to introduce the fundamentals of digital speech processing, analyze the basic subject related to speech processing such as discrete time and continuous time signals, linear time-invariant systems, convolution, Z-transform etc., Models for Speech Production, Complete Model of Auditory Processing, Digital Representation of speech, Cepstrum Analysis of Speech Signal, linear predictive speech coding, Feature Extraction, speaker verification and speaker Identification Systems.*

Module I (12 hours)

The Fundamentals of Digital Speech Processing; A Review of Discrete-Time Signal and Systems, the Z-transform, the DFT, Fundamental of Digital Filters, FIR system, IIR Systems, Phonetic Representation of Speech, Models for Speech Production, the human Ear, perception of loudness, critical bands, pitch perception, auditory masking, complete model of auditory processing.

Module II (10 hours)

Time–Domain Methods for Speech Processing; Time-Dependent Processing of speech, short-time energy and Average Magnitude, short time average Zero-crossing rate; Digital Representation of speech Waveform Sampling speech signals, statistical model, instantaneous quantization, instantaneous companding, quantization for optimum SNR, adaptive quantization, feed-forward feedback adaptions.

Module III (7 hours)

Definition of the Cepstrum and Complex Cepstrum, the Short-Time Cepstrum, Computation of the Cepstrum, Short-Time Homomorphic Filtering of Speech, Application to Pitch Detection, Applications to Pattern Recognition, The Role of the Cepstrum.

Module IV (16 hours)

Block diagram of Simplified Model for Speech Production; Basic Principles of Linear Predictive Analysis- the Auto Correlation Method, Cepstral Analysis; The Prediction Error Signal. Digital Speech Processing for Man-Machine Communication by voice. Speaker Recognition Systems- Pre-emphasis, Normalization, Frame blocking, Windowing, Feature Extraction (LPC, PCA, MFCC), Vector quantization, speaker verification and speaker Identification Systems.

COURSE / LEARNING OUTCOMES

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

CO1: Define and outline the fundamental concepts of digital signal processing related to digital speech processing such as discrete and continuous time signals, Z-transform, DFT, digital filters etc.(*Knowledge*)

CO2: Explain the mechanism of speech production and reception in the human body. (*Comprehension*)

CO3: Explain the fundamentals of digital speech processing including models for speech production, feature extraction etc. (*Comprehension*)

CO4: Design speaker verification and speaker identification systems.(*Application*)

CO5: Analyze the human auditory system, speech signals, models for speech production, feature extraction systems etc.(*Analyze*)

CO6: Design a simple model for speech production.(*Synthesis*)

CO7: Evaluate a speech signal, speech production system, and speaker verification and speaker identification system.(*Evaluation*)

Suggested Readings

1. L.Rabiner and B-H Juang, Fundamentals of Speech Recognition, Pearson.
2. L.R.Rabinu and R.W Schafer, Digital Processing of Speech Signals, Pearson.
3. D. Jurafsky and J H Martin, Speech and Language Processing, Pearson.
4. L.R.Rabinu and R.W Schafer, Theory and Applications of Digital Speech Processing, Pearson.
5. B Gold, N Morgan and D Ellis, Speech and Audio Signal Processing: Processing and Perception of Speech and Music, Wiley.

ECNT0041: INTRODUCTION TO NANOTECHNOLOGY

(3 credits – 45 hours)

Objectives: *This course will introduce the students to Nanotechnology. The course is designed to build up a basic understanding of the nano concepts. It will provide the students the knowledge of synthesis of nanomaterials, their characterization techniques as well as touch upon some applications of nanotechnology.*

Module I (10 hours)

Basics of Nanotechnology: Importance of Nanotechnology, History of Nanotechnology, Properties of Nanomaterials, Difference between Bulk and Nanomaterial, Molecular building blocks for nanostructure systems, Forces between atoms and molecules - Particles and grain boundaries – strong Intermolecular forces – Electrostatic and Vander Waals forces between surfaces.

Module II (12 hours)

Physics of nanomaterials: Atomic scale structure of nanoparticles, nanotubes, nanowires, nanodots etc.; electronic and optical characteristic properties of quantum dots, quantum wires and quantum wells; concept of quantum confinement: 0D, 1D and 2D nanostructures; Size effects – Fraction of Surface Atoms – specific Surface Energy and Surface Stress. Nanofluidics, Nanophotonics, Nanothermodynamics, Plasmonics – plasmons and surface plasmons, SPR, Core-shell quantum dots and quantum-dot-quantum wells.

Module III (12 hours)

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

Module IV (5 hours)

Characterization methods: Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), X-ray diffraction spectroscopy (XRD)

Module V (6 hours)

Applications: Nanosensors and nanoelectronics, Micro and Nano electromechanical systems, Photonic crystals, Nanopiezotronics.

COURSE / LEARNING OUTCOMES

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

CO1: Recognize the principles underlying the field of Nanotechnology. (*Knowledge*)
CO2: Discuss the concepts underlying this disruptive field of new technology. (*Comprehension*)
CO3: Apply this knowledge for fabricating new materials and devices in the nanoscale. (*Application*)
CO4: Analyze new materials and devices in the nanoscale using various characterization tools. (*Analyze*)
CO5: Synthesize new nano-structured materials through various synthesis methods.(*Synthesis*)
CO6: Evaluate synthesized materials for their various properties. (*Evaluation*)

Suggested Readings

1. G. L. Hornyak, J. Dutta, H. F. Tibbals, A. Rao Introduction to nanoscience CRC Press
2. G. L. Hornyak, J. Dutta, H. F. Tibbals, A.Rao Introduction to nanotechnology CRC Press
3. T. Pradeep, Nano: The Essentials McGraw Hill
4. D. Maclurcan and N. Radywyl (Eds.) Nanotechnology and Global Sustainability CRC Press
5. E. Lichtfouse, J. Shwarzbauer, D. Robert, Environmental Chemistry for a Sustainable World Vol.2 Springer Verlag

ECDP6002: DIGITAL SIGNAL PROCESSING LAB

(2 credits)

Write Matlab code for the following:

1. Generation of various unitary signals.
2. Sampling and see the effect of aliasing.
3. Calculate linear convolution of two sequences.
4. Circular convolution of two sequences.
5. Obtain correlation of two sequences.
6. DFT of a signal.
7. Obtain FFT (decimation in time) of a signal.
8. Calculate FFT (decimation in Frequency) of a signal.
9. Design various FIR filters.
10. Design various IIR filters.
11. Find Discrete Wavelet Transform of a sequence.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify the different MATLAB functions useful for DSP (*Knowledge*)
CO2: Recall the various theories/phenomenon to do the simulation in MATLAB. (*Knowledge*)
CO3: Identify the particular methodology to be adopted for writing the various programs in MATLAB. (*Knowledge*)
CO4: List out the various software tools requirements for DSP. (*Knowledge*)

CO5: Classify a system design problem in various parts to be solved/ simulated in MATLAB. (*Comprehension*)

CO6: Describe the various component/module of the MATLAB program of a particular problem. (*Comprehension*)

CO7: Explain the algorithm behind any program. (*Comprehension*)

CO8: Interpret the results obtained properly. (*Analyze*)

CO9: Enhanced comprehension and appreciation of how concepts are related from one course to another to form a unified knowledge base. (*Comprehension*)

CO10: Extend the MATLAB programs in system design perspective. (*Comprehension*)

CO11: Apply mathematical skills and how these skills are important in writing MATLAB programs for DSP. (*Application*)

CO12: Construct software implementation skills and design skills especially from a systems perspective. (*Application*)

CO13: Analyze or study the advance topics like Multivariate signal processing in MATLAB. (*Analyze*)

CO14: Troubleshoot different errors encountered in developing a MATLAB program. (*Analyze*)

CO15: Analyze different digital filters in FDA tool of MATLAB. (*Analyze*)

CO17: Compile a technical report on the different experiments. (*Synthesis*)

CO18: Develop a knowhow on DSP using MATLAB. (*Synthesis*)

CO19: Improve skill to simulate, design and analysis of different discrete time signals and signal processing techniques (*Synthesis*)

CO20: Evaluate the simulated results. (*Evaluation*)

CO21: Justify the results with proper mathematical relationship. (*Evaluation*)

CO22: Contrast on limitations of the program developed. (*Evaluation*)

Suggested Readings

1. John G. Proakis, Digital Communications, 4th edition, McGraw Hill, 2001.
2. Stephen G. Wilson, Digital Modulation and Coding, Pearson Education (Asia) Pte. Ltd, 2003.
3. Simon Haykin, Digital communications, John Wiley and sons.
4. Wayne Tomasi, Advanced Electronic communication systems, 4th Edition Pearson Education Asia.
5 B.P.Lathi, Modern digital and analog communication systems , Oxford University Press.

ECRS6003: RESEARCH SEMINAR I - MTECH

(2 credits)

Objectives: *The 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 during the last two semesters of the M. Tech programme. 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

1. Literature survey on a chosen topic
2. Presentation on the chosen topic, comprising the following three components:
   a. Presentation
   b. Report
   c. Viva voce examination

COURSE / LEARNING OUTCOMES

At the end of this Seminar students will be able to:

CO1: List sources of primary and secondary data for review of a topic of interest. (*Knowledge*)

CO2: Locate various sources of primary and secondary data for review of a topic of interest. (*Comprehension*)

CO3: Prepare a review report on topic of interest from the various listed sources of information. (*Application*)

CO4: Illustrate scientific concepts for a topic of interest with simple words, diagrams, explanations, conclusions etc. (*Analysis*)

CO5: Arrange the related information gathered and present it. (*Synthesis*)

CO6: Summarize research findings on a specific topic in the form of a review article. (*Evaluation*)

ECNE6004: NANOTECHNOLOGY LAB

(2 credits)

1. Calculate molarity for different solutions. Learn to use the scientific balance (adjustments, taring, etc.)
2. Prepare stock solution of the following (100 ml)
   i. 10mM $Zn(NO_3)_2 . 6H_2O$
   ii. 10mM 100ml $C_6H_{12}N_4$
   iii. 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.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Define the basics of chemical synthesis procedure of various Nano materials. (*Knowledge*)

CO2: Define the basic procedure of characterizing various Nano-materials (*Knowledge*)

CO3: State the rules of chemical synthesis labs (*Knowledge*)

CO4: Explain the working and operation of the different instruments/devices used in the lab (*Comprehension*)

CO5: Describe about the disposal of wastes from nanotechnology based activities (*Comprehension*)

CO6: Develop simple nanotechnology based devices providing low cost solutions to local issues(*Application*)

CO7: classify and analyze the various characterizing tools for the desired characteristics(*Analyze*)

CO8: Synthesis of nanomaterial with the desired shape and size (*Synthesis*)

CO9: Evaluate the performance of different synthesized Nano materials for specific application by characterizing with appropriate characterizing tool (*Evaluation*)

CO10: Evaluate the performance of different Nano materials based sensors and devices (*Evaluation*)

ECDC6006: ELECTRONIC DEVICES AND CIRCUITS LAB
(2 credits)

1. To Study the Characteristics of Zener Diodes.
2. Static Characteristics of a Bipolar Junction Transistor – a) CE Mode and b) CB Mode
3. Transistor as a switch.
4. To Study The Characteristics of JFET.
5. Series voltage Regulator.
6. Design of Power supplies: Rectifier (capacitor filter), voltage doubler / quadrupler.
7. LDR and Phototransistor.
8. Design of amplifiers: Transistor amplifiers with and without feedback.
9. Differential amplifiers.
10. Design of oscillators(using PSpice).

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify electronic devices and tools used in the lab. *(Knowledge)*
CO2: Illustrate how electronic devices and tools are operated/connected for making circuits. (*Comprehension*)
CO3: Apply knowledge and understanding of electronic devices and their operation principles to making electronic circuits. (*Application*)
CO4: Analyze complex electronic circuits. (*Analysis*)
CO5: Design electronic circuits using different devices and components to perform certain operations. (*Synthesis*)
CO6: Compare performances of different electronic circuits for various applications. (*Evaluation*)

BTECAE6007: ANALOG ELECTRONIC CIRCUIT LAB
(2 credits)

1. To Study the Characteristics of Zener Diodes.
2. Static Characteristics of a Bipolar Junction Transistor (CE Mode)
3. To Study The Characteristics of JFET
4. Series voltage Regulator .
5. Design of amplifiers: Transistor amplifiers with and without feedback.
6. Inverting and non-inverting op-amps
7. Op-amp linear applications: adders, subtractors.
8. Op-amp based active filters.
9. 555 timer applications.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Able to recognise different electronic components and devices. (*Knowledge*)
CO2: Able to explain the working principle and operate the various components used in the laboratory. (*Comprehension*)
CO3: Able to perform various experiments using the electronics components. (*Application*)
CO4: To practically analyse the characteristics of various electronic components and circuits such as diodes, BJTs, FETs, voltage Regulators, amplifiers and filters. (*Analyze*)
CO5: To troubleshoot problems involved in designing of an electronic circuit. (*Analyze*)
CO6: Able to assemble and design the various electronic circuits. (*Synthesis*)
CO6: Able to practically determine the various parameters of electronic circuits. (*Evaluation*)

ECRS6008: RESEARCH SEMINAR II - MTECH

(4 credits)

Tasks to be performed by the students during this research Seminar include

1. Preparation of the Project Proposal that will be developed during semesters 3 and 4 and/or extensive literature survey leading to the project proposal
2. Presentation on the proposed proposal comprising the following three components:
   a. Presentation
   b. Report
   c. Viva Voce Examination
3. Extra credits will be given for any publication during this phase.

COURSE / LEARNING OUTCOMES

At the end of the Research Seminar students will be able to:

CO1: List sources of primary and secondary data for review of a topic of interest. (*Knowledge*)
CO2: Locate various sources of primary and secondary data for review of a topic of interest. (*Comprehension*)
CO3: Prepare a review report on topic of interest from the various listed sources of information. (*Application*)
CO4: Illustrate scientific concepts for a topic of interest with simple words, diagrams, explanations, conclusions etc. (*Analysis*)
CO5: Arrange the related information gathered and present it. (*Synthesis*)
CO6: Summarize research findings on a specific topic in the form of a review article. (*Evaluation*)

ECMP6009: PROJECT PHASE I - MTECH

(12 credits)

Objectives: *During this phase the student will start a research project applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester*

E-resource for learning:
LaTeX, www.spokentutorial.org

COURSE / LEARNING OUTCOMES

At the end of Project Phase Istudents will be able to:

CO1: Select a project of interest. (*Knowledge*)
CO2: Defend the topic of interest for continuing work, by doing initial studies on it. (*Comprehension*)
CO3: Prepare a working methodology for the project for its successful completion. (*Application*)
CO4: Design and experiment on the selected project. (*Analysis*)
CO5: Devise tools and methods for experimenting and troubleshooting for getting expected outcomes. (*Synthesis*)
CO6: Explain, justify and defend the project work by presenting the work and writing a report. (*Evaluation*)

ECDL6010: DIGITAL ELECTRONICS AND LOGIC DESIGN LAB

(2 credits)

1. To study and verify the truth table of logic gates.
2. To realize half/full adder and half/full subtractor.
3. To convert given binary numbers to gray codes.
4. To verify the truth table of MUX and DEMUX.
5. To verify the truth table of one bit and four bit comparators using logic Gates.
6. To study shift register in all its modes i.e. SIPO/SISO, PISO/PIPO.
7. Realization of 3-bit Asynchronous counter and Mod-N counter design
8. Realization of 3-bit synchronous counter design.
9. Truth table verification of Flip-Flops: (i) RS-Type, (ii) D- Type, (iii) T- Type, (iv) J-K Master Slave
10. Realization of 2:4 decoder and 4:2 encoder design.
11. Design and testing of Ring counter/ Johnson counter.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify and recognize the various logic gate ICs and other components and instruments used in DLD lab (*Knowledge*)
CO2: Identify the problems related to solving Boolean algebra (*Knowledge*)
CO3: Demonstrate the working and operation of hardware involved in designing and building of digital circuits (*Comprehension*)
CO4: Apply Boolean laws for solving and minimizing logic functions practically (*Application*)
CO5: Practically analyze different combinational and sequential circuits (*Analysis*)
CO5: Design and build various combinational circuits and sequential circuits (*Synthesis*)
CO6: Practically examine and verify the behavior of the different digital circuits(*Evaluation*)

ECAC6011: ANALOG INTEGRATED CIRCUITS LAB

(2 credits)

Any ten or more experiments from the following are to be performed depending on the no of laboratory classes.

1. Inverting, Non Inverting amplifier using op-amp
2. Adder – Subtractor using op-amp
3. Integrator – Differentiator using op-amp
4. Comparator – Zero crossing detector using op-amp
5. Schmitt trigger using op-amp
6. Triangular wave generator using op-amp
7. Monostable or Astable multivibrator using op-amp
8. Active Filters– LPF 1st and 2nd order using op-amp
9. Active Filters- HPF 1st and 2nd order using op-amp
10. Digital to analog converter using op-amp
11. Analog to Digital converter using op-amp.
12. 555 Timer application as monostable or astable multivibrator
13. Instrumentation amplifier
14. RC phase shift oscillator using op-amp
15. Wein Bridge oscillator using op-amp

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

- CO1: Identify and recognize the components and ICs (741 and 555) used in the lab. (*Knowledge*)
- CO2: Explain and demonstrate the working and operation of operational amplifier (741) and IC555 and other components and hardware used in the lab. (*Comprehension*)
- CO3: Compute the important parameters required, in designing of analog circuits using operational Amplifiers.(*Application*)
- CO4: Experiment with different types of circuits based on operational amplifiers and some specialized ICs.(*Application*)
- CO5: Troubleshoot analog circuits by analyzing the output based on design.(*Analysis*)
- CO6: Design circuits using operational amplifiers for various applications. (*Synthesis*)
- CO7: Develop analog circuits based on specified requirement using operational amplifiers. (*Synthesis*)
- CO8: Evaluate the performance and characteristics of the various op-amp based analog circuits designed in the lab. (*Evaluation*)

ECMI6012: MINI PROJECT I

(2 credits)

Mini projects of the fourth semester are assigned to students individually or in groups by the Department under the supervision of the designated faculty member. The objective of this mini project is to train the students to design, simulate or study mini electronic or communication systems which will give them hands on experience in re-creating the principles they have studied in their engineering classes.

COURSE / LEARNING OUTCOMES

At the end of Mini Project I students will be able to:

- CO1: Define Electronic components like diodes, transistors etc. (*Knowledge*)
- CO2: Define standard signals and LTI system.(*Knowledge*)
- CO3: Define fundamental blocks of communication system.(*Knowledge*)
- CO4: Explain the working principle of a diode, transistors. (*Comprehension*)
- CO5: Explain mathematical concept of an LTI system. (*Comprehension*)
- CO6: Explain the fundamental blocks of communication system(*Comprehension*)
- CO7: Determine the different components, circuits required in designing a particular project. (*Application*)
- CO8: Compute the different parameters, specifications & values of electronic components, etc required for developing the project(*Application*)
- CO9: Analyze the working principle of different electronic circuits like adaptor, filter etc. (*Analysis*)
- CO10: Analyze the working principle of different communication related circuits. (*Analysis*)
- CO11: Design a mini electronics and basic communication system based project using different electronic components.(*Synthesis*)
- CO12: Evaluate the performance of the developed mini electronic and communication system project. (*Evaluation*)

ECMP6013: PROJECT PHASE II - MTECH

(16 credits)

Objective: *During this phase the student will carry forward and complete the work that they have started in Phase I. It is expected that the student will publish at least one research paper in a well-known journal to augment their work during this phase. Published papers will carry extra weightage during evaluation. The mode and components of evaluation and the weightages attached to them shall be published by the Department at the beginning of the semester.*

E-resource for learning:

LaTeX, www.spokentutorial.org

COURSE / LEARNING OUTCOMES

At the end of Mini Project II students will be able to:

CO1: Select a project of interest. (*Knowledge*)
CO2: Defend the topic of interest for continuing work, by doing initial studies on it. (*Comprehension*)
CO3: Prepare a working methodology for the project for its successful completion. (*Application*)
CO4: Design and experiment on the selected project. (*Analysis*)
CO5: Devise tools and methods for experimenting and troubleshooting for getting expected outcomes. (*Synthesis*)
CO6: Explain, justify and defend the project work by presenting the work and writing a report. (*Evaluation*)

ECOE6014: OPTICAL ELECTRONICS LAB

(2 credits)

1. To study experimentally the Electro Optic effect using He –Ne laser and Lithium Niobate crystal.
2. To measure the wavelength of He-Ne Laser light using Fresnel Biprism.
3. To measure the width of a single slit using diffraction.
4. To measure the diameter of thin wire using diffraction.
5. To measure the Separation of two pin holes using diffraction.
6. To measure Brewster angle of a glass plate and its refractive index
7. To study and Produce circularly polarized light by Fresnel Rhomb
8. To measure the number of lines in a transmission grating.
9. To measure the wavelength of He – Ne Laser light using a grating.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify and recognize the various optical components. (*Knowledge*)
CO2: Explain the modulation of light that occurs due to electro-optic effect (*Comprehension*)
CO3: Explain the important characteristics of light and other optical components used in the lab. *(Comprehension*)
CO4: Measure basic width, diameter and separation using diffraction (*Application*)
CO5: Measure the wavelength of LASER light using bi-prism and grating (*Application*)
CO6: Examine and analyze the important characteristics of light. (*Analysis*)
CO7: Apply the knowledge of the subject and build a minor project demonstrating the study of various characteristics of different light sources. (*Synthesis*)
CO8: Compare and assess the various characteristics of different sources of light. (*Evaluation*)

ECES6015: EMBEDDED SYSTEM AND APPLICATION LAB
(2 credits)

1. Introduction to development board (8051)
2. LED and its pattern
3. Seven segment display
4. LCD interfacing
5. Keyboard interfacing.
6. ADC and DAC interfacing
7. Motor driver
8. Relay Driver
9. Serial communication
10. Assignment based on above mentioned experiments.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Write assembly language and C program using 8051 microcontroller (*Knowledge*)
CO2: Familiarize with the tools, microcontroller boards and simulators used in embedded system lab. (*Knowledge*)
CO3: Explain the instruction set of 8051 microcontroller. (*Comprehension)*
CO4: Explain the concept and operation of assemblers and development board used in Lab (*Comprehension*)
CO5: Perform various experiments using 8051 microcontroller. (*Application*)
CO6: Apply knowledge of programming for interfacing (*Application*)
CO7: Relate different peripheral devices with 8051 microcontroller. (*Analysis*)
CO8: Assemble various I/O devices with 8051 microcontroller (*Synthesis*)
CO9: Examine the performance of 8051 based embedded systems (*Evaluation*)

ECSP6016: STATISTICAL SIGNAL PROCESSING LAB
(2 credits)

The experiment has to be in MATLAB or with any other such tool.

1. Frequency interpretation of Random Process.
2. Realization of filters (FIR, IIR, Innovation Filter, whitening filter)
3. Wold's Decomposition
4. Autocorrelation and PSD of AR, MA and ARMA process
5. Realization of optimal filters.
6. LPC
7. LMS, NLMS, RLS algorithm.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Define scalar and multiple random variables using theory of probability.(*Knowledge*)
CO2: Define power spectral density of stationary random process. (*Knowledge*)
CO3: Define LMS, NLMS and RLS algorithm. (*Knowledge*)
CO4: Explain the concept of Random variable and Random process. (*Comprehension*)
CO5: Explain AR, MA and ARMA models. (*Comprehension*)
CO6: Explain the basic properties of estimations like MSME, Mean absolute error, MAP estimation etc. (*Comprehension*)
CO7: Explain the estimation of signal in presence of White Gaussian Noise using Linear Minimum Mean-Square Error (LMMSE). (*Comprehension*)

CO8: Compute autocorrelation and Power spectral density of AR, MA and ARMA process. (*Application*)
CO9: Realize and compute various parameters of FIR, IIR, Innovation, Whitening and optimal filters. (*Application*)
CO10: Analyze the frequency interpretation of Random Process. (*Analysis*)
CO11: Analyze the working principles of FIR, IIR, Innovation and Whitening Filters. (*Application*)
CO12: Analyze the working of LMS, NLMS, RLS algorithm. (*Application*)
CO13: Design power spectrum estimators, linear and nonlinear transformation of stochastic processes. (*Synthesis*)
CO14: Implement LMS, RLS algorithm. (*Synthesis*)
CO15: Evaluate the power spectral densities of different random signals. (*Evaluation*)
CO16: Evaluate the performance of different filters to filter random signals. (*Evaluation*)

ECCM6017: OPTICAL COMMUNICATION LAB
(2 credits)

1. Setting up Fiber Optic Analog Link using 650 nm wavelength LED
2. Study of Bending Loss over Optical Fiber
3. Study of radiation pattern of LED
4. Setting up an AC characteristics of an Intensity Modulation LASER and Fiber Optics system
5. Setting up an analog Time Division Multiplexed and Demultiplexed signal
6. Setting up the Frequency Modulation Technique
7. Study of Pulse Wide Modulation
8. Bit Rate Measurement
9. Setting up of Fiber Optics voice link using IM/FM/PWM Technique.
10. Study of various types of losses that occur in optical fibers and measure the loss in dB of optical fiber patch cords individually and also connected in tandem using an in-line adaptor.
11. Computer to Computer communication using RS232 interface via Fiber Optic Link.
12. Study of the performance of an analog and digital, free space communication system.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify and recognize the various components of a Fiber Optics Link (*Knowledge*)
CO2: Identify and recognize the different types of optical fibers and other components of Fiber Optic Communication lab such as optical sources, detectors, amplifiers and connectors, etc. (*Knowledge*)
CO3: Explain the phenomena of light transmission through an optical fiber link (*Comprehension*)
CO4: Examine and analyze the important components/parameters/ characteristics of a fiber optic link. (*Knowledge*)
CO5: to measure basic fiber parameters (*Application*)
CO6: to measure propagation loss/attenuation in optical fiber (*Application*)
CO7: Examine and analyze the important components/parameters/ characteristics of a fiber optic link (*Analysis*)
CO8: Design a Fiber Optic analog and digital Link (kit and optical bench) (*Synthesis*)
CO9: Apply the knowledge of the subject and build a minor project demonstrating some applicability in practical scenario (*Synthesis*)
CO10: Design and simulation of a fiber optic communication system and related parameters/fiber characteristics in Matlab (*Synthesis*)

CO11: Compare and assess the various modulation techniques employed in FOCS (IM, FM, PWM, TDM) (*Evaluation*)

ECSA6018: EMBEDDED SYSTEMS AND APPLICATIONS LAB

(2 credits)

1. Introduction to MPLAB and Embedded C.
2. LED interfacing with PIC Microcontroller
3. 7 Segment display interfacing with PIC Microcontroller
4. LCD interfacing with PIC Microcontroller
5. Keyboard interfacing with PIC Microcontroller
6. ADC and DAC interfacing with PIC Microcontroller
7. Serial Communication using PIC Microcontroller
8. Timer using PIC Microcontroller
9. Interrupt using PIC Microcontroller
10. Basic programming using AVR Microcontroller

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Write assembly language and C program using PIC and AVR Microcontroller (*Knowledge*)
CO2: Explain the instruction set of PIC and AVR microcontroller(*Comprehension*)
CO3: Perform various experiments using PIC and AVR microcontroller. (*Application*)
CO4: Relate different peripheral devices with PIC and AVR microcontroller (*Analysis*)
CO5: Assemble various I/O devices with different microcontrollers (*Synthesis*)
CO6: Examine the performance of various microcontroller based embedded systems (*Evaluation*)

ECDS6019: DIGITAL IMAGE AND SPEECH PROCESSING LAB

(2 credits)

Objectives: *This course's objectives are to learn how to perform fundamentals of digital image processing operations such as conversion from RGB to Gray, implementation of various image filtering operations, edge detection operations and some important operations used in Speech Processing using Matlab.*

1. Read a colour image. Convert the RGB Image into gray. And then resize the gray Image into smaller size image. Find out the negative of a given image.
2. Read a colour image. Convert the RGB Image into gray. Perform gamma correction, log transformation and power law transformation on the gray image.
3. Perform 2D convolution between two matrices.
4. Perform Low Pass Filter on a gray image.
5. Perform High Pass Filter and Median filter on a gray image.
6. Perform edge detection on a gray image using sobel, Prewitt, Roberts and Laplacian Operator.
7. Take a speech signal as an input and find out the Short Time Energy of the signal.
8. Take a speech signal as an input and find out the Short Time Average Magnitude of the signal.
9. Take a speech signal as an input and find out the Short Time Average Zero Crossing Rate of the signal.
10. Find out the MFCC of a speech signal.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Review of various MATLAB commands to write simple programs. (*Knowledge*)
CO2: Explain the implementation of fundamentals of digital image and speech processing in MATLAB. (*Comprehension*)
CO3: Perform digital image processing operations such as conversion from RGB to Gray, implementation of various image filtering operations and edge detection operations. (*Application*)
CO4: Perform speech processing operations such as feature extraction operations and finding out the energy, magnitude and zero crossing rate of the speech signal. (*Application*)
CO5: Analyze images by implementing various digital image processing operations such as image filtering, edge detection etc. (*Analysis*)
CO6: Analyze speech signals by implementing various speech processing operations such as feature extraction etc. (*Analysis*)
CO7: Perform digital image and speech processing operations in MATLAB. (*Synthesis*)
CO8: Evaluate the different operations such as implementation of various image filtering operations and edge detection operations, feature extraction operations etc. (*Evaluation*)

ECMM6020: MICROPROCESSORS AND MICROCONTROLLERS LAB
(2 credits)

1. Introduction to 8085 kit and simulator.
2. Addition and Subtraction of two 8 –bit numbers without using H-L pair and with H-L pair.
3. Decimal Addition of two 8-bit numbers using DAA and without DAA Operation
4. Multiplication of two 8-bit numbers.
5. Perform AND, OR, NOT, rotate and shift operation on an 8 bit number.
6. Find the Largest number and smallest number in an Array.
7. Arrange an array in ascending order.
8. Addition of 10 bytes data.
9. Search a bytefrom an array
10. Binary to Gray and Gray to Binary Conversion.
11. Find one's complement and two's complement of an 8 bit no.
12. To generate Fibonacci Series up to 10th term.
13. To count the number of 1's and 0's `in a Register.
14. Interfacing with Traffic Light controller and Stepper motor Controller.
15. Interfacing with 8 channels 8- bit ADC Card and Dual channel 8- bit DAC Card.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify the basic components of the 8085 kit. (*Knowledge*)
CO2: Recall the different instructions/commands, etc. to be used for assembly language programming. (*Knowledge*)
CO3: Explain the concept of microprocessor interfacing techniques. (*Comprehension*)
CO4: Apply the subject knowledge to write programs using ALP in 8085 (*Application*)
CO5: Apply knowledge of programming for interfacing and designing of microprocessor based systems. (*Application*)
CO6: Analyze various Assembly Language Programs and interfacing circuits practically. (*Analysis*)

CO7: Design and develop a microprocessor-based systems (*Synthesis*)
CO8: Assemble the various I/O devices with 8085 (*Synthesis*)
CO9: Evaluate the performance of various microprocessor based systems (*Evaluation*)

ECAC6021: ANALOG COMMUNICATION TECHNIQUES LAB

(2 credits)

1. Realization of "Colpitt Oscillator" using BJT (Bipolar junction Transistor).
2. Realization of "Hartley Oscillator" using BJT (Bipolar junction Transistor).
3. Realization of "Amplitude Modulation Circuit".
4. Realization of "Envelope Detector Circuit" which is used to envelope an AM signal.
5. Realization of "Band pass and Band reject filter".
6. To Study the Characteristic of Single Sideband AM Modulation.
7. To Study Armstrong Frequency Modulator.(using both discrete circuit and kit)
8. To Study the Frequency Division Multiplexing/De-multiplexing with Sinusoidal Wave.
9. To Study Pulse Width Modulation using IC-555 Timer.
10. To Study the Measurement of Noise Figure.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Understanding of the theoretical knowledge through practical (*Knowledge*)
CO2: Comprehension and simulation modulation and demodulation circuits such as AM,FM and PAM. (*Comprehension*)
CO3: Apply basic knowledge of signals and systems. (*Application*)
CO4: Analyze the nature of signals during the transmission & reception.(*Analysis*)
CO5: Design different circuits related to generation and detection of AM based application, carrier generation, filtering applications, multiplexing etc. (*Synthesis*)
CO6: Evaluate analog modulated waveform in time /frequency domain and also find modulation index. (*Evaluation*)

ECDP6022: DIGITAL SIGNAL PROCESSING LAB

(2 credits)

At least eight experiments are to be performed from the following.

1. Different types of Signal generation using MATLAB. (Both continuous and discrete.)
2. Linear Convolution of sequences. (Without using the inbuilt function (conv) available in MATLAB.)
3. Circular Convolution of two Sequences. Comparision of result with the result obtained from Linear convolution.
4. i) Finding Auto correlation of a sequence
   ii) Finding cross correlation of 2 sequences
   iii) Finding power spectral density of a sequence.
5. Finding linear convolution of periodic sequences using DFT and IDFT.
6. Implementation of FFT (Fast Fourier Transform) algorithm
   i) Decimation in Tane (DIT)
   ii) Decemation in Frequency (DIF)
7. Design of FIR filter (lowpass, highpass, bandpass). Using windowing technique (harming window, haming window, rectangular window, Kaiser window)
8. Design of IIR filter. (Design of Butterworth Filter Design of Chebyshev filter).
9. Convolution of long duration sequences using overlap add, overlap save meter.
10. Working with a DSP processor. (fixed point -TMS320C-5X / Floating point) series.
11. Implement convolution (Linear and circular convolution)
12. FIR and IIR implementation.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recognize and outline the basics of MATLAB software (*Knowledge*)
CO2: Identify the built in functions and coding techniques of MATLAB (*Knowledge*)
CO3: Classify and explain the different data types in MATLAB software. (*Comprehension*)
CO4: Demonstrate the applications of Matlab in signal and system manipulations (*Comprehension*)
CO5: Design and simulate digital systems such as digital filters using MATLAB and applying the same in fields like Communication, VLSI etc. (*Application*)
CO6: Classify and analyze various digital signals, transform techniques and filtering techniques using MATLAB simulation (*Analysis*)
CO7: Simulate different digital signals and LTIC digital systems using MATLAB simulation (*Synthesis*)
CO8: Evaluate the performance of different MATLAB coding methods, algorithm for simulation and digital signals processing schemes. (*Evaluation*)

ECMI6023: MINI PROJECT II

(2 credits)

Mini projects are assigned to students individually or in groups by the Department under the supervision of the designated faculty member. The objective of the mini project is to train the students to design, simulate or study mini electronic or communication systems which will give them hands on experience in re-creating the principles they have studied in their engineering classes. Mini projects executed during the fifth semester must display a greater maturity of knowledge than those in the fourth semester.

COURSE / LEARNING OUTCOMES

At the end of Mini Project II students will be able to:

CO1: To recognize the different electronic components and instruments used in building up a basic electronic and communication system. (*Knowledge*)
CO2: To explain the working and operation of different components and related hardware involved in designing a system. (*Comprehension*)
CO3: To explain different problems encountered in designing a system (*Comprehension*)
CO4: To apply the domain knowledge in finding out solutions for real life problems (*Application*)
CO5: To compare and analyze the characteristics/output of various electronic used in the design of the project.(*Analysis*)
CO6: To assemble the various electronic components and design/develop a mini project based on some real life problem. (*Synthesis*)
CO7: To evaluate the performance and output of various electronic components used in the project (*Evaluation*)
CO8: To evaluate the performance and output of the developed project (*Evaluation*)

ECVD6024: VLSI DESIGN LAB

(2 credits)

1. Code the behavior of AND, OR, NOT, NAND, NOR, Ex-OR and Ex-NOR. Repeat the experiment using FPGA board.
2. Behavioral, Structural and Dataflow modeling of Half-Adder. Repeat the experiment using FPGA board.
3. Code the behavioral modeling of Half-Adder in VHDL and use this behavioral model to implement structural modeling of Full-Adder. Repeat the experiment using FPGA board.

4. Code the behavioral modeling of Full-Adder in VHDL and use this behavioral model to implement structural modeling of 4-bit parallel adder. Repeat the experiment using FPGA board.
5. Code the behavioral modeling of 4-bit carry look ahead adder in VHDL. Repeat the experiment using FPGA board.
6. Code the behavioral modeling of 4:1 multiplexer in VHDL and use this model to implement 8:1 multiplexer. Repeat the experiment using FPGA board.
7. Code the behavioral modeling of RS Flip-Flop and modify it to J-K, D and Master Slave J-K Flip-Flop. Repeat the experiment using FPGA board.
8. Code the behavioral modeling of 4-bit binary up-down counter in VHDL. Repeat the experiment using FPGA board.
9. Code the behavioral modeling of 4-bit shift register in VHDL. Repeat the experiment using FPGA board.
10. Code the structural modeling of4-bit synchronous counter. Repeat the experiment using FPGA board.
11. Code the generic modeling of all the gates. Repeat the experiment using FPGA board.
12. Design a state machine for a 4-bit pattern identifier. Pattern to be identified is 0110. Overlap pattern is permitted. Output will be 1 for every pattern to be matched.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Define Hardware Descriptive Language (VHDL and VERILOG). (*Knowledge*)
CO2: Define Combinational and Sequential digital circuits. (*Knowledge*)
CO3: Define Field Programmable Gate Array (FPGA). (*Knowledge*)
CO4: Comprehend the working principles of various combinational and sequential circuits. (*Comprehension*)
CO5: Explain dataflow, behavioral and structural modelling of hardware descriptive language. (*Comprehension*)
CO6: Explain the basic steps in running a program written in VHDL/VERILOG in Xilinx. (*Comprehension*)
CO7: Explain the fundamental blocks present in FPGA. (*Comprehension*)
CO8: Explain the basic steps for interfacing, downloading and executing a HDL program in FPGA. (*Comprehension*)
CO10: Design and simulate list of combinational and sequential digital circuits using Xilinx-VHDL/VERILOG Language. *(Application*)
CO11: Analyze the working principle of list of combinational and sequential digital circuits (*Analysis*)
CO12: Analyze the test bench waveform of the simulated circuits using Xilinx ISE. (*Analysis*)
CO13: Synthesize the list of combinational and sequential circuits using Xilinx tool. (*Synthesis*)
CO14: Implement the simulated circuits in FPGA. (*Synthesis*)
CO15: Evaluate the performance of combinational and sequential circuits in Xilinx. (*Evaluation*)
CO16: Evaluate the Output of combinational and sequential circuits in FPGA. (*Evaluation*)

ECCT6025: DIGITAL COMMUNICATION LAB
(2 credits)

1. To study and implement PPM using IC555 Timer.
2. Study of PCM using Time Division Multiplexing (Trainer based and Simulation).
3. Design and study of a sampling and reconstruction circuit using discrete components.
4. Study of Delta Modulation and Adaptive Delta Modulation using hardware kit.

5. Generation and detection of ASK Modulation and Demodulation using
   a) Hardware kit
   b) Discrete components
6. Generation and detection of FSK Modulation and Demodulation using
   a) Hardware kit
   b) Simulation
7. Generation and detection of PSK and DPSK Signals using
   a) Hardware kit
   b) Simulation
8. Study of QPSK Modulation and Demodulation.
   a) Hardware kit
   b) Simulation
9. Design of a Block Code Encoder. (6, 3)/ (7, 4) Block Code.
10. Design of a PN Sequence Generator.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Define pulse modulation techniques and to recognize the necessary hardware to design them. (*Knowledge*)

CO2: Identify a technique to convert an analog signal into digital signal using sample and hold circuit. (*Knowledge*)

CO3: Define various digital modulation techniques and to recognize the necessary hardware to design them. (*Knowledge*)

CO4: Explain the necessary hardware required for pulse modulation. (*Comprehension*)

CO5: Explain the hardware required in a sample and hold circuit. (*Comprehension*)

CO6: Explain the hardware required for various digital modulation techniques and for PN sequence generation. (*Comprehension*)

CO7: Compute important parameters/factors related to hardware components required for designing of Analog-to-Digital converter, pulse modulation techniques, digital modulation techniques and PN sequence generator. (*Application*)

CO8: Analyze the significance and characteristics of the components used in the hardware for Analog-to-Digital conversion, pulse modulation techniques, digital modulation techniques and PN sequence generation. (*Analysis*)

CO9: Develop hardware for Analog-to-Digital conversion, pulse modulation techniques, digital modulation techniques and PN sequence generation (*Synthesis*)

CO10: Select and evaluate the necessary components required to design hardware for Analog-to-Digital conversion, pulse modulation techniques, digital modulation techniques and PN sequence generation.(*Evaluation*)

ECME6026: MICROWAVE AND ANTENNA ENGINEERING LAB

(2 credits)

1. V-I characteristics of Gunn Diode.
2. Study the characteristics of Square Wave Modulation of Reflex- Klystron tube for NV-9000 .
3. Determine the frequency and wavelength in a rectangular wave guide working on TE10 mode.
4. Determine the SWR and Reflection Co-efficient.
5. Study the function of the Multi-hole Directional Coupler.
6. Study of Scattering parameters of Circulator.
7. Study of Scattering parameters of E-plane Tee and H-plane Tee.
8. Study of Scattering parameters of Magic Tee

9. Study of the Reciprocity theorem for antennas, the variation in the radiation strength at a given distance from the antenna and to perform Polarisation test.
10. Study the Radiation Pattern for Yagi-UDA folded dipole antenna and the Simple dipole λ/2 antenna.

(Following experiments are to be simulated in Matlab)

11. Create a default open ended rectangular waveguide. Vary its properties and display it. Plot the E and H field distribution of this waveguide at 2.1GHz.
12. Create a dipole antenna of length 3m and width 0.5m and then plot its radiation pattern in both polar and rectangular co-ordinate system. Visualize 2D slices from 3D data. Also calculate the HPBW and FNBW from the plot.
13. Create and view a default horn antenna. Vary its properties and plot its radiation pattern. Also calculate the HPBW and FNBW from the plot.
14. Create a default linear antenna array using dipole antenna as individual element. Visualize the geometry of the array, the radiation pattern, directivity and current distribution.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Describe the knowledge on different passive/active components and how to connect them to perform experiments.(*Knowledge*)

CO2: Identify the characteristics and performances of different microwave components, devices and circuits using standard test bench.(*Comprehension*)

CO3: Apply the theoretical knowledge for measuring different parameters experimentally. (*Application*)

CO4: Analyse and test the characteristics and performances of different microwave components, devices and circuits using standard test bench. (*Analysis*)

CO5: Analyse and test the characteristics of dipole and Yagi antenna through radiation pattern plots and polarization matching. (*Analysis*)

CO6: Design and determine the performance characteristics of different antennas and antenna arrays in MATLAB.(*Synthesis*)

CO7: Compare the experimental results with theoretical values and provide a suitable conclusion. (*Evaluation*)

ECAM6027: EMBEDDED SYSTEMS LAB

(2 credits)

1. Introduction to 8051 micro controller boards and AVR Micro controller boards.
2. Introduction to 8086 and 8051 microcontroller simulator.
3. ALP to display a message without array and using array.
4. ALP to transfer one byte and two byte nos. from one set of memory location to another using 8086.
5. ALP to add, subtracts, multiply and divide of one byte and two byte nos. using 8086.
6. ALP to rotate, AND, OR, NOT of one byte and two byte nos. using 8086.
7. ALP to find some mathematical expression using 8086.
8. ALP to transfer one byte and two byte nos. from one set of memory location to another using 8051.
9. ALP to add, subtracts, multiply and divide of one byte and two byte nos. using 8051.
10. ALP to rotate, AND, OR, NOT of one byte and two byte nos. using 8051.
11. ALP to find some mathematical expression using 8051.
12. ALP using Recursive and iterative procedure, timers using 8086.
13. ALP to interface LEDs, 7 Segment display and LCD using 8051.
14. ALP to On/off DIP switches using 8051.
15. ALP to interface ADC and DAC using 8051.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Familiarize with the tools, microcontroller boards and simulators used in embedded system lab. (*Knowledge*)
CO2: Recall the different instructions/commands, etc. to be used for programming (*Knowledge*)
CO3: Explain the concept of assemblers and development board (*Comprehension*)
CO4: Apply the subject knowledge to write programs using 8086 microprocessor and 8051 microcontroller. (*Application*)
CO5: Apply knowledge of programming for interfacing (*Application*)
CO6: Compare and analyze the instruction set of 8086 microprocessor and 8051 microcontroller. (*Analysis*)
CO7: Able to assemble various input and output devices with 8051 microcontroller (*Synthesis*)
CO8: Able to compare and evaluate the performance of 8086 microprocessor and 8051 microcontroller (*Evaluation*)

ECSP6028: SIGNAL PROCESSING LAB

(2 Credits)

At least eight experiments are to be performed from the following.

1. Different types of Signal generation using MATLAB. (both continuous and discrete.)
2. Linear Convolution of sequences. (Without using the inbuilt function (conv) available in MATLAB.)
3. Circular Convolution of two Sequences Compression of result with the result obtained from Linear convolution.
4. Socket Programming (java or c).
    i) Finding Auto correlation of a sequence
    ii) Finding cross correlation of 2 sequences
    iii) Finding power spectral density of a sequence.
5. Finding the convolution of periodic sequence using DFT and IDFT.
6. Implementation of FFT (Fast Fourier Transform) algorithm
    i) Decimation in Tane (DIT)
    ii) Decemation in Frequency (DIF)
7. Design of FIR filter (lowpass, highpass,bandpass). Using windowing technique (harming window, haming, window rectangular window, Kaiser window.
8. Design of IIR filter. (Design of Butterworth Filter Design of Chebyshev filter).
9. Convolution of long duration sequences using overlap add, overlapsave meter.
10. Working with a DSP processor. (fixed point -TMS320C-5X / Floating point) series.
    i) Implement convolution (Linear and circular convolution)
    ii) FIR and IIR implementation.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Familiarize with MATLAB software. (*Knowledge*)
CO2: Define various signals and systems and various operations used in digital systems.(*Knowledge*)
CO3: State various algorithms for fast Fourier transform as well as various digital filters.(*Knowledge*)
CO4: Explain various signals and systems using MATLAB.(*Comprehension*)
CO5: Explain various algorithms for fast Fourier transform using MATLAB. (*Comprehension*)
CO6: Discuss various operations used in digital systems using MATLAB. (*Comprehension*)

CO7: Explain the various digital filters using MATLAB. (*Comprehension*)

CO8: Generate various signals and calculate the output of various operations used in signal and systems using software tools like MATLAB. (*Application*)

CO9: Calculate fast Fourier transform of a signal as well as design various digital filters using MATLAB. (*Application*)

CO10: Analyze various signals and systems using MATLAB. (*Analysis*)

CO11: Analyze various algorithms for fast Fourier transform using MATLAB. (*Analysis*)

CO12: Analyze various operations used in digital systems using MATLAB. (*Analysis*)

CO13: Analyze various digital filters using MATLAB. (*Analysis*)

CO14: Synthesize various signals and systems using MATLAB.(*Synthesis*)

CO15: Synthesize various LTI systems using MATLAB. (*Synthesis*)

CO16: Synthesize various algorithms for fast Fourier transform using MATLAB. (*Synthesis)*

CO17: Synthesize various operations used in digital systems using MATLAB. (*Synthesis*)

CO18: Evaluate the behavior and characteristics of various signals and systems under different conditions. (*Evaluation*)

CO19: Select an LTI system for processing a signal in a given situation using MATLAB. (*Evaluation*)

CO20: Select an algorithm for fast Fourier transform for a specific condition using MATLAB (*Evaluation*)

CO21: Pick an operation to be used in digital systems using MATLAB. (*Evaluation*)

ECMI6029: MINI PROJECT III

(2 credits)

Mini projects are assigned to students individually or in groups by the Department under the supervision of the designated faculty member. The objective of the mini project is to train the students to design, simulate or study mini electronic or communication systems which will give them hands on experience in re-creating the principles they have studied in their engineering classes. The mini projects taken up in the sixth semester are expected to be more advanced than the mini projects taken up in previous semesters.

COURSE / LEARNING OUTCOMES

At the end of Mini Project II students will be able to:

CO1: Recall the concepts of different electronic devices and components (*Knowledge*)

CO2: Explain the working principle of various electronic and communication systems/hardware involved in developing the project. (*Comprehension*)

CO3: Select appropriate components/hardware require for the project design (*Application*)

CO4: Compute/Estimate the important design parameters involved in project. (*Application*)

CO4: Able to analyse the performance and input/output characteristics of all electronic components involved in the project (*Analysis*)

CO5: Assemble all the components and make an integrated electronic systems. (*Synthesis*)

CO6: Examine, demonstrate and evaluate performance of the developed project. (*Evaluation*)

ECOP6030: FIBER OPTIC COMMUNICATION LAB

(2 credits)

1. Setting up a fiber optic analog link using 650nm wavelength LED
2. Setting up a fiber optic analog Link using 950 nm wavelength LED
3. Setting up the frequency modulation technique.
4. Study of bending loss over optical fiber.
5. Study of numerical aperture of an optical fiber.

6. Setting up an analog time division multiplexed and de-multiplexed through optical fiber communication link.
7. Study of the characteristics of laser diodes.
8. Optical Power (P_o) of laser diode vs. laser diode forward current (IF).
9. Monitor photo diode current (IM) vs. laser optical power output (Po).
10. Study of radiation pattern of LED.
11. Study of Pulse Wide Modulation technique through optical fiber link
12. Setting up of fibre-optic link in optical bench
13. Measuring the refractive index of glass using Brewster's Angle

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify and recognize the various instruments/devices and experimental kit used in the fiber optics lab (*Knowledge*)
CO2: Identify and recognize the different types of optical fibers and other components of Fiber Optic Communication lab such as optical sources, detectors, optical amplifiers and connectors, etc. (*Knowledge*)
CO3: Describe and explain the phenomena of light transmission through an optical fiber link (*Comprehension*)
CO4: Examine and analyze the important components/parameters/ characteristics of a fiber optic link (*Comprehension*)
CO5: Measure basic fiber parameters (*Application*)
CO6: Measure propagation loss/attenuation in optical fiber (*Application*)
CO7: Examine and analyze the important components/parameters/ characteristics of a fiber optic link (*Analysis*)
CO8: Design a Fiber Optic analog and digital Link (kit and optical bench) (*Synthesis*)
CO9: Compare and assess the various modulation techniques employed in FOCS (IM, FM, PWM, TDM) (*Evaluation*)

ECTS6031: TRAINING SEMINAR

(2 credits)

Objective: *During the semester break at the end of the third year, students are required to undergo an Industrial Training. The purpose of the Industrial Training is to expose students to real-life industry situations, so that they may be able to apply the engineering knowledge and skills that they have gained through class-room teaching and lab activities, in an on-the-job situation. After the period of training, students are to present their experience in the form of reports and seminar presentations. Students will be evaluated on the basis of seminar, viva voce examination and written reports.*

COURSE / LEARNING OUTCOMES

At the end of Training Seminar students will be able to:

CO1: Familiarize the students with actual industrial scenarios. (*Knowledge*)
CO2: Illustrate the various issues of electronics and communication industry based on their field experience. (*Comprehension*)
CO3: To be capable of applying their domain knowledge and skills gained through classroom teaching and lab activities, in an on-the-job situation. (*Application*)
CO4: Analyse and present their experience in the form of reports and seminar presentations. (*Analysis*)
CO5: To summarize the application of different devices and instruments used in electronics and communication industry (*Comprehension*)
CO6: To relate the acquired knowledge of electronics and communication with the practical industrial scenario (*Synthesis*)

CO7: To examine and evaluate the use of different communication techniques/electronic devices/instruments/concepts learned, in actual industrial scenario (*Evaluation*)

ECCMP6032: MAJOR PROJECT (PHASE I)
(4 credits)

During the last year of their study, B. Tech. students are required to take up a major project. This may be an individual project or a group project. The Major Project is an integral learning experience that encourages students to break away from the compartmentalization of the different courses they have studied during the three years of their study and aims to provide opportunities to explore the inter-relationships and inter-connectedness of the various courses and gather them together into a single learning experience.

The major project focuses upon the following:

- Interdisciplinary: The major project provides a platform for students to apply the knowledge and skills acquired from different courses.
- Collaboration: It encourages students to work in groups over an extended period of time. They clarify the task, plan their work, share the responsibilities and work towards the successful completion of the project.
- Process and Product: Project work focuses on both process and product. The process would include collaboration, gathering and processing of information. The product may take the form of a working model, a complete software package, etc.
- Written and Oral presentation: Project work provides students with opportunities to present their findings as a written thesis in a prescribed format and orally with an intended audience and purpose in mind.

During the first phase in the seventh semester, students are expected to choose the project, prepare a synopsis under the guidance of a project supervisor appointed by the department, present the synopsis to the committee set up for the purpose, get approval for the synopsis and start the project work. Students are expected to submit weekly activity reports and present a progress seminar during this phase. They will also undergo a viva voce examination, in which they will be examined on all the basic areas of the discipline in which they have chosen their project

E-resource for learning
LaTeX, www.spoken-tutorial.org

COURSE / LEARNING OUTCOMES

At the end of Major Project I students will be able to:

CO1: Define the problem statement for the project work.(*Knowledge*)
CO2: Recall the various theories/phenomenon through the background study. (*Knowledge*)
CO3: Define the hypothesis for the project work through literature survey. (*Knowledge*)
CO4: Identify the particular methodology to be adopted for the project work. (*Knowledge*)
CO5: List out the various hardware and software requirements. (*Knowledge*)
CO6: Classify the whole project work in various modules. (*Comprehension*)
CO7: Describe the various component/module of the project. (*Comprehension*)
CO8: Explain the working model of the proposed work. (*Comprehension*)
CO9: Interpret the results obtained properly. (*Analysis*)
CO10: Enhanced comprehension and appreciation of how concepts are related from one course to another to form a unified knowledge base. (*Comprehension*)
CO11: Extend the work for Major project Phase II (*Comprehension*)
CO12: Apply mathematical skills and relate how these skills are important in engineering.(*Application*)
CO13: Construct software implementation skills and design skills especially from a systems perspective. (*Application*)

CO14: Develop technical writing and communication skills. (*Application*)
CO15: Analyze or study the advance electronic or communication systems.(*Analysis*)
CO16: Troubleshoot different problems encountered in designing a system. (*Analysis*)
CO17: Design a part of the whole project. (*Synthesis*)
CO18: Compile a technical report on the part of the project. (*Synthesis*)
CO19: Develop a knowhow on the topic selected for the project. (*Synthesis*)
CO20: Propose a model for the second phase of the project. (*Synthesis*)
CO21: Evaluate the performance of the work done. (*Evaluation*)
CO22: Justify the results with proper mathematical modeling. (*Evaluation*)
CO23: Contrast on limitations of the work done. (*Evaluation*)

ECMP6033: MAJOR PROJECT (PHASE II) AND VIVA VOCE

(8 credits)

During the second phase students are expected to focus on process and completion of the projects and prepare project reports under the guidance of the Supervisors. The internal assessments shall be evaluated by the DPEC and the external assessment shall be done by the external examiner(s) assisted by the DPEC and the supervisor. The modality and components of the internal assessment and their weightages shall be notified at the beginning of each semester. The External assessment shall have the following components:

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

COURSE / LEARNING OUTCOMES

At the end of Major Project II students will be able to:

CO1: Define the problem encountered in Phase-I. (*Knowledge*)
CO2: Recall the various theories/phenomenon through the background study. (*Knowledge*)
CO3: Define the hypothesis for the project work through literature survey. (*Knowledge*)
CO4: Identify the particular methodology to be adopted for the project work. (*Knowledge*)
CO5: List out the various hardware and software requirements. (*Knowledge)*
CO6: classify the whole project work in various modules. (*Comprehension*)
CO7: Describe the various component/module of the project. (*Comprehension*)
CO8: Explain the working model of the proposed work. (*Comprehension*)
CO9: Interpret the results obtained properly. (*Comprehension*)
CO10: Enhanced comprehension and appreciation of how concepts are related from one course to another to form a unified knowledge base. (*Comprehension*)
CO11: Extend the model for future working model (*Comprehension*)
CO12: Apply mathematical skills and how these skills are important in engineering. (*Application*)
CO13: construct software implementation skills and design skills especially from a systems perspective. (*Application*)
CO14: Develop technical writing and communication skills. (*Application*)
CO15: Analyze or study the advance electronic or communication systems. (*Analysis*)
CO16: Troubleshoot different problems encountered in designing a system. (*Analysis*)
CO17: Design a part of the complete system. (*Synthesis*)
CO18: Compile a technical report on the project. (*Synthesis*)
CO19: Develop a knowhow on the topic selected for the project. (*Synthesis*)
CO20: Propose a future scope of the work carried out. (*Synthesis*)
CO21: Should acquire teamwork skills for working effectively in groups. (*Synthesis*)
CO22: Evaluate the performance of the work done. (*Evaluation*)
CO23: Justify the results with proper mathematical modeling. (*Evaluation*)
CO24: Contrast on limitations of the system designed. (*Evaluation)*

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Vision

To be a centre of technological excellence for outstanding education and research in electrical and electronics engineering, contributing to the world socially committed engineers capable of accepting the continuous challenges of technological advancements.

Mission

The department of Electrical and Electronics Engineering of Don Bosco College of Engineering and Technology, School of Technology, Assam Don Bosco University seeks to:

1. Achieve excellence in teaching, research, practice and extension activities in the fields of Engineering in general and Electrical and Electronics Engineering in particular.
2. Provide a strong foundation for the students to make them professionally competent for industry and research.
3. Create an environment for the holistic development of individuals, encouraging them to serve the society with commitment and integrity.
4. Offer necessary support and guidance to individuals to shape their ideas into reality.

Programme Educational Objectives (PEOs)

(i) To create an environment, give opportunity and also encourage the individuals to build a strong foundation of Electrical and Electronics Engineering as well as in related interdisciplinary fields of study, to be able to contribute to the need of the industry and the society at large.

(ii) To make students capable of generating ideas, apply their knowledge and analyse the situations for executing live projects in Electrical and Electronics Engineering, with modern tools, equipment and software.

(iii) To inculcate the habit of teamwork and infuse management skills in the students for their future professional life.

(iv) To guide students to become ethical professionals in their own fields of work and be conscious about the effect of technology on the environment.

DETAILED SYLLABUS

EEAP0002: ADVANCED POWER ELECTRONICS

(3 credits - 45 hours)

Objective: *The use of semiconductor devices has pervaded the industrial applications relating to the field of Electrical, Electronics, Instrumentation and Control Engineering. Power-electronic components find their use in low as well as high power applications. The purpose of this course is to provide a good understanding of the power-electronic components and the behavior of power-electronic controllers by systematically presenting the various advanced aspects of semiconductor devices and power controllers.*

Module I: Power devices (15 hours)

Review of line commutated converters, inverters, voltage control and Power factor improvement. Power Devices: BJT, MOSFET, IGBT and GTO - operating characteristics and gate drive requirements and circuits. Switched - mode rectifier: various power circuit configurations and wave shaping techniques. Synchronous link rectifiers: power circuit configurations, control techniques, applications of converters in load compensation, series compensators, and multilevel converters.

Module II: Inverters (15 hours)

Voltage source inverters- single phase and six step inverters, voltage control and PWM strategies, and implementation aspects, modification of power circuit for four quadrant operation. Current source inverters- single phase and three phase power circuit configuration and analysis. Load commutated inverters- principle of operation, modification of power circuit configuration for low frequency operation. Phase Controllers.

Module III: Converters (15 hours)

Principles of operation of non-isolated DC-DC converter: buck, boost, buck-boost, Cuk, flyback, forward, push-pull, half bridge, full bridge & isolated Cuk Converters etc. Input & output filter design, multi-output operation of isolated converters, MMF equations, Principles of control pulse generation: PWM & PFM. Modelling of the converters using state averaging techniques, Small signal analysis of DC-DC converters and closed loop control.

COURSE/LEARNING OUTCOMES

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

CO1: Relate fundamental semiconductor physics to properties and operation of semiconductor switching devices, and identify and interpret those properties unique to power devices. (*Knowledge*)

CO2: Select an appropriate power semiconductor device for a particular application. (*Application*)

CO3: Predict the voltage and current waveform across a given device for any given converter. (*Comprehension*)

CO4: Apply network theorems to analyse and interpret various power converter topologies. (*Application*, *Analysis*)

CO5: Apply advanced knowledge and analysis techniques to design and critically assess key aspects of power converters such as rectifiers, DC-DC converters and AC-DC inverters. (*Application*)

CO6: Compare applicability of various power electronics circuits, concepts and applications in the context of their impact upon the power network, in particular assessing the impacts on power quality, power factor and harmonic interference. (*Analysis*)

CO7: Research, design, construct and simulate a complete power conversion application based on a complex set of user specifications. (*Synthesis & Evaluation*)

Suggested Readings

1. N. Mohan, T.M. Undeland and W.P. Robbins, Power Electronics: converters, applications and design, John Wiley and Sons.
2. M.H. Rashid, Power Electronics, Prentice Hall of India.
3. B.K. Bose, Power Electronics and A.C. Drives, Prentice Hall.
4. L. Umanand, Power Electronics: essentials and application, Wiley.
5. R.W. Ericson, Fundamentals of Power Electronics, Chapman & Hall.
6. P. T. Krein, Elements of Power Electronics, Oxford Press.

EESP0003: SWITCHGEAR AND ADVANCED POWER SYSTEM PROTECTION

(3 credits - 45 hours)

Objective: *In the present scenario, the deregulated energy market is under competitive environment. To compete with the rivals, market driven power utilities are being forced to improve their productivity and efficiency. System availability needs to be kept very high to ensure maximum continuity of electrical supply with minimum damage to life, equipment and property. This is only possible, if a dedicated and smart control and protection system is present. This course aims at introducing the students to the various advanced topics of switchgear and power system protection.*

Module I: Circuit Breakers (15 hours)

The electric arc and circuit-breaker. Establishing an arc, discharge characteristic of arc, long arc, short arc, energy transfer between electric field and the arc column, energy transfer out of the column. Theories of arc interruption - restriking voltage and energy balance theories and their applications. Switchgear installation and criteria for selection. Circuit breaker ratings, principles of ac circuit breaking, current chopping, switching of capacitive currents. Kilometric faults, resistance switching, dc current interruption. Principles of fusegear. Salient features and characteristics of different arc interrupting media – air, oil, air-blast, SF6, and vacuum.

Module II: Protective Relays (20 hours)

a) General philosophy of protection-Characteristic function of protective relays, basic relay elements and relay terminology, basic construction of static relays, non-critical switching circuits.
b) Protective relays: protection of generators, transformer protection, magnetizing inrush current, application and connection of transformer differential relays, transformer over current protection. Bus protection, Techniques applicable for line protection: long EHV line protection, local and remote backup protection, breaker failure protection.
c) Placement of reactors in power system- Transformer tap changing, Protection of boosters - capacitors in an interconnected power system.

Module III: Digital Protection (10 hours)

Digital signal processing: digital filtering in protection relays, numeric protection, testing Digital filtering in protection relays, digital data transmission, relay hardware, relay algorithms, concepts of modern coordinated control system.

COURSE/LEARNING OUTCOMES

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

CO1: Recall the different aspects and concepts of power system protection basics and state various advanced topics of switchgear and power system protection employed in a dedicated and smart protection system. (*Knowledge*)

CO2: Explain the advanced topics in power system protection such as advanced topics in circuit breaker operation, switchgear, primary and backup protection, Protection of boosters - capacitors in an interconnected power system, digital protection, etc. (*Comprehension*)

CO3: Solve the advanced problem of power system protection; compute the parameters of a system under fault using proper method and equipment. (*Application*)

CO4: Analyze need of keeping the System availability high to ensure maximum continuity of electrical supply with minimum damage to life, equipment and property. (*Analysis*)

CO5: Generalize the philosophy of switchgear and power system protection. (*Synthesis*)

CO6: Examine a particular section of system design for its protective characteristics to ensure optimum reliability. (*Evaluation*)

Suggested Readings

1. C. H. Flurscheim., Power Circuit Breaker Theory and Design, Peter Peregrinus Ltd.
2. J.L. Blackburn, Protective Relaying – Principles and Applications, Marcel Dekkar, INC, New York.
3. B. Ram and Vishwakarma, Power System Protection and Switchgear, TATA McGraw Hill.
4. Y.G. Paithankar, S.R. Bhide, Fundamental of Power System Protection, PHI.
5. T.S.M. Rao, Power System Protection – Static Relays, Tata McGraw Hill.
6. S.P. Patra, S.K. Basu and S. Choudhary, Power System Protection, Oxford IBH Pub.
7. B. Ravindernath and M. Chander, Power System Protection and Switchgear, Wiley Eastern Ltd.
8. K. Regaller, Current Interruption in High Voltage Networks, Plenum Press.
9. Stanley, H. Horowitz, Protective relaying for power systems II, IEEE Press.

EEAE0004: APPLICATIONS OF POWER ELECTRONICS IN POWER SYSTEMS

(3 credits - 45 hours)

Objective: *This course gives an introduction to the fundamental concepts of high voltage dc transmission systems and technology of flexible ac transmission systems to enhance controllability and power transfer capability in ac systems, involves applications of power electronics in power systems in the range of a few tens to hundred megawatts to improve reliability of power supply and opens up new opportunities for controlling power and enhancing the usable capacity of present, as well as new and upgraded lines.*

Module I: HVDC (10 hours)

Need for HVDC, AC vs. DC: Comparative advantages. Converters and their characteristics. Control of the converters (CC and CEA), Parallel and series operation of converters. Equivalence of a dc system in an ac system. Per unit systems. AC-DC load flow analysis

Module II: Power Quality and filters (10 hours)

Control Strategies to improve system stability, Power Quality problems in distribution systems, harmonics, harmonics creating loads, modelling, harmonic propagation, Series and parallel resonances, harmonic power flow, Mitigation of harmonics, filters, passive filters, Active filters, shunt, series hybrid filters, voltage sags and swells, voltage flicker. IEEE standards: shunt compensator and series compensator

Module III: Shunt and series compensators (20 hours)

a) Introduction: Steady state and dynamic problems in AC systems. Flexible AC transmission systems (FACTS), Principles of series and shunt compensation, improvement of transient stability and power oscillation damping using shunt and series compensation.

b) Shunt Compensator: Static VAR compensators (SVC), Thyristor Controlled Reactor(TCR), Thyristor Switched Capacitor(TSC), Fixed capacitor Thyristor Controlled Reactor(FC-TCR), TSC-TCR, Static Synchronous compensator (STATCOM), hybrid VAR generator.

c) Series Compensator: GTO Thyristor Controlled Series Capacitor (GCSC), Thyristor Switched series capacitor (TSSC), Thyristor Controlled series compensators (TCSC), Static synchronous series compensator (SSSC)

Module IV: Regulators and combined compensators (7 hours)

Static voltage and phase angle regulators: voltage and phase angle regulation, power flow control by PAR, TCVR and TCPAR, Basic operating principles and characteristics of Unified power flow controller (UPFC) and Interline Power Flow Controller (IPFC)

COURSE/LEARNING OUTCOMES

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

CO1: Define various Flexible Transmission System Devices and High Voltage Transmission Systems. (*Knowledge*)

CO2: Explain the operation of converters, HVDC transmission systems and various Flexible AC Transmission Systems Devices. (*Comprehension*)

CO3: Find out various power quality problems faced by modern power systems and their solution techniques. (*Application*)

CO4: Compare the different Flexible Transmission System Devices. (*Analysis*)

CO5: Summarize fundamental concepts of flexible ac transmission systems. (*Synthesis*)

CO6: Determine characteristics of various FACTS devices and converters. (*Application*)

Suggested Readings

1. N.G. Hingorani, L. Gyugyi, Understanding FACTS: Concepts and Technology of flexible ac transmission system, Wiley.
2. E.W. Kimbark, Direct current Transmission, Vol. I, Wiley Interscience.
3. J. Arrillaga, High Voltage Direct Current Transmission, Peter Peregrines.
4. K.R. Padiyar, HVDC Power Transmission Systems, New Age International (P) Ltd., Publishers.
5. Y.H. Song and A.T. Johns, Flexible ac transmission systems (FACTS), Institution of Electrical Engineers Press, London.
6. K.R. Padiyar, FACTS controllers for transmission and Distribution systems, New Age international Publishers.
7. J. Arrillaga, C.P. Arnold and B.J. Harker, Computer Modelling of Electrical Power Systems, John Wiley & Sons.
8. G.T. Heydt, Power Quality, Stars in a Circle Publications, Indiana.
9. T.J.E. Miller, Static Reactive Power Compensation, John Wiley and Sons, New York.
10. R.M. Mathur and R.K. Varma, Thyristor - based FACTS controllers for Electrical transmission systems, John Wiley & Sons.

EECS0005: ADVANCED CONTROL SYSTEMS

(3 credits - 45 hours)

Objective: *The objective of this course is to present in detail different topics of advance control engineering like various representation of control system, concept of feedback, design of controller, different models and the stability of different control system.*

Module I: Introduction (8 hours)

Introductory matrix algebra and linear vector space, State space representation of systems, linearization, solution of state equations. Evaluation of state transition matrix (STM). Simulation of state equation using SCILAB SCICOS/XCOS program.

Module II: System representation and transformation (9 hours)

Similarity transformation and invariance of system properties due to similarity transformations, minimal realization of SISO, SIMO, MISO transfer function, discretisation of a continuous time state space model, convert state space model to transfer function model using Fadeeva algorithm.

Module III: Feedback control (10 hours)

Fundamental theorem of feedback control, Controllability and controllable canonical form. Pole assignment by state feedback using Ackermann's formula. Controllable canonical form and numerically stable method based on controllable Hessenberg form. Algebraic Riccati equation using Eigenvalue and Eigenvector methods, iterative method and numerically stable algorithm.

Module IV: Controller design (8 hours)

Controller design using output feedback. Observability and observable canonical forms. Design of full order observer using Ackermann's formula, observable canonical form, observable Hessenberg canonical form, and Bassgura algorithm. Duality.

Module V: Observability based controller (10 hours)

Observer based controller design. Reduced order observer design. Internal stability of a system. Stability in the sense of Liapunov, Asymptotic stability of linear time invariant continuous and discrete time systems. Solution of Liapunov type equation. Model decomposition and decoupling by state feedback. Disturbance rejection. Sensitivity and complementary sensitivity functions, internal model control (IMC).

COURSE/LEARNING OUTCOMES

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

CO1: Explain different state space representation of systems and simulate state equation using SCILAB program. (*Comprehension*, *Analysis*)

CO2: Classify different types of Controllers based on different fundamental theorem. (*Analysis*)

CO3: Demonstrate procedure of designing different controllers using different methods like iterative method and numerically stable algorithm.(*Application*)

CO4: Develop mathematical models and understand the mathematical relationships between the sensitivity functions and how they govern the fundamentals in control systems. (*Synthesis*)

CO5: Explain the design of observability based controllers and internal stability of a system. (*Comprehension*)

CO6: Evaluate system representation using SISO,MISO,SIMO transfer function. (*Evaluation*)

Suggested Readings

1. N.N. Nise, Control System Engineering, 5e, Willey & Sons.
2. B.C. Kuo, Automatic Control System, 4e, Prentice Hall.
3. W.A. Wolowich, Automatic Control Systems, Basic Analysis and Design, Indian Edition, Oxford University Press.
4. K. Ogata, Modern Control Engineering, 5e, Prentice Hall.

EEIN0006: INDUSTRIAL INSTRUMENTATION

(3 credits - 45 hours)

Objective: *The objective of this course is to impart knowledge of different control elements of a control system used in industries. It mainly discusses controllers of different types, their implementation, their characteristics, and various modes of operation*

Module I: Signal Conditioning (10 Hours)

Introduction to Signal Conditioning, Analog-Digital Signal conversions, Process control principles, Identification of elements, Block diagram, The loop Control system, evaluation stability, Regulation-Evaluation criteria, Cyclic response.

Module II: Final Control Element (12 Hours)

Final Control Element: Final control operation, Signal conversions- Analog electrical signal, Digital electrical signals, Direct action – Pneumatic signals; Actuators, Electrical actuators, Pneumatic actuators; Control elements – Fluid valves- Signal conditioning of transducers, Temperature transducers, Flow transducers.

Module III: Industrial Electronics (13 Hours)

Power diode – Power transistor – Power MOSFET – SCR – TRIAC – GTO – IGBT MCT – Protection of power devices. Block diagram of closed loop speed control of DC motors, Necessity of inner current control loop, current sensing, Block diagrams including rectifier and inverter for speed control of AC motors (frequency control only)

Module IV: Control Methods (10 Hours)

Control Loop Characteristics: Control system configurations- Cascade control, Multivariable control, Feed forward control, Split range control, Inferential control, Adaptive control. Control system quality – Loop disturbance, Optimum control, Measure of quality, Stability; Process loop tuning.

COURSE/LEARNING OUTCOMES

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

CO1: Gain knowledge of different control elements of a control system used in industries. (*Knowledge*)

CO2: Explain the physics of pressure, temperature, level and flow measurement, the mechanical and electrical aspects of instruments used to control dynamics of processes and the dynamics of automatic control including proportional control, automatic reset, derivative action and integral timing. (C*omprehension*)

CO3: Demonstrate knowledge of industrial process valve maintenance and instrumentation, including calibration, configuration, troubleshooting, and use of valves with instrumentation.(*Application*)

CO4: Analyse different controllers, their implementation, their characteristics and various modes of operation. (*Analysis*)

CO5: Characterise and tune simple processes and appreciate the relevance of control systems to safety and profitability. (*Synthesis*)

CO6: Decide appropriate tools for the modeling of plant dynamics and design of well-tuned control loops, understand the importance and application of good instrumentation for the efficient design of process control loops for process engineering plants and design simple but effective plant wide control strategies using appropriate heuristics.(*Evaluation*)

Suggested Readings

1. M. H. Rashid, "Power Electronics Circuits, Devices and Application", PHI.
2. G. M. Chute and R. D. Chute, " Electronics in Industry", McGraw Hill Ltd, Tokyo.
3. C.D. Johnson, Process Control Instrumentation Technology, Pearson Education.
4. C.D. Johnson, Microprocessors in Process Control, PHI.
5. G. Stephanopoulos, Chemical Process Control, Prentice-Hall International.
6. S.E. LeBlanc, D.R. Coughanowr, Process Analysis and Control, McGraw-Hill Higher Education.
7. P.B. Deshpande and R.H. Ash, Elements of Computer Process Control with Advanced Control Applications, Instrument Society of America, Prentice Hall.
8. J.K. Paul, Real- Time microcomputer control of Industrial processes, Kluwer Publications, Netherlands.
9. S. K. Singh, Computer Aided Process Control, PHI.
10. D.E. Seborg, T.F. Edgar, D.A. Mellichamp, Process Dynamics and Control, Wiley India.

EEOT0007: OPTIMIZATION THEORY AND APPLICATIONS

(3 credits-45 hours)

Objective: *This subject introduces optimization theory and its importance in solving of engineering problems. Students can learn linear and nonlinear programming, constrained and unconstrained optimization in this subject.*

Module I: Introduction and Linear Programming (18 hours)

a) Importance in solving system engineering problems, Convex sets and functions, affine and convex sets, supporting and separating hyper planes, dual cones and generalized inequalities.
b) Introduction to Linear Programming problem- Formulation, Simplex Method, Dual Simplex Method, Sensitivity Analysis, Duality in Programming.

Module II: Introduction to Nonlinear Programming (10 hours)

Unconstrained optimization-formulation of quadratic optimization problems, gradient descent and steepest descent methods; Quasi-Newton Method, Fibonacci & golden section, Quadratic Interpolation method.

Module III: Constrained Optimization (10 hours)

Direct optimization, Cutting plane methods, methods of feasible direction, analytic center cutting plane methods, Multi-objective optimization-Genetic Algorithm and Particle swarm optimization, Kuhn-Tucker conditions.

Module IV: Dynamic Programming (7 hours)

Principle of optimality, recursive equation approach, application to shortest route, Cargo Loading, allocation & production, schedule problems.

COURSE/LEARNING OUTCOMES

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

CO1: Define and explain the importance in solving system engineering problems using Linear Programming. (*Comprehension*)
CO2: Identify and describe the various types of formulation methods like Simplex Method, Dual Simplex Method. (*Comprehension*)
CO3: Establish the need for linear programming in solving system. (*Application*)
CO4: Describe the dual cones, the nature and performance of various types of the problem by sensitivity analysis and generalized inequalities. (*Comprehension*)
CO5: Compute the formulation of Quadratic Optimization Problems, gradient descent and steepest descent problems. (*Application*)
CO6: Classify the different non-linear programming methods. (*Analysis*)
CO7: Summarize Kuhn-Tucker conditions and compare the use of principle of optimality, recursive equation approach. (*Synthesis*)
CO8: Evaluate the performance characteristics of genetic algorithm and Particle Swarm Optimization. (*Evaluation*)

Suggested Readings

1. S. S. Rao, Optimization theory and applications, Wiley Eastern Ltd.
2. K. V. Mittal, Optimization methods, Wiley Eastern Ltd.
3. R. Fletcher, Practical Optimization, John Wiley and Sons, New York.
4. M. S. Bazaraa , H. D. Sherali and C. Shetty , Nonlinear Programming, Theory and Algorithms, John Wiley and Sons, New York.
5. N. A. Kheir, System modeling and computer simulation, Marcel Decker, New York.
6. G.A Korn., Interactive Dynamic System Simulation, McGraw Hill, N.Y.

EEES0008: EMBEDDED SYSTEMS AND APPLICATIONS

(4 credits - 60 hours)

Objective: *This subject gives an introduction to basics of various types of microcontroller. Also it teaches Assembly as well as C programming of microcontroller 8051 and applications of microcontroller in different measurement systems.*

Module I: Introduction (11 Hours)

History of Microcontroller and microprocessor, Difference between Microcontroller and microprocessor, Introduction to MPU of different categories- such as Microcontroller-8051, AVR etc, their specific features, advantages.

Module II: Microcontroller 8051 (9 Hours)

Introduction, MCS-51 Architecture, Registers, I/O Ports, Memory organization, Hardware interrupts, Timer and Serial input/out.

Module III: Assembly/ C Programming of Microcontroller 8051 (10 Hours)

Instructions- Addressing modes, Arithmetical, Logical Jumps. Loops and Call etc., Interrupts, Timers/ Counters and Serial Communications.

Module IV: Application of MCS-51 (20 Hours)

Interfacing 7-segment display. LCD, Keyboard, principle DAC and ADC using ladder network. Multi-channel programmable parallel data BUS ADC, Multi-channel programmable SPI base ADC. Basic features of an embedded system used for real-time practical application. Data- logger. Development of instrumentation system for measurement of - light intensity, temperature, pressure, flow, frequency, pulse width, voltage, angular speed, pH etc. Generation of PWM wave. PID controller, analytical instruments such as Sequential control and interlock control.

Module V: Introduction to AVR ATmega 16/32 (10 Hours)

Basic port operation, configuration in-built ADC for sampling analog signal, serial data communication through TxD and RxD and fundamental of timer operations.

COURSE/LEARNING OUTCOMES

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

CO1: Select a microcontroller for a given application. (*Knowledge*)
CO2: Explain the use the various functional blocks of a microcontroller. (*Comprehension*)
CO3: Apply knowledge of digital electronics and high level language programming concepts in computing (*Application*)
CO4: Analyse a problem, identify and define the computing requirements appropriate to its solution. (*Analysis*)
CO5: Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs. (*Evaluation*, *Synthesis*)
CO6: Develop skill in simple program writing for 8051 & AVR microcontroller application. (*Synthesis*)

Suggested Readings

1. A.V. Deshmukh , Microcontrollers : Theory and Applications, Tata McGraw-Hill.
2. Md A. Mazidi, J.G. Mazidi and R.D. McKinlay, The 8051 Microcontroller and Embedded system using assembly and C, Pearson Education India.
3. Md A. Mazidi, Sarmad Naimi, Sepehr Naimi, The AVR Microcontroller and Embedded using assembly and C, Prentice Hall.

EEED0009: ADVANCED ELECTRIC DRIVES

(3 credits - 45 hours)

Objective: *This course helps in the detailed analysis of AC and DC drives and control with converters, cyclo-converter and choppers and voltage control of AC motor drives along with stability considerations and application.*

Module I: Modeling of Machines (11 Hours)

Generalized theory and Kron's primitive machine model, Modeling of dc machines, Modeling of induction machine, Modeling of synchronous machine, Reference frame theory and per unit system.

Module II: Induction motor control (12 Hours)

Control of Induction Motor Drive, Scalar control of induction motor, Principle of vector control and field orientation, Sensorless control and flux observers, Direct torque and flux control of induction motor, Multilevel converter- fed induction motor drive, Utility friendly induction motor drive.

Module III: Control of synchronous motor (12 Hours)

Control of synchronous motor, Self-controlled synchronous motor, Vector control of synchronous motor; Cycloconverter-fed synchronous motor drive, Control of synchronous reluctance motor.

Module IV: Control of special motors (10 Hours)

Control of Special Electric Machines; Permanent magnet synchronous motor.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the Kron's primitive model of machines, generalized theory of machines along with reference frame theory etc. (*Comprehension*)

CO2: Explain the various controlling methods of DC and AC machines. (*Comprehension*)

CO3: Employ the modeling methods to model Induction machine, Synchronous machines and DC machines. (*Application*)

CO4: Compare between the different controlling methods used for controlling AC and DC machines. (*Analysis*)

CO5: Relate the modeled machines with the actual machines. (*Analysis*)

CO6: Evaluate the modeling and controlling methods to analyze the outcome of a machine. (*Evaluation*)

Suggested Readings

1. R. Krishnan, Electric Motor Drives: Modeling analysis and control, Prentice hall of India.
2. B.K. Bose, Power Electronics and AC drives, Prentice Hall of India.
3. P. Vas, Vector Control of A.C machines, Clarendon Press, Oxford.
4. H. Leonhard, Control of Electric Drives, Springer, Verilog.
5. T.J.E. Miller, Brushless permanent magnet and reluctance motor drives, Clarendon Press, Oxford.
6. N. Mohan, Advanced Electric Drives: Analysis, Control, and Modeling Using MATLAB/Simulink, Wiley.
7. S.K. Pillai, A First Course on Electrical Drives, New Age International.
8. S.K. Pillai, Basics of Electrical Drives, New Academic Science

EEAP0010: ADVANCED POWER SYSTEM ANALYSIS

(3 credits - 45 hours)

Objective: *This course gives an introduction to the fundamental concepts related to the design, analysis of modern power generation systems and their operation in economic mode, develops awareness of the technical problems associated with operation of such systems and their control, analytical and numerical modeling skills for handling particular problems.*

Module I: Bus Matrices (12 hours)

Building algorithm for bus impedance matrix, Modification of bus impedance matrix for change of reference bus for network changes, Formation of bus admittance matrix and modification, Gauss elimination, Node elimination (Kron reduction), Sparsity, Calculation of Z bus elements for Y bus. Z -matrix for short circuit studies

Module II: Optimal power flow (12 hours)

Introduction, Linear programming and nonlinear programming techniques to optimal power flow problems, Control of active and reactive power, reactive power optimization, Security and contingency studies.

Module III: Hydrothermal Scheduling (13 hours)

Economic load dispatch in thermal and hydro thermal system; Hydroelectric plant model. Energy scheduling, Incremental water rate. Coordination equations for short-range hydrothermal scheduling with fixed head hydro plant. Computational flow-chart. Optimal scheduling of hydrothermal system using discretization and gradient vector approach.

Module IV: Unit Commitment and State Estimation (8 hours)

a) Unit commitment problem. Solution of the problem by priority list scheduling and using dynamic programming principle.
b) Introduction to state estimation, maximum likelihood weighted least square error estimation, State estimate of an AC network.

COURSE/LEARNING OUTCOMES

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

CO1: Define bus admittance matrix, impedance matrix, optimal power flow, unit commitment etc. (*Knowledge*)
CO2: Explain the various optimal power flow problem of power system network. (Comprehension)
CO3: Solve various problems related to power systems. (*Application*)
CO4: Analyze of power generating system in economic mode. (*Analysis*)
CO5: Summarize the fundamental concepts related to the design of modern power system. (*Synthesis*)
CO6: Determine co-ordination equations and evaluate the results for various power system problems. (*Evaluation*)

Suggested Readings

1. G.W. Stagg and A.H EI-Abaid, Computer methods in Power system analysis, McGraw Hill, New York.
2. G. L. Kusic, Computer-Aided Power System Analysis, Prentice Hall of India, New Delhi.
3. I.J. Nagrath and D.P. Kothari, Modern Power System Analysis, TMH, New Delhi.
4. B. R. Gupta, Generation of Electrical Energy, S. Chand & Co. Ltd. N. Delhi
5. J.J. Grainger and W. D. Stevenson, Power System Analysis, McGraw Hill, New York.
6. A. J. Wood and W.F. Wollenberg, Power Generation, Operation, and Control, 2nd Edn., John Wiley & Sons, New York.
7. O. I. Elgerd, Electric Energy Systems Theory: An Introduction, McGraw Hill, New York.

8. P.S.R. Murty, Power System Operation and Control, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
9. R. Bergen, Vijay Vittal, Power Systems Analysis, Prentice Hall of India, New Delhi
10. M.A. Pai, Computer Techniques in Power System Analysis, Tata McGraw hill, New Delhi.

EEIC0011: POWER SYSTEM INTERCONNECTION AND CONTROL

(3 credits - 45 hours)

Objective: *The objective of this course is to learn about power system operation and control as well as different constraint aspects of generation of electrical energy. Also knowledge about operation of restructured power systems is important for understanding electric utilities and deregulation. This course also aims at this aspect of power system economics towards designing markets for electricity.*

Module I: Power System Operation (14 hours)

Control of voltage, frequency and tie-line power flows, Q-v and P-f control loops. Mechanism of real and reactive power control. Load frequency control problem. Models of various subsystems of a generating unit.Governor characteristics.Steady-state and dynamic analysis. Types of Automatic load frequency controls for interconnected power systems, types of energy interchange.

Module II: Voltage and reactive power control (12 hours)

Positive and negative reactive power, power factor improvement, Var requirements during peak and off-peak hours, Line voltage regulation and compensation, Sources of VARS: Var generation by synchronous machines, Automatic excitation control (IEEE type 1)- static and dynamic responses, Shunt compensation by SVS, Series compensation, Shunt reactor, synchronous condensers, FACTS controllers. Voltage control using tap changing and regulating transformer, Excitation systems: requirements, types- ac, dc and static types; Automatic Voltage Regulators- duties, qualities, principle of operation and types.

Module III: Modelling of Turbine, Generator and Automatic Controllers (11 hours)

Steam turbine model, governor model; Modelling of generator for steady state conditions: Alternator parallel operation-effect of change in excitation, change in steam supply, sharing of load; Synchronizing current and power; swing equation; Generator Model for load frequency control; Computer control of power system: hardware and software requirement,Data acquisition, SCADA.

Module IV: Power System Restructuring (8 hours)

Fundamentals of restructured system, Market Architecture, Deregulation, Power system restructuring models based on energy trading and contractual arrangements, Different ISO models, Transmission Pricing in a restructured electricity market, Congestion Management: types- price area based, ATC based and OPF based, Inter zonal and intra zonal congestion management, ATC, ABT, Ancillary Services in restructured electricity market.

COURSE/LEARNING OUTCOMES

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

CO1: State the different constraint aspects of generation of electrical energy and power system interconnection and control. (*Knowledge*)

CO2: Describe the operation of restructured power system in terms of electric utilities and deregulation. (*Comprehension*)

CO3: Solve problems of advanced topics like load-frequency control modeling and solution, Voltage and reactive power control, Deregulation, Power system restructuring, etc. (*Application*)

CO4: Compare the different electricity market models and the related market operation aspects like congestion management, ATC calculation, transmission pricing etc. (*Analysis*)

CO5: Summarize the concept of interconnected system operation together with power system economics towards designing markets for electricity. (*Synthesis*)

CO6: Evaluate interconnected power system for its efficient control and economic operation. (*Evaluation*)

Suggested Readings

1. P.S.R.Murty, Power System Operation and Control, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. L.L. Lai, Power System Restructuring and Deregulation: Trading, Performance and Information Technology, John Wiley and Sons.
3. B.R. Gupta, Generation of Electrical Energy, S. Chand & Co. Ltd. N. Delhi.
4. B.R. Gupta, Er. VandanaSinghal, Power System Operation and Control, S. Chand & Co. Ltd. N. Delhi.
5. P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan, Electrical Power System, PHI Learning Private Limited.
6. Lorrin Philipson, H. Lee Willis, Understanding electric utilities and de-regulation, Marcel Dekker Pub.
7. Steven Stoft, Power system economics: designing markets for electricity, John Wiley and Sons.
8. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, Operation of restructured power systems, Kluwer Academic Pub.
9. Mohammad Shahidehpour, Muwaffaq Alomoush, Restructured electrical power systems: operation, trading and volatility, Marcel Dekker Pub.

EEAI0012: ADVANCED INSTRUMENTATION

(3 credits - 45 hours)

Objective: *The objective of this course is to teach the general concept of measurement system. It gives knowledge of different types of sensors, transmitter and their design. Also it introduces the students to virtual instruments, Data acquisition system, and graphical user interface (GUI)*

Module I: Introduction (12 Hours)

General concepts and terminology of measurement systems, static and dynamic characteristics, errors, standards and calibration. Least square calibration curves, Calibration accuracy, installed accuracy, Effect of measurement error on quality control decision in manufacturing, static sensitivity. Computer aided calibration and measurement, Generalized Mathematical modeling of instruments, Classification of instruments based on their order, response of instruments to standard test input (Step, Impulse, ramp), frequency response studies.

Module II: Sensors and Transmitters (11 Hours)

Sensors, Thermal sensors; Metal resistance versus temperature devices; Resistance temperature detectors, Characteristics of thermistor and thermocouple, Design considerations of thermal sensors. Introduction to transmitters, Two wire and four wire transmitters, Smart and intelligent transmitters, Design of transmitters.

Module III: Signal conditioning, Data acquisition and transmission (12 Hours)

Cable transmission of analog voltage and current signals, Cable transmission of digital data, Fiber optic data transmission, Radio telemetry, Synchro position repeater systems, Slip rings and rotary transformers. Engineered data acquisition and processing Systems. Versatile modular system emphasizing analog signal processing; Instrument inter connection systems, Sensor based computerized data system, Computer aided experimentation, Conditional description of the computer system.

Module IV: Virtual Instrumentation (10 Hours)

Historical perspective, Advantages, Block diagram and architecture of a virtual instrument, Data flow techniques, Graphical programming in data flow, Comparison with conventional programming, Development of virtual Instrument using Graphical User Interface (GUI).

COURSE/LEARNING OUTCOMES

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

CO1: Outline the overall system of measurement and its mathematical modelling. (*Knowledge*)

CO2: Distinguish and explain the different types of sensors and transmitters. (*Comprehension*)

CO3: Demonstrate the use of virtual instrumentation, data acquisition system and graphical user interface in instrumentation. (*Application*)

CO4: Investigate design considerations of thermal sensors. (*Analysis*)

CO5: Design and simulate simple instrumentation systems. (*Synthesis*)

CO6: Evaluate performance parameters of modern industrial grade instrumentation systems. (*Evaluation*)

Suggested Readings

1. E.O. Doebelin, Measurement Systems - Application and Design, Fifth Edition, Tata Mc-Graw-Hill International Edition, New York.
2. D.E. Seborg, T.F. Edgar, D.A. MelliChamp, Process Dynamics and Control, Second Edition, Wiley-India.
3. J.P. Bentley, Principles of Measurement Systems, Third Edition, Addison Wesley Longman Ltd., U.K.
4. C.D. Johnson, Process Control Instrumentation Technology, Eighth Edition, Pearson Prentice Hall.
5. L.K. Wells & J. Travis, LabVIEW for everyone, Prentice Hall, New Jersey.

EEOS0013: OPTIMAL CONTROL SYSTEMS

(3 credits - 45 hours)

Objective: *The objective of this subject is to introduce the students to different optimal control theory, computational methods in optimal control and application of mathematical programming to practical problems.*

Module I: Introduction (10 Hours)

Static and dynamic optimization. Parameter optimization.

Problem formulation, state variable representation of systems, performance measures for optimal control problems, selecting a performance measure, examples.

Module II: Calculus of Variations (12 Hours)

Problems of Lagrange, Mayer and Bolza. Euler - Language equation and transversality conditions, Lagrange multipiliers. Pontryagin's maximum principle theory; application to minimum time, energy and control effort problems and terminal control problem.

Module III: Dynamic programming (13 Hours)

Belaman's principle of optimality, multistage decision processes. Application to optimal Control; Linear regulator problem: matrix Riccati equation and its solution, tracking problem.

Module IV: Computational methods (10 Hours)

Computational methods in optimal control, application of mathematical programming, Singular perturbations, practical examples.

COURSE/LEARNING OUTCOMES

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

CO1: Define different optimal control theory applicable to control system operation. (*Knowledge*)

CO2: Explain problem formulation, state variable representation of systems and selection of performance measures for optimal control problems. (*Comprehension*)

CO3: Apply Euler-Lagrange equation Pontryagin's maximum principle etc. for solution of optimal control problems. (*Application*)

CO4: Analyse using dynamic programming techniques to different optimal control problems. (*Analysis*)

CO5: Conclude about different optimal control methods and their application in different optimal control problems. (*Evaluation*)

CO6: Determine performances of different optimal control systems using computational methods. (*Application*)

Suggested Readings

1. D.E. Kirk, Optimal Control Theory, Prentice-Hall.
2. A.P. Sage and C.C. White II, Optimum Systems Control, 2nd ED., Prentice- Hall.
3. D. Tabak and B.C. Kuo, Optimal Control by Mathematical Programming, Prentice Hall.
4. B.D.O. Anderson and J.B. Moore, Linear Optimal Control, Prentice-Hall.

EEPI0014: PROCESS CONTROL INSTRUMENTATION

(3 credits - 45 hours)

Objective: *The objective of this course is to introduce different process modeling, nonlinear process control, controller characteristics. Also it introduces computer control, direct digital control, and supervisory control as part of advanced process control*

Module I: Process modeling (10 hours)

Introduction to Process control and process instrumentation , Hierarchies in process control systems. Theoretical models, Transfer function, State space models, Time series models, Development of empirical models from process data, Chemical reactor modeling.

Module II: Introduction to Nonlinear process control (14 hours)

Model Reference Nonlinear Controller (MRNC) - MRNC incorporating integral and derivative actions - MRNC for systems with relative order two or higher, Series cascade control of nonlinear systems, parallel cascade control of nonlinear systems, Control of nonlinear , non-minimum phase systems with input multiplicities. Parallel cascade control of non-minimum phase systems with input multiplicities- control of nonlinear systems with significant actuator dynamics, Control of nonlinear systems with actuator delay, nonlinear control of multi variable systems with input or output constraints, problems.

Module III: Introduction to controller characteristics (9 hours)

Process characteristics, process equation, process load, process lag, self-regulation, control system parameters, error, variable range, control parameter range, control lag, dead time, cycling, controller modes, discontinuous controller modes, two-position modes, multiposition mode, floating control mode, continuous controller modes, composite controller modes.

Module IV: Advanced process control (12 hours)

Multi-loop and multivariable control, Process Interactions, Singular value analysis, Tuning of multi loop PID control systems. Decoupling control. Computer control of processes: Direct Digital Control (DDC), Supervisory Control and advanced control strategies.

COURSE/LEARNING OUTCOMES

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

CO1: Define various models for process control. (*Knowledge*)
CO2: Explain role of instrumentation in process control (*Comprehension*)
CO3: Apply model reference non-linear process controller (MRNC) for systems with relative order two or higher (*Application*)
CO4: Analyse different controller characteristics. (*Analysis*)
CO5: Assess the performance of Multi-loop and multivariable control, PID control, Decoupling control systems.(*Evaluation*)
CO6: Compare different computer control of processes: Direct digital control, supervisory control and advance control strategies. (*Analysis*)

Suggested Readings

1. M. Chidambaram, Nonlinear Process Control, New Age International (P) limited publishers, New Delhi.
2. D.C. Johnson, Instrumentation Technology, (7th Edition), Prentice Hall India.
3. Ernest O. Doebelin, Measurement system Application and Design, McGraw Hill International Editions.
4. D.E. Seborg, T.F. Edgar and D.A. Mellichamp, Process Dynamics and Control, John Wiley.
5. Sherman, R.E. (Ed), Analytical instrumentation, Instrument Society of America Publication.
6. F.G. Shinskey, Process Control Systems: Applications, Design and Tuning (3rd Edition), McGraw Hill Book Co.
7. B.W. Bequette, Process control: modeling, design, and simulation, Prentice Hall PTR.
8. K. Krishnaswamy, Process Control, New Age International.

EECN0015: CIRCUIT THEORY AND NETWORKS

(4 credits – 60 hours)

Objective: *The objective of this course is to understand the physical laws that govern the response of circuits and networks. The student should obtain equations to solve circuits in steady and in transitory state through the application of mathematical and software tools.*

Module I (18 hours)

a) Different types of systems and networks: Continuous and Discrete, Fixed and Time varying, Linear and Non-linear, Lumped and distributed, Passive and Active Networks and Systems;
b) Network theorems and their applications in circuit analysis, Formulation of network equations, Source transformations, Loop variable analysis and node variable analysis.

Module II (16 hours)

a) Laplace transform of impulse and sinusoidal steps waveforms for RL, RC, LC and RLC Circuits.
b) Fourier series and Fourier Transform.
c) Transient analysis of different electrical circuits with and without initial conditions
d) Three-phase circuit fundamentals

Module III (18 hours)

a) Graph of network, concept of tree branch, tree link. Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials.
b) Two port networks, Open circuit Impedance and Short circuit admittance parameters, Transmission parameters, hybrid parameters, and their inter-relations.

Module IV (8 hours)

a) Indefinite admittance matrix - their applications to the analysis of active network, Active filter analysis and synthesis using operational amplifier, resonance.
b) Coupled circuits: analysis of coupled circuits, self and mutual inductance, coefficient of coupling.

COURSE/LEARNING OUTCOMES

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

CO1: Define and explain the various network theorems in circuit analysis. (*Knowledge*)
CO2: Identify and describe the various types of systems and networks and the various methods required for formulation of networks equations. (*Comprehension*)
CO3: Establish the need for initial conditions to describe the transient analysis of different electrical circuits. (*Application*)
CO4: Describe the impulse and sinusoidal steps for RL, RC and RLC using Laplace transform and fundamentals of three phase circuits. (*Comprehension*)
CO5: Explain the Fourier series and Fourier transform. (*Comprehension*)
CO6: Compute the applications of Indefinite Admittance Matrix to the analysis of active networks. (*Application*)
CO7: Classify the different two port networks and analyze their inter-relations. (*Analysis*)
CO8: Summarize and compare the use of various network theorems in circuit analysis. (*Synthesis*)
CO9: Evaluate graph of a network, tie-set matrix, loop currents, cut-set matrix and their node-pair potentials (*Evaluation*)

Suggested Readings

1. D Roy Choudhury, Networks and Systems, New Age International
2. Abhijit Chakrabarti, Circuit Theory (Analysis and Synthesis), Dhanpat Rai and Co., New Delhi
3. ME Van Valkenburg, Network Analysis, Prentice Hall
4. Joseph Administer, Electric Circuits, Schaum's Outline Series
5. David A Bell, Electric Circuits, PHI
6. MS Shukhija and TK Nagsarkar, Circuits and Networks, Oxford University Press, 2010
7. William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, TMH.

EEMS0016: ELECTRICAL AND ELECTRONIC MATERIALS

(3 credits – 45 hours)

Objective: *The course is aimed at imparting knowledge of various types of materials that is being used for electrical and electronic equipment. Various properties of the materials will be discussed which will enable engineers to decide on appropriate selection and use of material for desired application.*

Module I: Introduction to Electrical and Electronic Materials (15 hours)

Engineering materials, Classification, properties, Energy bond description. Conductive materials: Ohm's law and relaxation time of electrons: relaxation time, collision time and mean free path. Electric scattering and resistivity of metals, Heat developed in current carrying conductor, thermal conductivity of metals, Superconductivity, cryoconductors.

Module II: Dielectric properties in static field (15 hours)

Polarization and its mechanism, dielectric constant of monoatomic gases

a) dielectric breakdown in liquids: colloidal theory, Bubble theory, Breakdown due to liquid globules
b) dielectric breakdown of solids: Intrinsic breakdown, Frochlich's theory, Theory of Van Hippel, Thermal and discharge breakdown
c) dielectric breakdown in gases : Growth of current, breakdown mechanism, electron ionization coefficient, secondary ionization coefficient, Townsend's criterion
d) Dielectric properties in alternating field: Frequency dependence of electronic polarisiblity, ionic polarization as function of frequency, complex dielectric constant of non dipolar solids, dielectric losses.

Module III: Insulating materials (7 hours)

Dielectric gases, liquid insulating materials, solid insulating materials, modern trends in electrical insulators, insulation measurement, electric strength of liquids, factor influencing the characteristics of insulating system. Effect of moisture on insulating system. Insulating materials for electric and electronic equipments.

Module IV: Magnetic properties of materials (8 hours)

Magnetic material classification, origin of permanent magnetic dipole, Dimagnetism, Paramagnetism, ferromagnetic domains, Magnetostriction, factor affecting permeability and hysteresis loss, anti ferromagnetism, ferrimanetism, magnetic resonance

COURSE/LEARNING OUTCOMES

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

CO1: Define the various types of conductors, semiconductors, insulators and magnetic materials used in Electrical and electronics engineering. (*Knowledge*)
CO2: Classify the different materials into various categories based on their usage and nature. (*Analysis*)
CO3: Analyze the characteristics of the various materials used in Engineering. (*Analysis*)
CO4: Predict the causes for the breakdown in different types of engineering materials. (*Synthesis*)
CO5: Hypothesize the problems in practical conditions. (*Evaluation*)
CO6: Explain and defend the use of different materials used for electrical application. (*Comprehension*)

Suggested Readings

1. CS Indulkar, S Thiruvengadam, An Introduction to Electrical Materials, S Chand Publications, New Delhi
2. SP Seth and PV Gutpa, A Course in Electrical Engineering Materials, Dhanpat Rai Publications, New Delhi
3. A. J. Dekker, Electric Engineering Materials, Prentice Hall.
4. S.K.Bhattacharya, Electrical and Electronic Engineering Materials, Khanna Publishers, New Delhi.
5. S.M. Dhir, Electronic Components and Materials, Tata Mc Graw Hill, New Delhi.
6. J. Allison, Electronic Engineering Materials and Devices, McGraw Hill.

EEMT0017: ELECTROMAGNETIC THEORY

(3 Credits – 45 hours)

Objective: *The aim of the course is to introduce students to electromagnetic theory including vector differential and integral operators, electrostatics, magnetostatics and related applications.*

Module I (14 hours)

a) The coordinate systems, rectangular, cylindrical, and Spherical coordinate system. Coordinate transformation. Gradient of a scalar field, Divergence of a vector field and Curl of a vector field. Their physical interpretation. The Laplacian. Divergence theorem, Stokes' theorem. Useful vector identifies.
b) Electrostatics: The experimental law of Coulomb, Electric field intensity. Field due to a line charge, Sheet Charge and continuous volume charge distribution. Electric flux and flux density; Gauss's law. Application of Gauss's law. Energy and Potential . The potential gradient. The Electric dipole. The equipotential surfaces. Energy stored in an electrostatic field. Boundary conditions. Capacitors and Capacitances. Poisson's and Laplace's equations. Solutions of simple boundary value problems. Method of images.

Module II (10 hours)

a) Steady electric currents: Current densities, Resistance of a conductor; The equation of continuity. Joules law. Boundary conditions for current densities. The EMF.
b) Magnetostatics: The Biot-Savart law. Amperes' force law. Torque exerted on a current carrying loop by a magnetic field. Gauss's law for magnetic fields. Magnetic vector potential. Magnetic field intensity and Ampere's circuital law. Boundary conditions. Magnetic materials. Energy in magnetic field. Magnetic circuits. Application to cathode ray oscilloscope.

Module III (15 hours)

a) Faraday's Law of Induction, Self and Mutual inductance. Maxwell's equations from Ampere's and Gauss's laws. Maxwell's equations in differential and integral forms, Equation of continuity. Concept of displacement current. Electromagnetic boundary conditions. Poynting's theorem, Time- Harmonic EM fields. Application to transformer.
b) Plane wave Propagation: Helmholtz wave equation. Plane wave solution. Plane wave propagation in lossless and lossy dielectric medium and conducting medium. Plane wave in good conductor, surface resistance, depth of penetration.
c) Polarization of EM wave - Linear, Circular and Elliptical polarization. Normal and Oblique incidence of linearly Polarized wave at the plane boundary of a perfect conductor, Dielectric- Dielectric Interface. Reflection and Transmission coefficient for parallel and perpendicular polarizations, Brewstr angle.

Module IV (6 hours)

Antennas: Physical concept of radiation from an antenna. Wave equations in terms of potential functions. The concept of retarded vector potential. Hertzian Dipole: near zone fields, Radiation fields, Radiation resistance, Directive gain and directivity. A magnetic dipole. A short dipole antenna. The Half wave Dipole Antenna. Monopole Antenna. Pattern Multiplication Antenna Arrays, Linear Arrays. Receiving Antennas.

COURSE/LEARNING OUTCOMES

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

CO1: State the various theorems related to Electromagnetism. (*Knowledge*)
CO2: Describe the coordinate systems and their use in Electromagnetic field theory. (*Comprehension*)
CO3: Apply the Electromagnetic field theory in various applications of Electrical and Electronics Engineering. (*Application*)
CO4: Analyze Maxwell's equations and their applications. (*Analysis*)
CO5: Develop the concepts of Electrostatics, Steady Electric Currents, Magnetostatics, Plane Wave Propagation and Antennas. (Synthesis)
CO6: Evaluate the performance of a circuit in presence of Electromagnetic fields. (*Evaluation*)

Suggested Readings

1. W.H. Hayt, Engineering Electromagnetics, TMH
2. T.V.S. Arunmurthy, Electromagnetic Fields (Theory and Problems), S.Chand
3. P.V. Gupta, Introductory Course in Electromagnetic Fields, Dhanpat Rai and Co., 2007
4. S.P. Seth, Elements of Electro Magnetic Fields, Dhanpat Rai Publications
5. Constantine A Balamis, Antenna Theory: Analysis and Design, 3rd Ed., Wiley

EEEI0018: ELECTRONIC INSTRUMENTATION AND MEASUREMENTS

(4 credits - 60 hours)

Objective: *The course is aimed at introducing the concept of measurement and the related instrumentation requirement as a vital ingredient of electronics and communication engineering to learn basic concepts of electronic measurements, importance of signal generators and signal analyzers in measurements and relevance of digital instruments in measurements.*

Module I (14 hours)

a) Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error. DC Voltmeters - Multirange, Range extension/Solid state and differential voltmeters, AC voltmeters - multi range, range extension, shunt. Thermocouple type RF ammeter, Ohmmeters series type, and shunt type, Multimeter for Voltage, Current and resistance measurements.
b) Signal Generator - fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Square pulse, Random noise, sweep, Arbitrary waveform.

Module II (16 hours)

a) Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers.
b) Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO, Measurement of amplitude and frequency.

Module III (16 hours)

a) Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, probes for CRO- Active and Passive, attenuator type, Frequency counter, Time and Period measurement.
b) AC Bridges- Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance - Schearing Bridge. Wheatstone bridge. Wien Bridge, Errors and precautions in using bridges. Q-meter.

Module IV (14 hours)

a) Transducers- active and passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors.
b) Measurement of physical parameters force, pressure, velocity, humidity, moisture, speed, proximity and displacement. Data acquisition systems.

COURSE/LEARNING OUTCOMES

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

CO1: Define and outline the fundamental characteristics of Electrical and electronics measuring Instruments (*Knowledge*)
CO2: Classify and explain the different types of measuring instruments. (*Comprehension*)

CO3: Compute the various parameters related to Electrical and Electronics measuring instruments. (*Application*)
CO4: Analyze various range extension techniques of measuring instruments. (*Analysis*)
CO5: Simulate and analyze the different bridge circuit models. (*Analysis*, *Synthesis*)
CO6: Evaluate the performance of different measuring instruments based on the nature and performance characteristics and assess their importance in measurement. (*Evaluation*)

Suggested Readings

1. A.K. Sawhney, Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai, 2009
2. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, 1st Ed., PHI
3. H. S. Kalsi, Electronic Instrumentation, TMH India
4. D. Patranabis, Sensors and Transducers, 2nd Ed., PHI.
5. David A. Bell, Electronic Instrumentation and Measurements, 2nd Ed., PHI.

EEMN0019: ELECTRO-MECHANICAL ENERGY CONVERSION I

(4 Credits – 60 hours)

Objective: *The objective of this course is to combine mechanics with the fundamentals of electricity and magnetism to apply mathematics, science, and engineering knowledge to the electromechanical energy conversion devices. Further the course aims at understanding electromechanical energy conversion principles and to identify, formulate, and solve electromechanical device problems.*

Module I: Principles of Electro-mechanical Energy Conversion (6 hours)

Introduction, Flow of Energy in Electromechanical Devices, Energy in magnetic systems (defining energy and Coenergy), Dynamic equation of a simple system, Singly Excited Systems; determination of mechanical force, mechanical energy, torque equation, Doubly excited Systems; Energy stored in magnetic field, electromagnetic torque.

Module II: Transformers (14 hours)

a) Single phase transformer : construction, ideal transformer, equivalent circuit, losses and efficiency, all-day efficiency, testing of transformers regulation of transformers.
b) Auto Transformer : single phase auto transformer, volt-amp relation, efficiency, conversion of a two-winding transformer to an auto transformer, saving in conductor material, advantages, disadvantages and applications of auto transformers.

Module III: D.C. Generators (20 hours)

Construction of DC Machines, Armature winding, Emf equation, classification of DC generators on the basis of excitation, Armature Reaction, Commutation, Interpoles and Compensating Windings, Performance Characteristics of D.C. generators, regulation of DC generators.

Module IV: D.C. Motors (20 hours)

Performance Characteristics of D.C. motors, Starting of D.C. motors; Concept of starting (3 point and 4 point starters), torque equation, armature torque and shift torque, Speed control of D.C. motors; Field Control, armature control and Voltage Control (Ward Lenonard method), Electrical braking, Efficiency and Testing of D.C. machines (Hopkinson's and Swinburn's Test).

COURSE/LEARNING OUTCOMES

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

CO1: Define and outline the fundamental characteristics of Electrical and electronics measuring Instruments (*Knowledge*)
CO2: Classify and explain the different types of measuring instruments. (*Comprehension*)
CO3: Compute the various parameters related to Electrical and Electronics measuring instruments. (*Application*)
CO4: Analyze various range extension techniques of measuring instruments. (*Analysis*)
CO5: Simulate and analyze the different bridge circuit models. (*Analysis*, *Synthesis*)
CO6: Evaluate the performance of different measuring instruments based on the nature and performance characteristics and assess their importance in measurement. (*Evaluation*)

Suggested Readings

1. P.S. Bimbhra, Electrical Machines, 17th editions, Khanna Publishers
2. P.S. Bimbhra, Generalised Theory of Electrical Machines, Khanna Publishers
3. BL Thereja, AK Thereja, A Textbook of Electrical Technology, Vol II, S Chand.
4. I.J. Nagrath, D.P. Kothari, Electrical Machines, Third edition, TMH
5. Parker Smith, Problems in Electrical Engineering, CBS Publishers and distributors
6. J.B. Gupta, Theory and Performance of Electrical Machines, S.K. Kataria and Sons
7. V.K. Mehta, Principles of Electrical Machines, S. Chand and Company.

EELM0020: ELECTRICAL AND ELECTRONIC MEASUREMENTS

(4 credits – 60 hours)

Objective: *This subject is aimed at familiarizing the students with the principle, construction and uses of instruments utilized for the measurement of Current, Voltage, Power, Frequency and Phase beside the measurement of passive elements.*

Module I (20 hours)

a) Error Analysis in Measurements: Source of error – Instruments errors – Human errors – Environmental errors – Combination of errors – Mean and variance – Standard deviation – Limits of error.
b) General features: Construction and principle of operation of moving coil, moving iron, Dynamometer, Induction type, Thermal and Rectifier type deflecting instruments. Deflecting, controlling and damping torques, extension of instrument ranges using shunts, multipliers and instrument transformers. Measurement of low, medium and high resistances, Kelvins double bridge, multimeters, megger, localization of cable faults, loss of charge method.
c) Performance characteristics of instruments, static characteristics, accuracy, resolution, precision, expected value, sensitivity; dynamic characteristics – speed of response, fidelity, lag and dynamic error.

Module II (18 hours)

D.C. and A.C. potentiometers, Measurement of high voltage, Electrostatic instruments, measurement of inductances, capacitance and frequency by A.C. Bridges: Maxwell's bridge – Hay's bridge, Wien's bridge, Anderson Bridge, High voltage Schering Bridge. Measurement of power in polyphase circuits, various wattmeter connections. A.C. and D.C. energy meters. Special meters – power factor meter, frequency meter, q-meter

Module III (8 hours)

a) C.R.O. construction and principle measurement of voltage, current, frequency and phase by oscilloscope, potentiometric recorders
b) Electronic voltmeters – analog and digital. Digital multimeters, Audio oscillators, signal generators and frequency counter.

Module IV (14 hours)

a) Instrument Transformers: Principle of Current and Potential transformers- Phasor diagram – nominal ratio – phase angle error, Ratio error – Constructional Features and applications.
b) Transducer: Electrical transducer, resistive transducer, thermistor, strain gauges, inductive transducer, LVDT, piezoelectric transducer, temperature transducers.

COURSE/LEARNING OUTCOMES

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

CO1: Recognize various types of measuring instruments used in electrical systems for measurement of -different electrical and non-electrical parameters. (*Knowledge*)
CO2: Explain the working principles of different types of electrical measuring instruments. (*Comprehension*)
CO3: Use various instruments like ammeter, voltmeter, wattmeter, current transformer, potential transformer, potentiometer, bridges etc for measurement of various important electrical quantities. (*Application*)
CO4: Analyse errors in different measuring instruments due to different sources and their remedies. (*Analysis*)
CO5: Assemble various appropriate components and instruments in circuits for applying to measurement of electrical quantities. (*Synthesis*)
CO6: Assess performances of different devices and machines using right measurement instruments and procedure. (*Evaluation*)

Suggested Readings

1. A.K. Sawhney, Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai, 2009
2. Golding Wides, Measuring Instruments and Measurements, Wheeler
3. H.S. Kalsi, Electronic Instrumentation, TMH India
4. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement techniques, 1st ed., PHI.
5. D. Patranabis, Sensors and Transducers, 2nd ed., PHI

EEEM0021: ELECTRICAL MACHINES

(4 credits – 60 hours)

Objective: *This course on Electrical Machines, generally offered for students who do not major in Electrical Engineering, is an introductory course in electro-mechanical energy conversion devices. This course gives an introduction to DC as well as AC machines and transformers, to enable the students to use this knowledge for applying to situations arising in their disciplines.*

Module I: D.C. Machines (15 hours)

Constructional details, emf equation, Methods of excitation, Self and separately excited generators, Characteristics of series, shunt and compound generators, Principle of operation of D.C. motor, Back emf and torque equation, Characteristics of series, shunt and compound motors, Starting of D.C. motors, Types of starters, Testing, Hopkinson's test and Swinburne's test, Speed control of D.C. shunt motors.

Module II: Transformers (18 hours)

Constructional details, Principle of operation, emf equation, Transformation ratio, Transformer on no load, Parameters referred to HV/LV windings, Equivalent circuit, Transformer on load, Regulation, Testing – Load test, open circuit and short circuit tests, Efficiency of Transformers, All day efficiency, Auto Transformers, Introduction to 3-phase transformers.

Module III: Induction Motors (15 hours)

Construction, Types, Principle of operation of three-phase induction motors, Torque-slip Characteristics, Equivalent circuit and performance, Losses and Efficiency, Starting and speed control, Single-phase induction motors.

Module IV: Synchronous and Special Machines (12 hours)

Construction of synchronous machines, Types, Induced emf, Voltage regulation; Brushless alternators, 3-phase synchronous motor, Stepper motor, Servo motor, techo generators, brushless dc motors.

COURSE/LEARNING OUTCOMES

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

CO1: Define and outline the fundamental concepts of electro-mechanical energy conversion devices. (*Knowledge*)
CO2: Explain the constructional details and principle of operation of DC machines, Transformer, Induction Motors, Synchronous and special machines. (*Comprehension*)
CO3: Design different electrical machines according to the requirement. (*Synthesis*)
CO4: Analyze various methods of field excitation. (*Analysis*)
CO5: Design different Generators, Motors, and Transformers etc. (*Synthesis*)
CO6: Evaluate the performance of different electrical Machines. (*Evaluation*)

Suggested Readings

1. BL Thereja, AK Thereja, A Textbook of Electrical Technology, Vol II, S Chand.
2. P.S. Bimbhra, Electrical Machines, 17th edition, Khanna Publishers
3. P.S. Bimbhra, Generalised Theory of Electrical Machines, Khanna Publishers
4. I.J. Nagrath, D.P. Kothari, Electrical Machines, Third edition, TMH
5. Parker Smith, Problems in Electrical Engineering, CBS Publishers and distributors
6. J.B. Gupta, Theory and Performance of Electrical Machines, S.K. Kataria and Sons

EECE0022: CONTROL SYSTEM ENGINEERING

(4 credits – 60 hours)

Objective: *To familiarize the students with concepts related to the operation analysis and stabilization of closed loop and open loop control systems using various control techniques. The course is also aimed at developing knowledge on various controllers and digital control system.*

Module I (16 hours)

Basic concepts of control systems, Open and closed loop systems; Mathematical model of physical systems, transfer function, block diagram algebra, signal flow graph (SFG), Mason's gain formula, application of SFG to control systems; Feedback theory: Types of feedbacks, effect of degenerative feedback on control system, regenerative feedback; Components: A.C. Servo motor, DC servo motor, AC tacho meter, synchro, amplidyne, stepper motor. State space model, state variable i/p and o/p, continuous time model, state equations.

Module II (17 hours)

Time domain analysis: Standard test signals: Step, ramp, parabolic and impulse signals. Time response of first and second order systems to unit step and unit ramp inputs. Time response of second order systems to unit step input. Time response specifications. Steady state errors and error constants of different types of control systems. Concepts of stability: Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion, application of Routh stability criterion to linear feedback systems, relative stability Root locus techniques: Root locus concepts, rules for construction of root loci, determination of roots from root locus, root contours. Systems with transportation lag.

Module III (20 hours)

a) Frequency domain analysis: Introduction, Bode plots, determination of stability from Bode plots, polar plots, Nyquist stability criterion, application of Nyquist stability criterion to linear feedback systems. Closed loop frequency response: Constant M circles, constant N circles, use of Nicolas chart
b) Controllers: Introduction, Proportional, derivative and integral control actions, P, PI and PID controllers and their applications to feedback control systems, Zeigler- Nichols method of tuning PID controllers for known dynamic model of the plant.

Module IV (7 hours)

State variable analysis: Introduction, concept of state variables, state vector, input and output vector, general state model representation of linear time invariant, SISO and MIMO systems and their block diagram representations, state model representations of physical systems

COURSE/LEARNING OUTCOMES

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

CO1: Define and explain feedback and feed-forward control architecture and discuss the importance of performance, robustness and stability in control design. (*Knowledge & Comprehension*)

CO2: Familiarize the students with concepts related to the operation analysis and stabilisation of closed loop and open loop control systems using various control techniques. (*Comprehension*)

CO3: Interpret and apply block diagram representations of control systems and design different controllers based on empirical tuning rules. (*Application*)

CO4: Identify the engineering solutions in a global, economic, environmental, and societal context. (*Analysis*)

CO5: Demonstrate the ability to design a control system to perform an engineering application. (*Synthesis*)

CO6: Determine different engineering complexities and fluently apply engineering tools and techniques for systematic synthesis and design processes. (*Evaluation*)

Suggested Readings

1. Benjamin C Kuo, Automatic Control System, 7 ed, PHI
2. L. J. Nagrath, M. Gopal, Control Systems Engineering, New Age International.
3. K. Ogata, Modern Control Engineering, PHI.
4. R. Anandanatarajan, P. Ramesh Babu, Control Systems Engineering, Scitech Publications.
5. D. Roy Choudhury, Modern Control Engineering, PHI.
6. BS Manke, Linear Control System, Khanna Publishers
7. Eronini I. Umez-Eronini, System Dynamics and Control, PWS Publishing, CL-Engineering.

EEMN0023: ELECTRO-MECHANICAL ENERGY CONVERSION II

(4 credits – 60 hours)

Objective: *The course is aimed to introduce electro-mechanical energy conversion principles and three-phase systems, induction, and synchronous machines and the power systems employing these devices.*

Module I (13 hours)

Synchronous Machine I: Constructional features, Armature winding, EMF equation, Winding coefficients, Equivalent circuit and phasor diagram, Armature reaction, O.C. and S.C. tests, Voltage Regulation using Synchronous Impedance method, MMF Method, Potier’s Triangle Method, Parallel operation of synchronous generators, operation on infinite bus, synchronizing power and torque coefficient.

Module II (10 hours)

a) Synchronous Machine II: Two reaction theory, Power flow equations of cylindrical and salient pole machines, Operating characteristics.
b) Synchronous motor: Starting methods, Effect of varying field current at different loads, V- Curves, Hunting and damping, Synchronous condenser.

Module III (17 hours)

a) Transformer-I: Three phase transformer Construction, Three – phase unit transformer and Bank of three single phase transformers with their advantages, Three-phase transformer Groups (Phasor groups) and their connections, Y-Δ connection, Open delta connection, Three-phase/ 2 phase Scott connection and its application.
b) Transformer-II: Sumpner's test, All day efficiency, polarity test Excitation Phenomenon in Transformers, Harmonics in Single phase and 3-phase transformers, Parallel operation and load sharing of Single phase and three phase transformers, Three winding transformers, Tertiary winding
c) Three phase Induction Machine-I: Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, Equivalent circuit, Torque and power equations, Torque-slip characteristics, No load and blocked rotor tests, efficiency, Induction generator.

Module IV (20 hours)

a) Three phase Induction Machine-II: Starting, Deep bar and double cage rotors, Cogging and Crawling, Speed control (with and without emf injection in rotor circuit.)
b) Single phase Induction Motor: Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, repulsion motor. AC Commutator Motors: Universal motor, Single phase a.c. series compensated motor, Stepper motors.

COURSE/LEARNING OUTCOMES

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

CO1: Recognise all single phase and three phase ac machines used in power generation, distribution and utilization. (*Knowledge*)
CO2: Classify different types of ac motors and generators used for different purposes. (*Comprehension*)
CO3: Demonstrate ac machines, their starting, input, output, unloaded and loaded conditions. (*Application*)
CO4: Compare the performances in terms of losses, efficiency and regulation of different types of ac machines. (*Analysis*)
CO5: Assemble different components of circuits using ac machines for different purposes like testing, parameter determination, etc. (*Synthesis*)
CO6: Assess losses, efficiency and regulation etc. of different types of ac machines. (*Evaluation*)

Suggested Readings

1. P.S. Bimbhra, Electrical Machines, 17th editions, Khanna Publishers
2. P.S. Bimbhra, Generalised Theory of Electrical Machines, Khanna Publishers
3. I.J. Nagrath, D.P. Kothari, Electrical Machines, Third edition, TMH
4. Parker Smith, Problems in Electrical Engineering, CBS Publishers and distributors
5. J.B. Gupta, Theory and Performance of Electrical Machines, S.K. Kataria and Sons

EEPS0024: ELECTRICAL POWER SYSTEMS I

(3 credits – 45 hours)

Objective: *This is a basic course which aims to make students aware of the basic concepts of electrical power systems and spells out the various components of an electrical power system. This course will be a stepping stone to other courses in power systems such as Power System Operation and Control, Electrical Power System II, etc.*

Module I (20 hours)

a) Line Constants: Introduction to power system, Single line diagram. Resistance – Conductor materials. ACSR, expanded ACSR, hollow and bundle conductors. Use of standard wire tables. Inductance - Inductance of solid cylindrical conductor, composite conductor. Concept of G.M.D. Inductance of single conductor with ground return, 2-conductor single phase line, inductance of three phase single circuit and double circuit lines with symmetrical and unsymmetrical spacing. Skin effect and proximity effect. Bundle conductors. Internal impedance of conductor. Bessel real and Bessel imaginary. Capacitance- Capacitance of isolated conductor, 2-conductor single phase line, three phase single circuit and double circuit lines with symmetrical and unsymmetrical spacing. Method of image and effect of ground. Charging current.

b) Performance of Lines: Representation of lines, short transmission lines, medium length lines, long transmission lines, ABCD constants, Ferranti effect.

Module II (10 hours)

a) Insulators: Different types of insulators. Leakage path, wet flashover and dry flashover distances, potential distribution over a string of suspension insulators, Methods of equalizing the potential. String efficiency.

b) Cables: Insulating materials. Construction of single core and multi-core cables, Armouring, laying and jointing. H.V cables: pressure cables- oil filled and gas filled cables. Stress and capacitance of single core cable, most economical size of conductor. Capacitance and inter-sheath grading. Dielectric stress in bushing insulator. Capacitance and stress in 3 core cable, sheath effects, sheath current, insulation resistance, breakdown voltage and mechanism of breakdown. Thermal characteristics of cables.

Module III (15 hours)

a) Neutral grounding: Effectively grounded system. Under grounded system. Arching ground. Methods of neutral grounding. Resonant grounding (Peterson coil). Earthing transformer. Generator neutral breaker. Grounding practice as per Indian electricity rules. Equipment grounding.

b) Circuit breakers: Fuses: Function: Important terms and classification. HRC fuses: Characteristics and advantages. Time delay fuse. Switchgears: Functions, principles of circuit breaking. DC and AC circuit breaking. Arc voltage and current waveforms. Restriking and recovery voltages, Current zero pause. Current chopping, capacitive current breaking. AC circuit breaker ratings. Arc in oil, arc irruption theories and processes. Bulk oil CB and MOCB, air circuit breaker, air –blast CBs. Vacuum and SF6 CBs. Testing of circuit breakers.

c) Static Substation: Classification. Interconnection of substations, Necessity. Function and arrangement of substation equipment. Layout diagram- single line diagram with different bus-bar arrangements. Current limiting reactors: Types and construction, substation grounding.

COURSE/LEARNING OUTCOMES

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

CO1: Define the line constants, cables, insulators etc and recognize various equipments used in Electrical Engineering. (*Knowledge*)

CO2: Describe the purpose of different devices used in Power System. (*Comprehension*)

CO3: Choose the correct equipments according to the needs and requirement. (*Application*)

CO4: Analyze the instruments and their optimal working capacity. (*Analysis*)

CO5: Combine the concept of working of different equipments which in turn will help in understanding the working of a substation. (*Synthesis*)

CO6: Justify the use and working conditions required for the devices concerned in Power System. (*Evaluation*)

Suggested Readings

1. C.L. Wadhwa, Electrical Power Systems, Fourth edition, New Age International Publishers
2. BR Gupta, Power System Analysis and Design, S. Chand
3. D.P. Kothari, I.J. Nagrath, Power System Engineering, Second edition, TMH
4. VK Mehta, Principles of Power System, S. Chand
5. W.D. Stevenson Jr., Elements of Power System Analysis, McGraw Hill
6. O.I. Elgerd, Electric Energy System Theory, McGraw Hill
7. Allen J. Wood, Brune F. Wollenberg, Power Generation, Operation and Control, 2/e, John Wiley and Sons, Inc.

EEPE0025: POWER ELECTRONICS

(4 credits – 60 hours)

Objective: *The course helps to develop an in-depth understanding of power electronic circuits for voltage and current control and protection and helps in learning switching characteristics of transistors and SCRs, triggering methods of SCR, and study of power supplies to electronic devices.*

Module I (15 hours)

a) Power Electronic Devices: Thyristor- SCR, Construction, Gate Characteristics, Turn-on and Turn-off mechanisms, Device ratings; Gate Triggering Circuits; Series and Parallel operation of Thyristors.
b) Phase Controlled Thyristors, Inverter Grade Thyristors, ASCR, RCT, DIAC, TRIAC, SUS, SBS, SCS, LASCR, Power MOSFET, IGBT, GTO, MCT, IGCT, MTO, ETO, PIC, Silicon Carbide Devices.

Module II (15 hours)

a) Controlled Rectifiers- Half controlled and full controlled, Single Phase and Three phase rectifiers.
b) Dual converters - Ideal and practical, Non-circulating and circulating current mode.
c) Choppers - Configuration, Jones and Morgan Chopper, A.C. Choppers, Multiphase choppers, Flyback converters, Buck, Boost, Buk-Boost and Cuk converters.

Module III (15 hours)

a) Inverters- Half Bridge and Full Bridge inverters, PWM inverter, Three phase inverters, Series and Parallel inverters, Current source inverters; Cycloconverters; AC Regulators.
b) Resonant Converters- Zero voltage and zero current switching, load resonant converter, resonant switch converter.

Module IV (15 hours)

a) Protection and Cooling of Power Switching Devices; Control of D.C. and A.C. drives.
b) Applications of Power Electronics- UPS, SMPS, HVDC, SVAR compensators, RF heating, Welding, Lamp ballast, Battery charger, Emergency lighting system, Static Circuit Breaker etc.

COURSE/LEARNING OUTCOMES

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

CO1: Identify different power electronic devices as well as recall different characteristics of the devices. (*Knowledge*)

CO2: Describe the working of different power converters such as rectifiers, choppers and inverters. (Comprehension)

CO3: Construct simple power converters. (*Application*)

CO4: Categorize different protecting circuits for semiconductor devices. (*Analysis*)

CO5: Analyse different power electronics converters. (*Analysis*)

CO6: Assess and compare power quality of the converters. (*Evaluation*)

Suggested Readings

1. M.D. Singh, K.B. Khanchandani, Power Electronics, 2/e, TMH
2. V.R. Moorthi, Power Electronics - Devices, Circuits and Industrial Applications, 1/e, Oxford University Press
3. M.R. Rashid, Power Electronic Circuits, Devices and Applications, Third Edition, PHI
4. N. Mohan, T.M. Underloned and W.P. Robbins, Power Electronic Converters, Applications and Design, John Wiley and Sons

EEPD0026: POWER ELECTRONICS AND DRIVES

(4 credits - 60 hours)

Objective: *The course helps to develop an in-depth understanding of power electronic circuits for voltage and current control and protection and helps in learning switching characteristics of transistors and SCRs, triggering methods of SCR, and study of power supplies to electronic devices.*

Module I (15 hours)

a) Power Semiconductor Devices: Power diodes, Power Transistors and Thyristors, Static V-I Characteristics of SCR, TRIAC, GTO and IGBT, Turn-On and Turn-OFF Mechanism of SCR, its gate characteristics, Device Specification and rating, series and parallel operation, thyristor protection circuits, design of snubber circuit.

b) Triggering Circuits: Types of triggering schemes: DC, AC and pulsed triggering, UJT triggering scheme, R-C triggering scheme, cosine – law triggering scheme.

c) Commutation: Principle of natural commutation and forced commutation, circuits for forced commutation (Resonant commutation, voltage commutation, current commutation, load commutation).

Module II (15 hours)

a) Control Rectifiers (AC to DC Converter) : Single Phase- Circuit Configuration and Principle of operation of half wave, full wave controlled rectifiers (full converters and semi converters) wave form of voltage and current at the output and across the thyristor for R-L and R-L-E load, effect of source inductance, importance of freewheeling diode for inductive loads. Input power factor for Rand R-L load, Ripple factor. Average output voltage and currents.

b) Three Phase Controlled Rectifiers: Half wave and full wave full controlled bridge rectifiers. Three phase semi-converters, average output voltage and current for R and R-L load.

Module III (15 hours)

a) Inverters (DC to AC Converters): Single Phase – Series Inverters: Circuit description and principle of operation for simple and improved circuit. Parallel inverter: Basic circuit description and principle of operation without and with feedback diodes.

b) Bridge Inverters: Principle of operation : Principle of operation of modified Mc Murray and Mc Murray Bedford inverters. Concept of voltage source inverter and current-source inverter.

c) Three Phase Inverters: Concept of three phase bridge inverters, principle of operation (180° conduction mode and 120° conduction mode), wave form of output voltage and current for R and RL load.

Module IV (15 hours)

a) DC Choppers: Basic Principles of class A, B, C, D, E Choppers, voltage commuted chopper, current commutated chopper and load commutated chopper. Jones Chopper and Morgan Chopper.
b) Cyclo Converter (Single Phase): Basic Principle of Single phase Mid Point Cyclo Converters and brides types cyclo converters.
c) Application: Over voltage protection, zero voltage switch, integral cycle triggering (or Burst Firing), Uninterruptible power supply (UPS), Arc welding, HVDC transmission.

COURSE/LEARNING OUTCOMES

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

CO1: Identify different power electronic devices as well as recall different characteristics of the devices. (*Knowledge*)
CO2: Describe the working of different power converters such as rectifiers, choppers and inverters. (*Comprehension*)
CO3: Construct simple power converters. (*Application*)
CO4: Analyse different power electronics converters. (*Analysis*)
CO5: Reconstruct simple triggering circuits. (*Synthesis*)
CO6: Assess and compare power quality of the converters. (*Evaluation*)

Suggested Readings

1. Singh and Kanchandani, Power Electronics, TMH.
2. M. H. Rashid, Power Electronics Circuits, Devices and Applications, PHI.
3. Vithayathil, Power Electronics – Principles and Applications, McGraw-Hill.
4. Lander, Power Electronics, McGraw-Hill.

EEPS0027: ELECTRICAL POWER SYSTEMS II

(4 credits – 60 hours)

Objective: *This is an advanced course in Electrical Power Systems and builds upon an earlier course, which is a pre-requisite for this course. This course studies in detail HVDC Transmission, design of transmission lines, voltage protection, load flows and distribution systems, among other things.*

Module I (8 hours)

HVDC Transmission: Rectification, Inversion, Kinds of D.C. links, Parallel and Series connection of Thyristors, Power flow, Parallel operation of D.C. links with A.C. network, Ground return, Circuit breaking, Advantages and disadvantages, Economic distance for d.c. transmission.

Module II (8 hours)

a) Corona: Critical disruptive voltage, Corona loss, Line design based on Corona, Disadvantages of Corona, Radio interference, Inductive interference between power and communication lines.
b) Mechanical design of transmission lines: Catenary curve, sag calculations, stringing chart, sag template, equivalent span, stringing of conductors, vibration dampers.

Module III (15 hours)

a) Symmetrical components and fault calculations: 3-phase systems, Positive, Negative and Zero sequence components, Sequence impedances, fault calculations, sequence network equations, L-G faults, Faults on Power Systems, Phase shift Δ-Y Transformers, Reactors, Short-Circuit capacity of a Bus.
b) Travelling waves and voltage control

Module IV (15 hours)

a) Load Flows: Bus classification, Nodal admittance matrix, Load flow equations, Iterative methods, N-R method, Line flow equations, Fast-decoupled load flow
b) Economic Load Dispatch: System constraints, Economic dispatch, Optimum load dispatch, Exact transmission loss formula, Automatic load dispatching, PLCC.

Module V (14 hours)

a) Distribution System: Effect of System voltage on transmission efficiency. Economic choice of conductor size, Kelvin's law, types of distributors and feeders (radial and ring), voltage drop and load calculation for concentrated and distributed loads.
b) Power system synchronous stability : the swing equation, equal area criterion, critical clearing angle.

COURSE/LEARNING OUTCOMES

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

CO1: List the components used for HVDC transmission and explain its operation and advantages and disadvantages. (*Knowledge*, *Comprehension*)
CO2: Solve various power flow problem in a power system network and analysis of power generating system in economic mode. (*Application*)
CO3: Classify various types of the faults existing in electric distribution and transmission systems and determine different electrical parameters during faults. (*Application*)
CO4: Analyse various stability problems faced by the power system network and find solutions to these problems. (*Analysis*)
CO5: Summarize topics of power systems like HVDC transmission transmission line design, voltage protection, load flows etc. (*Synthesis*)
CO6: Assess effect of system voltage on transmission efficiency, economic conductor size, voltage drop and load value. (*Evaluation*)

Suggested Readings

1. C.L. Wadhwa, Electrical Power Systems, Fourth edition, New Age International Publishers.
2. D.P. Kothari, I.J. Nagrath, Power System Engineering, Second edition, Tata McGraw Hill.
3. W.D. Stevenson Jr., Elements of Power System Analysis, Mc Graw Hill.
4. O.I. Elgerd, Electric Energy System Theory, Mc Graw Hill.
5. Allen J. Wood, Brune F. Wollenberg, Power Generation, Operation and Control, 2/e, John Wiley and Sons, Inc.
6. B.J. Cory, B.M. Weedy, Electric Power System, 4/e, John Wiley and Sons Inc.

EEHV0028: HIGH VOLTAGE ENGINEERING

(3 credits – 45 hours)

Objective: *The subject helps in the detailed analysis of breakdown that occur in gaseous, liquids and solid dielectrics and information about generation and measurement of High voltage and current along with High voltage testing methods.*

Module I (15 hours)

a) Introduction: Electric Field Stresses, Gas/Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

b) Breakdown in Gaseous and Liquid Dielectrics: Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids.

Module II (8 hours)

a) Breakdown in Solid Dielectrics: Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

b) Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators.

Module III (12 hours)

a) Measurement of High Voltages and Currents: Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

b) Over Voltage Phenomenon and Insulation Coordination: Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

Module IV (10 hours)

a) Non-Destructive Testing of Material and Electrical Apparatus: Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements.

b) High Voltage Testing of Electrical Apparatus: Testing of Insulators and bushings, Testing of Isolators and circuit breakers, Testing of cables, Testing of Transformers, Testing of Surge Arresters, Radio Interference measurements.

COURSE/LEARNING OUTCOMES

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

CO1: Define the intrinsic breakdown, Townsends's breakdown, Paschen's law etc, along with Non Destructive testing and various high voltage testing methods. (*Knowledge*)

CO2: Describe the breakdown phenomenon in various types of dielectrics. (*Comprehension*)

CO3: Choose the correct testing methods for high voltage apparatuses. (*Application*)

CO4: Interpret the test results and identify the problems associated with them. (*Analysis*)

CO5: Hypothesize the suitable conditions required for the proper working of the dielectrics along with high voltage devices. (*Synthesis*)

CO6: Recommend the dielectric material required for high voltage apparatus. (*Evaluation*)

Suggested Readings

1. M.S.Naidu and V. Kamaraju, High Voltage Engineering, TMH.
2. E.Kuffel, W.S.Zaengl, J.Kuffel, High Voltage Engineering:Fundamentals, Elsevier.
3. C.L.Wadhwa, High Voltage Engineering, New Age Internationals.
4. Ravindra Arora, Wolfgang Mosch, High Voltage Insulation Engineering, NAI.

EECE0029: ADVANCED CONTROL SYSTEM ENGINEERING

(4 credits – 60 hours)

Objective: *This course presents advanced control concepts and techniques in terms of state space, describing function, phase plane and stability analysis including controllability and observability. It also deals with modern control and optimal control systems.*

Module I: Sampled Data Systems (10 hours)

Sampling process, mathematical analysis of sampling process, application of Laplace transform. Reconstruction of sampled signal,zero order, first order hold. Z-transform definition, evaluation of Z-transform, inverse Z-transform, pulse transfer function, limitations of Z-transform, state variable formulation of discrete time systems, solution of discrete time state equations. Stability definition, Jury's test of stability, extension of Routh-Hurwitz criterion to discrete time systems.

Module II: State Space Analysis (15 hours)

a) State Space Representation, Solution of State Equation, State Transition Matrix, Canonical Forms – Controllable Canonical Form, Observable Canonical Form, Jordan Canonical Form.
b) Controllability and Observability: Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability form Jordan canonical form and other canonical forms.

Module III: Describing Function Analysis (13 hours)

a) Introduction to nonlinear systems, Types of nonlinearities, describing functions, describing function analysis of nonlinear control systems.
b) Phase-Plane Analysis: Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, singular points, phase-plane analysis of nonlinear control systems.

Module IV: Stability Analysis (12 hours)

a) Stability in the sense of Lyapunov., Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for the Linear and Nonlinear continuous time autonomous systems.
b) Modal Control: Effect of state feedback on controllability and observability, Design of State Feedback Control through Pole placement. Full order observer and reduced order observer.

Module V (10 hours)

a) Calculus of Variations : Minimization of functionals of single function, Constrained minimization. Minimum principle. Control variable inequality constraints. Control and state variable inequality constraints. Euler-Lagrangine Equation.
b) Optimal Control: Formulation of optimal control problem. Minimum time, Minimum energy, minimum fuel problems. State regulator problem. Output regulator problem. Tracking problem, Continuous-Time Linear Regulators.

COURSE/LEARNING OUTCOMES

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

CO1: Identify different state variables of a system. (*Knowledge*)
CO2: Describe stability analysis procedure of a system. (*Comprehension*)
CO3: Choose appropriate controllers for a system. (*Application*)
CO4: Analyse stability of a system. (*Analysis*)
CO5: Formulate mathematical model of a system. (*Synthesis*)
CO6: Evaluate stability of a system after application of appropriate control mechanism. (*Evaluation*)

Suggested Readings

1. M. Gopal, Modern Control System Theory, New Age International.
2. K. Ogata, Modern Control Engineering, PHI.
3. I.J. Nagarath, M.Gopal, Control Systems Engineering, NAI.
4. Stainslaw H. Zak, Systems and Control, Oxford Press.
5. M. Gopal, Digital Control and State Variable Methods, Tata McGraw-Hill.
6. K. Ogata, Discrete-Time Control Systems, Pearson.

EEPP0030: POWER SYSTEM PROTECTION

(4 credits – 60 hours)

Objective: *This course introduces the basic theory, construction, usage of current and voltage transformers, relays and circuit breakers. This course introduces the protection systems used for electric machines, transformers, bus-bars, overhead and underground lines, and for over-voltages.*

Module I (15 hours)

Faults on power system and their classification, evolution of a power system, protection system attributes, system transducer, principles of power system protection, over current protection: over current relay, IDMT and DTOC relays, Directional over-current relays, Feeder protection.

Module II (15 hours)

Differential Protection: Simple differential protection, Zone of protection, Percentage differential relay, Earth Leakage protection; Transformer Protection: Over current protection, Differential protection of single and three phase transformers, Star-delta and Delta star connections, Harmonic restraint for magnetizing inrush; Inter-turn and incipient faults in transformers, Busbar protection.

Module III (15 hours)

Distance relaying: Introduction, impedance, Reactance, and MHO relays, Three stepped distance protection, Carrier added protection of transmission lines; Generators protection: Stator and rotor faults, Abnormal operating conditions, Generator, differential protection, earth fault relays.

Module IV (15 hours)

Static comparators as relays, Amplitude and phase comparators, Synthesis of distance relaying using static comparators, electronic circuits for Static relays; Microprocessor based numerical protection, Digital filtering, Numerical overcurrent, differential, and distance protection, effect of CT and PT saturation's on Numerical relays.

COURSE/LEARNING OUTCOMES

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

CO1: State the basic theories, construction and usage of different types of power system protective equipment such as CT, PT, relays, circuit breakers, and microprocessor based numerical protection etc. (*Knowledge*)

CO2: Classify and explain different protection systems used for electric machines, transformers, bus-bars, overhead and underground lines, and for over- voltages. (*Comprehension*)

CO3: Apply the knowledge to select suitable protective scheme for various sections of electrical power systems such as protection of alternator, motor, transformer, transmission lines, feeders, etc. (*Application*)

CO4: Solve power system protection related problems to ensure high reliability of the system. (*Application*)

CO5: Analyze and relate to protection against various faults such as earth fault, phase fault, etc. across different sections in electrical power systems using protective schemes like DTOC relays, IDMT relays, distance relays, differential protection, 3-zone protection, comparators, static and numerical relays etc.(*Analysis*)

CO6: Summarize the overall power system protection concepts. (*Synthesis*)

CO7: Access the reliability and security of a given power system network from the view-point of protection. (*Evaluation*)

Suggested Readings

1. Sunil S Rao, Switchgear Protection and Power Systems, Khanna Publishers
2. JB Gupta, Switchgear and Protection, SK Kataria and Sons
3. Y.G. Paithankar, S.R. Bhide, Fundamental of Power System Protection, PHI.
4. P.M. Anderson, Power System Protection, Wiley-IEEE Press.

EEPE0031: POWER PLANT ENGINEERING

(4 credits – 60 hours)

Objective: *The course provides students with a broad understanding of electricity generation by conversion of various forms of energy to electrical energy and associated technology, operation and decision making on power plants.*

Module I: Hydel Power (16 hours)

Introduction to different sources of energy and general discussion on their application to generation. Hydel power: Hydrology - Catchment area of a reservoir and estimation of amount of water collected due to annual rainfall, flow curve and flow duration curve of a river and estimation of amount stored in a reservoir formed by a dam across the river, elementary idea about Earthen and Concrete dam. Turbines- Operational principle of Kaplan. and Francis turbine and Pelton wheel, specific speed, workdone and efficiency. Hydroplant - head gate, perstock, surge tank, scroll case, draft tube and tailrace, classification of plants, turbines for different heads, plant capacity as a base load and peakload station, plant auxiliaries.

Module II: Thermal Power (16 hours)

Overall plant components in Block dams indicating the air, circuit, coal and ash circuit, water and steam circuit, cooling water circuit; various types of steam turbines, ash and coal handling system, elementary idea about a water tube boiler, Super heater, Reheaters, Economiser air preheater dust collection, draft fans and chimney; condensers, feed water heaters, evaporate and makeup water, bleeding of steam; cooling water system; Governors, plant layout and station auxiliaries.

Module III: Nuclear Power (16 hours)

Introduction to fission and fusion, reactor construction, controlled chain reaction, operational control of reactors, Brief study of various types of reactors (Boiling water, pressurised water, sodium graphite, breeder) layout of nuclear power plant. Electrical System: Different types of alternators, methods of cooling; Excitation system - Shaft mounted D. C. generator, elements of static and brush less excitation, field flashing, AVR - magnetic amplifier and thyrister convertor types. Main transformer, unit transformer and station reserve transformer. Commissioning tests of alternators and transformers.

Module IV (12 hours)

Choice of size and number of generating units - Review of the terms maximum demand, load factor, diversity factor, plant capacity and use factor, load and load duration curve and their effect on the generating capacity. Reserve units (hot, cold and spinning reserve) Effect of power factor on the generating capacity and economy. Different types of power tariffs. Brief idea about national grid and its operational problems.

COURSE/LEARNING OUTCOMES

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

CO1: Enumerate the various energy resources and energy systems available for the production of electric power. (*Knowledge*)
CO2: Identify elements and their functions of thermal, hydro, nuclear, wind and solar power plants. (*Knowledge*)
CO3: Analyse economics of power plants and list factors affecting the power plants. (*Analysis*)
CO4: Understand and discuss the environmental impact of electric power production on air quality, climate change, water, and land. (*Analysis*)
CO5: Perform the preliminary design/analysis of the major components or systems of a conventional or alternative energy power plant. (*Synthesis*)
CO6: Assess load factor, diversity factor, plant capacity and use factor, their effect on generating capacity. (*Evaluation*)

Suggested Readings

1. P.K. Nag, Power Plant Engineering, 3/e, TMH
2. GK Nagpal, Power Plant Engineering, Khanna Publishers
3. BR Gupta, Generation of Electrical Energy, S Chand and Company
4. M.V Despande, Elements of Electrical Power System Design, A. H. Wheeler.
5. B.G.A. Skrotizki and W.A.Vopat, Power Station Engineering And Economy, TMH.
6. S. L. Uppal, Electrical Power, Khanna Publishers.

EEUE0032: UTILIZATION OF ELECTRICAL ENERGY

(4 credits – 60 hours)

Objective: *This course deals with the fundamentals of illumination and its classification and the electric heating and welding. It is a detailed study of all varieties of electric drives and their application to electrical traction systems.*

Module I (15 hours)

a) Electric drives: Type of electric drives, Types of motor used in electric drives, Choice of motor, Speed control, Temperature rise, Applications of Electric drives, Advantages and disadvantages of electric drives, Types of industrial loads- continuous, intermittent and variable loads, load equalization.
b) Electric heating: Advantages and methods of electric heating, Resistance heating, induction heating and dielectric heating, Industrial applications.

Module II (10 hours)

a) Electric welding: Resistance and arc welding, electric welding equipment, Comparison between A.C. and D.C. Welding.
b) Illumination fundamentals: Introduction, terms used in illumination, Laws of illumination, Polar curves, Photometry, integrating sphere, Sources of light.

Module III (20 hours)

a) llumination methods: Discharge lamps, MV and SV lamps – comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.
b) Electric vehicles: Main components and working of electric vehicles and its comparison with combustion engine driven vehicles, Hybrid electric vehicles.

Module IV (15 hours)

a) Electric traction-II: Mechanics of train movement. Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

b) Electric traction-III: Calculations of tractive effort, power, specific energy consumption for given run, Effect of varying acceleration and braking retardation, Adhesive weight and braking retardation adhesive weight and coefficient of adhesion.

COURSE/LEARNING OUTCOMES

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

CO1: Outline the various electric drives and their applications. (Knowledge)
CO2: Explain mechanism of electric train movement and methods of electric braking. (Comprehension)
CO3: Determine specific energy consumption. (Application)
CO4: Identify heating and welding scheme for a given applications. (Application)
CO5: Examine and determine size of lamps and their fittings for a particular illumination. (Application)
CO6: Assess the effect of varying acceleration and braking retardation. (Evaluation)

Suggested Readings

1. E. Openshaw Taylor, Utilisation of Electric Energy, Orient Longman.
2. Partab, Art and Science of Utilization of Electrical Energy, Dhanpat Rai and Sons.
3. N.V. Suryanarayana, Utilization of Electrical Power including Electric drives and Electric traction, New Age International.
4. C.L. Wadhwa, Generation, Distribution and Utilization of electrical Energy, New Age International.

EEED0033: ELECTRICAL DRIVES

(4 Credits – 60 hours)

Objective: *This course provides a good knowledge on AC and DC drives including control of DC motor drives with converters and choppers and voltage control of AC motor drives along with stability considerations and applications.*

Module I: Introduction To Electrical Drives and Its Dynamics (15 hours)

Electrical drives, Advantages of electrical drives, Parts of electrical drives, choice of electrical drives, Dynamics of electrical drives, Fundamental torque equation, speed-torque conventions and multi-quadrant operation. Equivalent values of drive parameters, components of load torques, nature and classification of load torques, calculation of time and energy loss in transient operations, steady state stability, load equalization. Selection of motor power rating: Thermal model of motor for heating and cooling, Classes of motor duty, determination of motor rating.

Module II: DC Motor Drives (15 hours)

Starting braking, transient analysis, single phase fully controlled rectifier, control of separately excited dc motor, Single-phase half controlled rectifier control of separately excited dc motor.Three phase fully controlled rectifier – control of separately excited dc motor, three phase half controlled rectifier – control of separately excited dc motor, multi-quadrant operation of separately excited dc motor fed from fully controlled rectifier. Control of dc series motor, chopper controlled dc drives for separately excited dc motor and series motor.

Module III: Induction Motor Drives (15 hours)

Operation with unbalanced source voltage and single phasing, operation with unbalanced rotor impedances, analysis of induction motor fed from non-sinusoidal voltage supply, starting braking, transient analysis. Stator voltage control: Variable voltage and variable frequency control, voltage source inverter control, closed loop control, current source inverter control, rotor resistance control, slip power recovery, speed control of single phase induction motors.

Module IV: Synchronous Motor Drives (10 hours)

Operation from fixed frequency supply, synchronous motor variable speed drives, and variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thyristor inverter.

Module IV: Industrial Drives (5 hours)

Steel mill drives, cement mill drives, paper mill drives and sugar mill drives. Microprocessor for control of electric drives.

COURSE/LEARNING OUTCOMES

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

CO1: Identify the need and choice of various electrical drives. (*Knowledge*)
CO2: Predict the class of motor duty. (*Analysis*)
CO3: Model and analyse electrical motor drives and their sub-systems (converters, rotating machines and loads) (*Application & Analysis*)
CO4: Select a suitable rotating machine for an electrical motor drive. (*Application*)
CO5: Select a suitable power electronic converter structure for an electrical motor drive. (*Application*)
CO6: Select a suitable control structure and calculate control parameters for an electrical motor drive. (*Evaluation*)

Suggested Readings

1. G.K. Dubey, Fundamentals of Electrical Drives, Narosa
2. S.K. Pillai, A First Course On Electric Drives, Wiley Eastern Ltd.
3. N.K. De and P.K. Sen, Electrical Drives, PHI.
4. V. Subrahmanyam, Electric drives, TMH.
5. M.H. Rashid, Power Electronics and AC drives, Pearson.
6. B.K. Bose, Modern Power Electronics and AC drives, Pearson.

EEAM0034: ENERGY AUDIT AND MANAGEMENT

(3 credits – 45 hours)

Objective: *The objective of the course is to introduce energy audit need, measurement, energy performance diagnosis and analysis and carry out financial analysis and cost prediction for energy saving. The course also addresses energy management issues in various sectors.*

Module I (8 hours)

Need for Energy Conservation, standards and practices in energy conservation; Energy Audit: Principles of energy audit, preliminary energy audit and detailed energy audit. Procedures for carrying out energy audit. Energy- production relationship, specific energy consumption, least square method, Cusum technique, data energy flow diagram. Sankey diagram. Instruments used for energy audit.

Module II (15 hours)

Thermal Energy Audit: Purpose, Methodology with respect to process Industries - Power plants and Boilers. Steam System - Losses in Boiler, Methodology of Upgrading Boiler Performance; Energy conservation in Pumps, Fans and Compressors, Air conditioning and refrigeration systems, Steam Traps-Types, Function, Necessity; Electrical Energy Audit: Potential areas for Electrical Energy Conservation in Various Industries-Energy Management Opportunities in Electrical Heating, Lighting system, Cable selection - Energy Efficient Motors - Factors involved in determination of Motor Efficiency

Module III (12 hours)

Concept of energy management: Energy inputs in industrial, residential, commercial, agriculture and public sectors, Comparison of different energy inputs on the basis of availability, storage feasibility, cost (per unit output) etc. Electrical Energy Management-energy Accounting, Measurement and management of power factor, voltage profile, current energy requirement, power demand monitoring, target setting.

Module IV (10 hours)

Concept of Supply Side Management and Demand Side Management (DSM), Load Management, Voltage profile management from receiving end. Methods of implementing DSM. Advantages of DSM to consumers, utility and society; Simple payback period analysis, advantages and limitations of payback period. Time value of money, net present value method. Internal rate of return method, profitability index for cost benefit ratio.

COURSE/LEARNING OUTCOMES

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

CO1: State the need of energy audit which would give a positive orientation to the energy cost reduction and decide preventive measures and quality control programmes for the conservation of energy. (*Knowledge*, *Evaluation*)

CO2: Explain different energy conservation techniques for enhancing the energy performance of various sectors and solves different industrial and environmental problems by using different modern engineering tools. (*Comprehension*, *Application*)

CO3: Apply different financial analysis and diagnose the performance of different sectors by lending technically feasible solutions with economic and other organizational considerations within a specified time frame. (*Application*, *Evaluation*)

CO4: Analyse energy utilisation and identify areas of energy wastages to decide the cost prediction of different sectors for energy saving. (*Analysis*)

CO5: Assemble different systematic approach for decision making in the area of energy management in order to balance the total energy input with its use. (*Synthesis*)

CO6: Evaluate the energy dynamics of the system under study in order to seek opportunities to reduce the amount of energy input into the system without negatively affecting the output. (*Evaluation*)

Suggested Readings

1. S.C. Tripathy, Electric Energy Utilization and Conservation, TMH.
2. C.B. Smith, Energy Management Principles, Pergamon Press.
3. S. Rao, Energy Technology- Non-conventional Renewable and Conventional, Khanna Publishers.
4. P.R. Trivedi and K.R. Jolka, Energy Management, Commonwealth Publication.

EEOC0035: POWER SYSTEM OPERATION AND CONTROL

(4 credits – 60 hours)

Objective: *This course aims at making the student aware of the basic concepts of power systems and spells out the constraints in power system operation. The course also covers principles of frequency control, voltage and power flow control and economic operation of power systems.*

Module I (10 hours)

Fundamental of power System: concepts or real and reactive powers, Complex power per unit representation of power system. Transmission capacity, series and shunt compensation, Load characteristics, Real power balance and its effect on system frequency, Load frequency mechanism, reactive power balance and its effect on system voltage, on load tap changing transformer and regulating of transformer, Introduction to FACT devices.

Module II (10 hours)

Load Flow Analysis – The static load flow equation (SLFE), Definition of the load flow problem, Network model formulation, A load flow sample study, Computational aspects of the load flow problem, effect of regulation transformers.

Module III (10 hours)

Load frequency Control: Dynamic incremental state variable, PF versus QV control MW frequency of an individual generator, modeling of speed governing system, Turbine, Division of power system into control areas, P-F control of single control area and two are control, Economic dispatch controller.

Module IV (15 hours)

a) Economic Operation of Power System : Distortion of load between units within a plant, Transmission losses as function of plant generation, Calculation of loss coefficients, Distribution of loads between plants with special reference to steam and hydel plants, Automatic load dispatching, Unit commitment
b) Power System Stability: Steady state stability, transient stability, Swing equation, Equal area criterion for stability.

COURSE/LEARNING OUTCOMES

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

CO1: Recognize the basic constraints in power system operation and control. (*Knowledge*)
CO2: Illustrate the principles of frequency control, voltage and power flow control and economic operation of power systems. (*Comprehension*)
CO3: Find out suitable method to solve various power system and operation control related issues such as real and reactive power balance, load flow problem, load frequency control, economic operation of power system, power system stability. (*Application*)
CO4: Analyze and identify power system operation related problems to eliminate them using various devices and controllers. (*Analysis*)
CO5: Organize various components and instruments for appropriately applying to power system operation and control. (*Synthesis*)
CO6: Assess performances of a power system network for its operation and control using different methods, devices and controllers by applying right procedure. (*Evaluation*)

Suggested Readings

1. CL Wadhwa, Electrical Power Systems, New Age International
2. Hadi Saadat, Power System Analysis, TMH.
3. B. R. Gupta, Power System Analysis and Design, S. Chand and Co.
4. O.I. Elgerd, An introduction to Electric Energy System Theory, TMH.
5. W.D. Stevenson, Elements of Power System Analysis, TMH.
6. PSR Murty, Operation and Control in power system, BS Publications
7. WD Stevenson, Elements of power system analysis, TMH Publications
8. J Wood and BF Wollenburg, Power generation operation and control, John Wiley & Sons.

EEIT0036: INSTRUMENTATION AND TELEMETRY

(4 credits-60 hours)

Objective*: After completing this course student will be able to explain different types and operating principles of transducers and will understand the techniques of measurement of non-electrical quantities with electrical transducers. Students will also be aware of different optical measurement techniques and use optical fibre sensors for measurements. Last module includes basics of data acquisition and communication of the measured parameters.*

Module I Primary Sensing Elements and Transducers (15 hours)

a) Functional elements of a measurement system, Primary sensing elements Transducers, Classification of transducers, Basic requirements of a transducer, Selection criteria of transducers.

b) Passive and Active Electrical transducers- Resistive transducers: working principle; Potentiometer; Strain gauge,Inductive transducers: working principle; LVDT; RVDT; Synchros, Capacitive transducers: working principle,Piezoelectric Transducers: working principle, Photoelectric transducers and Digital Transducers.

Module II Measurement of non-electrical quantities (22 hours)

a) Measurement of temperature: Thermal-Expansion methods, Thermoelectric (Thermocouples), Electrical-Resistance (RTD), Semiconductor (Thermistors), LM35.

b) Measurement of pressure: Manometers, Elastic transducers, High pressure measurement, Low Pressure measurement.

c) Measurement of flow: Turbine, electromagnetic, hot-wire anemometer, orifice, venturi-meter, ultrasonic methods.

d) Measurement of force: Elastic type, Piezoelectric type.

e) Measurement of level: Resistive, float, force-balance, bubbler or purge, capacitive and ultrasonic methods.

Module III Optical Instrumentation (10 hours)

a) Devices: Photoconductive cells, photovoltaic cells, photo-junctions (diodes and transistors), LDR.

b) Fibre optic measurements: Optical fibre sensors, Intrinsic and extrinsic types, intensity modulated and interferometric type optical fiber sensors, distributed sensing with fiber optics,Optical power measurements.

Module IV Telemetry, Transmitters and Data Acquisition System (13 hours)

a) Telemetry: Introduction and characteristics, Landline Telemetry, Radio Telemetry, Pneumatic telemetry

b) Signal Conditioning, 4-20 mA transmitter, grounded load and floating load concept of I to V converter., Smart transmitters with Modbus.

c) Data Acquisition: Components of Analog and Digital Data Acquisition System, Types of Multiplexing Systems, Uses of Data Acquisition System, Use of recorders in Digital systems, Modern Digital Data Acquisition System.

COURSE/LEARNING OUTCOMES

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

CO1: Identify different functional elements of an instrumentation system. (*Knowledge*)

CO2: Classify and explain various types of transducers. (*Comprehension*)

CO3: Apply knowledge of different transducers to build instrumentation system. (*Application*)

CO4: Compare the performances of different transducers for measurement of pressure, flow, temperature Level. (*Analysis*)

CO5: Assemble different elements of a telemetry system for transmitting sensor data. (*Synthesis*)

CO6: Decide on the type of optical fiber sensor suitable for measurement of different quantities. (*Evaluation*)

Suggested Readings

1. E.O. Doeblin, Dhanesh Manik, Measurement Systems Application and Design, Tata-McGraw Hill
2. A.K. Sawhney, Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai

3. J.B. Gupta, A course in Electrical and Electronic Measurements and Instrumentation, S.K. Kataria and Sons
4. S.K. Singh, Industrial Instrumentation & Control, Tata-McGraw Hill
5. D. Patranabis, Sensors and Transducers, PHI
6. D Patranabis - Telemetry principles - Tata McGraw Hill.
7. Bishnu P. Pal- Fundamental of fiber optics in telecommunication and sensor systems, New Age International (P) Limited.

EERE0037: RENEWABLE ENERGY SOURCES AND MANAGEMENT

(3 Credits – 45 hours)

Objective: *This course gives a fundamental understanding of various renewable energy sources available in nature, harnessing of renewable energy sources for environment benefits, mitigating Global warming/Climate change and Energy Security and designing, promoting and implementing renewable energy solutions & gaining knowledge on different renewable energy policies, and management of renewable energy.*

Module I Introduction (5 hours)

Energy situation and renewable energy sources. Need to develop new energy technologies, Global energy scene, Indian energy scene. Nonconventional renewable energy sources, potential of renewable energy sources. Limitations of renewable sources. Wave energy, tidal energy, ocean thermal energy conversion (OTEC).

Module II Solar Energy (15 hours)

a) Terrestrial solar radiation, measurement of solar radiation.Low Temperature collectors: Flat plate collectors, optical characteristics of absorber and cover, heat transfer and transmission losses, collector model, collector equations.
b) Applications of solar energy: Solar drying, solar distillation, solar air conditioning and refrigeration.
c) Photo voltaic energy conversion, basics of power generation, Solar cell, equivalent circuit diagram. P-V & I-V characteristics, effect of insolation, temperature, diurnal variation, shading. Modules, connections, ratings. Power extraction : tracking and MPPT schemes. standalone systems, grid interface, storage.

Module III Wind energy (10 hours)

Origin, direction, velocity and measurement of wind; aerodynamic construction of rotor blade; Harmonic problem Wind Energy Conversion System: Basic principle of wind energy conversion – nature of wind, Power in the wind, Classification of WECS, components of a wind energy conversion system – Performance of Induction Generators for WECS – Classification of WECS Induction Generator: Self excited Induction Generator for isolated Power Generators, Theory of self excitation, Capacitance requirements, Power conditioning schemes – Controllable DC Power from SEIGs,Wind survey and generation in India.

Module IV Bioconversion (8 hours)

Biomass, physical and biological thermal methods of bioconversion.Solid fuels, ethanol, methanol, vegetable oils. Biomass fuels in IC engines. Alcohol fuels, vegetable oils, producer gas.

Module V Energy Management and Conservation (7 hours)

Energy management, energy surveying and auditing, flowchart for construction of energy audit, energy indices, Conservation of electrical energy, Conservation act, effects of energy conservation on energy characteristic, energy saving options. Energy storage: role of storage in electricity supply, hydrogen energy.

COURSE/LEARNING OUTCOMES

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

CO1: Recognize the various sources of Renewable Energy in the world. (*Knowledge*)
CO2: Describe the working of the different types of renewable sources. (*Comprehension*)
CO3: Apply the theoretical knowledge gained into practical fields of Renewable energy generation. (*Application*)
CO4: Model new renewable sources such as solar, wind and biomass types, for electrical energy generation. (*Analysis*)
CO5: Develop renewable energy sources with improved performance and enhanced efficiency. (*Synthesis*)
CO6: Evaluate the new energy conversion systems from Energy Conservation and Management point of view. (*Evaluation*)

Suggested Readings

1. G.D. Rai, Non-conventional energy sources, Khanna publishers.
2. B.H. Khan, Non-Conventional Energy Resources, McGraw Hill.
3. Thomas Markvart, Solar Electricity, John Wiley & Sons.
4. L. Johnson Gary, Wind Energy Systems, Prentice Hall Inc.
5. L.L. Freris, Wind Energy Conversion, Prentice Hall (UK) Ltd.
6. A.C. Baker, Tidal Power, Peter Peregrinus Ltd.
7. G.N. Tiwari, Solar Energy Fundamentals, design, modeling & application, Narosa Publishing.

EEBE0038: BASIC ELECTRICAL ENGINEERING

(4 credit - 60 hours) (L – T – P: 3 – 1 – 0)

Objectives:

- To understand and analyze basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations.

Module I: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module II: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, R-L, R-C, R-L-C combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module III: Electrical Machines (14 hours)

DC Machines: Principle of operation of generators and motors, construction of DC machine, EMF and Torque Equations, Classification and applications of DC machines.
Transformer: Construction and principle of operation of a single phase transformer, EMF equation, introduction of auto-transformer.
Induction Motor: Classification and applications, Construction and principle of operation of single phase and three-phase induction motor

Module IV: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module V: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

COURSE/LEARNING OUTCOMES

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

CO1: Define basic terminologies related to electrical circuits and machines. (*Knowledge*)
CO2: Explain Kirchhoff's Law and the various network theorems. (*Comprehension*)
CO3: Identify and describe active, passive, linear and non-linear circuit elements. (*Comprehension*)
CO4: Explain single phase EMF generation and the concept of capacitive and inductive reactance and describe the fundamentals of three phase circuits. (*Comprehension*)
CO5: To explain the basic concepts of magnetic, AC and DC circuit and the working principle, construction, applications of DC machines, AC machines & measuring instruments (*Comprehension*)
CO6: To analyze circuits using Kirchhoff's voltage & current laws, and node analysis. (*Analysis*)
CO7: To compute power dissipation, power factor, and maximum power transfer and other important parameters of single phase AC circuits. (*Application*)
CO8: To explain the basics of domestic wiring and electrical installations. (*Comprehension*)

Suggested Readings

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

EERS6003: RESEARCH SEMINAR I - MTECH

(2 credits)

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 during the last two semesters of the M. Tech programme. 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

1. Literature survey on a chosen topic
2. Presentation on the chosen topic, comprising the following three components:
    a. Presentation
    b. Report
    c. Viva voce examination

COURSE/LEARNING OUTCOMES

At the end of the Research Seminar students will be able to

CO1: Identify the steps required to do research and projects. (*Knowledge*)
CO2: Explain the methodology of research and journaling. (*Comprehension*)
CO3: Apply the research presentation skills in seminars and conferences. (*Application*)
CO4: Select topics to pursue research in technical fields. (*Analysis*)
CO5: Defend their research dissertations and reports. (*Evaluation*)
CO6: Develop research topics and present the research ideas. (*Synthesis*)

EECN6005: CIRCUITS AND NETWORKS LAB

(2 credits)

(At least 8 experiments should be conducted)

1. Transient response in R-C network
2. Determination of impedance (Z) parameters of two port network
3. Determination of admittance (Y) parameters of two port network
4. Frequency response of LP and HP filters
5. Verification of Millman's theorem
6. Verification of superposition theorem
7. Verification of reciprocity theorem
8. Verification of Thevenin's theorem
9. Verification of maximum power transfer theorem
10. Introduction to Sci-Lab
11. Verification of network theorems using Sci-Lab

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: Identify and recognize the various instruments/devices used in the circuit and networks lab. (*Knowledge*)

CO2: Identify and recognize the different types of components of Circuit and Networks Lab such as resistors, rheostats, function generators, CRO, dual power supply etc. (*Knowledge*)

CO3: Describe the transient response in R-C network. (*Comprehension*)

CO4: Examine and analyze the important components/parameters/characteristics of LP and HP filters. (*Analysis*)

CO5: Perform hands on experiments to measure impedance and admittance parameters of two port Network. (*Application*)

CO6: Examine and analyze superposition and reciprocity theorem (*Analysis*)

CO7: Design nodal, mesh and various theorems using Sci-Lab (*Synthesis*)

CO8: Compare and evaluate the transient analysis in RC and RLC series network using hardware and Scilab (*Evaluation*)

EERS6006: RESEARCH SEMINAR II - MTECH

(4 credits)

Tasks to be performed by the students during this research Seminar include

1. Preparation of the Project Proposal that will be developed during semesters 3 and 4 and/or extensive literature survey leading to the project proposal
2. Presentation on the proposed proposal comprising the following three components:
   a. Presentation
   b. Report
   c. Viva Voce Examination
3. Extra credits will be given for any publication during this phase.

COURSE/LEARNING OUTCOMES

At the end of the Research Seminar II students will be able to

CO1: Identify the steps required to do research and projects. (*Knowledge*)

CO2: Explain the methodology of research and journaling. (*Comprehension*)

CO3: Apply the research presentation skills in seminars and conferences. (*Application*)

CO4: Select topics to pursue research in technical fields. (*Analysis*)

CO5: Defend their research dissertations and reports. (*Evaluation*)

CO6: Develop research topics and present the research ideas. (*Synthesis*)

EEMP6007: PROJECT PHASE I - MTECH

(12 credits)

Objective: *During this phase the student will start a research project applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester*

E-resource for learning:

LaTeX, www.spokentutorial.org

COURSE/LEARNING OUTCOMES

At the end of the Project Phase I students will be able to

CO1: Outline different stages of the project. (*Knowledge*)
CO2: Summarize the available literature on the project area. (*Comprehension*)
CO3: Select different tools and technologies required to complete the project. (*Comprehension)*
CO4: Apply theories learned to solve the problems related to the project. (*Application*)
CO5: Experiment different tools and technologies and thereby selecting the most suitable one required for the project. (*Synthesis*)
CO6: Analyze and examine the results obtained to remove redundant data and gain new insights. (*Analysis*, *Evaluation*)

EEEI6008: ELECTRONIC INSTRUMENTATION AND MEASUREMENTS LAB

(2 credits)

List of Experiments:

1. Extension of range of Ammeter.
2. Extension of range of Voltmeter.
3. Measurement of frequency using Lissajous Pattern.
4. Measurement of phase-angle using Lissajous Pattern.
5. Measurement of resistance by Wheatstone bridge method.
6. Study of Maxwell bridge circuit.
7. Measurement of frequency by Wien Bridge using Oscilloscope.
8. Measurement of Inductance by Anderson Bridge.
9. Study of schering bridge circuit.
10. Measurement of Capacitance by De Sauty Bridge.
11. Study of transducers (RTD/Thermistor/Thermocouple).
12. Study of energy meter.
13. Measurement of power by wattmeter method.
14. Measurement of resistance by ammeter voltmeter method.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: List various measuring instruments used for measurement of electrical quantities (*Knowledge*)
CO2: Explain the correct procedure of using a C.R.O (*Comprehension*)
CO3: Apply different electrical measuring instruments for different measurement Applications. (*Application*)
CO4: Compare performances of different type of measuring instruments to be applied for measurement of electrical quantities. (*Analysis*)

CO5: Assemble different measuring instruments in a circuit for measurement of electrical parameters. (*Synthesis*)
CO6: Assess values of resistance, power, energy by using various electrical measuring instruments. (*Evaluation*)

EEMN6009: ELECTROMECHANICAL ENERGY CONVERSION LAB I
(2 credits)

(At least eight experiments are to be performed from the following)
1. To obtain magnetization characteristics of a d.c. shunt generator
2. To obtain load characteristics of a d.c. compound generator (a) Cumulatively compounded (b) Differentially compounded
3. To obtain load characteristics of a dc shunt generator
4. To obtain load characteristics of a dc series generator
5. To obtain efficiency of a dc shunt machine using Swinburn's test
6. To perform Hopkinson's test and determine losses and efficiency of DC machine
7. To obtain speed-torque characteristics of a dc shunt motor
8. To obtain speed control of dc shunt motor using (a) armature resistance control (b) field control
9. To obtain speed control of dc separately excited motor using Ward Leonard method
10. To study polarity and ratio test of single phase transformers
11. To obtain efficiency and voltage regulation of a single phase transformer by Sumpner' s test

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: Recognize various dc machines and single phase transformer. (*Knowledge*)
CO2: Explain the starting procedures of different dc machines. (*Comprehension*)
CO3: Use different machines for different applications e.g. speed control, voltage control etc. (*Application*)
CO4: Analyse performances of different motors and generators using standard procedure. (*Analysis*)
CO5: Organize different load tests on different dc machines and single phase transformer. (*Application*)
CO6: Evaluate efficiency, voltage regulation speed regulation of dc machines and single phase transformer.(*Evaluation*)

EELM6010: ELECTRICAL AND ELECTRONIC MEASUREMENT LAB
(2 credits)

(Any 8 experiments may be conducted)
1. Study the construction of PMMC, Dynamometer, Electro thermal and Rectifier type instrument, Oscilloscope and digital multimeter.
2. Calibrate moving iron and electrodynamometer type ammeter/voltmeter by potentiometer.
3. Calibrate dynamometer type Wattmeter by potentiometer.
4. Calibrate A.C. energy meter.
5. Measure the resistivity of material using Kelvin Double Bridge.
6. Measurement of Power using Instrument transformer.
7. Measurement of Power in Polyphase circuits.
8. Measurement of Frequency by Wien Bridge using Oscilloscope.
9. Measurement of Inductance by Anderson Bridge.

10. Measurement of Capacitance by De Sauty Bridge.
11. Measurement of inductance by Maxwell's inductance Bridge
12. Measurement of resistance using Wheatstone Bridge
13. Measurement of inductance and Q-factor by Maxwell's capacitance Bridge
14. Measurement of capacitance using Schering Bridge.
15. Characteristic of filament lamp

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: List various measuring instruments used for measurement of electrical quantities. (*Knowledge*)
CO2: Explain with diagrams measurement circuits for measurement of resistance, inductance, capacitance, power, emf etc.(*Comprehension*)
CO3: Apply different electrical measuring instruments for different measurement applications. (*Application*)
CO4: Compare performances of different type of measuring instruments to be applied for measurement of electrical quantities. (*Analysis*)
CO5: Combine various measuring instruments in a circuit for accurate measurement of various electrical parameters. (*Synthesis*)
CO6: Determine and examine important electrical parameters like power factor, reactive power, and active power etc. by using different measuring instruments in proper manner. (*Evaluation*)

EEMI6011: MINI PROJECT I

(2 credits)

Mini projects taken up in the fourth semester are assigned to students individually or in groups by the Department under the supervision of the designated faculty member. The objective of this mini project is to train the students to design, simulate or study mini electrical or electronic systems which will give them hands on experience in re-creating the principles they have studied in their engineering classes.

COURSE/LEARNING OUTCOMES

At the end of Mini Project I students will be able to

CO1: Recognize different components used in circuit making such as diodes, transistors, resistors etc. (*Knowledge*)
CO2: Explain the purpose of different components used in circuits. (*Comprehension*)
CO3: Compute the outcome of any circuit both practically and mathematically (*Application*).
CO4: Modify a circuit to improve the outcome and reduce losses if there is any. (*Analysis*)
CO5: Develop a new circuit based on requirement. (*Synthesis*)
CO6: Justify the results obtained from the circuit.(*Evaluation*)

EEEM6012: ELECTRICAL MACHINES LAB

(2 credits)

1. To obtain magnetization characteristics of a d.c. shunt generator
2. To obtain load characteristics of a dc shunt generator
3. To obtain efficiency of a dc shunt machine using Swinburn's test
4. To obtain speed-torque characteristics of a dc shunt motor
5. To obtain speed control of dc shunt motor using
   (i) armature resistance control
   (ii) field control

6. To obtain efficiency and voltage regulation of a single phase transformer by Sumpner's test
7. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
8. To perform load test on a three phase induction motor and draw:
   (i) Torque -speed characteristics
   (ii) Power factor-line current characteristics
9. To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging and leading power factors by
   (i) EMF method (ii) MMF method
10. To study speed control of three phase induction motor by keeping V/f ratio constant.
11. To study speed control of three phase induction motor by varying supply voltage.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO 1: Identify the different Electrical Machines. (*Knowledge*)
CO2: Describe the various Electrical Machines and its excitation systems. (*Comprehension*)
CO3: Apply the theoretical concept of electrical machines in doing practical experiment. (*Application*)
CO4: Analyze or study the different methods to calculate efficiency and voltage regulation of different electrical machines. (*Analysis*)
CO5: Compile a technical report on the different experiments. (*Synthesis*)
CO6: Evaluate the experimental results with the theoretical calculation. (*Evaluation*)

EEPS6013: POWER SYSTEM AND POWER ELECTRONICS SIMULATION LAB
(2 credits)

Objective: *The objective of the course is to simulate, model, design and develop various circuits and systems in electrical power systems and power electronics.*
1. Transmission Line parameters
   a) Computation of inductance of overhead transmission line
   b) Computation of Capacitance of overhead transmission line
2. Voltage distribution and string efficiency of overhead line insulators
3. Formation of Y-bus matrix by
   a) Direct inspection method
   b) Singular transformation method
   c) Bus building algorithm method
4. Formation of z-bus matrix by bus building algorithm
5. Fault Analysis
6. Load Flow Analysis
   a) Solution of Load Flow using Newton-raphson Method
   b) Solution of Load Flow using Fast-decoupled Method
7. Study of the triggering of scr using ujt
8. Study of the triggering of scr using 555 ic
9. Study of the triggering of scr using op-amp 741 ic
10. Study of the single phase pwm inverter using mosfet and igbt

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: Recall the basic necessary concept of electrical power systems and power electronics, like transmission line parameter calculation, Y-bus, Z-bus, efficiency of insulator string of overhead transmission line, operation and triggering of SCR, PWM inverter etc.(*Knowledge*)
CO2: Demonstrate solution of power system and power electronics problems using programming and simulation in SCILAB and MATLAB. (*Application*)
CO3: Differentiate the various methods of Y-bus and Z-bus calculation. (*Analysis*)
CO4: Apply programming language to calculate fault current and voltages for different types of faults in power system. (*Application*)
CO5: Analyze the load flow problem using N-R method and Fast-decoupled method. (*Analysis*)
CO6: Explain and combine the different triggering methods of SCR using IJT, 555 IC and OPAMP. (*Comprehension*, *Synthesis*)
CO7: Assess the performance of single phase PWM inverter.(*Evaluation*)

EECS6014: CONTROL SYSTEM SIMULATION LAB

(2 credits)

Objective: *The objective of the course is to simulate, model, design and develop different control systems.*

1. Simulating the system- step & sine test.
2. Simulating discrete time systems.
3. State space representation.
4. Multiple subsystems and block diagram reduction.
5. Finding steady state error.
6. Design of P, PI, PD and PID controllers.
7. Implementation of algorithms for multivariable systems for pole placement
8. Observer design
9. Stability computations
10. Solutions of Lyapunov and Ricatti equations

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: Define different test signals.(*Knowledge*)
CO2: Discuss different types of systems and controllers. (*Comprehension*)
CO3: Predict output from different systems subjected to different inputs. (*Application*)
CO4: Analyse stability of different systems. (*Analysis*)
CO5: Develop closed loop systems. (*Synthesis*)
CO6: Evaluate performance of different controllers. (*Evaluation*)

EESE6015: POWER SYSTEM AND POWER ELECTRONICS LAB

(2 credits)

Objective: *The objective of the course is to design, develop and test various circuits and systems in electrical power systems and power electronics.*

1. Transient stability of power systems
    a. Transient and small signal stability analysis: single-machine infinite bus system.
    b. Transient stability analysis of multi machine power systems.
2. Load frequency dynamics of single and two area power system

3. Reactive power control by
    a. Series compensation
    b. Shunt compensation
    c. Facts devices
    d. Static var systems
4. Economic load dispatch
5. Over current relay testing system
    a. To plot idmt characteristics of ocr.
    b. To perform experiment on definite/ instantaneous mode setting of the relay.
6. Characteristics of a differential relay
    a. To plot characteristics of % biased differential relay (merz-price method).
    b. Pick up test for differential relay.
7. Transformer differential protection testing
    a. For transformer in zone trips fault.
    b. For transformer out zone or non-trip faults.
8. To develop the state space model of an rlc circuit.
9. To develop the state space model of buck converter.
10. To determine by using simulation the load voltage and load current graph for $\alpha=10^0$, 50^0 and 90^0 of
    a. Single phase half wave rectifier.
    b. Single phase full wave rectifier.
11. To determine by using simulation the load voltage and load current graph for $\alpha=10^0$, 50^0 and 90^0 of
    a. Single phase half wave inverter.
    b. Single phase full wave inverter.
12. To find the power absorbed by the load, the power lost in the line and the efficiency of the pfc circuit.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: State the concept of transient stability and small signal stability in power systems. (*Knowledge*)
CO2: Interpret important concepts like Load-frequency analysis, reactive power control, economic load dispatch, RLC circuits, Buck converter, rectifier circuits etc., using programming and simulation. (*Comprehension*)
CO3: Apply theoretical knowledge for practical testing of some important component of power system and power electronics, like Over-current relay, Differential relay, Transformer differential protection, rectifier and PFC circuits, etc.(*Application*)
CO4: Separate the simulation scenarios of single phase half wave and full wave rectifiers for different triggering angles. (*Analysis*)
CO5: Summarize the different designs of reactive power control methods in power systems. (*Synthesis*)
CO6: Determine and evaluate the power absorbed, power lost in a system with load, line and PFC circuit. (*Evaluation*)

EECI6016: CONTROL AND INSTRUMENTATION ENGINEERING LAB
(2 credits)

Objective: *The objective of the course is to design, develop and test various circuits and systems in Control and Instrumentation Engineering.*

1. Synchro characteristics and synchro systems.
2. Experiments on Level Process Control Station
3. Micro-processor based wave form generation

4. Micro-processor based stepper motor control
5. AC servo system – closed loop position control and closed loop velocity control.
6. Compensators – design, simulation and hardware implementation
7. Thermistor characteristics and linearization, Thermocouple
8. RTD- 3 wire and 4 wire, IC temperature sensor
9. Capacitive transducer
10. LDR and photo diodes

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: Define different observer systems. (Knowledge)
CO2: Explain different advance control loops. (Comprehension)
CO3: Apply intentional non-linearities. (Application)
CO4: Calculate and analyze different parameters of the pressure control kit. (Application, Analysis)
CO5: Develop characteristic of P/I converter. (Synthesis)
CO6: Estimate and evaluate the performance of different controllers. (Evaluation)

EEMP6017: PROJECT PHASE II - MTECH

Objective: *During this phase the student will carry forward and complete the work that they have started in Phase I. It is expected that the student will publish at least one research paper in a well-known journal to augment their work during this phase. Published papers will carry extra weightage during evaluation. The mode and components of evaluation and the weightages attached to them shall be published by the Department at the beginning of the semester.*

E-resource for learning:
LaTeX, www.spokentutorial.org

COURSE/LEARNING OUTCOMES

At the end of the Project phase II students will be able to

CO1: Recall the different stages of the project. (*Knowledge*)
CO2: Identify new tools and technologies appropriate for the project. (*Knowledge*)
CO3: Develop new process and/or product. (*Application*)
CO4: Analyze the validity of results obtained during the project.(*Analysis*)
CO5: Write research papers on the project.(*Synthesis*)
CO6: Defend the authenticity of the project.(*Evaluation*)

EECE6018: CONTROL AND SIMULATION LAB
(2 credits)

Software based experiments (Use MATLAB, SCILAB, LABVIEW software, etc.)

1. To determine time domain response of a second order systems for step input and obtain performance parameters.
2. To convert transfer function of a system into state space form and vice-versa.
3. Transfer function of DC motor.
4. To plot root locus diagram of an open loop transfer function
5. To determine range of gain ‘k’ for stability using root locus.
6. To plot a Bode diagram of an open loop transfer function and examine the stability of the closed loop system.
7. To draw a Nyquist plot of an open loop transfer function and examine the stability of the closed loop system.

8. Effect of feedback on DC servo motor.
9. Solution of state equation using ODE45 and lsim.
10. To study behaviour of separately excited dc motor in open loop and closed loop conditions at various loads.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: Define time domain and frequency domain analysis.(*Knowledge*)
CO2: Discuss root locus, Bode diagram etc.(Comprehension)
CO3: Predict output from different systems subjected to different inputs. (*Application*)
CO4: Analyse stability of different systems. (*Analysis*)
CO5: Formulate mathematical models of systems.(*Synthesis*)
CO6: Evaluate performance of feedback systems (*Evaluation*)

EEMN6019: ELECTROMECHANICAL ENERGY CONVERSION LAB II

(2 credits)

At least eight experiments are to be performed from the following, out of which there should be at least two software based experiments.

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw:
   (i) Torque -speed characteristics
   (ii) Power factor-line current characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by keeping V/f ratio constant.
5. To study speed control of three phase induction motor by varying supply voltage.
6. To perform open circuit and short circuit tests on a three phase alternator and determine voltage regulation at full load and at unity, 0.8 lagging and leading power factors by (i) EMF method (ii) MMF method.
7. To determine V-curves and inverted V-curves of a three phase synchronous motor.
8. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and draw the power-angle curve.
9. To study synchronization of an alternator with the infinite bus by using: (i) dark lamp method (ii) two bright and one dark lamp method.
10. Scott connection of 3-phase transformer
11. Load test of 3-phase transformer
12. Load test on a 3-phase slip-ring induction motor

Software based experiments (Develop Computer Program in 'C' language or use Scilab/MATLAB or other software)

13. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including resistance, or capacitance in the rotor circuit.
14. No load and block rotor test of single phase induction motor.
15. To determine speed-torque characteristics of a three phase induction motor by (i) keeping v/f ratio constant (ii) increasing frequency at the rated voltage.
16. Draw O.C. and S.C. characteristics of a three phase alternator from the experimental data and determine voltage regulation at full load, and unity, 0.8 lagging and leading power factors.
17. To determine steady state performance of a three phase induction motor using equivalent circuit.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: Study the method of synchronization of alternators with the infinite bus. (*Knowledge*)
CO2: Explain the procedure for performing experiments related to AC machines.(*Comprehension*)
CO3: Find out the resistances and reactance of single phase and three phase Induction Motors.(*Application*)
CO4: Compare the different characteristics of rotating and non-rotating machines.(*Analysis*)
CO5: Combine the different components to perform a particular experiment on AC machines.(*Synthesis*)
CO6: Determine and evaluate the characteristics of different types AC machines and their performances.(*Evaluation*)

EEMI6020: MINI PROJECT II

(2 credits)

Mini projects are assigned to students individually or in groups by the Department under the supervision of the designated faculty member. The objective of the mini project is to train the students to design, simulate or study mini electrical or electronic systems which will give them hands on experience in re-creating the principles they have studied in their engineering classes. Mini projects executed during the fifth semester must display a greater maturity of knowledge than those in the fourth semester.

COURSE/LEARNING OUTCOMES

At the end of Mini Project II students will be able to

CO1: Identify different types of converter based on input and output.(*Knowledge*)
CO2: Classify different types of semiconductor devices.(*Comprehension*)
CO3: Predict output of different converters.(*Application*)
CO4: Analyse different types of triggering circuits such as R and RC etc.(*Analysis*)
CO5: Explain the transfer and output characteristics of power semiconductor devices. (*Comprehension*)
CO6: Evaluate and compare the threshold values of different parameter of the semiconductor devices with that of data given in the datasheets. (*Evaluation*)

EEPD6021: POWER ELECTRONICS AND DRIVES LAB

(2 credits)

Any 10 out of the following to be performed

1. Study of the half-wave controlled rectifier with resistive load.
2. Study of the half-wave controlled rectifier with R-L load.
3. Study of fully controlled bridge rectifier with resistive load.
4. Study of fully controlled bridge rectifier with R-L load.
5. Study of the characteristics of DIAC and plotting of its V-I characteristics curve.
6. Study of the characteristics of UJT.
7. Study of the full-wave controlled rectifier (mid-point configuration) with resistive load.
8. Study of the full-wave controlled rectifier (mid-point configuration) with R-L load.
9. Study of the resistor triggering circuit.
10. Study of the resistor capacitor triggering circuit (half-wave).
11. Study of voltage-commutated chopper.

EEMI6022: MINI PROJECT III

(2 credits)

Mini projects are assigned to students individually or in groups by the Department under the supervision of the designated faculty member. The objective of the mini project is to train the students to design, simulate or study mini electrical or electronic systems which will give them hands on experience in re-creating the principles they have studied in their engineering classes. The mini projects taken up in the sixth semester are expected to be more advanced than the mini projects taken up in previous semesters.

COURSE/LEARNING OUTCOMES

At the end of Mini Project III students will be able to

CO1: State the benefits of using microcontrollers and microprocessors in circuits.(*Knowledge*)
CO2: Convert a simple circuit to multi functioning circuit using microcontrollers and microprocessors.(*Comprehension*)
CO3: Construct a fully automotive circuit depending upon the requirement.(*Synthesis*)
CO4: Demonstrate the differences between the circuits using controllers and those not using it.(*Application*)
CO5: Collect information about different parameters in the projects. (*Analysis*)
CO6: Choose among the different controllers and processors available to identify the best one for the work.(*Evaluation*)

EECE6023: CONTROL SYSTEM ENGINEERING LAB

(2 credits)

1. Effect of P, PD, PI, PID Controller on a second order systems.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To study DC position control system.
5. To study synchro-transmitter and receiver and obtain output V/S input characteristics.
6. To determine speed-torque characteristics of an ac servomotor.
7. To study performance of servo voltage stabilizer at various loads using load bank.
8. To test controllability and observability using SCILAB functions
9. To design Lag, Lead and Lag-Lead compensators using SCILAB (both Analog and Digital version)
10. To design controller gains using pole placement.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: State working of different controllers. (*Knowledge*)
CO2: Review different temperature sensors. (*Comprehension*)
CO3: Choose appropriate transmitters to transmit signals from the sensors. (*Application*)
CO4: Analyse stability of different systems. (*Analysis*)
CO5: Formulate state space models of systems.(*Synthesis*)
CO6: Evaluate performance of different control algorithms. (*Evaluation*)

EETS6024: TRAINING SEMINAR

(2 credits)

Objective: *During the semester break at the end of the third year, students are required to undergo an Industrial Training. The purpose of the Industrial Training is to expose students to real-life industry situations, so that they may be able to apply the engineering knowledge and skills that they have gained through class-room teaching and lab activities, in an on-the-job situation. After the period of training, students are to present their experience in the form of reports and seminar presentations. Students will be evaluated on the seminar, viva voce examination and written reports.*

COURSE/LEARNING OUTCOMES

At the end of the Training Seminar students will be able to

CO1: Recognize the importance of learning the practical aspects of engineering education. (*Knowledge*)

CO2: Describe the engineering processes involved in the industry.(*Comprehension*)

CO3: Demonstrate the use of engineering knowledge into the practical field.(*Application*)

CO4: Analyze the actual technological advancements in the industry and present their experience in the form of reports and seminar presentations.(*Analysis*)

CO5: To relate the acquired knowledge of Electrical and Electronics with the practical industrial scenario (*Synthesis*)

CO6: To examine and evaluate the use of different Electrical and electronic machines/ devices/instruments/concepts, etc., learned in actual industrial scenario (*Evaluation*)

EEMP6025: MAJOR PROJECT (PHASE I)

(4 credits)

During the last year of their study, B. Tech. students are required to take up a major project. This may be an individual project or a group project. The Major Project is an integral learning experience that encourages students to break away from the compartmentalization of the different courses they have studied during the three years of their study and aims to provide opportunities to explore the inter-relationships and inter-connectedness of the various courses and gather them together into a single learning experience.

The major project focuses upon the following:

- Interdisciplinary: The major project provides a platform for students to apply the knowledge and skills acquired from different courses.
- Collaboration: It encourages students to work in groups over an extended period of time. They clarify the task, plan their work, share the responsibilities and work towards the successful completion of the project.
- Process and Product: Project work focuses on both process and product. The process would include collaboration, gathering and processing of information. The product may take the form of a working model, a complete software package, etc.
- Written and Oral presentation: Project work provides students with opportunities to present their findings as a written thesis in a prescribed format and orally with an intended audience and purpose in mind.

During the first phase in the seventh semester, students are expected to choose the project, prepare a synopsis under the guidance of a project supervisor appointed by the department, present the synopsis to the committee set up for the purpose, get approval for the synopsis and start the project work. Students are expected to submit weekly activity reports and present a progress seminar during this phase. They will also undergo a viva voce examination, in which they will be examined on all the basic areas of the discipline in which they have chosen their project.

E-resource for learning
LaTeX, www.spoken-tutorial.org

COURSE/LEARNING OUTCOMES

At the end of the Major Project Phase I students will be able to

CO1: Identify different areas of research in the field of Electrical Engineering. (*Knowledge*)
CO2: Explain the importance of research in the chosen topic of interest. (*Comprehension*)
CO3: Apply theoretical knowledge to find out an appropriate topic of importance for research in the undergraduate level. (*Application*)
CO4: Analyse research work of technological importance published in various reputed national and international journals. (*Analysis*)
CO5: Formulate a research problem and objective of research to be carried out within a semester duration. (*Synthesis*)
CO6: Evaluate the project and present in a proper form. (*Evaluation*)

EEMP6026: MAJOR PROJECT (PHASE II) AND VIVA VOCE
(8 credits)

During the second phase students are expected to focus on process and completion of the projects and prepare project reports under the guidance of the Supervisors. The internal assessments shall be evaluated by the DPEC and the external assessment shall be done by the external examiner(s) assisted by the DPEC and the supervisor. The modality and components of the internal assessment and their weightages shall be notified at the beginning of each semester. The External assessment shall have the following components:

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

COURSE/LEARNING OUTCOMES

At the end of the Major Project Phase II students will be able to

CO1: List different stages of project work for the selected topic (Knowledge)
CO2: Describe the contribution of the outcome project for the benefit of the society. (Comprehension)
CO3: Demonstrate the observations and result either theoretical or experimental. (*Application*)
CO4: Analyse the observations and results obtained during the project work. (*Analysis*)
CO5: Compile a technical report on the project work. (*Synthesis*)
CO6: Evaluate the results obtained from the project work.(*Evaluation*)

EEBL6027: BASIC ELECTRICAL ENGINEERING LABORATORY
(1 credit) (L-T-P: 0-0-2)

Any ten experiments out of the following:
1. Calibration of Voltmeter.
2. Calibration of ammeter
3. Calibration of mili-voltmeter and ammeter
4. Calibration of mili-ammeter as voltmeter
5. Verification of Thevenin's Theorem.
6. Study of transient time-response of R-L and R-C circuits
7. Study of transient time-response of R-L-C circuits and resonance
8. Study of slip- torque characteristic of 3- phase Induction motor.
9. Study of connections of 3 phase transformer.

10. Study of DC-DC converter.
11. Study of DC-AC converter.
12. Reversal of direction of rotation of 3- phase induction motor by changing phase sequence.
13. Demonstration of components of LT switchgear.
14. Observation of the no-load current waveform of transformer on an oscilloscope.
15. Demonstration of cut-out sections of machines.

DEPARTMENT OF MECHANICAL ENGINEERING

Vision

To establish the department as a hub of quality technical education and research for aiding the industry and to strive for the upliftment of the North East Region and nation as a whole.

Mission

1. To train the youth to be intellectually competent with strong fundamentals in Mechanical engineering.
2. To create an environment for carrying out fundamentals and interdisciplinary research to address the future needs and challenges of a society and the industry.
3. To cultivate strong moral values and professional ethics to build them as responsible and environmentally conscious citizens.
4. To motivate, nourish and mould the students to be dynamic leader and entrepreneurs.

Program educational objectives (PEOs)

1. To develop the ability to design a system, component or process to meet the social and industrial requirements within realistic constraints.
2. To achieve high level of technical expertise through extensive project work, experiments, industrial visits and regular symposiums.
3. To inculcate professional ethics, leadership qualities and inherent creative instincts in students.
4. To encourage lifelong learning and to foster the ability to function on multi-disciplinary teams.

DETAILED SYLLABUS

MNEM0001: ENGINEERING MECHANICS

(3 credits – 45 hours)

Objective: *The main objective of this course is to develop the ability of the engineering students to analyze any engineering problem in a simple and logical manner, and apply a few well-understood basic principles to obtain a solution.*

Module I: Introduction to Statics(8 hours)

a) Definition: Statics and Dynamics, System of force, Resultant of force, Theorem of transmissibility, Concept of rigid body and particle, Free body diagram, Moment and Couple, Static equilibrium, Lami's and Varignon's theorem, Concept of stress and strain.
b) Friction, Laws of friction, application of friction in simple machines.

Module II: Truss and Beam (12 hours)

a) Types of beams, loads, types of support and Determination of support reactions.
b) Truss, Perfect and imperfect frames, Method of joints, Method of sections.

Module III: Centroid and Moment of Inertia (15 hours)

Centre of gravity and Centroid, Centroid of composite area, Mass and area Moment of inertia, Rotation of axes in Moment of inertia.

Module IV: Introduction to Dynamics (10 hours)

a) Rectilinear motion: Kinematics, equations of motion, Rectilinear translation, Momentum and Impulse.
b) Curvilinear motion: Curvilinear translation, equations of motion, kinetics of rotation of rigid body.
c) Work, Energy and Power, work-energy equation, Virtual work, D' Alembert principle.

COURSE/LEARNING OUTCOMES

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

CO1: State various principles, definitions, theorem related to mechanics relevant to engineering framework. (*Knowledge*)
CO2: Explain and illustrate ideas and concepts of engineering mechanics with problem solving attitude. (*Comprehension*)
CO3: Identify and analyze various systems with engineering mechanics perspective. (*Analysis*)
CO4: Solve problems and apply the ideas of mechanics in engineering applications. (*Application*)
CO5: Synthesizes the concepts of mechanics relevant to industrial applications. (*Synthesis*)
CO6: Decide the applicability of various methods for problem solving in engineering framework. (*Evaluation*)

Suggested Readings

1. R. S. Khurmi, A Textbook of Engineering Mechanics, S. Chand and Company Ltd.
2. Beer and Johnston, Vector Mechanics for Engineers, Vol I and II, Tata McGraw Hill.
3. J. L. Meriam and L. G. Kraige, Engineering Mechanics: Statics and Dynamics, Wiley India.
4. Shames, Irving, H., Rao, G. Krishno Mohana, Engineering Mechanics, PHI publication.
5. S. Timoshenko, D. H. Young, J. V. Rao, Engineering Mechanics, Tata McGraw Hill.

MNEM0002: ELEMENTS OF MECHANICAL AND CIVIL ENGINEERING

(4 credits - 60 hours)

Objective: *This course deals with understanding the basic concepts ideas of Civil engineering and Mechanical engineering to give exposure to realities existing in these foremost and parent engineering.*

Module I Thermodynamics (12 Hours)

a) Fundamental concepts and definitions: Thermodynamics system, surrounding and boundary, thermodynamic properties, path, processes and cycle, Macroscopic and Microscopic approach, Thermodynamic equilibrium, Pressure and Temperature, Zeroth Law of Thermodynamic.
b) Work transfer: Displacement work, path function, point function, Work done for constant volume, constant pressure, isothermal, adiabatic and polytropic processes, Internal energy, enthalpy specific heat at constant pressure and volume.
c) First Law of Thermodynamic and its application to non-steady flow systems, Steady flow energy equation, Limitation of First Law of Thermodynamic, Second Law of Thermodynamic, Clausius and Kelvin Planck Statements, concept of Entropy, Rankine cycle.

Module II: Fluid Mechanics (6 Hours)

Fundamental Concepts: Definitions of different types of fluids, Classification of fluids, Properties of fluids: Density, Viscosity, Surface tension, Capillary effect, Vapour Pressure, Classification of flows, Newton's law of Viscosity, Pascal's law, Pressure variation with depth, Manometers and its classification.

Module III: Manufacturing Technology (6 hours)

Fundamental Concepts: Types of materials: Ferrous metals, Non-Ferrous Metals, Alloys and Composites, Different Metal Forming Techniques, Casting, Welding.

Module IV: Theory of Machines (6 Hours)

Types of Belts and Gears, Transmission of Power by Belts and Gear Trains, Simple Belt Drive and Simple Gear, Drive, Velocity Ratio.

Module V: Surveying (10 Hours)

a) Introduction to Surveying: Definition of surveying, Principles of surveying, object and classification of surveying. Scales and Maps.
b) Chain Surveying: Different types of Chains and Tapes, measurement by tape and chain, errors in chain and tape measurements and their corrections and adjustment, chaining on flat and sloping ground, obstacle in chaining, direct and indirect methods of ranging.
c) Compass Surveying: Bearings and meridians, Types of Bearings, prismatic compass, surveyors compass, angular measurement, true north and magnetic north, magnetic declination, local attraction and its correction, Latitude and Departure, Compass traversing.

Module VI: Transportation Engineering (5 Hours)

Roadways, Railways, Airport (Indicative Introduction), Classification of Roads in India, Types of pavements, Flexible, Rigid and Semi Rigid, Ideal Cross Section, Definition of Basic Terms, Introduction to Earth, Gravel, WBM and Bituminous Road.

Module VII: Building Materials (15 Hours)

Definitions of Physical and Mechanical Properties, Stones: Classification of Rocks, Test for Stones, Attrition Test, Crushing Test, Hardness test, Qualities of good building Stone, Bricks: Manufacturing Process, Composition of good Brick Earth and Harmful ingredients, Kiln, Qualities of Good Bricks, Test for bricks, Classification of Bricks, Cement: Manufacturing process, composition and Harmful ingredients, Physical Properties and Test for Cement, Varieties of Cement, Aggregates: Sand, Classification and test, Grading, Mortar and Cement Concrete, Proportioning, Water Cement Ratio, Workability: Slump test, Placing of Concrete, Curing, Compressive Strength and testing, RCC works, Timber: Methods of Seasoning and Preservation, Defects in timber, Steel: Properties, Market forms of Steel, Other Materials: Ceramics, Paints, Varnishes and Distempers, Plastics, Latest trends in Building Material (indicative introduction).

COURSE/LEARNING OUTCOMES

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

CO1: State different laws and theories related to mechanical and civil engineering (*Knowledge*)

CO2: Explain the various laws and theorems in mechanical and civil engineering (*Comprehension*)

CO3: Demonstrate the use of various mechanical and civil engineering ideas and concepts in actual environment (*Application*)

CO4: Critically compare various techniques for mechanical and civil engineering requirements (*Analysis*)

CO5: Combine the learning of both mechanical and civil engineering for assembling and synthesizing various tools in engineering (*Synthesis*)

CO6: Examine and decide the environment in engineering perspective for developing various usage and tools. (*Evaluation*)

Suggested Readings

1. Nag P. K., Engineering Thermodynamics, 4th Edition, Tata McGraw Hill.
2. Chattopadhyay, P., Engineering Thermodynamics,2nd Edition, Oxford.
3. Domkundwar S., Kothandaraman C.P.,A Course in Thermal Engineering, 6th Edition, Dhanpat Rai & Co (p) Ltd.
4. Khurmi R. S., A Text Book of Engineering Mechanics, 20th Edition, S. Chand.
5. Rangwala, Building Materials
6. S.K. Duggal, Building Materials
7. Dr. B. C. Punmia, Surveying Vol I
8. S. K. Khanna, C. E. G. Justo, Highway Engineering.

MNEM0004: ENGINEERING MATERIALS

(3 credits - 45 hours)

Objective: *This course provides the introduction of the fundamentals of Material Science and Metallurgy to undergraduate students. The objective of the course is to understand the basic principles of material science and metallurgy. It includes mechanical testing to determine mechanical properties. It also includes various heat treatments, various engineering materials and their applications.*

Module I Introduction to metals and crystallography (11 Hours)

Classification of materials, various engineering materials, atomic structure of metals, crystal structure, crystalline and non-crystalline materials, Miller indices, anisotropic elasticity, imperfections in solids- point, line, surface, volume defects, grain structure, X-diffraction techniques-introduction, Bragg's law

Module II Mechanical behaviour of metals and testing (9 Hours)

Properties of materials – ductility, brittleness, toughness, fatigue behaviour. Types of stress-strain curves, interpretation of stress-strain curves, strain hardening, plastic deformation, cold working and hot working-recovery, recrystallization and grain growth. Testing of materials – tension and compression test, hardness test, impact test, fatigue test, creep test, non-destructive testing.Strengthening mechanisms in metals solid solution strengthening, Strain hardening, Dispersion and precipitation hardening,phase transformation.

Module III Phase transformation of metals (9 Hours)

Solubility of metals, alloys, constituent of alloys – eutectic, eutectoid, peritectic and peritectoid transformation, equilibrium phase diagrams, Ni-Cu, iron-carbon phase diagram, microstructures of various cooled steels- cooling rate effects, transformation rate effects and TTT diagrams.

Module IV Heat treatments (9 Hours)

Introduction and principles of heat treatment of steels, processing heat treatments for steels like full annealing, normalizing process and stress relief annealing, spheroidization. Heat treatments for nonferrous metals, strengthening heat treatments for steels, isothermal transformation diagram,Tempering of martensite, continuous cooling transformations. Quench media, austempering and martempering, Surface hardening of steels, flame,induction, laser and electron beam hardening, Pack, gas and liquid carburizing, nitriding, ion nitriding, Heat treatment furnaces and atmospheres, classification of furnaces, Heat treatment and energy and controlled atmospheres.

Module V Alloy steels and advanced materials (7 Hours)

Alloy steels – Limitation of plain carbon steels, effects of major alloying elements in steels, Classification of alloying elements, examples of alloy steels,Stainless steels – classification,heat treatment of stainless steels, High speed tool steels, Introduction of Advanced materials types, properties of composite materials, High temperature materials, Engineering ceramics- properties and use, Properties and use of polymers, Smart materials, nano-materials, shape memory alloys.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the nature of materials, specifically metals with respect to crystal structures, defects and phase transformation. (Comprehension)

CO2: State the various types of tests that can be undertaken to determine material behavior.(Knowledge)

CO3: Study various ferrous metals and its alloys, along with the different states they exist. (Comprehension)

CO4: Analyze the various heat treatment methods carried out in metals to change various parameters as per need. (Analysis)

CO5: Learn the effects of alloying and study advanced materials. (Comprehension)

CO6: Reinforce the important concepts, learnt during theory, through extensive laboratory work (Evaluation)

CO7: Synthesise the knowledge of different materials for the selection and application. (*Synthesis*)

CO8: Identify crystal structures for various materials and understand the defects in such structures. (*Application*)

CO9: Understand how to tailor material properties of ferrous and non-ferrous alloys. (*Comprehension*)

CO10: Quantify mechanical integrity and failure in materials. (*Application*)

Suggested Readings

1. Callister, Materials Science & Engineering, Wiley
2. V. Radhavan, Materials Science & Engineering, PHI
3. Narula, Materials Science, Tata McGraw Hill
4. B. Zakharov, Heat Treatment of Metals, CBS
5. R. K. Rajput, Materials Science & Engineering, Katson

MNMT0005: MANUFACTURING TECHNOLOGY I

(4 credits-60 hours)

Objective: *There are various processes in manufacturing for conversion of raw material into final products. The basic knowledge of these processes is essential for engineering students. This course provides students with an integrated treatment of the analysis of the manufacturing processes.*

Module I (12 hours)

a) Geometry of single point cutting tool: Tool in hand system, ASA and ORS, Tool signature.

b) The Lathe machine, lathe operations and application of lathe, lathe accessories and attachments, mechanism of lathe, Lathe machine's tools and types, Machining Time, depth of cut of lathe Capstan and Turret lathe, Drilling machine, types of drilling machine and application, drilling machine tools and nomenclature, machining times in drilling, cutting speed of drilling boring machine, Boring tools.

Module II (12 hours)

Shaper machine, types of shapers, Shaper mechanism, Planing machine, types of planning machine, cutting speed, depth of cut and machining time of shaper and planer, Slotting machine, types of slotting machine, Grinding machine, grinding wheels, Abrasives of grinder, mechanics of grinding process, Milling machine, types of milling machine, milling mechanism, milling attachments milling operations, milling tools, cutting speed, depth of cut, machining time. Broaching machine, Broaching methods

Module III (12 hours)

Pattern materials, Pattern making tools, types of patterns, Pattern making allowances. Moulding tools and equipments, types moulding sand, grain shape and size of sand, sand additives, properties of moulding sand, moulding processes

Module IV (12 hours)

weldability, types of welding, arc welding and equipments, gas welding and equipments. Resistance welding, Thermit welding, solid state welding, Brazing and Soldering.

Module V (12 hours)

Metal used in sheet metal work, tool, sheet metal operations, Sheet metal joints and allowances.

COURSE/LEARNING OUTCOMES

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

CO1: Recognize basic knowledge of manufacturing principles and mechanisms of various machine tools. (*Knowledge*)

CO2: Define various process parameters like speed, feed, depth of cut, MRR, cutting time etc. during machining operations (*Knowledge*)

CO3: Define various modern tools and engineering technology in manufacturing field. (*Knowledge*)

CO4: Explain the need for manufacturing technology in present day to day life. (*Comprehension*)

CO5: Classify various manufacturing techniques in the industries. (*Comprehension*)

CO6: Explain various machine tools, their processes and the process parameters. (*Comprehension*)

CO7: To identify, formulate and solve technical problems. (*Application*)

CO8: Earn ability to design and fabricate various prototypes. (*Application*)

CO9: Select and apply knowledge of mathematics, science, engineering, and technology to problems that require the application of principles and applied procedures or methodologies. (*Application*)

CO11: Learn an ability to identify, analyze, and solve broadly-defined production engineering technology problems. (*Analysis*)

CO12: Summarize various manufacturing technologies, machine tools depending upon their workability and capacity. (*Synthesis*)

CO13: Assess the impact of engineering technology solutions in a societal and global context. (*Evaluation*)

CO14: Determine the quality, timeliness, and continuous improvement in the production technologies. (*Evaluation*)

Suggested Readings

1. BS Raghuwanshi, A Course in Workshop Technology, Vol 1 and Vol 2, Dhanpat Rai
2. Hajra Choudhury, Elements of workshop Technology, Vol.1 and Vol.2, MPP
3. W Chapman, Workshop Technology, Part 1 and Part 2, Elsevier
4. PC Sarma, A Text Book of Production Engineering, S Chand
5. PC Sarma, A Text Book of Production Technology, S Chand
6. OP Khanna, Foundry technology, Dhanpat Rai

MNTD0006: THERMODYNAMICS

(4 credits-60 hours)

Objective: *Introduce students to thermodynamic terminology and concepts. To familiarize students with some common equipment used in energy systems and to reinforce students' knowledge and use of problem solving methods by solving a variety of thermodynamic process and systems applications.*

Module I (8 hours)

Introduction to 1^{st} law and its application to Steady flow energy equations in Nozzle, Throttling device, Turbine, Compressor, Condenser, Boiler etc. Introduction to 2^{nd} law: Heat engine, reversed heat engine and efficiency, refrigerator, heat pump and COP, Carton’s theorem and Corollary of carton’ theorem, Absolute thermodynamic temperature scale

Module II (8 hours)

Entropy, Clausius theorem, temperature entropy plot, Inequality of Clausius, Entropy principle and its applications, Entropy changes for closed system: Isobaric, Isochoric, Isothermal,Adiabatic and Polytropic processes. Availability and irreversibility.

Module III (12 hours)

Boiler, Classification of Boilers, Fire tube and Water tube, Cochran, Lancashire, Locomotive, Babcock and Wilcox. Industrial boiler: Packaged water tube boiler, Fluidized bed boiler. High Pressure boiler. Boiler Mountings and their functions. Boiler Accessories and its functions.

Module IV (12 hours)

Properties of steam: Phase transformation, Steam generation, Thermodynamic properties of steam, properties of wet and superheated steam, Steam table and mollier diagram. Vapour power cycles: Carnot cycle, Rankine cycle, Modified Rankine cycle, Reheat cycle, Regenerative cycle, Binary cycle

Module V (12 hours)

Introduction steam engine: simple steam engine plant, working of steam engine, Theoretical and actual indicator diagram, Indicated power of steam engine, efficiencies of steam engine. Steam Nozzles: types of nozzle, flow of steam through nozzle, expansion of steam considering friction, general relation between area, velocity, pressure in nozzle flow

Module VI (8 hours)

Air standard cycles: assumptions, Otto cycle, diesel, dual cycles their efficiencies and mean effective pressure. Comparison in between Otto, Diesel and Dual cycle. Lenoir cycle, Atkinson cycle,Brayton cycle, Stirling cycle.

COURSE/LEARNING OUTCOMES

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

CO1: Recall the basic definitions and terminology of thermodynamic system. (*Knowledge*)
CO2: Recognize the unidirectional behaviour of natural processes. (*Knowledge*)
CO3: Explain and differentiate between work consuming and work producing cycles. (*Comprehension*)
CO4: Illustrate the importance of air standard cycles. (*Comprehension*)
CO5: Calculate properties of various working substances at various states. (*Application*)
CO6: Determine how much useful energy can be produced from a given thermal source. (*Application*)
CO7: Compare the performance of various cycles for energy production. (*Analysis*)
CO8: Conclude on the behaviour of various cycles operating between temperature limits. (*Evaluation*)
CO9: Improve the energy production from a given thermal source by increasing the number of processes and the limiting conditions thereof. (*Analysis & Evaluation*)

Suggested Readings

1. R.K Rajput, Thermal Engineering, Laxmi publication
2. Dom Kundwar, A course in Thermal Engineering, Dhanpat Rai
3. P K Nag, Engineering Thermodynamics, Tata McGraw Hill
4. Y.A. Cengel, Themodynamics - An Engineering Approach, Tata McGraw Hill
5. K.K.Ramalingam, Steam Tables, Scitech

MNTM0007: THEORY OF MACHINES

(4 credits - 60 hours)

Objective: *To deepen understanding of kinematics analysis as an essential element of the design process Develop skills in analytical, graphical, and numerical methods for calculating kinematics and dynamics of machine elements.*

Module I (10 hours)

Kinematics : Mechanism and Machine, Links, Kinematic pairs, Degree of freedom, Kinematic Chain, Binary, Ternary, Quaternary Links and Joints, Inversions of Mechanisms, Different Types of Kinematic Chains and their Inversions.

Module II (10 hours)

Mechanisms with Lower Pairs: Pantograph, Straight Line Mechanisms, Approximate Straight Line Motion Mechanism: Watt's Straight mechanism, Modified Scott-Russel Mechanism, Gross-Hopper Mechanism, Tehebicheff's Mechanism, Robert's Mechanism, Application of Straight Line Motion in Engine indicators: Simplex indicator, Crosby indicator, Thomson Indicator, Double McInnes Indicator, Steering gears: Davis Steering gear, Ackermann Steering gear, Universal Hook's Joint.

Module III (15 hours)

Velocity and Acceleration in Mechanisms: Instantaneous centre method, Analysis of reciprocating Engine Mechanism by Instantaneous centre method, Analysis of four bar mechanism by instantaneous method, Method and types of instantaneous centres in a mechanism, Method for locating an instantaneous centre. Relative Velocity method, Velocities in four bar chain, Velocities in slider crank chain; Simple velocity and acceleration diagrams; rubbing velocity at pin joints; Acceleration of a body moving along circular path, Acceleration diagram for a link and slider crank mechanism, Coriolis acceleration component.

Module IV (15 hours)

a) Gears and Gear Trains: Classification of gears, Definition of terms used in gears, Law of gearing or condition for constant velocity ratio of gear wheels, velocity of sliding, Forms of Teeth, Cycloid profile teeth, Length of path of contact, length of arc of contact, Number of pairs of teeth in contact, Interference in involute gears, Minimum number of teeth required on the pinion in order to avoid interference, Minimum number of teeth required on the wheel in order to avoid interference, Helical gears, spiral gears.

b) Types of gear trains: simple gear train, compound gear train, Reverted gear train, Epicyclic gear train, Velocity ratio of gear train, Sun and planet gear, Torque and tooth loads in epicyclic gear train.

Module V (10 hours)

Belt Drive: Belt and Rope Drives and their classifications, Relations for torque, maximum power transmission, length of open and cross belts, belt slip, crowning of pulley.

COURSE/LEARNING OUTCOMES

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

CO1: Define link, pair, chain, mechanism, machine, degree of freedom; state law of gearing, law of belting. (*Knowledge*)

CO2: Recognize various mechanisms with lower and higher pairs; various drives and gear parameters (*Knowledge*)

CO3: Classify the different building elements in a mechanism and explain different possible relative motions between the elements; classify various types of gears and gear trains (*Comprehension*)

CO4: Perform velocity and acceleration analysis of different mechanisms. (*Application*)

CO5: Find out degree of freedom of a given mechanism. (*Application*)

CO6: Analyze a given belt or gear drive or mechanism for its suitability of application as per some constraints. (*Analysis*)

CO7: Synthesize mechanisms as per practical requirement and constraints. (*Synthesis*)

CO8: Judge and decide between various alternatives available in terms of different mechanisms for a particular application; various transmission systems and drives. (*Evaluation*)

Suggested Readings

1. SS Rattan, Theory of Machines, Tata Mc Graw hill publications.
2. RK Bansal, Theory of Machines, Laxmi publications.
3. J. Lal, Theory of Machines, Metropolitan Books Ltd.
4. J.J.Uicker, Jr, G.R.Pennock and J.E. Shigley, Theory of Machines and Mechanisms (3rd edition), Oxford University Press.
5. V.P. Singh, Theory of Machines.
6. A. Shariff, Theory of Machines.

MNSM0009: STRENGTH OF MATERIALS

(4 credits - 60 hours)

Objective: *This course is a foundation to many advanced techniques that allow engineers to design structures, predict failures and understand the physical properties of materials. The purpose is to develop the theoretical basis, derive the theories of strength of materials using sound mathematical principles and enable students to systematically solve engineering problems.*

Module I: Stresses and Strains (15 hours)

a) Simple Stresses and Strains: Concept and types of Stresses and Strains, Poisson's ratio, stresses and strains in simple and compound bars, stress-strain diagrams, Hook's law, elastic constants and their relationships, thermal stresses and strains in simple and compound bars.
b) Compound Stresses and Strains: Concept of surface and volumetric strains, two dimensional stress system, conjugate shear stress at a point on a plane, principal stresses and strains and principal planes, Mohr's circle of stresses.

Module II: Shear Force and Bending Moment (10 hours)

Definitions, SF and BM diagrams for cantilevers, simply supported beams with and without overhang and calculation of maximum SF and BM and the point of contraflexure under (i) concentrated loads, (ii) uniformly distributed loads(UDL) over whole span or a certain span, (iii) combination of concentrated loads and UDL, (iv) uniformly varying loads(UVL); application of bending moments, relation between bending moment, shear force and load.

Module III: Torsion (10 hours)

Definition of Torsion, torsion in thin circular tube, solid and hollow circular shafts, tapered shaft, stepped shaft and composite circular shafts, combined bending and torsion, equivalent torque, effect of end thrust.

Module IV: Bending, Shear Stresses and Deflection of Beams (15 hours)

Bending stresses in beams with derivation and application to beams of circular, rectangular, I, T and channel sections, composite beams, shear stresses in beams with combined bending, torsion and axial loading of beams, deflection of a beam by (i) double integration method, (ii) Macaulay's method, (iii) Moment Area method.

Module V: Columns and Struts (10 hours)

Combined bending and direct stress, middle third and middle quarter rules. Struts with different end conditions. Euler's theory and experimental results, Rankine Gardon formulae, Examples of columns in mechanical equipments and machines.

COURSE/LEARNING OUTCOMES

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

CO1: Define and explain the stress strain curves and its associated terms. (*Knowledge*, *Comprehension*)
CO2: Evaluate the stresses and strain developed in loaded bodies. (*Evaluation*)
CO3: Evaluate normal stresses and shear stress on an inclined plane of a loaded body as well as find out the principal stresses and planes wherever applicable.(*Evaluation*)
CO4: Construct shear force diagrams and bending moment diagrams for different beams with varying loads and boundary conditions. (*Synthesis*)
CO5: Compute the strength of shafts and tube subjected to bending moment and torsion. (*Application*)
CO6: Predict the deflection in different beams on the basis of loading conditions and beam geometry. (*Analysis*)
CO7: Analyze the buckling of various types of columns and different boundary conditions. (*Analysis*)

Suggested Readings

1. R. K Bansal " Strength of Materials" Laxmi Publication.
2. B. C. Punmia et. al., "Mechanics of Materials", Laxmi Publications (P) Ltd.
3. Beer and Johnston, "Mechanics of Materials", Prentice hall India
4. R.K Rajput, "Strength of Materials", SK Kataria and Sons, Delhi
5. Timoshenko S.P; "Elements of Strength of Materials", Tata McGraw Hill, New Delhi

6. Ramamrutham, S “Strength of Materials”, Dhanpat Rai and Sons, Delhi
7. Kazimi S.M.A, “Solid Mechanics”, Tata Mc Graw Hill Publishing Co; New Delhi.

MNHM0010: HYDRAULICS MACHINERY

(3 credits – 45 hours)

Objective: *The course familiarises students with basic facts relating to working principles of hydraulic machines and equipment used in all industrial fields. It deals with pumps, hydraulic motors, water turbines and fluid mechanisms such as hydraulic elements, hydraulic transmissions and couplings.*

Module I: Impact of free jets (10 hours)

Force exerted on stationary flat plate held normal to jet and inclined to jet, force exerted on curved plate, force exerted on moving flat plate normal to jet and moving inclined to the direction of the jet, jet propulsion of jet

Module II: Hydraulic Turbines (10 hours)

Classification of hydraulic turbines, Impulse and reaction turbines, Pelton wheel, work done and efficiency of Pelton wheel, Francis turbine, propeller turbine and Kaplan turbine, draft tube , specific speed, performance characteristics of hydraulic turbines, cavitation

Module III: Centrifugal pumps (10 hours)

Classification of centrifugal pumps, working principles and head of centrifugal pumps, losses and efficiencies of centrifugal pumps, effect of variation of discharge on efficiency, multi stage centrifugal pumps, characteristics of centrifugal pumps, Net Positive Suction Head, cavitation and priming of centrifugal pumps.

Module IV: Reciprocating pumps (10 hours)

Classification of reciprocating pumps, working principles of reciprocating pumps, discharge, work done, power for reciprocating pumps, single acting and double acting reciprocating pumps, slip, indicator diagram, air vessels.

Module V: Miscellaneous hydraulic machines (5 hours)

Hydraulic accumulator, hydraulic intensifier, hydraulic press, hydraulic crane, hydraulic lift, hydraulic ram, hydraulic coupling, hydraulic torque converter, jet pump, submergeable pump.

COURSE/LEARNING OUTCOMES

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

C01: Introduce and define governing principle of impulse momentum, various hydraulic turbines and pumps. (*Knowledge*)

C02: Classify and identify the various types of pumps and turbines, their performance characteristics, blade triangles and various efficiency study. (*Comprehension*)

C03: Solve various numerical problems based on the application of impulse momentum theory in impact of jet problems and performance characteristics of turbines and pumps based on velocity triangle approach. (*Application*)

C04: Analyze various results to estimate the performance of turbines and pumps. (*Analysis*)

C05: Generalize the results obtained through numerical approach and comment with suitable conclusion and future study if any. (*Evaluation*)

Suggested Readings

1. R.K Rajput, Text book on hydraulic machines, S.Chand.
2. Dr.R.K. Bansal, Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi publication.
3. Jagadish Lal, Fluid machines Including Fluid mechanics, Metropolitan Book Co.
4. P.N Modi and S.M Seth, Hydraulics and Fluid Mechanics, Standard Book House.

MNDM0011: DYNAMICS OF MACHINES

(4 credits - 60 hours)

Objective: *To understand the fundamentals of the theory of kinematics and dynamics of machines as well as to understand techniques for studying motion of machines and their components.*

Module I: Cams (12 Hours)

Types of followers, Nomenclature of followers, Motion of follower, Simple harmonic motion of follower, Uniform acceleration and retardation, Cycloidal motion, cam profile construction, cam profile for roller followers.

Module II: Balancing of Rotating Masses (12 Hours)

Static and dynamic balancing. Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Module III: Balancing of Reciprocating Masses (12 Hours)

Balancing of reciprocating engine, Partial balancing of primary force, Partial balancing of locomotives, Variation of tractive force, swaying couple, hammer blow, coupled locomotive, primary balance of multi-cylinder inline engine, Secondary balance of multi-cylinder inline engines, Method of direct and reverse cranks.

Module IV: Governors (12 Hours)

Types of Governor, Watt Governor, Porter governor, Proell Governor, Hartnell Governor, Wilson-Hartnell governor, Sensitivity, Stability, Isochronism, Hunting, Governor Effort and Power, controlling force.

Module V: Flywheel (12 Hours)

Fluctuations of energy, Co-efficient of fluctuation of energy and speed, function of flywheel.

COURSE/LEARNING OUTCOMES

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

CO 1: List different types of cam, follower and governors. (*Knowledge*)

CO 2: Recognize various types of motions exhibited by a cam and follower mechanism (*Comprehension*)

CO3: Explain the concept and need of balancing, its necessity and different effects on a system (*Comprehension*)

CO4: Illustrate the working of governor, flywheel (*Comprehension*)

CO5: Perform cam profile design for simple applications with standard motions (*Application*)

CO6: Compare between static and dynamic balancing of rotational parts (*Analysis*)

CO7: Synthesize a balanced system in case of systems with rotational mass, reciprocating mass (*Synthesis*)

CO8: Evaluate a designed system in terms of balancing; judge on the suitability of selection of a particular flywheel, governor for a specific application (*Evaluation*)

Suggested Readings

1. Rattan S.S., Theory of Machines, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2009.
2. Amitabha Ghosh and Ashok kumar Mallik , Theory of Mechanisms and Machines, Third Edition Affiliated East-West Press.
3. J. Lal, Theory of Machines, Metropolitan Books Ltd.
4. Joseph Edward Shigley and John Joseph Uicker, Theory of Machines and Mechanisms, Jr. Second Edition, MGH, New York

MNMT0012: MANUFACTURING TECHNOLOGY II

(4 credits - 60 hours)

Objective: *There are various processes in manufacturing for conversion of raw material into final products. The basic knowledge of these processes is essential for engineering students. This course provides students with a further treatment of the analysis of the manufacturing processes.*

Module I: Mechanics of metal cutting (14 hours)

Reference to ASA and ORS, Mechanism of chip formation, Type of chips. Orthogonal and oblique machining, Chip thickness ratio - velocity relationship, Stress, Strain and Strain rate, Merchant Circle Diagram, Measurement of cutting forces, Cutting variables and factors affecting them. Cutting Tool Materials. Tool wears and Tool life, Basic causes, Progressive tool wears, Tool life, Variables affecting the tool life, Taylor's tool life equation. Machinability, Definition, Techniques for improving Machinability. Tool nomenclature

Module II: Heat Generation and Cutting Temperature in Machining (10 hours)

Heat generation in machining - Location, causes, effects of cutting temperature on job and tool, variation of machining parameters and control of cutting temperature, cutting fluids – Types and applications.

Module III: CNC Machines (12 hours)

Introduction – working principle, coordinate system in CNC Machine Tools, path control, point to point, continuous, machining centers, part programming- manual, Computer Assisted Part Programming (CAPP), G codes and M codes, CNC program for operations, turning, drilling, threading, canned cycle operations.

Module IV: Non-conventional Machining (12 hours)

Need for non-conventional Machining, principles of operation - machine setups, applications, merits and demerits of (a) Abrasive Jet Machining, (b) Ultrasonic Machining, (c) Electrochemical Machining, (d) Electro-discharge Machining, (e) Laser Beam Machining, (f) Electron Beam Machining. Comparative study of the above processes.

Module V: Jigs and Fixtures (12 hours)

Introduction, elements of jigs and fixtures, principle of location, locating methods and devices, design principle for location; Clamping, principles for clamping, clamping devices; Indexing jigs and fixtures, indexing devices, fool-proofing.

COURSE/LEARNING OUTCOMES

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

CO1: Define machining and classify the associated nomenclatures. (*Knowledge*)
CO2: Define and state various uses of jigs and fixtures along with the associated principles. (*Knowledge*)
CO3: Explain the various non-traditional machining operations and understand the advantages and limitations of each. (*Comprehension*)
CO4: Classify the different causes of heat generation and explain the role of cutting fluids. (*Comprehension*)
CO5: Execute various machining operations through the use of CNC programming. (*Application*)
CO6: Analyze the various forces developed during machining with single point cutting tool. (*Analysis*)
CO7: Assess the various causes of tool wear and examine the various ways of preventing it. (*Evaluation*)
CO8: Summarise various metal processing parameters to apply in practical field. (*Synthesis*)

CO 9: Construct Mohr's circle diagram for evaluation for forces. (*Synthesis*)

Suggested Readings

1. A.B.Chattopadhyay, Machining and Machine Tools, Wiley India Pvt Ltd
2. P.N. Rao, Manufacturing Technology, Tata McGraw Hill
3. G.K. Lal, Introduction to Machining Science, New Age International Limited
4. P.H. Joshi, Jigs and Fixtures, Tata McGraw Hill
5. Amitabha Ghosh and Ashok Kumar M allick, Manufacturing Science, East West Press
6. P.K. Mishra, Non-Conventional Machining, Narosa Publishing House.

MNAT0013: APPLIED THERMODYNAMICS

(3 credits - 45 hours)

Objective: *This course is designed to introduce basic application of thermodynamic systems such as turbine, compressor refrigerator and air condition and their application in real life situations. The course will help students to understand the dynamics of energy through the air, gas or other media; calibration of measuring instruments and build students' ability to solve thermodynamic problems.*

Module I: Steam Turbine and Steam Condenser (11 hours)

Classification, Flow of steam through impulse and reaction turbines, Velocity diagrams, Compounding of steam turbines, Losses in steam turbine. Steam condenser-introduction and classification, Function of steam condenser, Elements of a condenser plant, sources of air in condenser, effects of air leakage in condenser, vacuum and condenser efficiency.

Module II: Air Compressor (12 hours)

Introduction; Reciprocating type – Single stage and multi-stage, Compression ratio and volumetric efficiency, effect of clearance, compressor efficiencies. Methods for improving thermal efficiencies. Compressor work and power. Intercooler and after-cooler. Rotary compressors: Classification, Centrifugal compressors: theory of operations, impeller and diffuser, impeller work; efficiency. Rotary Vs Reciprocating compressor.

Module III: Gas Turbine and Jet Propulsion (12 hours)

a) Gas turbine: introduction and classification, constant pressure combustion gas turbine , thermal and compressor efficiency, method of improving thermal efficiency of open cycle gas turbine, constant volume combustion gas turbine.
b) Jet propulsion: introduction and classification, thrust, thrust power, propulsive efficiency and thermal efficiency.

Module IV: Refrigeration and Air Conditioning (10 hours)

Fundamentals of refrigeration, C.O.P, reversed Carnot cycle, reversed Brayton cycle, simple vapour compression cycle, actual vapour compression cycle, volumetric efficiency, simple vapour absorption system. Introduction to psychometry and its properties, psychometric relation, psychometric chart and processes.

COURSE/LEARNING OUTCOMES

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

CO1: List the basic concepts and definitions used in engineering thermodynamics. (*Knowledge*)

CO2: Illustrate the mathematical skills to solve thermodynamics problems. (*Comprehension*)

CO3: Compute the performance and characteristics of mechanical components and energy systems. (*Application*)

CO4: Demonstrate the various psychrometric processes on a psychrometric chart and their practical implication. (*Application*)

CO5: Identify and categorize available renewable energy sources, energy conversion and application. (*Analysis*)

CO6: Synthesize solution to thermodynamic problems in HVAC systems, power plant, engines or renewable energy devices. (*Synthesis*)

CO7: Evaluate the relevant parameters of various energy systems and conclude the most efficient one in terms of it. (*Evaluation*)

CO8: Determine the most environmental friendly energy system in terms of emission parameters. (*Application & Analysis*)

Suggested Readings

1. R. K Rajput, Thermal Engineering, Laxmi publication
2. Domkundwar, A course in Thermal Engineering, Dhanpat Rai and Co (P) Ltd.
3. K. K. Ramalingam, Steam Tables, Scitech
4. Onkar Singh, Applied Thermodynamics, New Age.

MNMD0014: MACHINE DESIGN I

(4 credits - 60 hours)

Objective: *To make students learn about various design considerations and accordingly their applications into the design field. Afterwards, students will be able to have proper conceptualization of designing the essential machine components like screws, shafts, couplings, gears, joints, springs etc., under different safety limitations.*

Module I: Introduction to design (10 hours)

Overview and need of design, Design procedures, Engineering materials and their properties, Material selections and design considerations, BIS standards, Tolerances and Fits.

Module II: Design against static load (10 hours)

Modes of failure, Factor of safety, Stress-strain, Design of cotter and knuckle joints, Theories of failure: Maximum normal-stress theory, Maximum shear-stress theory and Distortion-energy theory.

Module III: Design against fluctuating load (10 hours)

Stress concentration, Modes of failure, Fluctuating stresses, Fatigue failure and S-N diagram, Notch sensitivity, Soderberg, Goodman and Gerber diagrams, modified Goodman diagrams, Fatigue design under combined stresses.

Module IV: Shafts, keys, Joints and couplings, Springs (20 hours)

a) Power Screw: Forms of threads, self locking screw, efficiency of screw. Threaded fasteners: I.S.O. Metric screw thread, Bolted joint in tension, Torque required for bolt tightening.

b) Permanent Joints: Design of Riveted joints and welded joints and their strength.

c) Shafts, keys and couplings: Design of shaft subjected to bending, torsion, axial and combined loading, keys, cotter and Knuckle joint.

d) Springs: Helical springs, Leaf springs, Spring materials, Design against static and fluctuating load.

Module V: Brakes and clutches (10 hours)

a) Brakes: Types of brakes, Energy absorbed by the brakes, Design of Block, band and disc brakes.

b) Clutches: Classification, application and design of friction clutches, Disc or Plate clutches, Cone clutches, Centrifugal clutches.

COURSE/LEARNING OUTCOMES

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

CO1: State and apply design procedures in mechanical engineering. (*Knowledge*)
CO2: Interpret and classify different types of failure criterion of mechanical parts under static and dynamic loading conditions. (*Comprehension*)
CO3: Learn the uses of the theories of failure and apply them to specific design problems associated with various type of stresses. (*Application*)
CO4: Learn different types of fits and tolerances and the application of system of tolerances defined by BIS and to decide the use of correct tolerance. (*Application*)
CO5: Design various types of machine elements by considering the environmental effect with incorporation of design factors and to evaluate safe dimensions. (*Synthesis*)
CO6: Synthesize, analyze and evaluate the design data available for components like shafts, keys, couplings, brakes, clutches etc. and to decide their use. (*Synthesis*, *Analysis*, *Evaluation*)

Suggested Readings

1. V. B. Bhandari, Design of Machine Elements, Tata McGraw Hill Publications.
2. J.E. Shigley et al., Mechanical Engineering Design, Tata McGraw-Hill Publications
3. P. C. Gope, Machine Design: Fundamentals and Applications, PHI Learning Pvt. Ltd.
4. U. C. Jindal, Machine Design, Pearson Education.
5. K Mahadevan et. al., Design Data Handbook, CBS Publishers and Distributors Pvt. Ltd.
6. V. B. Bhandari, Machine Design: Data book, Tata McGraw Hill Publications.
7. Design Data: Data book of Engineers, PSG College Kalaikathir Achchagam, Coimbatore.

MNOR0015: OPERATIONS RESEARCH

(4 credits - 60 hours)

Objective: *Operations Research can be described as a scientific approach to the solution of problems in the management of complex systems. In a rapidly changing environment an understanding is sought which will facilitate the choice and the implementation of more effective solutions which, typically, may involve complex interactions among people, materials and money.*

Module I: Introduction to Linear Programming (15 hours)

Introduction to linear programming - formulation, graphical method, Simplex method and its applications, initial basic feasible solution, optimality test, Big M method and Two Phase method.

Module II: Special topics in Linear Programming (15 hours)

Duality in linear programming, the dual simplex method, the revised simplex method, sensitivity analysis of linear programming, Goal programming, and Integer programming.

Module III: The Transportation Model and The Assignment Model (15 hours)

a) Formulation and solution of Transportation Model, North-west Corner method, Vogel's approximation method, stepping stone method, modified distribution method, degeneracy in Transportation problem, least time transportation problems,
b) Mathematical representation and solution of assignment model, Hungarian method.

Module IV: Sequencing Problem, Replacement Analysis and Queueing Model (15 hours)

Assumptions in sequencing problem, processing of n jobs through one machine, two machines and three machines, processing of two jobs through m machines. Replacement of items whose maintenance and repairing cost increase with time, i) ignoring changes in the value of money, ii) value of money changes with time; replacement of items that fail suddenly. Introduction to Queueing Model.

COURSE/LEARNING OUTCOMES

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

CO1: Recognize the use of operations research in handling various industrial as well as real life problems. (*Knowledge*)
CO2: Explain the various concepts like linear programming, transportation, assignment, sequencing etc. used in operations research framework. (*Comprehension*)
CO3: Apply various methods and techniques for problem solving in industry with operations research framework. (*Application*)
CO4: Analyze, criticize, and compare various techniques for operations research (*Analysis*)
CO5: Synthesize the use of operations research in actual environment. (*Synthesis*)
CO6: Evaluate, decide, and determine the best possible way to organize and maintain operations in industrial work scenario with better productivity. (*Evaluation*)

Suggested Readings

1. C. Mohan, "Optimization Techniques" New Age
2. D. S. Hira and P.K. Gupta, "Operations Research"S. Chand
3. J.K. Sarma"Operations Research "Macmillan
4. Taha " Operation Research an introduction"Pearson
5. Billey Gillet "Operations Research" PHI
6. N.G Nair "Operations Research" Dhanpat Rai Publication
7. Pablo Pedvegal " Introduction to Optimization" New Age.

MNMM0016: MECHANICAL MEASUREMENT

(3 credits - 45 hours)

Objective: *This course provides an introduction to the fundamentals of mechanical measurement devices and their use in mechanical field.*

Module I: Principles and characteristics of Measurement systems (7 Hours)

Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors.

Module II: Transducer (5 Hours)

Transducer, LVDT transfer efficiency, Primary and secondary transducers, electrical, mechanical, electronic transducer, advantages of each type of transducers.

Module III : Measurement of pressure and flow (10 Hours)

Introduction to pressure measurement, Manometer, types of manometer, Mechanical gauges pressure, electrical pressure transducers, measurement of high pressure. Measurement of low pressure - Mcleod gauge, ionization gauges pirani gauges. Introduction to flow measurement, rotameter, elbow meter, electromagnetic flow meter, hot wire anemometer, ultrasonic flow meter, Hydrometer.

Module IV: Measurement of force, torque velocity and acceleration (10 Hours)

Principle, analytical balance, platform balance, proving ring. Torque measurement – Rope brake, Prony brake, hydraulic dynamometer, eddy current dynamometer, mechanical tachometer, piezoelectric accelerometer and dynamometer.

Module V: Temperature and strain measurement (13 Hours)

Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer, Strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement.

COURSE/LEARNING OUTCOMES

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

CO1: Define basic concepts related to measurements. (*Knowledge*)
CO2: Classify different types of errors and compute the same while taking measurements. (*Comprehension*)
CO3: Classify the various types of transducers as well as understand the importance and functioning of LVDTs. (*Comprehension*)
CO4: Identify the different ways of measuring pressure and flow and criticize each method for its advantages and limitations. (*Evaluation*)
CO5: Identify the different ways of force, torque and acceleration as well as be able to criticize each method for its advantages and limitations. (*Evaluation*)
CO6: Identify the different ways of measuring temperature and criticize each method for its advantages and limitations. (*Evaluation*)
CO7: Identify the different ways of measuring strain and criticize each method for its advantages and limitations. (*Evaluation*)

Suggested Readings

1. R.K.Rajput, Mechanical measurements and Instrumentation, S.K.Kataria and Sons publishers, New Delhi
2. A.K. Sawhney, A Course in Mechanical Measurement & Instrumentation, Dhanpat Rai Publication, New Delhi
3. R. S. Sirohi, Mechanical Measurement, New Age Publications, New Delhi
4. D. S. Kumar, Mechanical Measurement and Control, Metropolitan Books Co. Pvt. Ltd.

MNMD0018: MACHINE DESIGN II

(4 credits - 60 hours)

Objective: *This course is a further extension of Machine Design I. The objective is to make students able to perform modifications in design which could meet the requirement standards for safe machine elements. The applications of empirical as well as standard equations with available design data will help students understand practical design engineering.*

Module I: Bearings (15 hours)

Types of bearings, Ball and roller bearings, Journal bearings, Static and dynamic load carrying capacity, Load life relationship, Taper roller bearings, Bearing lubrication and mounting.

Module II: Belt and chain drive (10 hours)

a) Design of belt drive: geometrical relationships, analysis, condition for maximum power, V belts.
b) Design of chain drive: geometrical relationships, sprocket wheels, design of chain drive.

Module III: Gears (20 hours)

a) Design of Spur gears: classification, selection of material, force analysis, gear tooth failures, beam strength of spur gear tooth, wear strength.
b) Design of Helical gears: virtual teeth and tooth proportions, force analysis, beam strength of helical gear tooth, effective load, wear strength.
c) Design of Bevel gears: force analysis, beam strength, wear strength, effective load.
d) Design of Worm gears: proportions of worm gears, force analysis, friction in worm gears, strength rating and wear rating of worm gears.

Module IV: Flywheels and IC engine components (15 hours)

a) Design of Flywheels: Turning moment diagram, solid disk flywheel, rimmed flywheel.
b) Design of IC engine components: cylinder, piston, connecting rod, crankshaft, valves.

COURSE/LEARNING OUTCOMES

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

CO1: Learn and differentiate between types of bearings and learn the method of selection of suitable bearings for different applications. (*Knowledge & Comprehension*)

CO2: Understand the use of belt drive based on power rating and to predict different parameters by interpolating the data available. (*Analysis*)

CO3: Learn, illustrate and develop the idea of gear tooth profile design, tooth strength and other parameters for different type of gears and to limit the error by precise computation. (*Knowledge & Comprehension*)

CO4: Analyze, identify and relate the design data available for components like bearings, belt, chain, gear, IC engine components etc. (*Application & Analysis*)

CO5: Solve a design problem involving practical situations and calculate suitable design dimensions by generalization of failure. (*Application & Synthesis*)

CO6: Synthesize and evaluate an assembly drawing of machine components using the suitable dimensions. (*Synthesis & Evaluation*)

Suggested Readings

1. V. B. Bhandari, Design of Machine Elements, Tata McGraw Hill Publications.
2. J.E. Shigley et al., Mechanical Engineering Design, Tata McGraw-Hill Publications.
3. P. C. Gope, Machine Design: Fundamentals and Applications, PHI Learning Pvt. Ltd.
4. U. C. Jindal, Machine Design, Pearson Education.
5. K Mahadevan et. al., Design Data Handbook, CBS Publishers and Distributors Pvt. Ltd.
6. V. B. Bhandari, Machine Design: Data book, Tata McGraw Hill Publications.
7. Design Data: Data book of Engineers, PSG college kalaikathir achchagam, coimbatore
8. BIS standards on Limits & Fits (IS 919), Surface Finish (IS 2073), Machine Tool Alignment, 1993

MNMT0019: ENGINEERING METROLOGY

(3 credits - 45 hours)

Objective: *The science of precision measurement is called Metrology. The aim of this course is to develop knowledge and skills regarding various measuring instruments among the students. The subject imparts knowledge about process control and quality control by making measurements and inspection of various parameters.*

Module I: Standards of Measurements (10 Hours)

Definition and objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, Wavelength standard, sub division of standard, line and end standard, calibration of end bars (Numerical), Slip gauges, wringing phenomena.

Module II: System of Limits, Fits and Tolerance and Gauging (12 Hours)

a) Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, Indian standards (IS 919-1963) - Concept of Limits of size and tolerances, compound tolerance, accumulation of tolerances, Natural tolerance and process capability, geometrical tolerance, positional tolerances; definition of fits, types of fits and their designation. Hole basis system, shaft basis system.

b) Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowances on gauges, Types of gauges - Plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

Module III: Comparators and Angular measurement (10 Hours)

a) Introduction to comparators, characteristics, classification of comparators, mechanical comparators - Johnson Mikrokator, sigma comparators, dial indicator; optical comparator - principles, Zeiss ultra optimeter; pneumatic comparators - back pressure gauges, solex comparators.

b) Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges, clinometers, profile projector.

Module IV: Interferometer and screw thread, gear measurement and surface texture (13 Hours)

a) Interferometer, principle of interference, gauge interferometer, Laser interferometer, Optical flats, use of optical flat, autocollimator.
b) Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire. Tool maker's microscope.
c) Gear tooth terminology, use of gear tooth Vernier caliper and micrometer.
d) Meaning of surface texture, order of geometrical irregularities, estimation of surface roughness, measurement of roughness by Stylus equipment.

COURSE/LEARNING OUTCOMES

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

CO1: Define and differentiate the basic measurement standards. (*Knowledge*)
CO2: Understand the principles of measuring instruments, gauges and their uses. (*Comprehension*)
CO3: Classify limits, fits and tolerances. (*Analysis*)
CO4 Compare the different methods for linear and angular measurement. (*Analysis*)
CO5 Perform the inspection of spur gear and thread elements. (*Application*)
CO6 Compare and evaluate the screw, gear and surface measurement techniques. (*Evaluation*)
CO7: Summarize the different measurement standards for the practical purpose. (*Synthesis*)

Suggested Readings

1. R. K Jain, Engineering Metrology, Khanna publishers, New Delhi
2. M.Mahajan, A Text book of Metrology, Dhanpat Rai and Co Ltd, New Delhi
3. N.V. Raghavendra, Engineering Metrology and Measurement, Oxford University Press, New Delhi
4. Anand Kr. Beroor, Metrology and Measurement, Tata McGraw-Hill Publications, New Delhi

MNMS0020: MANUFACTURING METHODS

(4 credits - 60 hours)

Objective: *The objective of this subject is to make the reader familiarize with different manufacturing processes and their underlying principles and make them understand the importance of manufacturing for humankind. This course provides the knowledge of different non-subtractive manufacturing methods with special emphasize on metal casting, metal forming and powder metallurgy and their associated processes. After successfully completing the course, the reader will be able to distinguish between various manufacturing processes and select the best suited method for manufacturing as per their special need & availability.*

Module I: Metal casting and allied processes (10 hours)

Introduction: Solidification behaviour in casting, Centreline shrinkage, Comparative study of different melting furnaces. Special casting methods, Permanent mould casting , Pressure Die casting, Hot chamber, Cold chamber, Air blown methods, Low pressure Die casting, Continuous casting. Non-metallic mould casting, Centrifugal casting, Investment casting. Casting defects, their causes and remedies, Inspection.

Module II: Metal forming and press work (14 hours)

a) Introduction: Classification, Hot, Cold and Warm working, Variables affecting mechanical working process.
b) Rolling: Principle, Condition for continuous rolling, Forces acting on metal during rolling, Types of rolling mills, Roll pass design, Roll Piercing.
c) Forging: Forgeability, Forgeable materials, Metallurgy of Forging, Classification, Hand forging operations, Forging hammers, Drop forging, Press forging, machine forging, Forging Defects, Die design considerations.
d) Extrusion: Classification, Principle of operations, Variation of ram pressure with ram travel, Principle of operations of Hydrostatic extrusion, side extrusion, impact and Hooker's extrusion. Wire, Rod and Tube drawing, Principle and Operation.
e) Press Work: Introduction, Different types of Press and Selection of Presses, Press Operations –Main parts of power press, Feeding mechanism, Press working dies, Principles and Operations of Cutting/Shearing and Deep drawing operations, Cutting and drawing dies, Design considerations.

Module III: High Energy Rate Forming (HERF) (6 hours)

Introduction, Reasons that prompted transition to HERF, Classification , Principles and operations of Explosive Forming, Electro-hydraulic Forming, Electro-magnetic forming.

Module IV: Thread and Gear Manufacturing (16 hours)

a) Production of Screw Threads:- Possible Methods and Their Characteristics: Casting, Forming (Rolling), Machining, Grinding, Near net shape production by investment casting and injection moulding, Non-conventional processes.
b) Production of gears: Casting, Rolling, Blanking, Injection moulding, Extrusion, Wire EDM; Machining:- (Form cutter methods such as Shaping, planing and slotting, milling , gear shaping by machining, broaching), and Generation methods such as Rack cutter, gear shaping by generation, gear hobbing). Gear finishing (Gear shaving, rolling, burnishing, grinding, and lapping)**.**

Module V: Powder Metallurgy (7 hours)

Introduction, Applications of P/M, Powder Characteristics, Powder production methods, Mixing and Blending, Briquetting techniques, Sintering, Infiltration and Impregnation. Cemented carbides. Advantages and Disadvantages of P/M.

Module VI: Surface Finishing Operations (7 hours)

Introduction, Classification, Principle and Operations of Lapping, Honing, Super finishing, Polishing, Buffing, Tumbling and Burnishing, Introduction to some advanced (Nano) finishing operations like AFF, MRAFF etc.

COURSE/LEARNING OUTCOMES

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

CO1: Define and characterize the various conventional and non-conventional manufacturing methods. (*Knowledge*, *Comprehension*)
CO2: Classify various manufacturing methods for its useful and suitable applications in industries. (*Comprehension*)
CO3: Solve manufacturing related problems for various products and processes relate to production. (*Application*)
CO4: Criticize the use of particular method for production of specific products in industry environment.(*Analysis*)
CO5: Draw conclusions on applications of manufacturing methods and its effectiveness on various production processes. (*Evaluation*)
CO6: Evaluate the effectiveness of various processes and examine the outcome of the methods for its productive implementation in industries. (*Evaluation*)

CO7: Organize and summarize the various manufacturing methods available for a particular job production within the required manufacturing as well as economic attributes and constraints. (S*ynthesis*)

Suggested Readings

1. P N Rao, " Manufacturing Technology," Vol 1-, McGraw Hill Education
2. Amitabha Ghosh and Asok Kumar Mallick, " Manufacturing Science," East West Press
3. P.C. Sharma, "Production Engineering ," S. Chand & Company Ltd.
4. Dr. R. Narayanasamy, " Metal Forming Technology," Ahuja Book Co. Pvt. Ltd.
5. G.E. Dieter, "Mechanical Metallurgy," McGraw Hill Publication.
6. Production Techology P.C. Sharma
7. Rajput R. K., A textbook of manufacturing technology, Laxmi Publications (P) Ltd., New Delhi, 2007.
8. Production Technology – HMT handbook
9. Manufacturing Processes by B.H. Amsteal, Philip F. Ostwald & Myron L. Begeman, John Wiley & Sons.

MNVC0022: VIBRATION OF MECHANICAL SYSTEMS AND CONTROL

(4 credits - 60 hours)

Objective: *This subject introduces the students to the various types of Mechanical vibrations and different types of machine component failures due to vibrations. Students will be familiarized with different types of vibration isolation and the mathematical modelling. Also the control systems engineering part aims at application of control theory to design systems with desired behaviours.*

Module I: Introduction (10 hours)

Definition, types of vibration:- Free and Forced vibration, Damped (viscous) and Undamped vibration; degrees of freedom (DOF), beats, mathematical models, displacement, velocity and acceleration, Resonance, Whirling of shafts.

Module II: Free Vibrations (15 hours)

a) Undamped free vibration: Derivation of differential equation by equilibrium method and energy method, Newton's 2nd law method, Solutions to differential equations of single degree and 2 degree of freedom system, mode shapes.
b) Damped free vibration: Introduction, free vibration with viscous damping- overdamped, underdamped and critically damped system, logarithmic decrement, Coulomb damping.

Module III: Forced Vibrations (15 hours)

a) Introduction, Response under a periodic force for first order and second order systems, resonance, vibration isolation and force transmissibility, vibration absorbers.
b) Multi degree of freedom systems: equations of motion, matrix methods, eigenvalue problems.

Module IV: Control systems engineering (20 hours)

Introduction, transfer function, mathematical modelling of physical systems, feedback systems, Laplace transforms, block diagrams, signal flow graphs. Controllers: proportional, integral, PI, PD and PID controllers. Stability analysis: Routh-Hurwitz stability criteria, relative stability. Root locus technique, Hydraulic, pneumatic and electronic controllers. Vibration Isolation, Vibration Absorber and tuning.

COURSE/LEARNING OUTCOMES

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

C01: Solve for the motion and the natural frequency of freely vibrating single degree of freedom (SDOF) undamped motion and damped motion as well as for Multi degree freedom system (MDOF). (*Application*)

C02: Identify and recognize the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions (Knowledge, *Comprehension*)

C03: Outline the basic concepts for isolation and control of vibration from mechanical systems (*Knowledge*)

C04: Decompose any periodic function into a series of simple harmonic motions using Fourier series analysis. (*Application*)

C05: Explain design parameters and indicate methods of solution for a complicated vibratory problem (*Comprehension*)

C06: Construct the equations of motion for free-body diagrams. (*Synthesis*)

C07: Construct the governing differential equation and its solution for a vibrating mass subjected to an arbitrary force. (*Synthesis*)

C08: Able to model reciprocating and oscillatory motions of any given mechanical system (*Synthesis*)

C09: Apply Newton's equation of motion and energy methods to model basic vibrating mechanical systems(*Application*)

C10: Identify, formulate and solve technical problems. (*Application*)

C11: Analyze the mathematical model of a linear vibratory system to determine its response (*Analysis*)

C12: Obtain linear mathematical models of real life engineering systems (*Synthesis*)

C13: Evaluate the motion and the natural frequency for forced vibration of a single degree of freedom damped or undamped system. (*Evaluation*)

C14: Obtain the complete solution for the motion of a single degree of freedom vibratory system (damped or undamped) that is subjected to non-periodic forcing functions. (Application)

C15: To obtain numerical solutions to vibration problems by simple algorithms, and display the findings in graphical form. (*Application*)

C16: Determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation (*Application*)

Suggested Readings

1. V. P. Singh, "Mechanical Vibrations," Dhanpat Rai & Co. (P) Ltd.
2. G. K. Grover, "Mechanical Vibrations," Nem chand and Brothers.
3. S. S. Rao., "Mechanical Vibrations," Pearson Education.
4. S. Salivahan et. al., "Control Systems Engineering," Pearson Education.

MNNM0023: NUMERICAL METHODS IN MECHANICAL ENGINEERING

(3 Credits - 45 Hours)

Objective: *To learn and understand the various numerical approximation methods used to solve different types of equations, which are used to model mechanical engineering phenomena. The subject gives an insight into how real life problems in the field of engineering are solved.*

Module I (15 Hours)

Taylor's Series; Roots of equations: The Bisection Method, The False Position Method, Simple Fixed Point Iteration, Newton Raphson method, Secant method. Roots of polynomials: Muller's and Bairstow's Method. Sets of Linear algebraic equations: Gauss Elimination method, Gauss Jordan elimination method, LU Decomposition method, Matrix Inversion method, Gauss Siedel iteration method. Numerical Integration: Trapezoidal rule, Simpson's 1/3rd Rule, Simpson's 3/8th rule, Ordinary Differential Equations: Euler's method, Runge Kutta Methods.

Module II (15 Hours)

Numerical solutions to Partial Differential Equations using Finite Difference Method (FDM): Elliptic Equations, Parabolic equations. Curve Fitting: Least Squares Regression, Interpolation.

Module III (15 Hours)

Basic finite element concepts - Basic ideas in a finite element solution, General finite element solution procedure, Application of Finite element concepts to 1D and 2D problems. Finite volume method: Conceptual Basics and Illustrations through 1-D Steady State Problems.

COURSE/LEARNING OUTCOMES

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

CO1: Apply numerical methods to solve ordinary differential equations.(*Application*)
CO2: Compute integrals numerically. (*Application*)
CO3: Judge and determine which numerical method can optimize the solution for specific problems in terms of computation effort and accuracy. (*Evaluation*)
CO4: Apply and classify the different approaches used to sole partial differential equations numerically.(*Application*)
CO5: Analyze data sets through applications of curve fitting methods.(*Analysis*)
CO6: Carry out Finite Element, Finite Difference and Finite Volume formulations of mechanical engineering problems. (*Synthesis*)
CO7: Determine and Evaluate the type of numerical approach that needs to be adopted while tackling engineering problems in general through their understanding of the pros and cons of each method.(*Evaluation*)

Suggested Readings

1. Steven C. Chapra et al, “Numerical Methods for Engineers”, Tata McGraw Hills Publication.
2. Dr. B. S. Grewal, “Numerical Methods in Engineering and Science with Programs in C and C+ +”, Khanna Publications.
3. Bhatti, M.A., “Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations”, Wiley, 2005.

MNPP0024: POWER PLANT ENGINEERING

(3 credits - 45 hours)

Objective: *This course will enable students to study the preliminary design of the major systems of conventional fossil-fuel steam-cycle, nuclear, gas turbine, combined cycle, hydro, wind, geothermal, solar, and alternate power plants. It will also make the students aware regarding the economic, environmental, and regulatory issues related to power generation.*

Module I: Introduction and Economics of Power Plant Generation (5 hours)

Introduction to different power plants, Load duration curves, Location of power Plants, Power plant economics and Indian energy scenario.

Module II: Steam Power Plant (15 hours)

Introduction, Rankine cycle, Carnot cycle, Reheating of steam, Regeneration, Steam power plant appraisal, Deaeration, Typical layout of steam power plant, Efficiencies in steam power plant, Cogeneration of power and process heat, Combined cycle power generation, Different types of fuel used for steam generation, Draught system, Natural Draught, Mechanical Draught.

Module III: Gas Turbine Power Plant and Diesel Electric Power Plant (10 hours)

a) Introduction, Classification of different gas turbine power plants, Analysis of closed cycle and open cycle constant pressure gas turbine plant, Reheat, Intercooling and regeneration cycle, components of gas turbine plants, Semi-closed gas turbine plant, gas turbine fuels and gas turbine materials.

b) Introduction, Application of diesel engines in power field, Advantages and disadvantages of diesel engine power plant, General layout, Performance characteristics, Supercharging.

Module IV: Hydro-Electric Power Plant and Nuclear Power Plant (10 hours)

a) Introduction, Classification of hydro-electric power plant, Site selection, Elements of hydro-electric power plant, Advantages of hydro-electric power plant, Classification of hydraulic turbines and its selection, Hydrographs, Flow duration curves.

b) Introduction to nuclear engineering, Types of nuclear reactors, Pressurized water reactor, Boiling water reactor, CANDU reactor, Gas-cooled reactor, Liquid metal fast breeder reactor, India's nuclear power programme.

Module V: Non- Conventional Power plants (5 hours)

Prospect of renewable energy source, Types of non-conventional power plants, solar plants, Wind power plants, Bio-mass plants, Geo-thermal power plant, Tidal powerplant.

COURSE/LEARNING OUTCOMES

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

CO1: Outline the basics of power plant engineering terminologies. (*Knowledge*)
CO2: Classify and explain various equipment of power plant engineering. (*Comprehension*)
CO3: Explain the design parameters of power plant. (*Comprehension*)
CO4: Solve power plant engineering problem. (*Application*)
CO5: Compare and identify various power plant equipment and design. (*Analysis*)
CO6: Summarize the non-renewable energies and their current status. (*Synthesis*)
CO7: Determine and evaluate the various design parameters of power plant. (*Evaluation*)

Suggested Readings

1. P. K. Nag, “Power Plant Engineering” Tata McGraw-Hill.
2. S.C. Arora and S. Domkundar, “A course in Power Plant Engineering” Dhanpat Rai, Publication.
3. R.K.Rajput, “Power Plant Engineering”, Laxmi Publishers.
4. Black and Veatch, “ Powerplant Engineering” ,McGraw-Hill.

MNIE0025: INDUSTRIAL ENGINEERING

(5 credits - 75 hours)

Objective: *The objectives of the Industrial Engineering program are: to graduate well rounded Industrial Engineers who are prepared for employment , to graduate Industrial engineers who have a strong sense of professionalism, with respect for fellow workers and their profession; and to provide graduates with a set of skills that will allow them to grow professionally and provide service and leadership in their careers.*

Module I: Work Study and Ergonomics (15 hours)

a) Introduction to work study, Scope of Work study (Motion/Method study and Work measurement).

b) Method study: Meaning, Process charts and diagrams, ASME symbols, Check lists and examples for developing better methods from existing methods;

c) Micro motion study: Meaning and scope, Therbligs, use of motion camera in micro motion study, SIMO chart.

d) Motion economy: Meaning, Principles related to (i) Workplace layout (ii) Design of tools and equipments and (iii) Use of human body.

e) Ergonomics (Human factors engineering): Meaning, Characteristics (Cognitive ergonomics and Physical ergonomics), Introduction ONLY to Anthropometry, Biomechanics and Musculoskeletal Disorders (MSD) such as CTS (Carpal Tunnel Syndrome) and RSI (Repetitive Stress Injury); Preventive measures by ergonomic designs.

f) Work measurement: Meaning, Methods such as (i) Stopwatch time study (ii) Work sampling (iii) Normal time, Rating factor (RF), allowances and determination of Standard Time.

Module II: Plant Location and Facility Layout (15 hours)

a) Meaning of plant location, factors affecting location decisions, location theory, Qualitative models and semi quantitative models: Brown and Gibbs model, Break-Even analysis model, single facility location problems and multi-facility location problems.

b) Meaning of plant/facility layout, Need for layout study, factors influencing plant layout, objections of good facility layout, Types of plant layout; Systematic Layout Planning (SLP)

c) Group Technology (GT), Flexible Manufacturing Systems (FMS) and flexible layout and Computer integrated manufacturing (CIM).

d) Line balancing: objectives, solution of Assembly Line Balancing (ALB) problems by: Largest Candidate Rule and RPW methods.

Module III: Product development and Design (8 hours)

a) Meaning of product, product life cycle (PLC) and product mix.

b) Decision to be taken during product development and design. Procedure for product development and design.

c) Value of a product: its meaning, Value analysis: its objectives, procedure: Simplification and Standardization.

Module IV: Production planning and Inventory Control (12 hours)

a) Meaning and objectives of production planning and control. Function of production planning and control, various steps in production planning and control (PPC)

b) Technological Forecasting – its meaning and scope, Qualitative and quantitative methods of forecasting and their scope in engineering industries.

c) Introduction to MRP and MRP II, evolution from Materials Requirement Planning (MRP) to Manufacturing Resource Planning (MRP II). Enterprise resource planning (ERP).

d) Inventory Management: Meaning of inventory, Necessity for maintaining inventory, Inventory classification, Meaning of inventory control, Costs associated with inventory system, Analysis of deterministic inventory model, Just in Time (JIT) and Kanban systems.

Module V: Quality Engineering (10 hours)

a) Meaning of quality, Objectives of quality control

b) Meaning of Total Quality and Total quality management (TQM)

c) Statistical quality control: Meaning and tools;

d) Reliability engineering: Meaning of reliability, series and parallel systems, design of for reliability.

e) Introduction to "TRIZ", the Russian acronym for the "Theory of Inventive Problem Solving."

Module VI: Maintenance Engineering and Networks Analysis for project management (15 hours)

a) Meaning and types of maintenance: Breakdown, Scheduled, Preventive and Predictive maintenance and their suitability, standards of maintenance.

b) (i) Meaning of project management and its objectives, Network development technique (Arrow diagram and AON diagram) for determination of critical path (CP), earliest and latest dates/times. (ii) PERT model: characteristics, probability density function used for PERT activities, probability density function used for the CP, Calculation of Expected length of CP and its standard deviation, calculation of probability of completion of a

PERT project (iii) CPM model: characteristics, difference with PERT, direct and indirect costs, concept of crashing (cost time trade off).

COURSE/LEARNING OUTCOMES

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

CO1: Understand the knowledge of professional and economical responsibility in the society. *(Knowledge)*

CO2: Recognize the impact of industrial engineering solutions in a global, economic, environmental and societal context. (*Comprehension*)

CO3: Acquire knowledge in operations management to solve business processes. (*Comprehension*)

CO4: Design a system, component or process in a production unit to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (*Application*)

CO5: Acquire the techniques, skills and to use modern engineering tools (PPC, TQM, MRP etc.) necessary for production system. (*Knowledge*, *Comprehension*)

CO6: Identify, formulate and solve engineering problems(*Application*, *Synthesis*)

CO7: Point out various drawbacks by carrying out case study for manufacturing units (*Analysis*)

CO8: Solve the expectations and requirements of internal and external customers (*Application*, *Analysis*)

CO9: Evaluate a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, health and safety, manufacturability, and sustainability. (*Evaluation*)

Suggested Readings

1. Barnes R. M, “Motion and Time Study- Design and Measurement of of Work” Wiley India Pvt. Ltd.
2. Bridger R.S, “ Introduction to Ergonomics” McGraw Hill.
3. Telsang M, “ Industrial Engineering” S. Chand.
4. Panneerselvam R. “ Production and Operation management” Prentice Hall of India.
5. Billington P.J, Mc Leavey D. W and Narasimhan S. L. “Production Planning and Inventory Control” Prentice Hall of India.
6. Jhamb L.C ,“ Production Planning and Control” Everest Publishing House.
7. Eilon S, “ Element of Production Planning and Control” Mc Millan.
8. Buffa E.S and Sarin R. K, “Modern Production and Operation Management” John Wiley.
9. Deb Tanmoy, “ Maintenance Management and Engineering” Ane Books Pvt Ltd.
10. Ebeling C.E, “ An Introduction To Reliability and Maintaibaility Engineering” Mc Graw Hill.
11. Besterfiled D. H, “Total Quality Control” Pearson.
12. Sharma S.K, “Industrial Engineering and Organization Management” S. K. Kataria and Sons.

MNRA0026: REFRIGERATION AND AIR CONDITIONING

(4 credits-60 hours)

Objective: *The objective is to study the characteristics and engineering design of heating, ventilating, air conditioning and refrigeration (HVAC and R) systems. This course will enable students to design efficient and effective solutions.*

Module I: Introduction and Principles of Refrigeration (10 hours)

Concept of throttling, Joule-thomson effect, Concepts of Refrigeration and Air conditioning. Difference between engine, refrigerator and heat pump. COP, power consumption of a refrigerating machine, Heat pump vs electric resistance heater.

Module II: Gas Cycle Refrigeration and Vapour Compression Systems (15 hours)

a) Simple cycles – Carnot and Bell-Coleman; Aircraft refrigerating system – simple, boot-strap, regeneration, reduced ambient; Actual cycles, DART.
b) Analysis of simple cycles, representation of T-S, p-h charts; methods of improving COP; Deviations of actual cycles from theoretical cycles. Compound compression with liquid flash cooler, flash inter-cooler multiple systems – COP, power required.

Module III: Vapour Absorption System and Refrigerants (10 hours)

a) Vapour Absorption Refrigeration System (VARS): Advantages of VARS over VCRS. Working principle of simple VARS, practical VARS. Limitations of VARS, maximum COP of a VARS, Lithium-bromide water System; Aqua-ammonia systems.
b) Nomenclature, classification, desirable properties. Important refrigerants and their comparisons, selection of refrigerants.

Module IV: Psychrometry and psychrometric processes (10 hours)

Basic definitions and principles related to Psychrometric ; Psychrometric Charts and Their Uses; adiabatic saturation and enthalpy deviation. Adiabatic mixing of air stream. Constant sensible heat and latent heat processes, Total heat process, sensible heat factors, grand sensible heat ratio lines, apparatus dew points, Bypass factors, Air washer humidifying efficiency, Summer Air conditioning, Winter Air conditioning.

Module V: Load Analysis, Comfort air-conditioning and Duct Design (15 hours)

Cooling load estimate, heating load estimate, high latent cooling load application, Air temperature, human health, body temperature regulation, comfort indices, comfort charts and their limitations, Different methods of duct design such as velocity reduction, equal friction static regain, distribution of air in rooms.

COURSE/LEARNING OUTCOMES

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

CO1: Define the different types of refrigeration systems and air-conditioning devices.(*Knowledge*)
CO2: Explain the working principle of various types of refrigeration systems. (*Comprehension*)
CO3: Classify the refrigeration systems on the basis of important relevant parameters. (*Comprehension*)
CO4: Solve a variety of problems related to refrigeration and air-conditioning systems. (*Application*)
CO5: Compute cooling load, sensible heat and latent heat in air conditioning systems using the property relations. (*Application*)
CO6: Analyze the characteristics and performance of basic and advanced HVAC systems. (*Analysis*)
CO7: Summarize and Hypothesize about the desirable properties of refrigerants with respect to ODP and GWP. (*Synthesis*)
CO8: Evaluate the factors affecting the evaporator capacity, condenser capacity and COP of refrigeration systems.(*Evaluation*)

Suggested Readings

1. C.P.Arora, ”Refrigeration and Air Conditioning” Tata McGraw-Hill.
2. Manohar Prasad, ”Refrigeration and Air Conditioning” New Age International Publishers.
3. R. K Rajput, “A textbook of Refrigeration and Air Conditioning,” S K Kataria and Sons
4. Domkundwar, “A course in Thermal Engineering,” Dhanpat Rai and Co (P) Ltd.
5. Onkar Singh, “ Applied Thermodynamics,” New Age.
6. Psychrometry chart

MNDM0027: COMPUTER AIDED DESIGN AND MANUFACTURING

(3 Credits - 45 Hours)

Objective: *To provide a holistic approach in learning through well designed course involving fundamental concepts and state-of-the-art techniques in the field of CAD/CAM. To equip students, with knowledge and skill to undertake, design, analysis, evaluation of system, processes and components of computer aided and manufacturing.*

Module I: Introduction (9 hours)

Introduction to CAD/CAM, need, advantages, Fundamentals of design process, stages in design process and product development cycle, Computers in design applications, role of computers in industrial manufacturing, components of CAD/CAM/CAE systems, Computer configuration for CAD applications, CAD software, definition of system software and application software, CAD database and structure, coordinate systems in CAD: WCS, UCS, SCS, Typical Product Life Cycle

Module II: Geometric Transformations (10 hours)

Intro to Rigid body transformation, affine transformation and general transformations; Basic transformations: Translation, Rotation, Scaling, Reflection and Shear; Introduction to Homogeneous coordinate representation: 2D and 3D; Concatenated transformation.

Module III: Geometric modeling (10 hours)

a) 3D wire frame modeling, wire frame entities- definitions interpolation and approximation curves, concept of parametric and nonparametric representation of curves, curve fitting techniques, definitions of cubic spline and Bezier, B-spline.
b) Surface modeling: Algebraic and geometric form, parametric space of surface, blending functions, Reparametrization of a surface patch, subdividing, cylindrical surface, ruled surface, surface of revolution, spherical surface, Composite surface, Bezier surface, B-spline surface.
c) Solid modeling: Definition of cell composition and spatial occupancy enumeration, sweep representation, constructive solid geometry, boundary representations.

Module IV: NC Part Programming and Robotics (9 hours)

a) Introduction to NC, CNC, DNC; NC coordinate system; Introduction to NC part programming: manual part programming, computer assisted part programming (APT language), advantages and limitations of programming methods.
b) Introduction to Robotics: Robot definition, origin and characteristics; History of robotics; Asimov's laws of robotics, types of robots, specifications and applications, advantages and limitations, Introduction to robot anatomy.

Module V: Group Technology and Flexible Manufacturing System (7 hours)

Group technology and flexible manufacturing system: Part families, parts classification and coding, production flow analysis, machine cell design, FMS workstations, Material handling and storage system, Computer control system, planning the FMS, analysis methods for flexible manufacturing system, Application of Group technology and FMS.

COURSE/LEARNING OUTCOMES

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

CO1: Recognize various hardware, software components and system requirements for implementing CAD/CAM; state the different laws governing robotics (*Knowledge*)
CO2: Illustrate the product design and manufacturing process (*Comprehension*)
CO3: Apply suitable modelling techniques satisfactorily in developing a model/product (*Application*)
CO4: Compare various types of modelling techniques, different geometric primitives, curves, surfaces (*Analysis*)

CO5: Perform various transformation operations to manipulate an object under consideration as per the need of the design/manufacturing process (*Application*)

CO6: Synthesize a CNC manual or computer assisted part program to use it for machining of different parts by various manufacturing operations. (*Synthesis*)

CO7: Evaluate the use of robotics and automation in different environment. (*Evaluation*)

CO8: Summarize the concepts of group technology, FMS and their applications (*Synthesis*)

Suggested Readings

1. Mickel P.Groover, "Automation, production systems and computer Integrated manufacturing", 3rd edition, PHI.
2. Ibrahim Zeid., "CAD/CAM Theory and practice" Tata Mcgraw Hill education private limited.
3. David D Bedworth, "Computer Integrated design and Manufacturing," McGraw Hill International
4. P. N. Rao, "CAD/CAM Principles and Applications", Tata McGraw Hill
5. Dr.K.C.Jain, Sanjay Jain, "Principles of Automation and Advanced Manufacturing Systems,", Khanna Publishers.
5. K. Lalit Narayan et al. "Computer aided design and manufacturing." PHI

MNAE0028: AUTOMOBILE ENGINEERING

(3 credits - 45 hours)

Objective: *This course is an introduction to the description and working of various mechanical parts of an automotive vehicle. After learning the course students will be able to understand the usage of mechanical components and their assembly. As there is a growing demand for design and development of modern environment friendly vehicles, this course serves as an introduction to enable students to develop better technologies.*

Module I: Automobile components (9 hours)

a) History and development of Automobiles, classification, layout of various components in an automobile, design considerations and materials.
b) Various parts: chassis, frame and body, aerodynamic considerations,
c) Various types of engines: Identification of petrol, diesel, gas and hybrid engines, Inline, Radial and V engines, Overhead Camshaft (OHC) engine, CRDI engine, Introduction to Single point injection or Throttle Body injection (TBI) engine and Multi point Injection (MPI) engine.
d) Tyres (with tube and tubeless, radial) and spark plugs (heat range, hot and cold).

Module II: Transmission System (9 hours)

a) Clutch: types and working.
b) Gearbox: classification, sliding mesh, constant mesh and synchro-mesh gear boxes, Gear shifting mechanism.
c) Manual transmission, Automatic transmission: torque converters, epicyclic gear train, freewheeling mechanism, propeller shaft and universal joint. Final drive: rear axle, mounting methods, differential mechanism.

Module III: Suspension system (9 hours)

a) History, functions and requirements, elements of a suspension system, loads and characteristics.
b) Springs: leaf, coil and torsion bar, air springs.
c) Shock absorbers: dampers. Different types of suspension systems. Wheels and tyres.

Module IV: Automotive mechanisms and systems (14 hours)

a) Steering mechanism: function and requirements, layout of steering system, front axle and stub axles, steering linkages, cornering force and self-righting torque, power steering.

b) Braking mechanism: function and requirements, classification, mechanical and hydraulic brakes, air brake, brake efficiency. Antilock braking systems (ABS).
c) Four wheel drive mechanism, variable valve timing (VVT) technology,
d) Cooling and Lubrication systems, SAE grades for lubricant oils used.
e) Exhaust system and Emission control system.
f) Vehicle safety systems.

Module IV: Introduction to Eco-friendly Vehicles

a) Electric and hybrid vehicles
b) Fuel cell operated vehicles

COURSE/LEARNING OUTCOMES

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

CO1: State the basic mechanisms involved in Automobile engineering. (*Knowledge*)
CO2: Classify and explain the basic layout of an automobile. (*Comprehension*)
CO3: Differentiate the uses of the structural components of an automobile and to identify their role. (*Application*)
CO4: Understand various drags/resistances on automobiles and compute their values. (*Application*)
CO5: Learn and understand the working and assembly of transmission system parts such as clutch, gearbox, propeller shaft, differential drive etc. (*Knowledge*, *Comprehension*)
CO6: Understand the concept of steering system and recognize different steering linkages. (*Comprehension*)
CO7: Learn about hybrid vehicles and modern technologies like regenerative braking, VVT etc. (*Knowledge*, *Comprehension*)
CO8: Identify the requirement of specific component of an automobile. (*Analysis*)
CO9: Understand the function of each automobile component and also have a clear idea about the overall vehicle performance. (*Comprehension*)
CO10: Explain the practical relevance of each component of an automobile. (*Application*)

Suggested Readings

1. P. S. Gill, Automobile Engineering I and II, S. K. Kataria and sons.
2. D. S. Kumar, Automobile Engineering, S. K. Kataria and sons.
3. K. K. Jain, R. B. Asthana, Automobile Engineering, Tata McGraw Hill publishing co. Ltd.
4. R K. Rajput, A Textbook of Automobile Engineering, Laxmi Publications (P) Ltd.

MNFM0029: FLUID MECHANICS I

(4 credits — 60 hours)

Objective: *This is an introductory course in the mechanics of fluid motion. It is designed to establish fundamental knowledge of basic fluid mechanics and address specific topics relevant to simple applications involving fluids.*

Module I: Fluid statics (12 hours)

Properties of fluids, classification fluids, Pascal law, Pressure measurement manometer, types of manometer and its application, Forces on submerged plane and curved surfaces, buoyant force, metacentre, centre of buoyancy, equilibrium of floating and submerged body.

Module II: Fluid kinematics (12 hours)

Lagrangian and Eulerian descriptions, Types of fluid flow: steady, unsteady, uniform, non uniform, laminar, turbulent , compressible, incompressible, rotational, irrotational, one, two, three dimensional flows, Continuity equation for three dimensions, velocity, acceleration, Velocity potential function, stream function, flow net, Vortex flow.

Module III: Fluid dynamics (12 hours)

Euler equation of motion, Bernoulli's equation, energy equation, Venturimeter, orificemeter and pitot tube, Momentum equation and its application, Navier Stokes equation.

Module IV: Dimensional and model analysis (12 hours)

Dimensional homogeneity, Rayleigh's method, Buckingham's pi theorem and its application. Model analysis: Geometric, Kinematic, Dynamic similarity, Dimensionless numbers etc.

Module V: Orifice, Notches and Weirs (12 hours)

Flow through orifices and mouthpieces, orifice coefficients Notch and Weirs: types of notch and weirs and application.

COURSE/LEARNING OUTCOMES

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

CO1: Define the properties of fluids.(*Knowledge*)
CO2: State basic fundamental law of fluid mechanics. (*Comprehension*)
CO3: Classify different types of fluids and types of fluid flow. (*Comprehension*)
CO4: Differentiate between fluid kinematics and fluid dynamics. (*Comprehension*)
CO5: Apply fundamental concepts of fluid mechanics to engineering application. (*Application*)
CO6: Analyze fluid flow problems with the application of fluid mechanics laws. (*Analysis*)
CO7: Synthesis the application of fluid mechanics in real engineering application like venturimeter, orificemeter, orifice, notches and weirs.(*Synthesis*)
CO8: Examine different types of fluid flow model by using dimensional and model analysis. (*Evaluation*)

Suggested Readings

1. F M White, Fluid Mechanics, Tata McGraw Hill
2. Sukumar Pati, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill
3. R. K. Bansal, A Text Book of Fluid Mechanics & Hydraulic Machine, Laxmi Publication
4. Ojah, Berndtsson, Fluid Mechanics & Machinery, Oxford
5. Y. A. Cengel, Fluid Mechanics Fundamentals & Applications, Tata McGraw Hill

MNTF0030: FLUID MECHANICS II

(4 credits - 60 hours)

Objective: *This course is fundamental to the understanding the flow behaviour of fluid. Theory of Fluid Flow is very important in various fields of Mechanical Engineering.*

Module I (13 hours)

Laminar flow, through circular pipes, parallel plates, Velocity distribution,mean velocity, velocity profile Kinetic energy factor and momentum, Head loss due to friction.

Module II (13 hours)

Turbulent flow: Reynold's experiment, laws of fluid friction, shear stress, types of boundary, Prandtl length concept, velocity distribution, mean velocity, velocity profile, resistance to flow in smooth and rough pipes , Darcy Weisbach equation

Module III (12 hours)

Boundary layer flow: Laminar boundary layer, Turbulent boundary layer, Laminar sub layer, Boundary layer thickness, displacement thickness, momentum thickness , energy thickness.

Module IV (12 hours)

Compressible flow: basic equation for compressible flow for isothermal and isentropic process, velocity of sound: sub sonic, sonic, supersonic flow, propagation of pressure waves in compressible flow, Stagnation properties, compressibility correction factor in the measurement of air speed; area – velocity relationship for compressible flow through a variable area duct, mass flow rate through a duct, critical condition and choking; flow through convergent-divergent nozzle.

Module V (10 hours)

a) Flow around submerged bodies- Introduction to concept and expression of drag and lift,pressure drag and friction drag, Streamlined and Bluff bodies
b) Fluidization, Fluidized bed and its applications.

COURSE/LEARNING OUTCOMES

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

C01: Introduce and define relationship of shear stress and pressure distribution, mean velocity, shear and velocity profile for circular pipes with laminar and turbulent flows. Establish the concept of basic equation for compressible flow for isothermal and isentropic process, velocity of sound and stagnation properties. (*Knowledge*)
C02: Classify and identify various laws of turbulent stress, different layers and thickness of boundary layer flow and velocity of sound.(*Comprehension*)
C03: Solve various numerical problems based on the application of circular pipe flow problems with laminar and turbulent cases and stagnation properties based problems. (*Application*)
C04: Analyze various results to estimate the performance of pipe flow problem, stagnation properties and gain an understanding to basic problems on incompressible and compressible flows. (*Analysis*)
C05: Generalize the results obtained through numerical approach and comment with suitable conclusion and future study if any.(*Synthesis*)
C06: Do a careful evaluation of the overall study which can be made with proper references from E Learning resources available.(*Evaluation*)

Suggested Readings

1. Sukumar Pati, Fluid Mechanics & Hydraulic Machines, Tata McGraw Hill
2. Dr.R.K. Bansal, Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications
3. R.K Rajput, Text book on Fluid Mechanics & Hydraulic Machines", S. Chand
4. S. M. Yahya, Fundamental of Compressible Flow, New Age
5. F.M White, Viscous Fluid Flow, McGraw Hill

MNHT0031: HEAT TRANSFER I

(4 credits-60 hours)

Objective: *The course objective of the following course is to understand the two main modes of heat transfer viz. conduction and convection. The understanding of conduction and convection mode of heat transfer will enable student to design and analyse different types of advanced heat transfer problems.*

Module I Introduction and Basic Concepts (5 hours)

Introduction, Application areas of heat transfer, Modes and Laws of heat transfer.

Module II Conduction (20 hours)

a) Three dimensional heat conduction equation in Cartesian coordinates and its simplified equations, thermal conductivity, thermal diffusivity.
b) One dimensional steady state heat conduction without heat generation:Heat conduction in plane wall, composite slab, composite cylinder, composite sphere,

electrical analogy, concept of thermal resistance and conductance, three dimensional heat conduction equations in cylindrical and spherical coordinates and its reduction to one dimensional form, critical radius of insulation for cylinders and spheres.

c) One dimensional steady state heat conduction with heat generation:Heat conduction with uniform heat generation in plane wall, cylinder and sphere with different boundary conditions.

d) Transient heat conduction:Validity and criteria of lumped system analysis, Biot and Fourier number, Time constant and response of thermocouple.

Module III Boundary Conditions and Extended Surfaces (10 hours)

Boundary and initial conditions: Temperature boundary condition, heat flux boundary condition, convection boundary condition, radiation boundary condition. Heat transfer through extended surface: Types of fins, Governing Equation for constant cross sectional area fins, solution for infinitely long and adequately long (with insulated end) fins and short fins, efficiency and effectiveness of fins.

Module IV Convection (25 hours)

a) Fundamentals of convection: Boundary layer concept, Basic governing equations, Mechanism of natural and forced convection, local and average heat transfer coefficient, Reynolds Number, Prandtl Number.

b) Forced Convection: Introduction, laminar boundary layer equations on a flat plate and in a tube, laminar forced convection on a flat plate and in a tube, empirical correlation for forced convection.

c) Natural Convection: Introduction, laminar boundary layer equations of free convection on a vertical flat-plate, concept of Grashoff Number, Empirical correlations for vertical plates, horizontal plates, inclined surface, vertical and horizontal cylinders, spheres.

COURSE/LEARNING OUTCOMES

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

CO1: Define different mode of heat transfer. (*Knowledge*)
CO2: State basic laws of heat transfer. (*Knowledge*)
CO3: Illustrate various mode of heat transfer application. (*Comprehension*)
CO4: Interpret heat conduction equation for different geometrical shape. (*Comprehension*)
CO5: Differentiate forced and free convection. (*Comprehension*)
CO6: Explain mechanism of free and forced convection. (*Comprehension*)
CO7: Compute heat conduction equation for different geometrical shape under different boundary condition. (*Application*)
CO8: Apply various empirical correlations of forced convection and free convection. (*Application*)
CO9: Compare differences between heat conduction and heat convection. (*Analysis*)
CO10: Analyze various factors effecting heat conduction and heat convection. (*Analysis*)
CO11: Assemble engineering appliance by using heat conduction and heat convection concept. (*Synthesis*)
CO12: Evaluate that engineering appliance by knowledge of heat conduction and heat convection. (*Evaluation*)

Suggested Readings

1. R.C. Sachdeva “FundameNtal of Engineering Heat & Mass Transfer” New Age
2. F. P. Incropera, D.P. Dewitt, “Fundamentals of Heat and Mass Transfer”John Wiley.
3. Y. A. Cengel and A.J. Ghajar, “Heat and Mass Transfer Fundamentals and Applications”Tata McGraw Hill Education Private Limited.
4. S.P. Sukhatme, “A Textbook on Heat Transfer” Universities Press.

5. A.F. Mills, "Basic Heat and Mass Transfer" Pearson.
6. M.N. Ozisik "Heat and Mass transfer A basic approach" Tata McGraw-Hill
7. P. S. Ghoshdastidar "Heat Transfer" Oxford

MNHT0032: HEAT TRANSFER II

(3 credits-45 hours)

Objective: *This course is a further extension of Heat Transfer I. The objective is to make students able to understand the mode of radiation heat transfer and phase change heat transfer in depth. The outcome of the present course will help the students to model and analyse advanced heat exchangers and advanced energy systems.*

Module I Radiation Heat Transfer (8 hours)

Nature and laws of thermal radiation, emissive power, Absorption, Reflection and Transmission, Concept of a black body, Intensity of Radiation, Laws of black body radiation, Radiation to and from surfaces.

Module II Radiation: Exchange between Surfaces (15 hours)

Radiation between two black bodies, Radiation shape factor (View factor) and its properties, Shape factors for different geometries, Radiation between two infinite parallel places, Radiation between two infinitely long concentric cylinders, Radiation between two gray bodies, Electrical Network Analogy for thermal radiation, Radiation shields.

Module III Heat Exchanger analysis and design (12 hours)

Classification and applications, Overall heat transfer coefficient, Fouling factor, LMTD method of analysis for parallel and counter flow, Effectiveness-NTU Method for parallel and counterflow heat exchanger, Introduction to cross flow heat exchanger, Shell and Tube Heat exchanger, LMTD correction factor.

Module IV Phase Change Heat Transfer and Mass Transfer (10 hours)

a) Boiling heat transfer, types of boiling, Pool boiling curve, Correlations of Boiling Heat Transfer, Condensation heat transfer, Dropwise condensation, Filmwise condensation, Laminar film condensation on a vertical plate- Nusselt's theory, Condensation on Horizontal tubes.
b) Mass transfer by molecular diffusion: Fick's law of diffusion, Diffusion coefficient, Concentration boundary layer and mass transfer coefficient, Analogy between momentum, heat and mass transfer.

COURSE/LEARNING OUTCOMES

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

CO1: Understand basic laws of thermal radiation. (*Knowledge*)
CO2: Define black body and state laws of black body.(*Knowledge*)
CO3: Define mass transfer and state law of diffusion. (*Knowledge*)
CO4: Explain various thermal radiation shape factors and its properties. (*Comprehension*)
CO5: Apply thermal radiation laws to different geometrical elements. (*Application*)
CO6: Classify various heat exchanger and its applications. (*Analysis*)
CO7: Compute various parameters to design heat exchanger by using LMTD method and NTU method. (*Application*)
CO8: Analyze effectiveness of parallel and counter flow heat exchanger. (*Analysis*)
CO9: Interpret the concepts of boiling and condensation heat transfer. (*Knowledge*)
CO10: Summarize the correlations of boiling and condensation of heat transfer.(*Synthesis*)
CO11: Evaluate the design parameters of heat exchanger. (*Evaluation*)
CO12: Synthesis the electrical network analogy for radiation. (*Synthesis*)

Suggested Readings

1. R.C. Sachdeva "Fundamental of Engineering Heat & Mass Transfer" New Age
2. F. P. Incropera, D.P. Dewitt, "Fundamentals of Heat and Mass Transfer" John Wiley.
3. Y. A. Cengel and A.J. Ghajar, "Heat and Mass Transfer Fundamentals and Applications"Tata McGraw Hill Education Private Limited.
4. S.P. Sukhatme, "A Textbook on Heat Transfer" Universities Press.
5. A.F. Mills, "Basic Heat and Mass Transfer" Pearson.
6. W. Kays, "Convective Heat Transfer" Mc Graw Hills Publications.
7. P. S. Ghoshdastidar "Heat Transfer" Oxford.
8. Dr. D.S. Kumar, "Heat and Mass Transfer" S.K. Kataria and Sons.
9. P.K. Nag, "Heat and Mass Transfer" Mc Graw Hill Publications.

MNIC0033: INTERNAL COMBUSTION ENGINES

(3 credits-45 hours)

Objective: *This course studies the fundamentals of how the design and operation of internal combustion engines affect their performance, operation, fuel requirements, and environmental impact. Topics include fluid flow, thermodynamics, combustion, heat transfer and friction phenomena, and fuel properties, with reference to engine power, efficiency, and emissions.*

Module I: Air-standard cycle and performance of I C Engines (15 hours)

Basic types of engines, Engine components and Basic engine nomenclature, I.C. Engine Classification, 4-stroke and 2- stroke engines, Comparison of S.I. and C.I. engines, performance parameter, air standard cycle- Otto cycle, Diesel cycle and Dual Cycle, Comparison of Otto, Diesel and Dual Combustion Cycles, Atkinson Cycle, fuel air cycles, effect of variation of specific heats, fuel-air ratio, compression ratio and dissociation,. Actual cycles, losses in actual cycle, Performance parameter: BHP, IHP, Mechanical Efficiency, BSFC and Methods for their measurement.

Module II: Carburetor, Diesel Injection and Ignition Systems (12 hours)

a) Elementary carburetor, complete carburetor, air fuel ratio, stoichiometric ratio, Spark plug, Magneto and battery ignition system, fuel pump, drawbacks of carburetor and introduction of multi-point fuel injection.
b) Diesel injection system, fuel pump, injectors and nozzles.
c) Firing order, Ignition timing, and valve timing diagram.

Module III: Combustion, Supercharging (12 hours)

a) Combustion in S.I and C.I engines, Parameters influencing combustion, Detonation and knocking in S.I. and C.I. engines and their prevention, Combustion chamber types, Basic principles of combustion chamber in I.C. engines,
b) Supercharging, Thermodynamic cycle with supercharging, supercharging power, Supercharging of I.C. engines, Effect of supercharging on performance of the engine, Turbocharging

Module IV: Lubrication system, Cooling system and Fuels of I.C. Engines (6 hours)

a) Lubrication and cooling of I.C. engines, properties of lubricating oils
b) Classification and desirable characteristics of I.C. engine fuels, Rating of S.I. and C.I. engine fuels: Octane number (RON and MON), Cetane number, CFR engine, Alternative fuels (liquid, gaseous, etc.)
c) Greenhouse gases and Exhaust emissions from I. C. engines (Pollutants: CO, HC, NOx, and PM)
d) Environmental effects of I. C. engine exhaust pollutants, Introduction to Catalytic converters and other technological changes in I C engines for control.

COURSE/LEARNING OUTCOMES

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

C01: To introduce and define various basic cycles applicable to IC engines, advancement of engine technology and pollution from IC engines using visual aids of learning methodology. (*Knowledge*)

C02: To classify and identify the various differences of the engine cycles and technology in order to interpret them. (*Comprehension*)

C03: To find out various performance parameters through numerical problems.(*Application*)

C04: To critically analyze various results of engine performance to understand the difference among various parameters. (*Analysis*)

C05: To generalize the results obtained through numerical approach and comment with suitable conclusion and future study if any. (*Synthesis*)

C06: A careful evaluation of the overall study can be made with proper references from E Learning resources available. (*Evaluation*)

Suggested Readings

1. M.L. Mathur and R. P. Sharma, “Internal Combustion Engine,” Dhanpat Rai company Ltd.
2. R.K. Rajput, “Internal Combustion Engine”, Laxmi publication.
3. S.K. Agrawal, “Internal combustion engine”, New age
4. V. Ganesan, “Internal combustion engine”, Tata McGraw Hill.

MNWP6001: WORKSHOP PRACTICE I

(2 credits)

Objective: *The prime objective of this course to introduce various machines, parts, tools widely used in manufacturing industries and to make engineering students familiar with the basics of workshop technology.*

1. Machine shop: Introduction to Machining Science, Geometry of Single point cutting tool, cutting fluid, cutting tool materials; Demonstration of Lathe machine, Shaper machine, Drilling machine and Grinding machine
   Job: To do turning, knurling, facing operations etc., on Lathe Machine.
2. Carpentry shop: Use of carpentry hand tools and equipments. Study of carpentry Joints
   Job: to make a Tee- joint or Cross-joint using wooden workpiece
3. Bench work and fitting shop: Use of hand tools in fitting shop, different types of files and measuring instruments
   Job: To make a paper weight of Mild Steel Slab.
4. Black Smithy and forging shop: Use of forging equipments and tools, firing in the Furnace.
   Job: To make Mild Steel Chisel
5. Welding shop: Introduction to welding - Arc welding, Gas welding
   Job: To make lap joint in arc welding.

COURSE/LEARNING OUTCOMES

At the end of Workshop Practice I students will be able to:

CO1: Recognize and list the basic tools and machines used in the workshop. (*Knowledge*, *Comprehension*)

CO2: Explain and demonstrate the basic operations done in different shops. (*Comprehension*, *Application*)

CO3: Perform the specific job given in the shop. (*Application*)

CO4: Identify and evaluate the applications of different shops. (*Evaluation*)

Suggested Readings

1. B. S. Raghuwanshi, A Course in Workshop Technology, Vol 1 and Vol 2 Dhanpat Rai
2. Hajrachoudhury, Elements of workshop Technology, Vol.1 and Vol.2, MPP
3. W. Chapman, Workshop Technology, Part 1 and Part 2, Elsevier
4. P.C. Sarma, A Text Book of Production Engineering, S Chand
5. R. S. Khurmi and J. K. Gupta, A text of Workshop Technology (Manufacturing processes), S. Chand
6. O P Khanna, Foundry technology, Dhanpat Rai
7. Ali Hasan and R.A Khan, Manufacturing Processes Workshop Practice, 1ed, Scitech Publication, Pvt Ltd

MNEM6002: ENGINEERING MECHANICS LAB

(2 credits)

The following experiments are to be performed:

1. Determination of Coefficient of Friction between two given surfaces.
2. Determination of the position of the Centroid of the given areas.
3. Determination of Moment of Inertia of the Fly Wheel.
4. Verification of Triangle Law of Forces.
5. Verification of Polygon Law of Forces.
6. Determination of efficiency of Screw Jack.
7. Worm and Worm wheel experiment.
8. To verify the law of moment of force for a simply supported beam.
9. To determine the Bending Moment at a section for a simply supported beam.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Define, state and implement the basic laws of statics and verify them. (*Knowledge*, *Comprehension*, *Application*)

CO2: Analyze and determine the values of various parameters of a system of force in Mechanics. (*Application*, *Analysis*)

CO3: Understand the application of vector mechanics and interpret the resultant.(*Comprehension*, *Analysis*)

CO4: Conceptualize the illustration of moment of inertia, mechanical advantage, bending moment setups and identify and evaluate their applications.(*Synthesis*, *Evaluation*)

MNWP6003: WORKSHOP PRACTICE II

(2 credits)

Practical Hands-on Training covering salient features of following Modules

Module I

Turning - Taper turning using tailstock offset method and taper turning attachment Eccentric external turning using a four jaw chuck.

Module II

Boring - Using a boring tool – both concentric and eccentric. Boring using a boring bar in a centre lathe. Square and hexagonal hole drilling using die-sinking EDM.

Module III

Grinding- Cylindrical grinding using grinding attachment in a centre lathe.

Module IV

Thread Cutting- Internal and external thread cutting using a single point cutting tool.

Module V

Gears - Cutting teeth of spur gears using form milling cutter in a universal milling machine, Gear hobbing, Gear shaping.

Module VI

Welding - Introduction. Edge/Joint preparation in welding and joining using shielded metal arc welding. Hands-on practice on metal inert gas welding (MIG) or gas metal arc welding. Hands-on practice on tungsten inert gas welding (TIG) or gas tungsten arc welding. Hands-on practice on spot welding. Hands-on practice on submerged arc welding

COURSE/LEARNING OUTCOMES

At the end of Workshop Practice II students will be able to:

CO1: Perform turning, taper turning, facing, knurling in lathe machine. (*Application*)
CO2: Perform drilling and boring operation. (*Application*)
CO3: Perform grinding operation.(*Application*)
CO4: Learn and perform thread cutting operation. (*Application*)
CO5: Manufacture spur gears in milling machine. (*Synthesis*)

Suggested Readings

1. B.S.Raghuwanshi, A Course in Workshop Technology, Vol 1 and Vol 2 Dhanpat Rai
2. Hajra choudhury, Elements of workshop Technology, Vol.1 and Vol.2, MPP
3. W. Chapman, Workshop Technology, Part 1 and Part 2, Elsevier
4. P.C Sarma, A Text Book of Production Engineering, S Chand
5. PC Sarma, A Text Book of Production technology, S Chand
6. O P Khanna, Foundry technology, Dhanpat Rai
7. Ali Hasan and R.A Khan, Manufacturing Processes Workshop Practice, 1ed, Scitech Publication, Pvt Ltd

MNTD6004: THERMODYNAMICS LAB

(2 credits)

1. Demonstration of Cochran Boiler
2. Demonstration of Babcock Wilcox Boiler
3. Demonstration of Lancashire Boiler
4. Demonstration of Boiler Mountings
    a. Spring loaded safety valve
    b. Feed check valve
    c. Blow off Cock
    d. Fusible Plug
    e. Pressure Gauge
5. Demonstration (Sectional) of 2 stroke petrol engine
6. Demonstration (Sectional) of 2 stroke diesel engine
7. Demonstration (Sectional) of 4 stroke petrol engine
8. Demonstration (Sectional) of 4 stroke diesel engine
9. Demonstration of a gas turbine
10. Demonstration of a steam engine or a locomotive boiler

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify different types of boilers and engines. (*Knowledge*)
CO2: Demonstrate the working and use of boilers and engines. (*Comprehension*)
CO3: Study of the mathematical behaviour of the thermal systems. (*Application*)

CO4: Analyze the dependence of relevant parameters on the performance of the thermal systems. (*Analysis*)
CO5: Synthesis the practical relevance of thermal systems. (*Synthesis*)
CO6: Evaluate a thermal system to assess its performance and characteristics. (*Evaluation*)

MNDG6005: MACHINE DRAWING AND COMPUTER GRAPHICS LAB

(3 credits)

1. **Review (1 lab)**
   Orthographic projection, missing lines, interpretation of views and sectioning.
2. **Part and Assembly drawing (2 labs)**
   Introduction, assemblies drawing of stuffing box, steam engine cross head, air valve, late tailstock, gate valve, screw jack, connecting rods, spark plug, tool post, safety valves etc. Drawing exercises.
3. **Specification of Materials (1 lab)**
   Engineering materials, code designation of steels, copper and aluminum and its alloys.
4. **Limits, Tolerance and fits (1 lab)**
   Introduction, Limit systems, tolerance, fits, Drawings and exercises
5. **Surface Roughness (1 lab)**
   Introduction, surface roughness, machining symbols, indication of surface roughness, drawing exercises
6. **Production Drawing (2 labs)**
   Introductions to developing and reading of production drawing of simple machine elements like helical gear, bevel gear, flange, pinion shaft, connecting rod, crankshaft, belt pulley, piston details etc. Idea about tool drawing.
7. **Computer Aided Drafting (3 labs)**
   Introduction, input, output devices, introduction to drafting software like AutoCAD, basic commands and development of simple 2D and 3D drawings.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Learn and draw and explain the orthographic projections, sections of solids and machine elements. (*Knowledge*, *Comprehension & Application*)
CO2: Draw assembly and parts drawing manually as well as by using softwares. (*Application*)
CO3: Study and indicate the limits, fits, tolerances and surface roughness in the machine drawing. (*Analysis*)
CO4: Develop the basics of production drawing manually as well as by using softwares such as AUTOCAD and evaluate them (*Synthesis*, *Evaluation*)

Suggested Readings

1. N.D. Bhatt, Machine Drawing, Charotar Book Stall, Anand, 1996.
2. N. Sidheswar, P. Kanniah and V.V.S. Sastry, Machine Drawing, Tata McGraw Hill, 1983.
3. SP 46: 1988 Engineering Drawing Practice for School and Colleges. Bureau of Indian Standards

MNET6006: ENGINEERING MATERIALS LAB

(2 credits)

1. To study the Impact testing machine and perform the Izod Impact tests.
2. To study the Impact testing machine and perform the Charpy Impact tests.

3. To study the Universal testing machine and perform the tensile test.
4. To study the torsion testing machine and perform the torsion test.
5. To study the fatigue testing machine and perform rotating beam fatigue test
6. To study the spring testing machine and perform the compression test on open coil helical spring.
7. To perform compression tests on UTM.
8. To study the Brinell hardness testing machine & perform the Brinell hardness test.
9. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
10. To study the Vickers hardness testing machine & perform the Vicker hardness test
11. Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Carry out experiments to determine impact strength of materials. (*Application*)
CO2: Carry out experiments to determine hardness of materials. (*Application*)
CO3: Determine shear modulus of materials through experiments. (*Application*)
CO4: Plot and analyze the stress strain curves of materials (*Analysis*)
CO5: Differentiate between different micro-structures of materials. (*Analysis*)
CO6: Carry out compression test of springs. (*Analysis*)
CO7: Find out fatigue life of materials. (*Application*)
CO8: Evaluate the various cautionary activities that needs to be executed while carrying out experiments (*Evaluation*)

MNFM6007: FLUID MECHANICS LAB
(2 credits)

1. Study of hydrostatic force
2. Determination of Meta-Centric height and stability of floating bodies
3. Experimental verification of Bernoulli's theorem
4. Study of discharge through orifices using orifice meter
5. Study of discharge over different notches
6. Study of different types of flow using Reynolds apparatus
7. Study of impact of jet on vanes
8. Determination of Dynamic Viscosity of fluid
9. Laminar flow apparatus
10. Pitot tube setup
11. To determine the coefficient of discharge using Venturimeter
12. Free vortex apparatus and Forced vortex apparatus

E-resource for learning
OpenFOAM, www.spoken-tutorial.org

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Introduce and define various studies for understanding the practical concepts of laws of fluid mechanics. (*Knowledge*)
CO2: Classify and identify the study of discharge over notches, orifice, hydrostatic force and experimental verification on Bernoulli theorem and laminar flow apparatus. (*Comprehension*)
CO3: Perform test in the laboratory for studying discharge and experimental verification of various applications, theories of fluid mechanics. (*Application*)
CO4: Critically analyze various results obtained from experiments. (*Analysis*)

CO5: Generalize the results obtained by preparing curves and comment with conclusion. (*Synthesis*)
CO6: Careful evaluation of the results can be done by doing further studies in the laboratory. (*Evaluation*)

MNTM6008: THEORY OF MACHINES LAB
(2 credits)

List of Experiments for Theory of Machines Lab

1. Study of various types of Kinematic links, pairs, chains and Mechanisms.
2. Study of inversions of four bar Mechanisms, Single and double slider crank mechanisms.
3. Study of various types of cam and follower arrangement.
4. Study of gyroscope and gyroscopic effect/couple.
5. Study of various types of gears – Helical, cross helical, worm, bevel gear.
6. Study of various types of gear trains – simple, compound, reverted, epicyclic and differential.
7. Study of different types of brakes and dynamometers.
8. Determination of the sleeve lift for various speeds of a Hartnell governor.
9. To plot follower displacement vs Cam rotation for various cam follower systems.
10. Investigation of balancing of rotating mass.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recognize various mechanisms, their inversions, relative motions and different constituting elements. (Knowledge)
CO2: Illustrate the working and use of various gears and gear train. (Comprehension)
CO3: Demonstrate the working of governor; cam and follower mechanism. (Application)
CO4: Point out the similarity and difference between various governors, brakes and dynamometers. (Analysis)
CO5: Construct a cam profile for a particular application. (Synthesis)
CO6: Synthesize a rotational mass system which is statically and dynamically balanced (Synthesis)
CO7: Evaluate a mechanical systems for its suitability for a particular application based on some constraints. (Evaluation)

MNAT6009: APPLIED THERMODYNAMICS LAB
(2 credits)

List of Experiments for Applied Thermodynamics Lab

1. Determination of dryness fraction of combined separating and throttling calorimeter
2. Study working model of steam turbine
3. To determine the coefficient of performance of refrigeration system
4. Study and performance test of single acting air compression
5. Study and performance test of rotary compression
6. Study and performance test of condenser unit
7. Study and performance test of air condition unit
8. To analyse the humidification heating, cooling and dehumidification process and plot them on psychrometric charts
9. To determine the bypass factor of cooling and heating coils of air conditioner

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify different types of calorimeters and condensers. (*Knowledge*)
CO2: Demonstrate the working and use of refrigeration systems. (*Comprehension*)
CO3: Study of the mathematical behaviour to understand the physics of thermal systems. (*Application*)
CO4: Analyze the dependence of relevant parameters on the performance of the thermal systems. (*Analysis*)
CO5: Synthesis the practical relevance of thermal systems. (*Synthesis*)
CO6: Evaluate a thermal system to assess its performance and characteristics. (*Evaluation*)

MNHY6010: HYDRAULICS LAB

(2 credits)

1. Hydraulic ram testing rig
2. Submersible pump testing rig
3. Reciprocating pump testing rig
4. Centrifugal pump testing rig
5. Francis turbine testing rig
6. Pelton turbine testing rig
7. Demonstration of Kaplan turbine

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: State working principle of various hydraulic equipments.(*Knowledge*)
CO2: Explain the basic operation of various hydraulic equipments. (*Comprehension*)
CO3: Apply the basic mathematical formulae to determine the characteristics of various hydraulic equipments.(*Application*)
CO4: Analyze the characteristics parameter of various hydraulic equipments. (*Analysis*)
CO5: Summarize the characteristics parameter of various hydraulic equipments. (*Synthesis*)
CO6: Evaluate the characteristics parameter of various hydraulic equipments. (*Evaluation*)

MNMI6011: MINI PROJECT I

(2 credits)

Objective: *The mini project is the first step to prepare the students for the major project. It should enable the students to apply the subject knowledge they gained and to develop their ideas in the different areas such as fluid and thermal, Design and Manufacturing under the guidance of expert and dedicated faculty members.*

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Identify a topic for going through a detailed literature review. (*Knowledge*)
CO2: Formulate the objective from a comprehensive literature study. (*Comprehension*)
CO3: Fabricate and simulate the mechanical component or system. (*Application*)
CO4: Analyze and optimize the operating parameters of a mechanical system. (*Analysis*)
CO5: Synthesise the mechanical device from the available resources. (*Synthesis*)
CO6: Evaluate and conclude the remarkable findings to highlight the relevance of the study. (*Evaluation*)

MNMM6013: ENGINEERING METROLOGY AND MEASUREMENT LAB

(2 credits)

1. Use of Vernier caliper, micrometer, depth gauge and height gauge –source of error in Measurement ideas on range, precision and accuracy/Calibration of Vernier / Micrometer / Dial Gauge
2. Study of Slip gauges and their use in linear measurements
3. Ideas on tolerance allowance, limits, fits.
4. Dial gauges their use in the measurement of small linear displacements, parallelism and concentricity.
5. Measurement of Angle using Sine bar
6. Study of Measurement of surface roughness, surface roughness parameters, surface finish evaluation
7. Measurement of straightness and flatness
8. Optical Profile Projector

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recognize various engineering measurement devices with its characteristics (Knowledge)

CO2: Translates the theoretical learning into applications with various engineering measurement devices and tools (Comprehension)

CO3: Perform various measurement tasks related to mechanical engineering (Application)

CO4: Point out implementations and critical use of various devices for precise measurement (Analysis)

CO5: Combine theoretical and practical knowledge into actual working environment for various measurement (Synthesis)

CO6: Examine the processes related to measurement in engineering and determine the use of various tools. (Evaluation)

MNMD6014: MACHINE DESIGN AND DRAWING LAB

(2 credits)

To design and draw (At least 5) of the following components under different safety limitations.

1. Screws
2. Shafts
3. Couplings
4. Gears
5. Joints
6. Springs
7. I.C. Engine parts.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Design different mechanical components and apply the Knowledge to find the safe dimensions.

CO2: Assemble drawings and design modifications of various components.

CO3: Conceptualize the use and application of available design data in designing the components.

MNMN6015: MINOR PROJECT

(2 credits)

The minor project is a step to prepare the student for the major project. It enables the student to apply the subject knowledge that they have gained and to develop their ideas in the different areas of mechanical engineering fields such as Thermal, Design, Fluid machinery, Manufacturing and Mechanical systems under the guidance of faculty members.

COURSE/LEARNING OUTCOMES

After successful completion of the Minor Project, student will be able to:

CO1: Recognize potential gaps and needs related to mechanical engineering through study of existing literature. (*Comprehension*)
CO2: Interpret the potential gaps in mechanical engineering through literature review. (*Comprehension*, *Analysis*)
CO3: Identify problem specification or need for development in the field of mechanical engineering. (*Comprehension*)
CO4: Develop conceptual design and methodology of solution for the problem. (*Synthesis, Analysis*)
CO5: Device solutions and build physical model /test if required. (*Analysis*)
CO6: Fabricate the mechanical model/prototype by using resources available (wherever applicable). (*Application*, *Synthesis*)
CO7: write a report and presentation of project. (*Comprehension*)
CO8: learn teamwork and share responsibility. (*Synthesis*)
CO9: Evaluate and validate their respective results and propose further scope for advancement in that particular domain. (*Evaluation*)

MNVC6016: VIBRATION OF MECHANICAL SYSTEMS AND CONTROL LAB

(2 credits)

Perform any 8 experiments from the following

1. To find the natural frequency of simple pendulum
2. To find the natural frequency of compound pendulum
3. To determine radius of Gyration "K" of given pendulum.
4. To study the free vibration and to determine the natural frequency of vibration of Two-Rotor system.
5. To study the torsional vibration and to determine the natural frequency vibration of single rotor system.
6. Study of longitudinal vibration and to determine the frequency of vibration.
7. To study the damped torsional vibration and determine the damping coefficient.
8. Determination of whirling speed of shafts
9. To determine the stiffness of spring mass damper system.
10. Determination of Natural Frequencies of Free Damped Oscillations.
11. Determination of the Amplitude of Forced Damped Oscillations.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Students are be able to find out natural frequency of freely vibrating single degree of freedom (SDOF) undamped motion and damped motion as well as for Multi degree freedom system (MDOF) by carrying out experiments. (*Application*)
CO 2: Recognise the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions (*Comprehension*)

CO3: Gain adequate knowledge for isolation and control of vibration from mechanical systems (*Knowledge*)
CO4: Acquire ability to explain linear mathematical models of real life engineering systems (*Comprehension*)
CO5: Determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation (*Application*)
CO6: Demonstrate the reciprocating and oscillatory motions of mechanical systems (*Application*)
CO7: Apply Newton's equation of motion and energy methods to model basic vibrating mechanical systems (*Application*)
CO8: To identify, formulate and solve technical problems. (*Application*)
CO 9: Obtain numerical solutions to vibration problems by simple algorithms, and display the findings in graphical form. (*Application*)
CO10: Acquire the ability to analyze the mathematical model of a linear vibratory system to determine its response. (*Analysis*)
CO11: Model and analyse damped mechanical systems and structures. (*Analysis*)
CO12: Evaluate the motion and the natural frequency for forced vibration of a single degree of freedom damped or undamped system. (*Evaluation*)
CO13: Determine the complete solution for the motion of a single degree of freedom vibratory system (damped or undamped) that is subjected to non-periodic forcing functions. (*Synthesis*)

MNIC6017: INTERNAL COMBUSTION ENGINE LAB
(2 credits)

Perform any 8 experiments from the following
1. Study of Carburetor
2. Study of Fuel pump and injector
3. Study of Ignition System
4. Test on single cylinder Petrol engine for determination of power.
5. To prepare heat balance sheet on multi-cylinder diesel engine / petrol engine.
6. Test on variable compression ratio engine.
7. To prepare variable speed performance test of a multi-cylinder /single cylinder petrol engine / diesel engine and prepare the curve (i) bhp, ihp, fhp Vs Speed (ii) Volumetric efficiency & indicated specific fuel consumption Vs Speed.
8. To study and draw the valve timing diagram four stroke, single – cylinder diesel engine.
9. Assignment on any one advanced technology related to I.C. Engine.
10. Assignment on alternative fuels used in I.C. Engine.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Introduce and define various performance characteristics of IC engines. (*Knowledge*)
CO2: Classify and identify the study of carburetor, fuel pump and injector, ignition system for indulging a practical understanding. (*Comprehension*)
CO3: Perform test in the laboratory for studying variable speed performance test of multi cylinder engine and Morse test. (*Applicatio*n, *Analysis*)
CO4: Critically analyze various results of petrol and diesel engines performance study to understand the difference among various parameters.(*Analysis*)
CO5: Generalize the results obtained by preparing curves and comment with suitable conclusion. (*Synthesis*)
CO6: Do careful evaluations of the results can be done by doing further studies in the laboratory under various conditions. (*Evaluation*)

MNTS6018: TRAINING SEMINAR

(2 credits)

Objective: *During the semester break at the end of the third year, students are required to undergo an Industrial Training. The purpose of the Industrial Training is to expose students to real-life industry situations, so that they may be able to apply the engineering knowledge and skills that they have gained through classroom teaching and lab activities, in an on-the-job situation. After the period of training, students are to present their experience in the form of reports and seminar presentations. Students will be evaluated on the seminar, viva voce examination and written reports.*

COURSE/LEARNING OUTCOMES

At the end of Training Seminar students will be able to

CO1: Prepare a written report on the study conducted during the training. (*Comprehension*)
CO2: Final Seminar, as oral Presentation before a departmental committee. (*Synthesis*)

MNMP6019: MAJOR PROJECT (PHASE I)

(4 credits)

The major project phase I requires an understanding of core concepts including mechanics, kinematics, thermodynamics, materials science, etc. students will learn to use these core principles along with tools like computer-aided design, ABAQUS, ANSYS to design and analyze manufacturing plants, industrial equipment and machinery, refrigeration and air conditioning systems, transport systems, aircraft, watercraft, robotics, medical devices, and others under the guidance of faculty members.

COURSE/LEARNING OUTCOMES

At the end of Project Phase Istudents will be able to

CO1: Recognize potential gaps and needs related to mechanical engineering through study of existing literature. (*Comprehension*)
CO2: Interpret the potential gaps in mechanical engineering through literature review. (*Comprehension*, *Analysis*)
CO3: Perform a feasibility study on the proposed topic. (*Comprehension*)
CO4: Formulate the problem statement. (*Synthesis*)
CO5: Analyze the proposed topic by application of basic principles of mechanical engineering. (*Analysis*)
CO6: Summarize their results using various engineering application tools. (*Synthesis*)
CO7: Fabricate the mechanical engineering component using resources available. (wherever applicable). (*Application*, *Synthesis*)
CO8: Draft reports of the work. (*Comprehension*)
CO9: Evaluate and validate their respective results and propose further scope for advancement in that particular domain. (*Evaluation*)

MNMP6020: MAJOR PROJECT (PHASE II) AND VIVA VOCE

(8 credits)

The major project phase II involves the students in realising their goal towards fulfilling the identified problem from the first phase of the major project. Accordingly students will design/fabricate/analyse whichever is/are needed. The complete report of the work in proper format is prepared and finally the work is evaluated. The modality and components of the internal assessment and their weightages shall be notified at the beginning of each semester.

COURSE/LEARNING OUTCOMES

At the end of Project Phase II students will be able to

CO1: Recognize potential gaps and needs related to mechanical engineering through study of existing literature. (*Comprehension*)

CO2: Interpret the potential gaps in mechanical engineering through literature review. (*Comprehension*, *Analysis*)

CO3: Perform a feasibility study on the proposed topic. (*Comprehension*)

CO4: Formulate the problem statement. (*Synthesis*)

CO5: Analyze the proposed topic by application of basic principles of mechanical engineering. (*Analysis*)

CO6: Summarize their results using various engineering application tools. (*Synthesis*)

CO7: Fabricate the mechanical engineering component using resources available. (wherever applicable). (*Application*, *Synthesis*)

CO8: Draft reports of the work. (*Comprehension*)

CO9: Evaluate and validate their respective results and propose further scope for advancement in that particular domain. (*Evaluation*)

MNTD6021: THERMODYNAMICS LAB

List of Experiments for Applied Thermodynamics Lab

1. Determination of dryness fraction of combined separating and throttling calorimeter
2. Study working model of steam turbine
3. To determine the coefficient of performance of refrigeration system
4. Study and performance test of single acting air compression
5. Study and performance test of rotary compression
6. Study and performance test of condenser unit
7. Study and performance test of air condition unit
8. To analyse the humidification heating, cooling and dehumidification process and plot them on psychrometric charts
9. To determine the bypass factor of cooling and heating coils of air conditioner

MNHT6022: HEAT TRANSFER LAB

(2 credits)

Any eight experiments(1-11) from the following list

1. Determination of Thermal Conductivity of metal rod
2. Determination of Thermal Conductivity of insulating powder
3. Determination of Thermal Conductivity of Composite wall
4. Determination of heat transfer coefficient in Natural Convection
5. Determination of heat transfer coefficient in Forced Convection
6. Determination of temperature distribution, fin efficiency in Natural / Forced Convection
7. Determination of Emissivity of a Test surface
8. Determination of Stefan Boltzmann Constant
9. Determination of effectiveness of heat exchanger
10. Study of pool boiling phenomenon and determination of critical heat flux
11. Determination of equivalent thermal conductivity of heat pipe

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to

CO1: Define basic mode of heat transfer. (*Knowledge*)

CO2: Explain the fundamental laws of heat transfer. (*Knowlede*)

CO3: Apply the basic mathematical formulae to determine the characteristics of various heat transfer equipments. (*Application*)

CO4: Analyze the characteristics parameter of various heat transfer equipments. (*Analysis*)
CO5: Summarize the characteristics parameter of various heat transfer equipments. (*Synthesis*)
CO6: Evaluate the characteristics parameter of heat transfer equipments. (*Evaluation*)

MNWM6023: WORKSHOP/MANUFACTURING PRACTICES

(3 Credits) (L-T-P: 1-0-4)

I) Manufacturing Practice

Objective: Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 hours)
2. CNC machining, Additive manufacturing (1 hour)
3. Fitting operations and power tools (1 hour)
4. Electrical and Electronics (1 hour)
5. Carpentry (1 hour)
6. Plastic moulding, glass cutting (1 hour)
7. Metal casting (1 hour)
8. Welding (arc welding and gas welding), brazing (1 hour)

Suggested Readings

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

(ii) Workshop Practice

1. Machine shop (10 hours)
2. Fitting shop (8 hours)
3. Carpentry (6 hours)
4. Electrical and Electronics (8 hours)
5. Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs)
6. Casting (8 hours)
7. Smithy (6 hours)
8. Plastic moulding and Glass Cutting (6 hours)

MNWM6023: WORKSHOP PRACTICES

COURSE/LEARNING OUTCOMES

At the end of the experiments students will be able to

CO1: Recognize different fabrication techniques. (*Knowledge*)
CO2: Identify the tools and machinery involved in the various experiments related to material processing. (*Comprehension*)
CO3: Demonstrate some of the advanced and latest manufacturing techniques being employed in the industry. (*Application*)
CO4: Recognize the different manufacturing processes which are commonly employed in the industry. (*Comprehension*)
CO5: Fabricate simple components using different materials and fabrication techniques. (*Application*)

DEPARTMENT OF CIVIL ENGINEERING

Vision

To be a recognized leader in Civil Engineering education and learning experiences providing state of the art education guided by innovative research and consultancy, inclusive technology and managerial skills for industry as well as societal needs towards sustainable development.

Mission

- To make the department a centre of excellence in Civil Engineering education which equips students with a strong conceptual foundation coupled with practical insight to meet the global industrial and environmental challenges.
- To produce spiritually inspired, socially committed and intellectually competent professionals of high calibre and strong ethical principles to serve the society and nation through team work and societal leadership.
- To establish the department as a recognized centre of research for developing sustainable solutions to engineering problems by providing knowledge base and consultancy services to the community.

Program Educational Objectives (PEOs)

1. To equip the students with necessary technical skills and professional expertise that make them competent for immediate employment or to pursue postgraduate studies in Civil Engineering disciplines.
2. To produce graduates who are spiritually motivated for life-long learning and morally committed for successful careers as civil engineers, managers, administrators, educators, engineering consultants and entrepreneurs.
3. To enhance students' abilities to identify and take up project and research topics which would be highly useful for the society considering the present environmental and industrial needs of the country.
4. To make the students able to communicate their innovative ideas to be effective in collaboration with other civil engineering teams that will make them achieve leadership position to solve different challenges of civil engineering problems.
5. To develop a sense of understanding of the multidisciplinary approach and an ability to relate engineering issues to the broader context of individual and society for sustainable development.

DETAILED SYLLABUS

CVPM0001: PROJECT MANAGEMENT IN CONSTRUCTION

(4 credits - 60 hours)

Objectives: *To understand the effect of management for project organization, design of construction process, labor, materials and equipment utilization and to study the various management techniques for successful completion of construction projects.*

Module I (15 Hours)

Basic concepts in the development of construction plans, Choice of technology and construction method, Defining work tasks, Defining precedence relationship among activities, estimating activity durations and resource requirements

Module II (15 Hours)

Work-study, work breakdown structure, Time estimates, Applications of CPM/PERT, statistical concepts, Man, Material, Machinery, Money optimization, scheduling, monitoring, updating

Module III (15 Hours)

Cost functions, time-cost trade off, resource planning- levelling and allocation, Resources - based networks, crashing, master networks, interface activities and dependencies, line of balancing techniques

Module IV (15 Hours)

Material management-purchases management and inventory control, ABC analysis, Human Resource Management

COURSE/LEARNING OUTCOMES

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

CO1: Understand the roles and responsibilities of the Owner, Designer and Contractor in various design and construction processes.

CO2: Handle Construction Documents: drawings, technical specifications and various construction contract forms.

CO3: Estimate construction cost ,Schedule and plan construction

CO4: Practice construction quality assurance and construction safety in the real projects.

CO5: Demonstrate appropriate communications, reporting, record keeping and various other construction project management.

Suggested Readings

1. Chitkara. K.K, Construction Project Management: Planning Scheduling and Control, Tata McGraw Hill Publishing Company, New Delhi
2. Calin M. Popescu, Chotchal Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopaedia of Terms and Applications, Wiley, New York
3. Chris Hendrickson and Tung Au, Project Management for Construction - Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall Pittsburgh, 2000
4. Moder, J., C. Phillips and E. Davis, Project Management with CPM, PERT and Precedence Diagramming, Van Nostrand Reinhold Company, Third Edition, 1983
5. Willis, E. M., Scheduling Construction Projects, John Wiley and Sons, 1986
6. Halpin, D. W.,Financial and Cost Concepts for Construction Management, John Wiley and Sons. New York

CVCE0002: CONSTRUCTION METHODS AND EQUIPMENT MANAGEMENT

(4 credits - 60 hours)

Objectives: *To enable the students in selecting the construction equipment appropriate to tasks, estimate equipment ownership and operating costs to schedule activities and to understand issues pertaining to construction methods, equipment usage and management.*

Module I (8 Hours)

Planning process for equipment methods, cost related to construction equipment (owning and operating), calculation of cost and depreciation, Replacement procedure and life of equipment

Module II (10 Hours)

Engineering fundamentals of moving earth, rolling resistance, effect of grade and tractive effort, effect of grade on performance of IC engines, earth moving, excavating and lifting equipment selection, Bulldozers, front end loaders, scrapers, trucks, excavators, back hoes, front shovels, cranes and forklifts; piles and pile driving equipment

Module III (6 Hours)

Production of crushed stone aggregate, concreting equipment, Asphalt mix production and placement, asphalt plants, and paving equipment

Module IV (18 Hours)

Estimating and optimizing construction equipment system productivity, Peurifoy's method, of optimizing productivity, Phelp's method, optimizing hauling system based on loading facility, Estimation of equipment productivity, mathematical models, simulations

Module V (18 Hours)

Scheduling equipment intensive horizontal construction projects- linear scheduling methods- precedence diagramming method, developing equipment resources packages, Scheduling lifting equipment for vertical construction, equipment financing decision, financing methods, rental and lease contract considerations

COURSE/LEARNING OUTCOMES

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

CO1: Explain equipment planning process, cost based construction, depreciation, fundamentals of earth moving, effect of rolling resistance, grade, tractive force, understand various construction equipments and plants, the estimation and optimization of equipment based on productivity, along with mathematical modeling and simulations, scheduling equipment financing decision, financing methods, rental and lease contract considerations etc.

CO2: Select construction equipment appropriate to tasks, estimation of equipment ownership and operating and maintenance costs as schedule activities and understand various issues pertaining to construction methods, equipment usage and management.

CO3: Apply directly to any project to find the suitable methods and equipment based on the site of the project to get the cost effective and timely completion of the project.

CO4: Identify approximate judgement of the results obtained from the analysis and optimise the scheduling cost duration based on the theory.

CO5: Verify the results obtained from the various analysis, and validate with the practical that observed at work site.

Suggested Readings

1. Robertwade Brown, "Practical Foundation Engineering Hand Book", McGraw Hill Publications
2. Patrick Powers .J, "Construction Dewatering: New Methods and Applications", John Wiley and Sons
3. Jerry Irvine, "Advanced Construction Techniques", CA Rockers, 1984
4. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder.C, "Construction Planning Equipment and Methods", McGraw Hill
5. Sharma S.C., "Construction Equipment and Management", Khanna Publishers, Delhi, 1988
6. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers Delhi, 1988
7. Dr. Mahesh Varma, "Construction Equipment and its Planning and Application", Metropolitan Book Company, New Delhi

CVIP0004: INFRASTRUCTURE PLANNING

(4 credits - 60 hours)

Objectives: *This course intends to introduce the students to various terms and components of infrastructure planning particularly in an urban setting. Important aspects such as water supply, sanitation, waste management, transport planning and management are taken to exemplify the management issues.*

Module I: Role of Infrastructure in Development (8 Hours)

a) Elements of Infrastructure (physical, social, utilities and services), Basic definitions, concepts, significance and importance.
b) Data required for provision and planning of urban networks and services, Resource analysis, provision of infrastructure and land requirements.

Module II: Planning and Management of Water, Sanitation and Stormwater (20 Hours)

a) Water – Sources, treatment and storage, transportation and distribution, quality, distribution networks, water harvesting, recycling and reuse, norms and standards of provision, institutional arrangements.
b) Sanitation – Points of generation, collection, treatment, disposal, norms and standards, grey water disposal, DEWATS, institutional arrangements.
c) Stormwater – Rainfall data interpretation, points of water stagnation, system of natural drains, surface topography and soil characteristics, groundwater replenishment, storm water collection and disposal, norms and standards, institutional arrangements.

Module III: Planning and Management of Municipal Wastes, Power and Fire (15 Hours)

a) Municipal wastes, generation, typology, quantity, collection, storage, transportation, treatment, disposal, recycling and reuse, wealth from waste, norms and standards, institutional arrangements.
b) Sources of power procurement, distribution networks, demand assessment, norms and standards, planning provisions and management issues.
c) Fire, history of fire hazards, vulnerable locations, methods of firefighting.

Module IV: Transport Infrastructure Planning, Management and Design (12 Hours)

a) Types of transport systems, evolution of transport modes, urban form and transport patterns, land use, transport cycle, concept of accessibility, hierarchy, capacity and geometric design elements of roads and intersections.
b) Basic principles of transport infrastructure design, Traffic and transportation surveys and studies, traffic and travel characteristics, Urban transport planning process – stages, study area, zoning, data base, concept of trip generation, environment and safety issues.

Module V: Life Cycle Analysis (5 Hours)

Multi-criteria analysis for comparison of infrastructure alternatives, Procurement strategies, Scheduling and management of planning activities.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the role of planning and management in different civil engineering infrastructures of water, sanitation, storm-water, municipal waste, power, fire, and transportation; recognize elements of infrastructure (physical, social, utilities and services); list the sources of water& power; identify points of sanitation, garbage generation, types of transport systems.

CO2: Distinguish different waste collection, treatment and disposal techniques; classify various transport patterns and traffic characteristics; extend life cycle analysis of infrastructures.

CO3: Choose appropriate planning methodologies to deal with the management of water, sanitation, storm-water, municipal waste, power, fire and transportation; produce capacity and geometric design elements of roads and intersections; choose norms and standards of provision of water& power distribution and sanitation techniques.

CO4: Identify the data required for provision and planning of urban networks and services; analyze the rainfall data for better prediction of storm-water and comparison of infrastructure alternatives;

CO5: Summarize urban transport planning process – stages, study area, zoning, and data base, concept of trip generation, environment and safety issues; categorize different form of wastes for treatment and safe disposal.

CO6: Assess the demand, planning provisions and management issues for any infrastructure in civil engineering domain.

Suggested Readings

1. Sameer Kochhar, Deepak B. Phatak, H. Krishnamurthy, Gursharan Dhanjal, "Infrastructure and Governance", Academic Foundation, New Delhi.
2. S. Mukherjee and D. Chakraborty, "Environmental Scenario in India", Routledge, London
3. Mohinder Singh and L. R. Kadiyali, "Crisis in Road Transport", Konark Publishers Pvt. Ltd., New Delhi
4. N. N. Bandela, D. G. Tare, "Municipal Solid Waste Management", B. R. Publishing.
5. J. A. Nathanson, P. E. John, N. R. Brisbane, "Basic Environmental Technology: Water Supply, Waste Disposal and Pollution Control", John Wiley and Sons.

CVSM0006: STRUCTURAL MASONRY

(3 credits - 45 hours)

Objectives: *To understand the behavior of masonry structures under gravity and lateral loads, design masonry structures for gravity, wind and seismic loads, design masonry infill as shear walls for lateral action and to apply strengthening techniques for repair and rehabilitation of masonry structures.*

Module I (10 Hours)

Introduction, Masonry units, materials and types, Strength of Masonry in Compression, Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, failure theories of masonry under compression, Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength

Module II (10 Hours)

Flexural and shear bond, flexural strength and shear strength, Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength, Permissible stresses, Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses

Module III (15 Hours)

Design of load bearing masonry buildings, Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels, Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall, Design of load bearing masonry for buildings up to 3 to 8 storeys using BIS codal provisions

Module IV (10 Hours)

Earthquake resistant masonry buildings, Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions, Masonry arches, domes and vaults, Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure

COURSE/LEARNING OUTCOMES

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

CO1: Know about the masonry units and mortar, properties of different masonry units and mortar. Defects and errors in masonry construction, Strength and stability of concentrically loaded masonry walls and factors affecting them. Strength formulae and mechanism of failure of masonry subjected to direct compression and understand the concept of composite wall beam elements and in filled frames.

CO2: Design load bearing masonry walls for buildings up to three stories using IS:1905 and SP-20. 5. Students will understand the concept of reinforced masonry and its applications.

CO3: Organize and arrange compression elements (beams and columns) of reinforced masonry shear walls. They also. They will know how to design these masonry structures.

Suggested Readings

1. Hendry A. W., “Structural Masonry”Macmillan Education Ltd., 2nd edition
2. Steven Sahlin, “Structural Masonry”Thomas Telford
3. Curtin, “Design of Reinforced and Pre-stressed Masonry”,Prentice Hall
4. Dayaratnam P,“Brick and Reinforced Brick Structures” Oxford and IBH Publications

CVFI0008: FINANCING INFRASTRUCTURE PROJECTS

(4 credits - 60 hours)

Objectives: *Any civil engineer involved in the task of infrastructure project planning and execution should have understanding of the various aspects of financing these projects. This course introduces some important facets in this direction so as to make the students conversant with the subject.*

Module I: Introduction to Infrastructure Financing (3 Hours)

Role of governments in financing infrastructure projects, Economic multiplier effects of infrastructure

Module II: Public Private Partnerships – Procurement Process (15 Hours)

Means of financing - public finance and private finance, Procurement of infrastructure projects through Public Private Partnership route, Types of PPP models, Contractual structure of PPP projects, Value for money evaluation, Lifecycle of PPP projects, PPP procurement process

Module III: Concession – Design and Award (12 Hours)

Concession for infrastructure - Design and award, Allocation of responsibilities, Price setting, Penalties and bonuses, Dispute resolution, Case studies

Module IV: Risk Management of Infrastructure Projects (12 Hours)

Risk management of infrastructure projects, Risk associated with various infrastructure projects, Risk identification techniques, Risk allocation frameworks, Risk mitigation strategies

Module V: Project Finance (15 Hours)

Financing infrastructure projects with private capital, Introduction to project finance concept, Analysing project viability, Designing security arrangements, structuring the project, preparing project financing plan

Module VI: Ratings of Infrastructure Projects (3 Hours)

Role of credit ratings in financing infrastructure projects, rating frameworks used by national and international credit agencies, Case studies

COURSE/LEARNING OUTCOMES

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

CO1: Recognize different ingredients for making concrete; list the physical and chemical properties of cement, aggregates and admixtures; write the tests for cement, aggregates, and admixtures, fresh and hardened concrete.

CO2: Illustrate the process of manufacturing of cement; explain the different stages of concrete production; explain the different methods of concrete mix design; classify different types of special concrete.

CO3: Apply IS method and ACI method for concrete mix design; demonstrate the engineering properties of hardened as well as fresh concrete.

CO4: Compare different methods of cement manufacturing; identify the critical physical and chemical properties of a concrete mix; compare and appraise the cylindrical and cubic strength of concrete.

CO5: Combine the concepts gained and formulate a concrete mix design based on the different methods.

CO6: Estimate the quantity of materials required for making a concrete mix of given strength; determine the properties of concrete and its different ingredients.

Suggested Readings

1. A. Akintoye, M. Beck, and C. Hardcastle, "Public Private Partnerships - Managing Risks and Opportunities", Oxford: Blackwell Science Limited.
2. J. D. Finnerty, "Project Financing – Asset Based Financial Engineering", New York: John Wiley and Sons, Inc.
3. T. Merna and C. Njiru, "Financing Infrastructure Projects (First Edition)", London: Thomas Telford.
4. P. K. Nevitt and F. J. Fabozzi, "Project Financing (7^{th} Edition)", London, UK: Euromoney Books.
5. G. Raghuram, R. Jain, S. Sinha, P. Pangotra and S. Morris, "Infrastructure Development and Financing: Towards a Public-Private Partnership", MacMillan.
6. R. Tinsley, "Project Finance in Asia Pacific: Practical Case Studies", London, UK: Euromoney Books.

7. C. Walker and A. J. Smith, “Privatized Infrastructure: The Build Operate Transfer Approach”, London: Thomas Telford.
8. E. R. Yescombe, “Principles of Project Finance”, California: Academic Press.
9. L. Kurowski and D. Sussman, “Investment Project Design - A Guide to Financial and Economic Analysis with Constraints”, New Jersey: John Wiley and Sons.
10. F. Pretorius, P. Lejot, A. McInnis, D. Arner and B. F. C. Hsu, “Project Finance for Construction and Infrastructure: Principles and Case Studies”, Oxford: Blackwell Publishing.
11. B. Weber and H. W. Alfen, “Infrastructure as an Asset Class – Investment Strategies, Project Finance and PPP”, West Sussex: John Wiley and Sons.

CVCT0009: ADVANCED CONCRETE TECHNOLOGY

(4 credits - 60 hours)

Objectives: *This course introduces the basic and neo-construction materials as components of concrete which have been further extended towards design, manufacture and placement techniques. It also adds special varieties of concrete to give exposure on the latest trends.*

Module I: Constituent Materials (18 Hours)

Aggregate: Classification, Testing of Aggregates, Fibers, Cement, Grade of Cement, Chemical composition, Hydration of Cement, Structure of hydrated Cement, Special Cement, Water, Chemicals and Minerals Admixtures: Water reducers, air entrainers, set controllers, specialty admixtures – structure, properties and effects on concrete properties, Introduction to supplementary cementing materials and pozzolans, Fly ash, blast furnace slag, silica fume, and metakaolin - their production, properties and effects on concrete properties, other mineral additives - reactive and inert.

Module II: Concrete Production and Properties (6 Hours)

Batching of ingredients, mixing, transport and placement, Consolidation, finishing and curing of concrete, initial and final set – significance and measurement.

Engineering properties of concrete, Compressive strength and parameters affecting it, Tensile strength - direct and indirect, Modulus of elasticity and Poisson's ratio, Stress strain response of concrete.

Module III: Principles of Concrete Mix Design (6 Hours)

Basic principles and Methods of Concrete mix design, Design of high strength concrete, IS method, ACI method, new approaches based on rheology and particle packing.

Module IV: Modern Trends in Concrete Manufacture (15 Hours)

Modern trends in concrete manufacture and placement techniques, Methods of transportation, Placing and curing, extreme weather concreting, special concreting methods, Vacuum dewatering of concrete, underwater concreting.

Module V: Special Concretes (15 Hours)

Properties and applications of High performance concrete, reactive powder concrete, Lightweight, heavyweight and mass concrete, fibre reinforced concrete, self-compacting concrete, Fly ash Concrete, Fibre reinforced Concrete, Polymer Concrete, Epoxy resins and screeds for rehabilitation – properties and application, Emerging trends in replacement of fine aggregates.

COURSE/LEARNING OUTCOMES

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

CO1: Recognize different ingredients for making concrete; list the physical and chemical properties of cement, aggregates and admixtures; write the tests for cement, aggregates, and admixtures, fresh and hardened concrete.

CO2: Illustrate the process of manufacturing of cement; explain the different stages of concrete production; explain the different methods of concrete mix design; classify different types of special concrete.
CO3: Apply IS method and ACI method for concrete mix design; demonstrate the engineering properties of hardened as well as fresh concrete.
CO4: Compare different methods of cement manufacturing; identify the critical physical and chemical properties of a concrete mix; compare and appraise the cylindrical and cubic strength of concrete.
CO5: Combine the concepts gained and formulate a concrete mix design based on the different methods.
CO6: Estimate the quantity of materials required for making a concrete mix of given strength; determine the properties of concrete and its different ingredients.

Suggested Readings

1. N. Krishnaraju, “Advanced Concrete Technology”, CBS Publishers.
2. A. M. Nevile, “Concrete Technology”, Prentice Hall, New York.
3. A. R. Santhakumar, “Concrete Technology”, World Rights Publisher.
4. Newman, John and Ban Sang Choo, "Advanced Concrete Technology - Concrete Properties", Elsevier.
5. V. M. Malhotra and A. A. Ramezaniaanpour, "Fly Ash in Concrete", Canmet.
6. S. Popovics, "Fundamentals of Portland Cement Concrete: A Quantitative Approach Vol. 1 Fresh Concrete" John Wiley and Sons.
7. P. Schiessl, "Corrosion of Steel in Concrete" Chapman and Hall.

CVTE0010: ADVANCED TRANSPORTATION ENGINEERING

(3 credits - 45 hours)

Objectives: *The objective of this course is to lay a solid foundation of transportation system planning, traffic engineering, transport economics and modern construction techniques adopted in transportation engineering as a whole by providing general concepts of planning, functional design, traffic operation and management of roads and their networks and other facilities in road transportation system.*

Module I: Urban Transportation Systems Planning (15 Hours)

Urban Transportation Planning Process, Urban Travel and Transportation Systems Characteristics, Travel Demands Forecasting, trip generation, trip distribution, modal split and traffic assignment, Land use/ Transportation systems, Introduction to Urban Mass Transportation Systems.

Module II: Traffic Engineering (12 Hours)

Driver behaviour, traffic information and control systems, traffic studies - volume, speed and delay studies, elements of traffic flow theory, characteristics of uninterrupted traffic, Capacity and LOS of Uninterrupted facilities, characteristics of interrupted traffic, traffic characteristics at unsignalised intersections, design of signalized intersections, capacity and LOS of signalized intersections, actuated signal control, signal coordination.

Module III: Transport Economics (8 Hours)

Economic Evaluation of Transportation Plans, Vehicle Operating Costs, Value of Travel Time Savings, Accident Costs, Traffic Congestion, Traffic Restraints and Road Pricing.

Module IV: Advanced Construction Techniques in Transportation Engineering (10 Hours)

Introduction to Modern Construction Techniques in Transportation Engineering, New Road Construction Concepts, Reliable Infrastructure, Green Infrastructure, Introduction to Multi-modal and multi-level design models of streets, Air purification by pavement blocks, NO_x reduction by pavement blocks, Development of high performance under layers with low cost materials and higher percentage of re-use.

COURSE/LEARNING OUTCOMES

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

CO1: Recognize the concepts and processes involved in urban transportation planning process.
CO2: Illustrate the traffic characteristics.
CO3: Compute the vehicle operating costs and the value of travel time savings.
CO4: Compare the green infrastructure with traditional methods of infrastructure.
CO5: Summarize the role of transportation planning in the development of the economy of a nation.
CO6: Evaluate the performance of various materials in reducing the pollution level.

Suggested Readings

1. L. R. Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publication.
2. P. Chakroborty and A. Das, "Principles of Transportation Engineering", PHI Learning Pvt. Ltd.
3. S. K. Khanna and C. E. G Justo, "Highway Engineering", Nem Chand and Bros, Roorkee.
4. S. P. Bindra, "A Course in Highway Engineering", Dhanpat Rai Publications.
5. G. V. Rao, "Transportation Engineering", Tata McGraw Hill.

CVHR0011: STRUCTURAL HEALTH MONITORING AND REHABILITATION OF STRUCTURES

(3 credits - 45 hours)

Objectives: *To make the students gain knowledge on the quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing and retrofitting of structures and demolition procedures.*

Module I: Application of SHM in Civil Engineering (5 Hours)

Introduction to capacitive methods, capacitive probe for concrete, SHM of a bridge, Application of external post tensioned cables, monitoring historical buildings.

Module II: Non-Destructive Testing of Concrete Structures (14 Hours)

Introduction to NDT, Situations and contexts where NDT is needed, classification of NDT procedures, visual inspection, half-cell electrical potential methods, Schmidt Rebound hammer test, resistivity measurement, electromagnetic methods, radiographic testing, ultrasonic testing infrared thermography, ground penetrating radar, radio isotope gauges, other methods.

Module III: Condition Survey and NDE of Concrete Structures (12 Hours)

Definition and objective of condition survey, stages of condition survey (Preliminary, Planning, Inspection, and Testing stages), possible defects in concrete structures, quality control of concrete structures, NDT as an option for Non-destructive evaluation of (NDE) of concrete structures, Case studies of a few NDT procedures on concrete structures.

Module IV: Rehabilitation and Retrofitting of Structures (14 Hours)

Repair, rehabilitation and retrofitting of structures, Damage assessment of concrete/steel structures, materials and methods for repairs and rehabilitation, Damage assessment and Evaluation models, Damage testing methods, Importance of re-analysis, execution of rehabilitation strategy, case studies.

Suggested Readings

1. Daniel Balageas, Claus-Peter Fritzen, Alfredo Güemes, "Structural Health Monitoring", John Wiley and Sons.
2. Douglas E Adams, "Health Monitoring of Structural Materials and Components - Methods with Applications", John Wiley and Sons.

3. J.P. Ou, H. Li and Z.D. Duan, "Structural Health Monitoring and Intelligent Infrastructure", Vol-1, Taylor and Francis Group, London, U.K.
4. K. Ravishankar, T.S. Krishnamoorthy, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers.
5. R.N. Raika, "Diagnosis and Treatment of Structures in Distress R and D Centre", Structural Designers and Consultants, New Bombay, India.
6. V.K. Raina, "Concrete Bridge Practice Construction, Maintenance and Rehabilitation", 2nd Edition, Shroff Publishers and Distributors.
7. W.H. Ransom, "Building Failures, Diagnosis and Avoidance", 2nd Edition, E. and FN Spon Publishers.
8. Handbook on 'Seismic Retrofitting of Buildings' Published CPWD, Indian Building Congress in Association with IIT Madras, Narosa Publishing House.

CVSM0012: STRENGTH OF MATERIALS

(4 credits – 60 hours)

Objectives: *This course deals with understanding the behavior of civil engineering materials and structural components under the action of external loads, which forms the first step towards designing any civil engineering structure.*

Module I (16 hours)

a) Simple stresses and Strains: Stress, strain, type of stresses, stress-strain curve, elastic limit, Hooke's law, elastic constants and their relationships, bars of uniform sections, bars of varying sections, bars of composite sections, compound bars, elongation due to self weight, bars of uniform strength, temperature stresses.
b) Strain Energy and Impact loading: Strain energy, stresses under gradual, sudden and impact loadings. Strain energy due to shear.
c) Compound stresses and strains: Stresses on inclined plane due to uniaxial stress state, due to simple shear, due to biaxial stress state, due to combined normal and shear stresses, Mohr Circle of Stress, principal stresses and principal planes.

Module II (14 hours)

Bending moments and Shear forces: Types of load, types of support, SF and BM, sign convention, SF and BM diagrams for cantilever, simply supported and overhanging beams, point of Contra- flexure, relationship between rate of loading, SF and BM.

Module III (16 hours)

Stresses in beams: Theory of simple bending, assumptions, neutral axis and moment of resistance, Bending stress- its distribution, section modulus, composite beams, relative efficiency of beam section, shear stress distribution in beams, shear centre, Direct and bending stress- stress distribution for an eccentrically loaded rectangular section.

Module IV (14 hours)

a) Torsional stresses in shafts: Analysis of torsional stresses, combined bending and torsion, equivalent bending moment and torque.
b) Cylindrical Shells: Thin cylinders - circumferential and longitudinal stresses. Derivation of formulae for radial and hoop stresses for thick cylinders, spherical shells.

COURSE/ LEARNING OUTCOMES

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

CO1: Students would be able Understand the behaviour of civil engineering materials, structural components under the action of external loads. (*knowledge*)
CO2: Students would be able to define Know the stress, strain, energy stored in materials, bending moments and shear force in a structure. (*Comprehension*)

CO3: Students would be able to compute the stress, strain, strain energy, bending moment and shear force under the influence of external loading. (*Application*)

CO4: Tackle various problems in computing stress, strain, bending moment and shear force. The students are able to tackle various criticalities that are encountered while computing stress, strain, bending moment and shear force. (*Synthesis*)

CO5: Analyse the variation of stress, strain energy, bending moment shear force as well as the variation of stresses in beams under different external loads. (*Analysis*)

CO6: Students would be able to evaluate the values of stress, strain, strain energy, bending moment and shear force to ascertain the strength of a loaded member and verify the procedures applied for the same. (*Evaluation*)

Suggested Readings

1. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Company (P) Ltd.
2. Dr. R. K. Bansal, A Textbook of Strength of Materials, Laxmi Publications (P) Ltd.
3. R. K. Rajput, Strength of Materials, S. Chand and Company Ltd.
4. S. S. Bhavikatti, Strength of Materials, Vikas Publishing House Pvt. Ltd.
5. Beer and Johnston, Mechanics of Materials, Tata McGraw-Hill
6. G. H. Ryder, Strength of Materials, ELBS and MacMillan.

CVFM0013: FLUID MECHANICS

(4 credits – 60 hours)

Objectives: *This course is fundamental to the understanding of the flow behavior of fluid, basically water in a guided regime. Flow of water is very important in many settings in which Civil Engineering is involved and so the study of Fluid Mechanics becomes very important to the student of Civil Engineering.*

Module I (8 hours)

Fluid statics: Important physical properties: density, specific weight, viscosity, surface tension, capillarity, compressibility, vapor pressure, Classification of fluids-ideal and real fluid, non-Newtonian fluids. Pressure at a point-Pascal's Law, pressure variation in a static fluid. Scales of Pressure-absolute and gauge pressure, Measurement of pressure-manometers, Forces on submerged plane and curved surfaces, Buoyant Force- centre of buoyancy, metacentre, determination of metacentric height, Equilibrium of floating and submerged bodies.

Module II (15 hours)

a) Fluid kinematics: Study of fluid motion-Lagrangian and Eulerian descriptions, continuity equation, Types and states of motion- steady and unsteady, uniform and non-uniform, laminar and turbulent flow, compressible and incompressible flows, one, two and three dimensional flows, stream function and velocity potential, flow net.
b) Fluid dynamics: Euler's equation of motion, energy equation and Bernoulli's equation and its application-venturimeter, orifice meter, Pitot tube, Momentum equation and its application to simple problems.

Module III (12 hours)

a) Flow through Openings: Orifices, Mouthpieces, orifice coefficients.
b) Notches and Weirs: Rectangular, triangular and trapezoidal notches and weirs, Francis's formula with end contraction, suppressed weir, Cipolletti weir, submerged weir, broad crested weir.

Module IV (16 hours)

a) Viscous or Laminar flow: Laminar flow through circular pipes, parallel plates, Kinetic Energy Correction and Momentum, Power Absorbed in Viscous flow, Loss of Head due to Friction in Viscous flow, measurement of viscosity.
b) Turbulent flow: Reynolds' experiment, laws of fluid friction, Shear stresses,

establishment of flow, types of boundaries, Prandtl mixing length concept, velocity distribution, mean velocity and resistance to flow in smooth and rough pipes.

Module V (9 hours)

Flow through pipes: Losses in pipe flow-major loss (Loss due to friction)-Darcy Weisbach equation, minor losses, Hydraulic gradient lines, Total Energy lines. Flow through Syphon, pipes in series and parallel, Equivalent pipe, branched pipes, time of emptying a reservoir through pipe. Power transmitted through pipes, nozzles. Water Hammer in pipes. Pipe Network, Hardy Cross Method.

COURSE/ LEARNING OUTCOMES

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

CO1: Define a fluid and its physical properties; Understand the fundamental concepts of velocity field, stress field, and viscosity. (*Knowledge*)

CO2: Differentiate fluids from solids; determine the properties of fluid and pressure and their measurement.(*Comprehension*)

CO3: Compute the compute forces on immersed plane and curved plates ,local and convective acceleration for a given velocity field. (*Application*)

CO4: Compare different methods for studying fluid motion; analyze various cases of laminar and turbulent flow; relate the physical principles with practical situations like pipe flow, flow through orifice etc.(*Synthesis*)

CO5: Combine the various principles of fluid mechanics and organize them to solve different types of problems related to pipe flow, pressure measurement, hydrostatic forces etc.(*Analysis*)

CO6: Decide under which situation to use which equation; examine different cases of laminar and turbulent flow in pipes; determine the practical applications of various fluid mechanics principles.(*Evaluation*)

Suggested Readings

1. Dr. R. K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd.
2. Yunus A. Cengel, John M. Cimbala, Fluid Mechanics, McGraw-Hill Companies
3. Frank White, Fluid Mechanics, Tata McGraw Hill Education Pvt. Ltd.
4. K.L. Kumar, Fluid Mechanics, S. Chand and Co.

CVES0014: ENGINEERING SURVEY I

(4 credits – 60 hours)

Objectives: *This first course in Engineering Survey gives an introduction to various methods of engineering survey along with an exposure to the different survey equipment used by civil engineers.*

Module I (12 hours)

a) Chain and compass traversing: Introduction, functions of traverse, types of traverse, terms related to traversing: meridian, bearing (types and conversions), declination, calculation of interior angles of a closed traverse from bearings, traverse computations: latitudes and departures, closing error and its corrections, balancing a traverse by Bowditch's graphical rule

b) Plane table surveying: Principles, merits and demerits, equipment and accessories, methods of locating details - radiation, intersection and resection, traversing, two and three point problem

Module II (14 hours)

a) Leveling: Classification, Definition of terms, principles of leveling, types of levels, leveling staffs, balancing of sights, distance of visible horizon, Profile and Cross-section leveling, fly leveling, reciprocal leveling, Trigonometric leveling, Precise leveling, booking and reduction in field book. Errors in leveling, effect of curvature and refraction.

b) Contouring: Contour, contour interval, horizontal equivalent, contour gradient, factors affecting contour interval, characteristics of contours, direct and indirect methods of contouring, uses of contour maps.

Module III (12 hours)

a) Theodolite: Measurement of horizontal angle and vertical angles, - method of repetition and reiteration, sources of errors, temporary and permanent adjustments, checks in traversing, omitted measurements. Various types of Theodolite - Vernier, Micro-optic and Electronic. Traversing by Theodolite.

b) Tacheometry: General principles of stadia system, analytic lens, determination of tacheometric constants, inclined sights with staff vertical, inclined sight with staff normal to the line of sight, tangential system.

Module IV (10 hours)

a) Computation of Area and Volume: Units and conversion factor, Area by Mid-ordinate, Average-ordinate, Trapezoidal and Simpson's Rule, Formulae for circulation of Cross-Sectional Area, Formulae for calculation of volume.

b) Setting out Works: Setting out of buildings, bridges, Reconnaissance and Preliminary survey.

Module V (12 hrs)

Curve Surveying: Introduction, Definition of Different terms, Types of Horizontal Curves, Elements of Simple Circular Curve, Setting out of Circular Curve by Chain and Tape, Setting out of Circular Curve by Rankine's Method, Transition Curve and its characteristic properties, Combination of Transition and Circular Curve, Combination of Vertical curve – computation for setting out by Tangent Correction

COURSE/ LEARNING OUTCOMES

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

CO1: Name the different types of surveying and define the basic concepts related to engineering survey. (*Knowledge*)

CO2: Differentiate between the traditional and modern methods of surveying. (*Comprehension*)

CO3: Apply the concepts of trigonometry and different other mathematical relations to compute the angles of a traverse, altitude of a location, areas and volumes of the areas to be surveyed.(*Application*)

CO4: Assemble the results from various methods of surveying to summarize the existing condition of an area.

CO5: Evaluate the limitations of the methods used to survey. (*Evaluation*)

CO6: Identify the appropriate methods to be used to complete the surveying works. (*Analysis*)

Suggested Readings

1. Dr. B. C. Punmia, Surveying Vol. – Iand II, Laxmi Publications (P) Ltd.
2. R. Subramanian, Surveying and Levelling, Oxford University Press.
3. Arora, Surveying, Standard Book House.

CVSB0015: STRUCTURAL ELEMENTS OF BUILDING

(4 credits – 60 hours)

Objectives: *This course encompasses the study of various structural components constituting different types of buildings, the understanding of which is a prime requisite to conceive and construct a civil engineering structure.*

Module I: Building Materials A (18 hours)

Cement Concrete: Properties of building materials like ductility, strength, stiffness, durability, hardness, toughness and weakness of material, Cement (Chemical composition, manufacturing, physical characteristics, hydration, properties of cement compounds, types of cement, grade, tests on cement), Coarse and Fine aggregates (Test for Aggregates, Influence of aggregate on properties of Concrete and Mortar, Selection of aggregate), Fresh Concrete (Batching, Mixing, Workability, Effect of Admixture), Hardened Concrete (Mechanical properties of Hardened Concrete, Water-cement ratio, Porosity, Curing, Durability of Concrete), High Performance Concrete, Concept of Concrete Mix design, Nominal Mix with reference to IS Code recommendations, Design Mix.

Module II: Building Materials B (10 hours)

a) Metals: Steel for reinforced concrete and prestressed concrete construction, structural steel sections.
b) Deterioration of building materials: Corrosion, chloride and sulphate attack on concrete, alkali aggregate reaction, acid aggregate reactions.
c) Other Materials: Asbestos, Glass, Paints and Varnishes.

Module III: Building Construction A (14 hours)

Principles of planning: Orientation and Functional planning of a Building, Types of Building, Building Bye-Laws, Dead and Live loads.

Module IV: Building Construction B (18 hours)

a) Brick and stone masonry: Types and bonds in brick work, Reinforced brick work, Defects in brick masonry, Classifications of stone masonry, Lintels and Arches. Scaffolding
b) Partition and cavity walls: Types of non bearing partition- brick partitions, timber partitions and glass partitions, construction of masonry cavity walls.
c) Foundation: Functions, types of shallow and deep foundations, feature of shallow foundation, foundations in water logged areas, masonry wall foundation.
d) Roofs: Types of roofs, various roof trusses-king post truss, queen post truss and simple steel roof trusses.
e) Floors: Brick floors, cement concrete floors, terrazzo flooring, mosaic floorings, and tiled flooring.
f) Staircase: Types and planning of staircase
g) Doors and Windows: Locations and types of door movement, various types of doors and windows, fixtures and fasteners for doors, fixing ventilators.
h) Miscellaneous: Damp proofing, Termite proofing, Acoustics, Sound Insulation and Fire Protection.

COURSE/ LEARNING OUTCOMES

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

CO1: Define the characteristics of construction materials such as cement, aggregate, fresh and hardened concrete, bricks and timber. Identify various components of buildings and their functions and get acquainted with construction materials.
CO2: Explain the manufacturing, characteristics, and properties of a number of different materials like bricks, timber, polymers, stones, steel and plasters, different masonry construction, and demonstrate the ability to select an appropriate building materials used in construction.
CO3: Apply different construction techniques in buildings
CO4: Identify the different components required for construction and point out the faulty layout.
CO5: Assemble the building components in their respective group.
CO6: Assess the quality and characteristics of construction materials.

Suggested Readings

1. B.C. Punmia, Building Construction, Laxmi Publication.
2. Gurucharan Singh, Building Planning, Design and Scheduling, Standard Publication Distributors.
3. S.C. Rangwala, Engineering Materials, Charotar Publication.
4. M. Chakraborty, Civil Engineering Drawing, Third Edition, Bhakti Vedanta book trust.
5. R. S. Malik, G. S. Meo, Civil Engineering Drawing, New Asian Publishers.
6. V. B. Sikka, A Course in Civil Engineering Drawing, S. K. Kataria and Sons.
7. National building Code of India, 1984, BIS, 2002.
8. Building Bye Laws, Guwahati Municipal Development Authority.

CVSA0016: STRUCTURAL ANALYSIS I

(4 credits - 60 hours)

Objective: *This course is in continuation of the course Strength of Materials dealt with in an earlier semester and deals with understanding the behavior of components of civil engineering structures under the action of external loads. This forms the first step towards designing any civil engineering structure.*

Module I (12 hours)

Deflection of beams: Beam Differential Equation. Slope and Deflection at a point, for cantilever and simply supported beams, Double Integration Method, Macaulay's Method, Moment Area Method, Mohr's theorem, relation between maximum bending stress and maximum deflection, Strain Energy due to bending, Castigliano's First Theorem, Conjugate Beam Method, Principle of virtual work, Maxwell's Reciprocal Deflection Theorem

Module II (20 hours)

a) Analysis of statically determinate structures: Analysis of Trusses. Deflection of truss joints, adopting Maxwell's method of reciprocal deflection
b) Statically Indeterminate Structures: Static and Kinematic Indeterminacies, order of Redundancy. Strain energy method, Analysis of frames with one or two redundant members using Castigliano's 2nd theorem. Lack of fit and temperature effect
c) Fixed and Continuous beams: Analysis of Propped Cantilever and Fixed Beams subjected to various types of loading. Effect of fixity. Moment Area Method. Analysis of Continuous beams, Clapeyron’s Three Moment Method

Module III (20 hours)

a) Moment Distribution Method: Stiffness of a member, Relative Stiffness and Distribution factors. Application of Moment Distribution for the analysis of Continuous Beams with Simply Supported ends, Fixed Ends and Sinking supports. Analysis of Frames with and without sway
b) Slope Deflection Method: Formulation of the Slope Deflection Method. Application of Slope Deflection Method for the analysis of continuous beams and portal frames with only horizontal and vertical members
c) Kani’s Method: Rotation factors, Application for the analysis of Continuous Beams with Simply Supported ends, Fixed Ends and sinking supports, Analysis of Frames with and without sway

Module IV (8 hours)

Column and Struts: Slenderness ratio, short and long columns, combined bending and direct Stresses, resultant stresses for rectangular column subjected to eccentric load, limit of eccentricity for no tension, crippling load, Euler’s theory, Rankine’s formula, Straight line and parabolic formula

COURSE/ LEARNING OUTCOMES

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

CO1: Students will be able to Define statically determinate and indeterminate structural members and bending moment shear force ,strain energy principles, different methods of finding internal forces and deflections.(*Knowledge*)

CO2: Classify beams frames and columns in terms of determinancy, stability and dimensions. (*Comprehension*)

CO3: Apply principles principles of statics etc. to determine the energy principles for analysing the frames and beams (*Application*)

CO4: Students will be able to analyse structural members with different types of loadings and different types of fixity and communicate the results by means of proper documentation.(*Analysis*)

CO5: Summarise the assumptions and limitations inherent in the analysis methods. (*Synthesis*)

CO6. Evaluate the load carrying capacity of structural members and assess the safety. (*Evaluation*)

Suggested Readings

1 S. Ramamrutham, Theory of Structures, Dhanpat Rai Publishing Company (P) Ltd.
2 S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Company (P) Ltd.
3 Prof. V.N. Vazirani, Analysis of Structures Vol. IandII, Khanna Publishers
4 Dr. R. K. Bansal, A Textbook of Strength of Materials, Laxmi Publications (P) Ltd.
5 B. C. Punmia, Theory of Structures, Laxmi Publications

CVHM0017: HYDRAULICS AND HYDRAULIC MACHINES

(4 credits - 60 hours)

Objective: *This course deals with the practical aspects of flow of water, which form the basis of analysis and design of hydraulic structures and machines.*

Module I (12 hours)

Dimensional and Model Analysis: Dimensional Homogeneity, Methods of dimensional analysis, Rayleigh's method, Buckingham's π-theorem, Important dimensionless parameter and their significance, Application of dimensional analysis to fluid flow problems, Model Analysis, Similitude, Types of forces acting in a moving fluid, Dimensionless Numbers, Model Laws, Classification of Models

Module II (16 hours)

a) Boundary Layer Theory: Boundary layer thickness- displacement, momentum and energy thickness, Laminar and turbulent boundary layer along a flat plate- momentum integral equation; Laminar sub-layer. Drag force on flat plate due to Boundary Layer
b) Forces on Submerged Bodies: Force exerted by a flowing fluid on a stationary body, expression for drag and lift, terminal velocity of a body

Module III (16 hours)

Open Channel flow: Channel section- Wetted perimeter, hydraulic radius, slope; Chezy's and Manning's formula, Economic section. Normal depth, specific energy, critical depth and critical velocity, prismatic and non-prismatic channel section, types of bed slope. Gradually varied flow-surface profile, equation of gradually varied flow-direct step method, backwater curve, rapidly varied flow-hydraulic jump in horizontal rectangular channel, depth and length of jump, loss of energy

Module IV (16 hours)

a) Impact of Jet: Impulse momentum principle, force of jet on fixed, hinged and moving, vertical and inclined flat plate. Force of jet on moving curved plate, water wheel and radial rotating curved vanes
b) Turbines: Classification, Impulse and reaction turbines, work done, power and efficiencies, Pelton wheel, Francis turbine, Kaplan turbine, draft tube, unit quantities, specific speed. Characteristic Curves of Hydraulic Turbines
c) Pumps: Centrifugal pump- velocity triangle, work done, manometric head, efficiency, minimum starting speed, multi stage pump. Reciprocating pump, main parts, working, discharge, indicator diagram, effects of acceleration and friction, Air vessels

COURSE/ LEARNING OUTCOMES

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

CO1: Know Basic concepts of fluid, Energy concepts of fluid in open channel, Energy dissipation, Water surface profiles at different conditions. (*Knowledge*)
CO2: Learn how to design models and prototypes for analysis, design the most economic channel section along with other different sections and different types of turbines and pumps. (*Comprehension*)
CO3: Analyse the type of forces that are acting on a moving fluid and the forces on submerged bodies, obtain the expression for drag , lift and terminal velocity of a body. (*Analysis*)
CO4: Select appropriate type of turbines for the given conditions and suggest type of pumps required for specific purposes. (S*ynthesis and Application*)

Suggested Readings

1 Dr. R. K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd.
2 Yunus A. Cengel, John M. Cimbala, Fluid Mechanics, McGraw-Hill Companies
3 Frank White, Fluid Mechanics, Tata McGraw Hill Education Pvt. Ltd.
4 K.L. Kumar, Fluid Mechanics, S. Chand and Co.

CVES0018: ENGINEERING SURVEY II

(4 credits-60 hours)

Objective: *This course in Engineering Survey gives an introduction to various methods of engineering survey along with an exposure to the different survey equipment used by civil engineers.*

Module I (30 hours)

a) Triangulation: Classifications of Triangulation System, Triangulation Figures, Strength of figure, Routine of Triangulation Survey. Intervisibility and height of station, Signal – Types – phase of signal, Baseline – Selection of site, Baseline measurement, correction to Tape measurements, Extension of short base, Satellite station and Reduction to centre, Introduction to Trilateration – its comparison with triangulation, Introduction to EDM and Total Station, Elevation of Geodetic Points – special features of precise leveling work
b) Theory of Errors: Error, Accuracy and Precision, Types of Errors, Laws of Accidental Error, Law of Weight, Principle of Least Squares, Determination of Probable Error
c) Triangulation Adjustments: Station Adjustment – Corrections to observed angles at a station using distribution of error, normal equation, method of difference and method of correlates
d) Figure Adjustments: Adjustment of angles of a triangle using normal equation method. Adjustment of Geodetic Triangle – general rules for applying correction to the three angles, Calculation of Spherical Excess, computation of the sides of a Geodetic Triangle,

Adjustment of a Chain of Triangles, Adjustment of a Geodetic Quadrilateral by Approximate Method.

Module II (18 hours)

a) Field Astronomy: Astronomical Coordinate Systems, relationship between Coordinates, Star at Horizon, Prime Vertical, Elongation and Culmination, Circumpolar Stars, Astronomical Triangle, Napier's rules and its use to calculate coordinates

b) Map projections: Map-Fundamental Characteristics, types, Geographic Coordinate system, S.O.I. scheme of Map Indexing. Map projection-An ideal map projection, Classification of map projection, Factor influencing choice of suitable map projections. Introduction to Global Positioning System and Geographical Information System.

Module III (12 hours)

a) Aerial Photogrammetry: Introduction and Types of photograph, Definition of Basic terminology, Vertical Photograph-Determination of scale, flying height, distance between points, Relief displacement-estimation of height from relief displacement. Stereoscopic viewing-Meaning, Ideal conditions, Stereoscopic fusion and perception of depth, parallax and its measurement, Parallax equation for estimating elevation of a point, Difference in elevation by stereoscopic parallax, Computation of Flight Planning.

b) Introduction to remote sensing: Components of a Remote Sensing System, Electromagnetic Spectra, Active and passive remote sensing, Satellite platform, sun synchronous and Geostationary. Satellite data products-Hand copy-Panchromatic and FCC, Visual interpretation keys, Digital interpretation of image, broad type of computer assisted operations, Introduction to use of remote sensing data.

COURSE/ LEARNING OUTCOMES

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

CO1: Students will be able to define and describe the five phases of the system development life cycle. (*Knowledge*)

CO2: Students will be able to study how to gather data to analyze and specify the requirements of a system and design system components and environments. (*Comprehension*)

CO3: Students will be able to study how to build general and detailed models that assist programmers in implementing a system. (*Application*)

CO4: Students will be able to study how to analyze a problem and design an appropriate solution using a combination of tools and techniques. (*Analysis*)

CO5: Students will be able to determine methods for evaluating the effectiveness and efficiency of a system. (*Synthesis*)

CO6: Students will be able to study how to design a database for storing data and a user interface for data input and output, as well as controls to protect the system and its data. (*Evaluation*)

Suggested Readings

1 Dr. B. C. Punmia, Surveying Vol. – II and III, Laxmi Publications (P) Ltd.

2 K.R. Arrora, Surveying Vol. – II and III, Standard Book House.

3 N.N. Basak, Surveying and Levelling, Tata McGraw-Hill.

4 R. Subramanian, Surveying and Levelling, Oxford University Press.

5 Satheesh Gopi, R. Sathikumar and N. Madhu, Advanced Surveying, Dorling Kindersley (India) Pvt. Ltd.

6 Thomas M. Lillesand, Ralph W. Kiefer; Remote Sensing and Image Interpretation, John Wiley and Sons, New York.

CVEG0019: ENGINEERING GEOLOGY

(3 credits - 45 hours)

Objective: *Planning, design and construction of foundation of civil engineering structures need clear understanding of the underlying geology. This course will provide essential inputs to the students in this regard.*

Module I (8 hours)

General Geology: Branches and scope of geology, surface features and internal structure of the Earth. Weathering of rocks – Agents and kinds of weathering. Formation of Soil, Soil Profile. Geological work of Natural Agencies – Wind, Running Water, Subsurface Water, Glaciers and Oceans.

Module II (14 hours)

a) Mineralogy: Definition of crystal and mineral, study of the structure, physical, optical and chemical properties and occurrence of Quartz, Feldspar, Mica, Carbonate, Amphibole and Pyroxene group of minerals. Structure of clay minerals - Kaolinite, Illite and Montmorillonite

b) Petrology: Mode of formation of igneous, metamorphic and sedimentary rocks- their occurrences, forms, texture and structure, classifications, mineralogical compositions and Engineering Importance. Engineering properties of rocks – Compressive strength, tensile strength, porosity, permeability, specific gravity, abrasive resistance. Rock quarrying with particular reference to rock blasting and few related numerical problems

Module III (16 hours)

a) Structural geology: Primary and Secondary Structures of Rocks, Strike and Dip, out crops, volcanoes, overlaps, inliers and outliers, types and classification, causes of formation of folds, faults, joints, unconformities and their recognition in the field. Importance of geological structures in Engineering. Stratigraphy of India (a general idea).

b) Applied Geology and Geological investigation: Geological and geophysical investigations in major Civil Engineering Projects. Geological studies for Dams and reservoir sites, Geological studies for selection of tunnels and underground excavations. Rock Exploration by Direct Penetration – Core Boring (Rock Quality Designation). Geophysical methods as applied to civil engineering for subsurface analysis (Electrical, Seismic, Magnetic and Gravitational Methods). Introduction to applications of remote sensing in geological studies

Module IV (7 hours)

Earthquake: Tectonic activities, seismic waves and seismographs, seismogram, depth of focus, magnitude and intensity, Distribution of Earthquakes in the world and India, Precaution and Significance in Civil Engineering

COURSE/ LEARNING OUTCOMES

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

CO1: Students will be able to Identify the different minerals and distinguishing features exhibited by the rocks. (*Knowledge*)

CO2: Students will be able to Identify the geological structures like folds, faults, joints and unconformities present in rocks and describe the processes of weathering, classify and distribution of soils. (*Comprehension*)

CO3: Students will be able to assess the occurrence of ground water in various lithological formations and location of bore wells and decide appropriate foundation design for superstructure as well as substructures like tunnels etc. (*Application*)

CO4: Students will be able to analyze site conditions to decide appropriate foundation design for superstructure as well as substructures like tunnels etc, failure planes in the site lithology relevant to civil engineering foundation design. (*Analysis*)

CO5: Students will be able to understand the site conditions and decide appropriate foundation design for superstructure as well as substructures like tunnels etc. (*Synthesis*)

CO6: Students will be able to Evaluate the suitability of site for the tunnel construction, recognize the causes and effects of earth quakes, and landslides and suggest mitigation measures. (*Evaluation*)

Suggested Readings

1 Parbin Singh, Engineering and General Geology, S.K. Kataria and Sons
2 P. K. Mukherjee, A Textbook of Geology, The World Press Pvt. Ltd.
3 Dr. B. P. Verma, Rock Mechanics for Engineers, Khanna Publishers
4 F. G. Bell, Fundamentals of Engineering Geology, BPB Publications
5 Marland P. Billings, Structural Geology, PHI Learning Pvt. Ltd.
6 D Venkat Reddy, Engineering Geology, Vikas Publishing House Pvt. Ltd.

CVRT0020: RURAL CONSTRUCTION TECHNOLOGY

(4 credits-60 hours)

Objective: *Through this course, the students will be given an exposure related to appropriate technology in the area of housing, water supply, sanitation, rural roads construction and minor irrigation works, etc.*

Module I (8 Hours)

Rural development planning and concept of appropriate technology: Scope, development plans, various approaches to rural development planning, concept of appropriate technology in rural development, role of civil engineering in rural development, organizational structures and management, rural development programme/projects.

Module II (16 Hours)

Rural Housing: Low cost construction materials for housing, low cost housing designs - architectural considerations for individual and group housing; composite materials - ferro-cement and fly ash, autoclaved calcium silicate bricks and soil-stabilized unburnt brick; plinth protection of mud walls; design consideration and construction of non-erodible mud plaster, water-proof and fire-retardant roof treatment for thatch roofs, pre-cast stone masonry block walling scheme, rat-trap bond for walls; prefab brick , panels for roof, ferro-cement flooring / roofing units, thin R.C. ribbed slab for floors and roofs, pre-cast R.C. channel , Unit for flooring/roofing scheme, pre-cast R.C. cored unit for flooring/roofing scheme, pre-cast R.C. plank flooring/ roofing scheme-Pan roofing scheme;-glued plywood web beams and roof panels; manual and power scaffold hoist, lifting device for prefab components; solar passive building design; building economics and management.

Module III (14 Hours)

Water Supply and Rural Sanitation: Epidemiology, Sources of water, BIS and WHO water standards, Quality, Storage and distribution for rural water supply works, basic design principles of treatment - low cost water treatment technologies, Hand pumps - types, installation and operation, maintenance of Mark-II hand pumps, conservation of water, rainwater harvesting, drainage in rural areas, design of low cost waste disposal systems, design and construction of low cost latrines - 2 pit pour flush water seal, Ventilated Improved Pit latrines, septic tank etc., Biogas technology, low cost community and individual Garbage disposal systems, recycling of organic/agricultural wastes, development of village ponds, Ferro-cement water storage tanks and latrines, cattle shed management, sewage farming standards for disposal and use for irrigation

Module IV (12 Hours)

a) Low Cost Roads and Transport: Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases, Bituminous Construction, Surface Treatments for roads in rural areas, Detailed features and Quality Control of Modified Penetration Macadam, Soil Stabilization, Lime, Lime-Fly ash and Cement Treated Course, Crusher-run-Macadam, Use of local materials

b) Flexible Pavement: Design factors, Basic Principles, Guidelines for Surfacing of Rural Roads, CBR method for Design of Flexible Pavement

Module V (10 Hours)

Low Cost Irrigation: Design Consideration and construction of tube-well, drip and sprinkler irrigation systems, water logging, reclamation of land, watershed and catchment area development, problems and features of watershed management, management plans, watershed structures

COURSE/LEARNING OUTCOMES

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

CO1: Identify appropriate technologies in the area of housing, water supply, sanitation, rural roads construction and minor irrigation works, etc.; list different low cost construction materials, low cost water treatment technologies, low cost sanitation methods, low cost transportation methods and irrigation system; recognize the importance of affordable structures for rural regions.

CO2: Discuss various approaches to rural development planning, role of civil engineers in rural development, building economics and management and rural sanitation technologies; distinguish solar passive buildings and its concept, sources of water, categories of pavement layers and methods of irrigation.

CO3: Prepare different composite materials as low-cost materials; choose low cost waste disposal system; produce biogas technology and recycling units for domestic wastes; demonstrate the stages of construction of ferro-cement water storage tanks etc.

CO4: Compare different low cost housing materials, rainwater harvesting methods, drainage systems and soil stabilization techniques; identify the problems of water-logging and watershed management.

CO5: Design prefabricated materials, low cost latrines, septic tanks, flexible pavements and watershed structures; explain the importance of plinth protection for mud walls, waterproof & fire retardant treatments for rural houses and the CBR method.

CO6: Appraise the different low cost construction methods for civil engineering infrastructures; assess the cost analysis for various composite materials; defend the concept of conservation of water; justify the need of low cost roads and irrigation system in our country.

Suggested Readings

1. A. G. Madhov Rao, D. S. Ramachandra Murthy, Appropriate Technologies for low cost Housing, Oxford and IBH Publishing Co. Pvt .Ltd.
2. Advances in Building Materials and Construction, CBRI, Roorkee
3. C. Satyanarayana Murthy, Design of Minor Irrigation and Canal Structures, Wiley Eastern Ltd.
4. Document on Rural Road Development in India Volume 1and 2, Central Road Research Institute, New Delhi.
5. B Watt, Ferro cement Water Tanks and their Construction, Intermediate Technology Publications Ltd., London
6. GB Rai, Non-Conventional Energy Sources, Khanna Publishers, New Delhi
7. Biogas Slurry Utilization, Consortium on Rural Technology (CORT), New Delhi

8. Bindeshwas Pathak, Sulabh Shauchalays, Hand Flush Water Seal Latrine, Sulabh International, Patna
9. Bindeshwas Pathak, Sulabh Shauchalays – A Study of Directed Chough, Sulabh International; Gandhi Marg, Patna
10. Ettler and Steel, Municipal and Rural Sanitation, McGraw Hill Book, Inc. Company, New York
11. Fores, B. Wright, Rural Water Supply and Sanitation, Wiley Eastern Private Ltd. New Delhi
12. S.K. Sharma, Principles and Practice of Irrigation Engineering, S. Chand and Company Ltd. New Delhi

CVFM0021: FINITE ELEMENT METHODS

(3 credits-45 hours)

Objective: *The objective of the course is to apprise the students about the basics of the Finite Element Technique, a numerical tool for the solution of different classes of problems in Civil Engineering. It is intended to cover the analysis methodologies for 1-D, 2-D and 3-D problems with the advantages and disadvantages clearly spelt out. It is expected that once the students are exposed to the course, they will be in a position to develop computer code for any physical problem using Finite Element techniques.*

Module I (5 Hours)

Introduction to Finite Element Analysis: Introduction, Basic Concepts of Finite Element Analysis, Introduction to Elasticity, Steps in Finite Element Analysis

Module II (12 Hours)

a) **Finite Element Formulation Techniques:** Virtual Work and Variational Principle, Galerkin Method, Finite Element Method, Displacement Approach, Stiffness Matrix and Boundary Conditions

b) **Coordinates and Elements:** Natural Coordinates, Triangular Elements, Rectangular Elements, Lagrange and Serendipity Elements, Solid Elements, Isoparametric Formulation, Stiffness Matrix of Isoparametric Elements, Numerical Integration: One Dimensional, Numerical Integration: Two and Three Dimensional, Worked out Examples

Module III (8 Hours)

Analysis of Frame Structures: Stiffness of Truss Members, Analysis of Truss, Stiffness of Beam Members, Finite Element Analysis of Continuous Beam, Plane Frame Analysis, Analysis of Grid and Space Frame

Module IV (15 Hours)

a) **Finite Element Method (FEM) for Two and Three Dimensional Solids:** Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements, Lecture, Numerical Evaluation of Element Stiffness, Computation of Stresses, Geometric Nonlinearity and Static Condensation, Axisymmetric Element, Finite Element Formulation of Axisymmetric Element, Finite Element Formulation for 3 Dimensional Elements, Worked out Examples

b) **FEM for Plates and Shells:** Introduction to Plate Bending Problems, Finite Element, Analysis of Thin Plate, Finite Element Analysis of Thick Plate, Finite Element Analysis of Skew Plate, Introduction to Finite Strip Method, Finite Element, Analysis of Shell

Module V (5 Hours)

Additional Applications of FEM: Finite Elements for Elastic Stability, Finite Elements in Fluid Mechanics, Dynamic Analysis

COURSE/LEARNING OUTCOMES

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

CO1: Know the Basic Concepts in mathematical modelling with partial differential equation, and fundamental properties for elliptic, parabolic and hyperbolic equations.

CO2: Appraise the basics of the finite element technique, in solving problems of solid mechanics in different Civil Engineering applications. Make judgement on the results obtained from the analysis.

CO3: Apply the formulation of the subject based on equilibrium, constitutive and compatibility condition, develop computer coding for any structural element, find the approximate solutions of any complex structural analysis problems in Civil engineering and apply isoparametric formulation, stiffness matrix, etc. in frame structure analysis.

CO4: Analyze truss members, continuous beam, plane frame, grid and space frame structure.

CO5: Solve parabolic and hyperbolic partial differential equations using the finite element method in space and finite differences in time, and to compare different time stepping algorithms and choose appropriate algorithms for the problem at hand. Communicate the output of the software. And simulate the real time structure accordingly.

CO6: Verify the results obtained from the various analysis, validate and evaluate the results obtain under the same field data.

Suggested Readings

1. C. S. Krishnamoorthy, Finite Element Analysis, Tata McGraw-Hill
2. David V. Hutton, Fundamentals of Finite Element Analysis, McGraw Hill
3. Erik G. Thompson, Introduction to the Finite Element Method: Theory, Programming and Applications, John Wiley
4. H. C. Martin and G. F. Carey, Introduction to Finite Element Analysis - Theory and Application, New York, McGraw-Hill
5. K. J. Bathe, Finite Element Procedures, Prentice-Hall of India, New Delhi, India
6. M. Mukhopadhyay, Matrix, Finite Element, Computer and Structural Analysis, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India
7. O. C. Zienkiewicz and Y. K. Cheung, The Finite Element Method in Structural and Solid Mechanics, McGraw Hill, London
8. R. D. Cook, Concepts and Applications of Finite Element Analysis, Wiley
9. S. S. Rao, Finite Element Analysis, Elsevier Butterworth-Heinemann
10. W. Weaver Jr. and J. M. Gere, Matrix Analysis of Framed Structure, CBS Publishers and Distributors, New Delhi, India

CVSA0022: STRUCTURAL ANALYSIS II

(4 credits — 60 hours)

Objective: *This course is in continuation with the courses of Strength of Materials and Analysis of structures I dealt with in earlier semesters and deals with understanding the behavior of components of civil engineering structures under the action of external loads. This forms a key step towards designing any civil engineering structure.*

Module I (20 hours)

a) Arches:
   i) Analysis of three hinged arches: Circular arches, parabolic arches, and arches with supports at different levels, temperature effect on three hinged arches
   ii) Analysis of two hinged arches: circular arches, parabolic arches, effect of rib shortening, temperature stresses, analysis of fixed arches: elastic centre method, effect of temperature change and yielding of supports

b) Cable and suspension Bridges: Cables under point load, uniformly distributed load, stresses in cables and shape of cable under self-weight, temperature stresses, three hinged stiffening girder and two hinged stiffening girder

Module II (10 hours)

Unsymmetrical bending: Introduction to centroidal principal axes of sections, principal moment of inertia, bending stresses in beam subjected to unsymmetrical bending, shear centre, shear centre for channel, angles and z-sections

Module III (10 hours)

Analysis of beams curved in plan: Analysis of circular beam loaded uniformly and supported on symmetrically placed columns, semi-circular beam simply supported on three supports equally spaced, semi-circular beams fixed at two ends and subjected to central concentrated load

Module IV (20 hours)

a) moving loads and influence lines: Application to determinate structures-influence lines for support reactions, shear force, bending moment for beams, trusses, 3-hinged arch, suspension bridges

b) Muller-Breslau's principles: Influence lines for statically indeterminate beams, influence lines for support reactions, bending moment, shear force in propped cantilever, two span continuous beams and for two hinged arch

COURSE /LEARNING OUTCOMES

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

CO1: Define structures like arches, cables and suspension bridges, curved beams; recognize the significance of influence line diagrams; recall the difference between symmetrical and unsymmetrical bending. (*Knowledge*)

CO2: Explain the different classes of loads on arches, suspension bridges and curved beams; illustrate the phenomenon of unsymmetrical bending; interpolate the influence line diagrams of a girder to interpret the response of a bridge under moving loads. (*Comprehension and Application*)

CO3: Use the conventional methods of structural analysis to compute the reactions, shear, bending and torsional moments in arches, curved beams and suspension bridges; construct influence line diagrams for different types of rolling loads; find out stresses due to unsymmetrical bending. (*Application*)

CO4: Relate the theoretical results obtained from analysis in real time design of these structures and identify the structural requirements; point out the factors affecting the performance of these structures (*Application*)

CO5: Conclude precisely the maximum values of design parameters for these structures and summarize the generalized structural requirements under different load cases (*Synthesis*)

CO6: Determine the suitable principles of analysis based on the determinacy of structures and assess the output diagrams for economic design of these structures (*Evaluate*)

Suggested Readings

1. S. Ramamrutham, Theory of Structures, Dhanpat Rai Publishing Company (P) Ltd.
2. S. Ramamrutham, Strength of Materials, Dhanpat Rai Publishing Company (P) Ltd.
3. Prof. V.N. Vazirani, Analysis of Structures Vol. I and II, Khanna Publishers
4. Dr. R. K. Bansal, Textbook of Strength of Materials, Laxmi Publications (P) Ltd.
5. B. C. Punmia, Theory of Structures, Laxmi Publications

CVDS0023: DESIGN OF STRUCTURES I

(4 credits — 60 hours)

Objective: *This is the first course of design of structures which deals with all fundamental concepts of R.C.C design. RCC has been the predominant structural entity in the present day civil engineering constructions; hence the importance.*

Module I (24 hours)

a) Introduction: Different design philosophies, principles of working stress and limit state methods (limit state method in detail)
b) Beams: Analysis of singly and doubly reinforced beams of rectangular and flanged sections, design for bending, compression, shear and torsion – design of singly and doubly reinforced beams of rectangular and flanged sections using limit state method, design of continuous beams, limit state of serviceability – deflections and cracking

Module II (10 hours)

Columns: Effective lengths, design of short columns and long columns with axial loads, uniaxial moment and biaxial moments - use of SP–16 charts

Module III (16 hours)

a) Slabs: Design of one way, two way, continuous and cantilever slabs, design of flat slab
b) Staircases: Design of straight flight and dog-legged staircases

Module IV (10 Hours)

Footings : Design of isolated footings- axial and eccentric loading- design of combined footings- rectangular and trapezoidal footings, design of strap footing, design of Piles.

COURSE /LEARNING OUTCOMES

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

CO1: Recognize the standard philosophies of structural design; list out the different elements of a building viz. beams, column, slabs, staircases, footings etc.; state their functionalities and define the various classes of loading acting on these structures. (*Knowledge*)

CO2: Differentiate between working stress and limit state methods of design; explain the suitability of these design methodologies; classify the different design parameters viz. bending, shear, torsion, compression, tension etc. and illustrate the applicability of singly reinforced and doubly reinforced sections. (*Comprehension*)

CO3: Apply the standard methodologies as per IS Codes to predict the response spectrum of different structural elements of a building; compute the bending moments and shear forces at different sections of these structures; predict the maximum and minimum values of design parameters. (*Application*)

CO4: Analyze different elements of a building under various loadings; identify their deflection and cracking patterns; and point out the parameters influencing their design.(*Analysis*)

CO5: Assemble the theoretical results synthesized from structural analysis and combine those outputs to carry out an organized structural design of a building; conclude the structural design with workable diagrams of bending, shear and axial forces. (*Synthesis*)

CO6: Evaluate the structural design of various components of a building to determine the reinforcement required for an economic design; assess the performance of these elements by examining their serviceability requirements. (*Evaluation*)

Suggested Readings

1. IS 456-2000- Code of practice for R.C.C design.
2. S. Unnikrishna Pillai and Devadas Menon, Reinforced Concrete Design, Tata McGraw-Hill
3. S. Ramamrutham and R.Narayan,Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company (P) Ltd.
4. P. C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India Ltd
5. N. Krishnaraju, Structural Design and Drawing - Reinforced Concrete and Steel, Universities Press Ltd.
6. Dr. B.C Punmia, Ashok Kr Jain and Arun Kr Jain ,Reinforced Concrete Structures Vol. I-Laxmi Publications
7. S.S. Bhavikatti, Design of R.C.C structural Elements Vol. I-New age international publishers.
8. H. Mehra and V. N Vazirani, Limit State Design, Khanna Publishers

CVGE0024: GEOTECHNICAL ENGINEERING I

(4 credits — 60 hours)

Objective: *Knowing the composition and characteristics of soil mass is of paramount importance for any Civil Engineer in order to estimate and predict its behavior. This course deals with estimating behavior of soil in quantitative matter which is a prerequisite for designing foundation of any structure.*

Module I (10 hours)

Formation of soil, types of soil deposits based on origin, phase–relationships, index properties, particle size distribution: sieve analysis, identification and classification of soils, consistency of clays: Atterberg limits and, plasticity, sensitivity and thixotropy, clay minerals – montmorillonite, elite and kaolinite, fabric and structure, classification of rocks, RQD, RMR system

Module II (15 hours)

a) Permeability of soils: Darcy's law – factors affecting permeability - constant head and falling head permeability tests - average permeability of stratified deposits
b) Principle of effective stress: Total, neutral and effective stress variation diagrams, quick sand condition, critical hydraulic gradient
c) Seepage through soils: Laplace equation, flow nets–construction of flow net, definition of phreatic line and exit gradient, applications of flow net

Module III (15 hours)

a) Compaction of soils: Factors affecting compaction, compaction test, optimum moisture content and zero air void line, field methods of control of compaction, methods of compaction of various types of deposits in field.
b) Compressibility and consolidation of soils: Introduction to the process of consolidation (spring-piston analogy), e-p curves, methods of estimating preconsolidation pressure, over consolidation ratio, Terzaghi's theory of one dimensional consolidation, consolidation test and determination of C_v, m_v and C_c, primary and secondary consolidation, compression characteristics of clays and settlement analysis of clays and sands.

Module IV (20 hours)

a) Shear strength of soils: Stress at a point, Mohr's stress circle, Mohr-coulomb failure criteria, definition of stress path, shear testing of soil - direct shear, unconfined compression, vane shear, triaxial, undrained and drained strengths, shear characteristic of sand, normally loaded and over consolidated clays, Skempton's pore pressure parameters

b) Stability of slopes: Finite and infinite slopes, concept of factor of safety, Swedish method, friction circle method, Taylor's stability number and chart, effect of submergence, steady seepage and sudden drawdown conditions

COURSE /LEARNING OUTCOMES

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

CO1: Know about the composition and characteristics of soil mass, predict the behaviour of soil mass in a quantitative manner , understand the interaction of soil with water, compaction, compressibility and consolidation ,shear strength of soils and the stability of slopes.(*Knowledge*)

CO2: Students will be able to classify the soil and their basic properties to analyse the phase relationships and index properties of soils and to analyse the effect of compaction, compressibility and consolidation on a soil mass. (*Comprehension*)

CO3: Students will be able to compute the index properties of soils, effect of compaction, compressibility and consolidation on a soil mass. The students are able to compute the behaviour of soil with water, shear strength of soils and the stability of a given slope.(*Application*)

CO4: Tackle various problems and criticalities encountered in geotechnical engineering , take up projects in geotechnical engineering and pursue research in the field of geotechnical engineering.(*Analysis*)

C05: The students would be able to evaluate the suitability of soil mass for different works and judge whether a soil mass need further modification in its properties. (*Evaluation*)

Suggested Readings

1. Gopal Ranjan and A.S.R Rao, Basic and Applied Soil Mechanics, New age international publishers
2. B.C Punmia, Ashok Kr Jain and Arun Kr Jain, Soil Mechanics and Foundations, Laxmi publications
3. K.R. Arora, Geotechnical Engineering, Standard Publishers Distributors, New Delhi, 2006
4. Alam Singh, Modern Geotechnical Engineering-CBS publishers and distributors
5. Terzaghi and Peck, Soil Mechanics in Engineering Practice – John Wiley and Sons, New York, 196

CVTE0025: TRANSPORTATION ENGINEERING I

(4 credits — 60 hours)

Objective: *This course introduces Transportation Engineering, a core civil engineering practice in the field with prime focus on the highway engineering sector. On completion a student should be competent enough for planning and designing of different types of roads with necessary quality control in road construction and maintenance.*

Module I Planning, surveys and geometric design (24 hours)

a) Introduction: Role of transportation, modes of transportation - advantages and limitations
b) Transportation planning: Need, objectives, hierarchy of plans, salient points of 20 year road development plans in India, road development plan - vision:2021, brief introduction to IRC, NHAI, PMGSY
c) Surveys and investigations: Various types of surveys with importance of each, route location survey - characteristics of ideal alignment, engineering survey-map study, reconnaissance, preliminary surveys, final location and detailed survey
d) Traffic surveys: Traffic flow characteristics, traffic volume, speed and delay study, origin and destination study, axle load survey
e) Geometric design: Design controls and criteria, highway cross section elements - sight distance, right-of-way, roadway width, kerbs, camber, super-elevation, horizontal and

vertical alignment, widening on curves, gradients, summit curve and valley curve, road intersections - intersection at grade, e.g., channelized and un-channelized rotary, grade separated intersections

Module II Highway materials and design (20 hours)

a) Materials: Subgrade soil, various classifications, strength of soil subgrade - direct shear test, C.B.R. test, plate load test, tests on aggregates and bituminous binder, IS and IRC specifications, bituminous materials, tar and new materials
b) Pavement design: Functions of pavement, types of pavement and their comparison, factors to be considered in design - design wheel load, ESWL, repetition of loads, strength characteristics
c) Design of flexible pavement: Standard methods: GI method, CBR method, triaxial method, McLeod method, I.R.C. guidelines
d) Design of rigid pavement: Factors affecting design, Westergaard's analysis of stresses, temperature stresses, critical combination of stresses, structural components of rigid pavement, general design considerations and IRC guidelines

Module III Highway construction and maintenance (16 hours)

a) General process of highway construction: Excavation, embankment preparation, compaction of subgrade, construction of WBM and bituminous roads, types of bituminous courses
b) Construction of cement concrete roads: Concrete mix design, construction of dry lean concrete sub-base (DLC), antifriction layer, manual construction method, equipment-based technique using slip-forms, construction of joints using dowels and tie bars, use of admixtures and additives in concrete
c) Highway maintenance: Pavement evaluation by present serviceability index, Bankelman beam method and dynamic cone penetrometer test, maintenance of gravel roads, WBM roads, bituminous surface and cement concrete surface

COURSE /LEARNING OUTCOMES

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

CO1: Define the objectives of highway planning. Students are able to recognize the various elements of geometric design of roads.(*Knowledge*)
CO2: Classify the different types of pavement and their design processes. (*Comprehension*)
CO3: Correctly use the techniques, components and tools of a typical automated machine and apply it in designing new machines (*Application*)
CO4: Predict the effect of stresses on rigid pavement. (*Application*)
CO5: Criticize the pros and cons of various methods of pavement design.(*Analysis*)
CO6: Assemble the various steps for highway construction.(*Synthesis*)
CO7: Determine the use of admixtures and additives on concrete as well as bituminous pavement.(*Evaluation*)

Suggested Readings

1. Khanna S.K. and Justo C.E.G., Highway Engineering, Nem Chand and Bros, Roorkee
2. Kadiayali L.R and Lal N.B, Principles and Practices of Highway Engineering, Khanna Publishers
3. Bindra S.P, A course in Highway Engineering, Dhanpat Rai Publications
4. Rao, G. V, Transportation Engineering, Tata McGraw Hill
5. Kadiayali L. R, Traffic Engineering and Transport Planning, Khanna Publication

CVEE0026: ENVIRONMENTAL ENGINEERING I

(4 credits - 60 hours)

Objectives: *Starting with an introductory lesson on environment vis-a-vis pollution of its components, this course basically deals with various issues related to water supply to community which constitutes a prime area of practice for civil engineers.*

Module I (6 hours)

a) Man and environment: Health and environment, interdisciplinary nature of environment, brief introduction to air, water and land pollutions
b) Natural resources of environment: Water supply system, its objectives and components

Module II (26 hours)

a) Water quantity: Various demands of water, design period, population forecasting, per-capita consumption – recommended rates, factors affecting consumption, variation of demand and its impact and design of water supply system, fire demand
b) Water quality: Impurities of water and water borne diseases, water analysis physical, chemical and bacteriological, sampling method, water quality tests and standards
c) Treatment of water: Methods, purposes, sequence of treatments, aeration, sedimentation – plain and with coagulation, coagulants and their dosage, feeding units, mixing basins and flocculation units, sedimentation tanks and their design, filtration – principle, type of filters, slow and rapid sand filters, pressure, diatomite and multimedia filters
d) Other treatments of water: Disinfection, necessity of chlorinating - chlorine dose, break point chlorination, feeding units, Ozonisation, hardness and softening of water, lime process, lime and soda ash process, base exchange process, removal of taste and odour, iron and manganese, swimming pool water treatment

Module III (20 hours)

a) Intake works and conveyance of water: River, reservoir and canal intakes, selection of intake, rising main – type of conduits, capacity and design, pipe flow formulae, different types of pipe materials and pipe joints, pumps – types and selection of pumps
b) Distribution system: Introduction, general requirements, classification, gravity system, direct pumping system, system with pumping and storage, methods of supply, available pressure in distribution system, storage and distribution reservoirs, layout and design of distribution system, equivalent pipe method, Hardy Cross method
c) Maintenance of distribution system: detection of leakage and wastage and their prevention
d) Plumbing of buildings for water supply: Services connection, water storage, system of water supply in buildings, plumbing system, detection and remedies of defects in plumbing system, building drainage (traps)

Module IV (8 hours)

Introduction to Land Pollution and Noise Pollution: Source, characteristics, problems, methods of management

COURSE /LEARNING OUTCOMES

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

CO1: Recognize the interaction between human and environment, need of systematic utilization of natural resources ,components of water supply system. (*Knowledge*)
CO2: Understand principles and operation of water treatment systems and the required appurtenances and accessories. (*Comprehension*)
CO3: Assess the quantity and quality of water. (*Application*)
CO4: Appraise the suitability of the design of treatment plants and unit processes. (*Analysis*)
CO5: Evaluate and summarise process operations and performance. (*Evaluation*)

CO6: Modify the existing processes where ever required. (*Synthesis*)

Suggested Readings

1. K.N. Duggal, Elements of Environmental Engineering, S. Chand and company Ltd.
2. S. K. Garg, Water Supply Engineering, Khanna Publishers.
3. Dr. B.C. Punmia, Water Supply Engineering, Laxmi Publications Pvt. Ltd.
4. Dr. P.N. Modi, Water Supply Engineering, Standard Book House, New Delhi.
5. Metcalf and Eddy , Waste Water Engineering, Tata McGraw hill Publishing Co. Ltd
6. G. S. Birdie, Water Supply and Sanitary Engineering, Dhanpat Rai Publishing Company

CVSA0027: STRUCTURAL ANALYSIS III

(4 credits — 60 hours)

Objectives: *This course is in continuation with the courses of Structural Analysis I and II dealt with in earlier semesters, and emphasizes on various methods of static and dynamic analyses of different structures under vertical and horizontal loading. This forms a key step towards designing any engineering structure.*

Module I: Approximate Analysis of Multi-Storey Frames (20 hours)

Approximate Analysis of Multi-Storey frames subjected to Vertical Loads, Method of Substitute Frames; Analysis of Building Frames subjected to Horizontal Loads, Portal Method and Cantilever Method

Module II: Matrix Analysis of Framed Structures (18 hours)

Basic concepts of Structural Analysis, Deformation in Framed Structures, Equilibrium, Compatibility, Static and Kinematic Indeterminacy, Action and Displacement Equations, Principle of Superposition, Equivalent joint loads, Energy Concepts, Virtual Work, Flexibility and Stiffness Matrices and their derivation and application, Local and global stiffness matrices, relationship between flexibility and stiffness matrix

Module III: Plastic Method of Analysis (15 hours)

Introduction, plastic moment of inertia, plastic section modulus, characteristic of plastic hinge, concept of Moment Redistribution, Static and kinematic method, combined mechanism for plastic collapse loads of beams, single bay two storey and two bay two storey portal frames, simple pitch roof frame, deflection at point of collapse

Module IV: Dynamic Analysis (7 hours)

Introduction, Degrees of freedom, Damping, Free Vibration, Natural frequency, Forced vibration, Simple Structures with single and two degrees of freedom

COURSE /LEARNING OUTCOMES

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

CO1: Define static and kinematic indeterminacies of structures; name the different types of loading in a multi-storey frame and state the methods applicable for these loading classes (*Knowledge*)

CO2: Differentiate between the basic concepts of plastic and elastic theories of analysis; explain the structural behaviour under dynamic loading and illustrate the failure mechanisms of structures. (*Comprehension*)

CO3: Apply advanced methods of structural analysis viz. matrix methods to compute the forces and deflections in structures; construct workable diagrams for different design parameters and find out collapse loads for multi-storey structures .(*Application*)

CO4: Identify the approximate methods and principles suitable for analyzing different frames based on their indeterminacies and compare the results with conventional methods.(*Analysis*)

CO5: Assemble the results from different methods of analysis and combine those results to summarize the collapse mechanism of structures.(*Synthesis*)

CO6: Examine the failure mechanisms and determine the factor of safety for horizontal and vertical loads under static and dynamic conditions(*Evaluation*)

Suggested Readings

1. V. N. Vazirani, M. M. Ratwani and S. K. Duggal, Analysis of Structures, Volume I and II, Khanna Publishers
2. R. Vaidyanathan and P. Perumal, Structural Analysis, Volume I and II, Laxmi Publications
3. Thandavamoorthy, Structural Analysis, Oxford Press
4. Gupta, Pandit and Gupta, Theory of Structures, McGraw Hill
5. B. C. Punmia, Theory of Structures, Laxmi Publications
6. S. Ramamrutham, Theory of Structures, Dhanpat Rai Publishing Company (P) Ltd.
7. V. K. M. Selvam, Fundamentals of Limit Analysis of Structures, Dhanpat Rai Publications

CVDS0028: DESIGN OF STRUCTURES II

(4 credits — 60 hours)

Objectives: *This is the second course of design of structures which deals with the basic concepts and their applications in the field of design of steel structures. Keeping in mind the skyrocketing trend of application of steel as a construction material in present day construction engineering, this course is intended to be the stepping stone for the students to the modern construction industry.*

Module I (4 hours)

Introduction and Design Approach: Properties of Structural Steel, I. S. Rolled Sections, I. S. Specifications, Factor of Safety, Permissible and Working Stresses, Plastic Method, Limit State Design Method, Introduction to Elastic Method

Module II (16 hours)

Connections: Type of Connections, Bolted and Welded Connections, Strength and Efficiency of Bolted and Welded Joints, Design of Bolted Joints - Lap and Butt Joint, Modes of Failure of a Bolted Joint, Advantages and Disadvantages of Welded Joints, Design of Fillet and Butt Welds, Design of Eccentric Connections, Gusset Plate and Bracket Connection

Module III (20 hours)

a) Tension Members: Net Sectional Area, Permissible Stress, Design of Axially Loaded Tension Member, Design of Member Subjected to Axial Tension and Bending, Splicing of Tension Members
b) Compression Members: Modes of Failure of a Column, Buckling Failure: Euler’s Theory, Effective Length, Slenderness Ratio, Design Formula: I.S. Code Formula, Design of Compression Members, Simple Struts, Design of Concentrically and Eccentrically Loaded Built-Up Compression Members, Laced and Battened Columns, Secondary Design Consideration, Column Splicing

Module IV (20 hours)

a) Beams: Design Procedure, Simple and Built-Up Beams, Laterally Restrained and Unrestrained Beams, Plate Girder: Plate Thickness, Web Crippling, Web Buckling, Connections and Curtailment of Flange Plates
b) Beam Column: Eccentricity of Load, Interaction Formulae, Design Procedure
c) Column Base: Centrally and Eccentrically Loaded Base Plate Design, Flat Slab Base, Gusseted Base, Grillage Foundation

COURSE /LEARNING OUTCOMES

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

CO1: Know about the design approaches using steel sections of various types, difference between design of concrete structures and design of steel structures and the advantages of steel structures over concrete structures. (*Knowledge*)
CO2: Classify different types of steel sections and connections that are used in the design of steel structures. (*Understanding*)
CO3: Apply the theories learnt to design tension members and compression members and the various connections using bolts and welds, beams, beam-columns and column-bases. (*Application*)
CO4: Analyse designed connections and members and point out the deficiencies in the connections in case the connections turn out to be unsafe and provide remedial measures in case of failure prediction. (Analysis)
CO5: Tackle various problems in design of steel structures, various criticalities that are encountered while designing steel structures, to take up projects involving design of steel structures and to pursue research in the field of design of steel structures. (*Synthesis*)
CO6: Evaluate the performance of a designed member. The students are able to examine a steel structure for any faults and defects. The students are able to judge whether a particular design are sufficient for a given situation. (*Evaluation*)

Suggested Readings

1. IS 800:2007-Code of practice for Steel Design
2. N. Subramanian, Design of Steel Structures, Oxford University Press.
3. S.S. Bhavikatti, Design of Steel Structures, I.K. International Publishing House Pvt. Ltd.
4. L.S. Negi, Design of Steel Structures, Tata McGraw Hill Education
5. S. Ramamrutham, Design of Steel Structures, Dhanpat Rai Publications
6. Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Design of Steel Structures, Laxmi Publications

CVGE0029: GEOTECHNICAL ENGINEERING II

(4 credits — 60 hours)

Objectives: *This course is in continuation with the course of Geotechnical Engineering I and deals with different types of foundation system and retaining structures, their analysis and geotechnical design, bearing and settlement behaviour under vertical stresses as well as various techniques of soil improvement. Students are expected to earn capability of making appropriate decision as regards type of foundation based on prevailing ground condition.*

Module I (20 hours)

a) Vertical Stresses: Introduction, Boussinesque and Westergaard's formula and Newmark's chart, vertical stress distribution beneath loaded areas and stress distribution diagrams.
b) Earth Pressures and Retaining Walls: Introduction, Earth pressure at rest, Rankine and Coulomb's theories for active and passive states, influence of surcharge, water table, wall friction and deformation on earth pressure, Culmann's graphical method, point of application, Design considerations for Retaining walls.

Module II (25 hours)

a) Introduction: Classification of foundation types and principles of selection.
b) Shallow Foundations: General Requirements for satisfactory action of footings.
c) Bearing Capacity: Terzaghi's theory, factors affecting bearing capacity, influence of eccentric and inclined loads, determination of allowable bearing pressure and proportioning of footing on clay and sand Settlement: Immediate and consolidation

settlements, compression characteristics of clays and settlement analysis of clays and sands, limits of settlement, correction for rigidity and three dimensional consolidation effects, settlement of foundation in sand and clay.

d) Deep Foundations: Uses and types of piles; Bearing capacity of single pile in clay and sand, Engineering News and Hiley's formula, Indian standard pile load test, group action, negative skin friction, Settlement of pile groups

e) Piers and caisson foundations, elements of well foundation, depth of well foundation, list of forces acting on well, remedial measures for shifts and tilts of well, permissible values

Module III (7 hours)

Machine Foundations: Types of machine foundations, modes of vibration of a block foundation, degrees of freedom of a block foundation, design criteria of a reciprocating machine foundation.

Module IV (8 hours)

a) Soil Exploration: Purpose, methods of soil exploration, methods of boring, soil samples and samplers, penetration and sounding tests, plate load test, geophysical methods, site investigation Reports.

b) Introduction to ground improvement techniques including use of geosynthetics and geotextiles

COURSE /LEARNING OUTCOMES

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

CO1: Define vertical stress, earth pressure in retaining wall, understand bearing capacity of shallow and deep foundation, settlement calculation and criteria of consolidated soil, Piers and caisson foundation, machine foundation, Soil exploration techniques. (*Knowledge*)

CO2: Classify foundation types, machine foundations. (*Comprehension*)

CO3: Apply the knowledge acquired in designing of foundations for structures, embankments, landslide, slope stability, storage systems for hazardous materials, and lessening of soil erosion. (*Application*)

CO4: Analyze shallow and deep foundations and verify of the results obtained from the various analysis based on the soil exploration, boring and geophysical site method. (*Analysis*)

CO5: Evaluate the earth pressures on foundations and retaining structures and the bearing capacity of soils and foundation settlements. (*Evaluation*)

Suggested Readings

1. Gopal Ranjan, A.S.R Rao, Basic and Applied Soil Mechanics, New Age International Publishers
2. V. N. S. Murthy, Geotechnical Engineering, Marcel Dekker, Inc.
3. Dr. B.C. Punmia, Ashok Kr Jain and Arun Kr Jain, Soil Mechanics and Foundations, Laxmi Publications
4. P. Purushothama Raj,Soil Mechanics and Foundation Engineering, Pearson

CVEE0030: ENVIRONMENTAL ENGINEERING II

(3 credits — 45 hours)

Objectives: *This course is in continuation with the course of Environmental Engineering I dealt with in previous semester and aimed at familiarizing the students with collection and characterization of wastewater samples, their treatment and disposal, wastewater treatment processes-chemical and biological and their applications in order to make them competent to understand and handle problems caused by sewage, sewerage and other types of water pollution.*

Module I (8 hours)

a) Introduction: Wastewater Generation and sources, Sanitation, sewage, sewer, sewerage, method of water collection conservancy and water carriage system, sewerage system types, selection of a system.
b) Waste water flow : Quantity of sanitary sewage, infiltration of water, variation in flow and its impact on wastewater system, quantity of stormwater, rational method, time of concentration, rainfall intensity duration relationship, Empirical formula.

Module II (5 hours)

Sewage Characteristics: Effluent Standards, Important parameters and their significance BOD, COD, DO nitrogen, test -physical, chemical and biological

Module III (12 hours)

Wastewater Collection: Sewerage system, Hydraulic flow of sewers, principle of lay out and planning shapes of sewers design of sewers, self-cleansing velocity and slopes, construction and testing of sewers line, sewers materials, joints and appurtenances, maintenance of sewerage system.

Module IV (12 hours)

Wastewater Treatment: Objectives, methods and their sequence and efficiencies, primary treatment- screening, grit removal, scum removal, primary treatment, sedimentation, secondary biological treatment- trickling filter, circulation, activated sludge process: sludge digestion and disposal.

Module V (8 hours)

Waste Water Disposal and Reclamation and Reuse of Sewage: Disposal by dilution, Self-purification of surface water bodies, Oxygen sag curve, disposal by irrigation, sewage farming, sewage sickness, septic tank and its general features, working principle and design consideration: Inhoff tank, oxidation pond, aerated lagoon etc.

COURSE /LEARNING OUTCOMES

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

CO1: Identify classes, objects, members of a class and relationships among them needed for specific problem. (*Knowledge*/*Evaluation*)
CO2: Write Java application programs using OOP principles and proper Program structuring. (*Application*/*Comprehension*)
CO3: Demonstrate the concepts of polymorphism and inheritance. (*Application*)
CO4: Write Java programs to implement error handling techniques using exception handling. (*Application*)
CO5: Analyze the real world problems and solve using Java programming. (*Analysis*/ *Application*)

Suggested Readings

1. BC Punmia, Wastewater Engineering, Laxmi Publications Pvt. Ltd.
2. Howard S. Peavy, Environmental Engineering , McGraw Hill
3. K. N Duggal, Elements of Environmental Engineering, S Chand And Company Ltd.
4. G.S Birdie, Water supply and Sanitary Engineering , Dhanpat Rai Publishing company

CVHW0031: HYDROLOGY AND WATERSHED MANAGEMENT

(4 credits — 60 hours)

Objectives: *This course deals with key features of hydrological science including precipitation data analysis, rainfall – runoff analysis, ground water hydrology, introduction to hydrographs and flood routing, hydrological design, risk analysis and uncertainty. It also familiarizes the students with important aspects of river engineering and flood management.*

Module I (12 Hours)

a) Introduction: Hydrology- definition and scope, hydrologic cycle and its components.
b) Precipitation: Forms, type and formation of precipitation, measurement of rainfall, analysis of rainfall data, correction of deficiencies in rainfall data, double mass curve, average rainfall over area, DAD analysis
c) Evaporation: Definition, factors affecting, measurement (Class A pan). Estimation using empirical methods (Meyer‘s and Rohwer‘s equation), Evaporation control. Evapo-transpiration- Definition, factors affecting, measurement, estimation (Blaney Criddle method) Infiltration - Definition, factors affecting, measurement (double ring infiltrometer), infiltration indices, Horton‘s equation of Infiltration

Module II (22 Hours)

a) Stream gauging, measurement of stream stage, estimation and measurement of stream discharge, rating curve.
b) Runoff, Hydrograph and Flood routing: Runoff components, factors affecting runoff, hydrograph and its components, base flow separation, Use of rational method, hydrograph method, unit hydrograph– concept, derivation, limitations and use, S-hydrograph and its uses.
c) Definition of Flood Routing, storage equation, reservoir routing and channel routing, Hydrologic models, Frequency Analysis and Frequency Distribution Models, Rainfall Intensity- Duration and Frequency (Return Period) Relationships. Time Series analysis, determination of trend component, periodic component and stochastic component

Module III (7 Hours)

Ground Water hydrology: Occurrence of groundwater, soil-water relationship, Aquifers, movement of groundwater, Darcy’s law, yield from wells for confined and unconfined aquifers, yield of an open well.

Module IV (12 Hours)

a) Flood Management and River Engineering: Basics of river engineering, river survey, protection by embankment, dyke, bank protection, types of bank protection and channel improvement works.
b) Flood control methods: Structural and nonstructural measures, flood plain Zoning, flood disaster monitoring and mitigation procedure, methods of forecasting, engineering methods for flood fighting.

Module V (7 Hours)

Soil erosion process, types of erosion, factors affecting erosion, assessment of erosion, modelling erosion using USLE, RUSLE Methods of controlling soil erosion by vegetative practice, mechanical practice, erosion control in torrents and gullies, soil conservation practices

COURSE /LEARNING OUTCOMES

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

CO1: Define various stages of hydrologic cycle, hydrograph, unit hydrograph, routing etc; list various river training works; state Darcy’s law; write different types of soil erosion. (*Knowledge*)
CO2: Explain various aspects of precipitation, evaporation and evapotranspiration; illustrate the methods for separating base flow from flood hydrograph; interpret different applications of unit hydrograph theory; explain the theory of flood routing and differentiate reservoir routing from channel routing. (*Comprehension*)
CO3: Analyze problems related to precipitation, infiltration and other abstractions, hydrographs, groundwater hydrology, routing etc; compare different techniques of flood routing; identify different models of soil erosion. (*Analysis*)

CO4: Compute average precipitation depth for a catchment, infiltration capacity from Horton's equation etc; solve problems related to flood hydrographs and unit hydrographs; predict the flood hydrograph for a reservoir or a river reach by routing techniques; find out various parameters related to groundwater flow. (*Application*)

CO5: Combine the concepts of surface hydrology with groundwater hydrology and conclude that for proper management of watersheds hydrologic analysis is critical. (*Synthesis*)

CO6: Decide which method to select for a particular hydrologic analysis and examine their suitability. (*Evaluation*)

Suggested Readings

1. K Subramanya, "Engineering Hydrology", Tata McGraw-Hill
2. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers
3. S.N. Ghosh, "Flood Control and Drainage Engineering"
4. G. Das, "Hydrology and soil Conservation Engineering".

CVEC0032: ESTIMATION AND COSTING

(4 credits — 60 hours)

Objectives: *This subject will introduce the students to the basics of estimation of quantity and cost of civil engineering projects including the methods of tendering and contracting. It also deals with the valuation of properties.*

Module I (8 hours)

a) Introduction: Purpose and types of estimates, standard methods of estimating
b) Specification: Aims of specification, types, open specification, general specification of different class buildings, detail specification of various items of works

Module II (24 hours)

a) Building estimate: Methods of building estimate, items of work, estimate of earthwork, P.C.C., R.C.C. brickwork, opening, flooring, finishing, roofing, plumbing
b) Road estimate: Estimate of earthwork for different roads, estimate of new road, railway track, culverts, bridges

Module III (6 hours)

a) Rate analysis: Purpose, factors affecting rate analysis, overhead costs, rate analysis of material, rate analysis of labour for different items
b) Schedule of rates: Assam schedule of rates, CPWD schedule of rates, schedule of rates for different items, carriage, bill of quantities

Module IV (16 hours)

a) Introduction to valuation: Purpose, income, outgoings, scrap value, salvage value, market value, book value, capitalized value, sinking fund, year's purchase, depreciation, obsolescence, annuity
b) Valuation process: Present day cost, different methods of valuation, valuation according to purpose
c) Lease and rent: Mortgage lease, types of lease, valuation of leasehold properties, types of rent, security, rate statement, rate fixation for government buildings

Module V (6 hours)

Tendering and contract: Tendering - purpose and methods, types of tenders, specifications, notice inviting tender, prequalification, pretender conference, tender documents, acceptance and selection criteria, elements of contract as per India contract Act 1872, types of contracting systems, sub-contract, contract law, disputes and arbitrations

COURSE /LEARNING OUTCOMES

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

CO1: Estimate the quantities of civil engineering materials required in a particular project and the cost of the project and conduct property valuation and tendering process.
CO2: Perform managerial functions like planning, organizing, staffing, leading & controlling a construction project.
CO3: Apply logical thoughts and prepare the rate analysis and bills
CO4: Comprehend detailed report on estimation and valuation process
CO5: Analyze and synthesize cost effective approach for civil engineering projects. analyse the rate of materials and labours required in the work and hence estimation of the cost involved.
CO6: Evaluate the cost of expenditure and prepare a detailed rate analysis report

Suggested Readings

1. Prof. B.N.Dutta, Estimation and Costing in Civil Engineering, UBS Publishers' Distribution (P) Ltd.
2. M. Chakraborti, Estimating, Costing, Specification and Valuation in Civil Engineering, Self-Published
3. Prof V.N. Vazirani and S.P. Chandola, Civil Engineering Estimating, Costing and Valuation, Khanna Publishers
4. G. S. Birdie, Textbook of Estimating and Costing, Dhanpat Rai Publications

CVIG0033: IRRIGATION ENGINEERING

(4 credits — 60 hours)

Objectives: *This course emphasizes in providing a comprehensive knowledge of different irrigation practices needed by civil engineers. It provides information about different irrigation activities, their application and advantages. The course further deals with theory and design of different hydrological structures. Further it briefly discusses about important soil - water relationship.*

Module I (14 Hours)

Introduction: Definition, necessity, benefits, ill effects of irrigation, types and different methods of irrigation and their application, major irrigation projects in India

Module II (20 Hours)

Soil water-plant relationship and water requirement of crops: Soil water classifications, field capacity, wilting point, available moisture, soil fertility manure and fertilizer, crop rotation, functions of soil water, crop seasons, consumptive use – evapotranspiration, measurements, command area, delta, duty, base period kor depth, kor period, irrigation requirements, depth and frequency of irrigation, factors affecting water requirements, principal crops of India, irrigation efficiencies

Module III (18 Hours)

a) Canal design: Canal section and bed slope, design of lined and rigid boundary canal – Manning's equation, design of alluvial canals – Kennedy's and Lacey's silt theories, their limitations
b) Canal headworks: Basic of layout and components of storage and diversion head works, concept of weirs, barrage, spillways and head regulator, sill excluder
c) Regulation works: Canal falls – necessity, location and various types
d) Cross drainage works: Necessity, types – aqueducts, super passages, level crossing, selection of suitable types

Module IV (8 Hours)

Soil properties and fertility and land reclamation: Land reclamation, soil characteristics, characteristics and factors affecting fertility of soils, purposes, methods, description of land and reclamation processes

COURSE /LEARNING OUTCOMES

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

CO1: Define irrigation, various terminologies like field capacity, wilting point, crop rotation, command area, duty, delta etc; recognize the principal crops in India; state different irrigation efficiencies.

CO2: Explain the consumptive use of water; illustrate different land reclamation processes; differentiate different methods for canal design and demonstrate the use and necessity of different irrigation/hydraulic structures.

CO3: Apply Kennedy's and Lacey's method for the design of irrigation canal;

CO4: Analyze different numerical problems related to soil water-plant relationship and water requirements of crops; compare the different design methods for designing irrigation canals.

CO5: Summarize the different concepts of irrigation engineering to get an overall idea related to the various challenges that need to be addressed for designing an efficient irrigation system.

CO6: Evaluate the factors leading to the assessment of water power potential and layout of a hydel plant.

Suggested Readings

1. N. N Basak, Irrigation Engineering, Tata McGraw Hills Education
2. S. R Sahasrabudhe, Irrigation Engineering, Katson Books
3. S. K. Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers

CVEG0034: EARTHQUAKE ENGINEERING

(4 credits — 60 hours)

Objectives: *The main objective of this course is to illustrate the fundamentals of structural and soil dynamics so as to foresee the potential consequences of strong earthquakes on urban areas and civil infrastructure. The course deals with the problems and solutions in attaining efficient earthquake-resistant structures and facilities. This course will be a stepping stone towards designing, constructing and maintaining structures to perform at earthquake exposure up to the expectations and in compliance with building codes.*

Module I (8 Hours)

Introduction: Earthquake - magnitude and intensity, ground motions, wave propagation parameters - peak ground acceleration, velocity and displacement, epicentre and hypocentre, focus of earthquake, recording of ground motions - sensors

Module II: Analysis and design for earthquake effects (14 Hours)

a) Structural dynamics – SDOF systems, equation of motions, free and forced vibrations, damping, response spectrum, MDOF systems
b) Earthquake analysis - idealization of structures, equivalent force concepts, equivalent seismic lateral loads using seismic coefficient method, response spectrum analysis, use of IS 1893-2002 for analysis and design of building structures
c) Introduction to seismic design of bridges, dams, industrial structures and retaining walls

Module III: Earthquake resistant construction (22 Hours)

a) Earthquake resistant design philosophy, concept of ductility in structures, ductile detailing requirements, codal provisions for ductile detailing (specific reference to IS: 13920-1993), specific reference to IS: 4326 for earthquake resistant construction of non-engineered buildings

b) Earthquake behaviour of buildings, soft storey effect in RC multistoried buildings, earthquake behaviour of masonry structures, repair and rehabilitation of RC structures, earthquake protection of non-structural elements in buildings

Module IV: Soil dynamics and soil structure interaction (10 hours)

Introduction of soil structure interaction (SSI), its effects and modeling, theory of soil liquefaction, liquefaction potential, criteria for liquefaction, factors affecting liquefaction, evaluation of zone and resistance against liquefaction: Seed and Idriss (1971) method, examples, anti-liquefaction measures

Module V (6 hours)

Earthquake risk mitigation: Earthquake risk mitigation, earthquake policy and disaster mitigation - review of damage during past earthquake natural disaster mitigation, lessons from past disasters, social and economic aspects, preparedness, public policies and role of engineers, strategies for quality control, vulnerability assessment of structures, retrofitting and strengthening of buildings and bridges, seismic micro-zonation

COURSE /LEARNING OUTCOMES

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

CO1: Understand the basics of engineering Seismology and concepts of theory of vibrations.

CO2: Explain the earthquake behaviour of buildings; illustrate the detailing requirements of buildings for earthquake resistant construction; classify the methods of dynamic analysis and translate the analytical outputs into risk mitigation strategies.

CO3: Solve the equations of dynamic motions to compute the magnitude of ground vibrations; predict the liquefaction potential of soil; apply earthquake analysis methods as per Indian Standard Codes to find out the response spectrum of structures viz. buildings, bridges, dams, retaining walls, industrial structures

CO4: Identify the codal provisions for ductile detailing of structures; compare the earthquake policies and strategies for quality control

CO5: Generalize the seismic behaviour of engineered and non-engineered structures; combine and summarize the concepts of retrofitting and strengthening the existing structures

CO6: Estimate the seismic performance of building with respect to damage pattern.

Suggested Readings

1. Manish Shrikhande and Pankaj, Earthquake Resistant Design of Structures, Phi Learning, 2006
2. Vinod Hosur, Earthquake-Resistant Design of Building Structures, Wiley and Sons
3. Anil K. Chopra, Dynamics of Structures Theory and Application to Earthquake Engineering, Pearson Education Singapore Pte Ltd.
4. Sekaran Rajasekaran, Structural Dynamics of Earthquake Engineering: Theory and Application, Woodhead Publishing Limited

CVTE0035: TRANSPORTATION ENGINEERING II

(4 credits — 60 hours)

Objectives: *This course is in continuation with the course of Transportation Engineering I with prime focus on various aspects of different modes of transportation like railways, airways and waterways. On completion a student should be competent enough in the planning and design of railways, airport and harbour engineering.*

Module I: Introduction to railways, its component parts and its function (16 hours)

Introduction with various aspects of railway engineering, permanent way component parts and its functions, various types of rails, functions, creep in rails, creep measurement, coning of wheels, rail fixations, sleepers - various types, merits and demerits, ballast – various types and subgrade preparation

Module II: Railway alignment and geometric design (14 hours)

Alignment, superelevation, negative superelevation, cant deficiency, example problems, points and crossings, layout of left hand and right hand turnouts, construction and maintenance of permanent way, appurtenant works, containerization

Module III: Airport engineering (12 hours)

Introduction to air transportation, history and international organizations role in development of airports, aircraft types and its characteristics, general layout of an airport and its component parts, site selection of airports as per ICAO, orientation of runway by wind rose diagrams, basic runway length determination, corrections to basic runway length, geometric design, types of airports as per landing and take-off and dimensions

Module IV: Water transportation (12 hours)

Introduction: inland water and ocean water transportation, purpose, classification and salient features of harbours, ports and docks, layout of a harbour, requirements of a good port, typical construction of a dock, break waters – necessity, vertical wall and mound breakwaters

Module V: Introduction to tunneling (6 hours)

Necessity of tunnels, classification, alignment and surveys, various methods of tunneling, tunnel lining, ventilation and drainage in tunnels

COURSE /LEARNING OUTCOMES

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

CO1: State the various components of railway engineering, airport engineering, water transportation as well as tunneling methods.
CO2: Illustrate the various elements of geometric design of railways.
CO3: Perform orientation of runways of an airport using the wind rose diagram.
CO4: Analyze the layout of a port, dock and a harbour. They are able to differentiate between vertical wall and mound breakwaters.
CO5: Assemble the various methods of tunneling. Students are able to classify the different types of tunnels.
CO6: Examine the role of various modes of transportation, their utilities and the importance of each type.

Suggested Readings

1. S. P. Arora, S. C. Saxena, A Textbook of Railway Engineering, Dhanpat Rai Publications
2. S. Chandra and M. M. Agarwal, Railway Engineering, University Press, New Delhi
3. S. C. Rangwala, Principles of Railway Engineering, Charotar Publishing House Pvt. Ltd.
4. S. K. Khanna, M. G. Arora and S. S. Jain, Airport Planning and Design, Nem Chand and Bros. Roorkee
5. R. Horonjeff and F. X. McKelvey, Planning and Design of Airports, McGraw-Hill
6. H. P. Oza and G. H. Oza, Dock and Harbour Engineering, Charotar Publishing House Pvt. Ltd

CVGO0036: ELEMENTS OF GEOINFORMATICS

(3 credits — 45 hours)

Objectives: *This elective course is designed to familiarize the students with the modern tools of Geoinformatics viz., remote sensing (RS) and geographical information system (GIS) which are useful for analysis and interpretation of occurrences on the earth's surface. Satellite remote sensing in optical bands has been introduced in more detail. Foundation of GIS will help the students to go ahead for using this tool in decision making and Bio-physical modelling.*

Module I: Basics of Geoinformatics (8 hours)

a) Map basics: definition of map and fundamental characteristics, types of map, scale of a map and its representations, map projection – meaning, types and characteristics of each
b) Coordinates system: geoid and reference ellipsoid, geographic coordinate system - projected coordinate, DEM - meaning and use, geo-referencing of map and image - its meaning and necessity, global positioning system (GPS) - important features and use

Module II: Foundation of remote sensing (10 hours)

a) Basics - definition, remote sensing system, passive and active remote sensing, electromagnetic spectrum, atmospheric window, relevant radiation principles, Stefan – Boltzmann law, Wien's displacement law, interaction of EMR with atmosphere and earth surface features, spectral signature, atmospheric and geometric influence of spectral response patterns
b) Data acquisition and visual interpretation: types of satellites, characteristic differences of optical and microwave data, multi-spectral and hyper-spectral data, data acquisition in optical bands - along track and across track scanning, examples of LANDSAT, SPOT and IRS, data acquisition in microwave bands, advantages and limitations - salient features of few satellites with microwave sensors such as RISAT, ERS etc., types of multi-spectral data products, hard copy and digital image (panchromatic, true colour and FCC etc.) visual interpretation of image - important keys, ground truth verification

Module III: Digital analysis and interpretation of satellite image (17 hours)

a) Introduction to the broad types of computer assisted operators
b) Image rectification and restoration - geometric correction, resampling using nearest neighbour, bilinear interpolation and cubic convolution, radiometric correction due to sun elevation and earth-sun distance, noise removal
c) Image enhancements – level slicing, contrast stretching, spatial filtering, convolution, edge enhancements, and spectral ratios, vegetation indices
d) Image classification - supervised, unsupervised and hybrid
    i) Supervised classification: Minimum distance, parallelepiped and maximum likelihood classification
    ii) Unsupervised: K means classifier, fuzzy classification of mixed pixels, classification using A.N.N.
    iii) Classification accuracy assessment - error matrix, producer's accuracy, user's accuracy, KHAT index
    iv) Data merging - multi-temporal merging, multi-sensor data merging, change detection procedures, biophysical modelling

Module IV: Introduction to geographic information system (GIS) (10 hours)

Definition of GIS, comparison of GIS with CAD, GIS architecture, components of a GIS – hardware, software, data, people, methods, GIS data type – spatial and attribute, spatial data types – point, line and polygon, raster and vector representation of data GIS workflow diagram with explanation, fundamental operation of GIS, application of GIS – few examples

COURSE /LEARNING OUTCOMES

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

CO1: Define the different types of maps, coordinate systems and recognize the importance and ease of surveying using remote sensing.
CO2: Classify different types of remote sensing. Students are able to illustrate the principles
CO3: Demonstrate the various methods of digital analysis and interpretation of satellite image.
CO4: Identify the hardware and software requirements for GIS analysis.
CO5: Organize the data obtained from various remote sensing sources to formulate the map of an area and utilize the same for various planning and other related works.
CO6: Determine the utilities of surveying using information technology compared to the traditional methods.

Suggested Readings

1. T.M. Lillisand and R.W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, New York
2. Satheesh Gopi, R. Sathikumar, N. Madhu, Advanced Surveying – Total Station, GIS and Remote Sensing, Pearson Education
3. Paul Longely, M.F. Goodchild, et al., Geographical Information System, Volume I and II, John Wiley and Sons, Inc. 1999
4. J. B. Cambell, Introduction to Remote Sensing, Taylor and Francis, London, 1996
5. F.F. Sabins, Remote Sensing: Principles and Interpretation, W.H. Freeman and Company, New York, 1997
6. Jensen, J.R., Remote Sensing of the Environment – An Earth Resources Perspective, Pearson Education, Inc. (Singapore) Pvt. Ltd., Indian edition, Delhi, 2000
7. George Joseph, Fundamentals of Remote Sensing, Universities press (India) Pte Ltd., Hyderabad, 2003

CVOF0037: OPEN CHANNEL FLOW

(Credits — 45 hours)

Objectives: *This course provides a basic understanding of the flow of water in open channels which is highly essential in planning, design and operation of water resource systems such as single and multi-purpose river valley development projects for irrigation, flood control, power generation etc.*

Module I (20 Hours)

a) Basic principles : Open channel, types and section elements, classification of flow, basic equations, velocity co efficient, pressure distribution and specific force
b) Uniform flow in rigid boundary channels : Boundary shear, flow over scattered roughness elements, Chezy's equation, Manning's equation, other resistance formulae, equivalent roughness, channel conveyance, section factor – curves for rectangular and trapezoidal channels, flow in a circular channel, relation between conveyance and depth

Module II (8 Hours)

Energy depth relationship : Specific energy, critical depth, specific energy curve, critical depth computation, control section, application of specific energy and critical depth concepts, channel transitions

Module III (10 Hours)

Gradually varied flow : Governing equation and its limitations, water surface profiles – classification and characteristics, flow profiles on mild, steep, critical, horizontal and adverse slopes, computation of G.V.F. in prismatic and non-prismatic channels by direct step method and by numerical method, delivery of channels

Module IV (7 Hours)

Rapidly varied flow-hydraulic jump : Types of jump, hydraulic jump in horizontal and sloping rectangular channels, location and length of jump on horizontal floor, forced hydraulic jump, jump in expanding rectangular channels, energy loss and application of hydraulic jump

COURSE /LEARNING OUTCOMES

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

CO1: Understand the various open channel flow equations, velocity coefficients, pressure distribution,

CO2: Cite the principles of mechanics of open surface flow of fluids, and be able to express these in terms of mathematics.

CO3: Quantitatively analyze different situations involving free-surface flows with regard to flow conditions, water depth, water velocity, forces etc.

CO4: Analyze problems associated with flow of water in streams and canals.

CO5: Design canals and associated structures, and adapt research in the field.

CO6: Solve problems in uniform, gradually and rapidly varied flows in steady state

Suggested Readings

1. K. Subramanya, Flow In Open Channels 3rd Edition, Tata McGraw Hill Education Private Limited
2. M. M. Das, Open Channel Flow, PHI Learning Private Limited
3. Rajesh Srivastava, Flow through Open Channels, Oxford University Press

CVDS0038: DESIGN OF STRUCTURES III

(5 credits - 75 hours)

Objectives: *This is the third course of design of structures which deals with the concepts of analysis and design of some advanced R.C.C and steel structures viz. bridges, prestressed concrete, overhead water tanks, girders, industrial buildings and tubular structures.*

Module I (30 hours)

a) General consideration of bridges: Types of bridges, economic spans, selection of suitable types of bridges
b) Loads and their distribution: IRC loads, Railway loads, military loading classes, analysis of deck slab for wheel loads, load distribution among various longitudinal beams of a bridge
c) Design of super-structure: R.C.C. Tee Beam Bridge, balanced cantilever bridge, Pratt truss steel bridge
d) Design of sub-structure: Various types of bearing and design, different types of foundation design

Module II (20 hours)

a) Prestressed concrete: Concept of Prestressing materials for Prestressed concrete, I.S. specifications; Analysis of Prestressed-resultant stress at section, Thrust line, load balancing concept, stress in tendons, Design of simple section
b) Deflection of prestressed concrete Beams: Factors influencing deflection, Deflection of uncracked and cracked members, Long time deflection, codal practices
c) Design of prestressed concrete sections: Design for flexure, shear, axial force, bond and bearing. Design of pre-tensioned members
d) Transfer of prestress: Transfer by bond, transmission length, code provision for bond and Transmission length

Module III (13 hours)

Water Tank: Circular and rectangular tanks, Intze type tank, column-brace type staging; Elevated steel water tank: Rectangular pressed steel tank, staging and footing

Module IV (12 hours)

Plate girder and gantry girder; Industrial Building: Elements of an industrial building, structural framing, Bracing; Tubular structures: Behaviour of tubular sections, combined stresses and connections

COURSE /LEARNING OUTCOMES

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

CO1: Recognize the different types of bridges, water tanks, prestressed concrete structures, industrial buildings and tubular structures; state their suitability and define the various classes of loading acting on these structures

CO2: Differentiate between pre-tensioned and post-tensioned concrete; explain the suitability of different types of bridges, tubular structures, RCC tanks and steel tanks; illustrate the different elements of bridges and industrial buildings

CO3: Apply the standard methodologies as per IS Codes to predict the response of prestressed concrete, bridge girders, water tanks under different classes of loads; compute the bending moments and shear forces at different sections of these structures

CO4: Analyse the super-structure and sub-structure of RCC bridges and prestressed concrete beams under various loadings; identify their deflection patterns; and point out the factors influencing their design

CO5: Assemble the analytical results and combine those outputs to carry out an organized structural design of those structures; conclude the structural design with necessary diagrams of bending, shear and axial forces

CO6: Evaluate the structural design of these structures to determine the reinforcement required for an economic design; assess the performance of these structures by examining the serviceability of these structures

Suggested Readings

1. N. Krishna Raju, Design of Bridges, 4th Edition, Oxford and Ibh Publishing Co. Pvt. Ltd
2. Jagadeesh and Jayram, Design of Bridge Structures, PHI Learning Private Ltd
3. Johnson Victor, Essentials of Bridge Engineering, 6th Edition, Oxford and Ibh Publishing Co. Pvt. Ltd
4. G. S. Pandit, Prestressed Concrete 1st Edition, CBS Publisher
5. N. Rajagopalan, Prestressed Concrete, Narosa Book Distributors Pvt. Ltd
6. Naaman A. E., Prestressed Concrete Analysis and Design Fundamentals, McGraw Hill
7. S. Ramamrutham, Prestressed Concrete, Dhanpat Rai Publishing Company
8. Ram Chandra, Design of Steel Structures (Volume I and 2), Standard Book House-Delhi
9. S. Ramamrutham, Design of Steel Structures, Dhanpat Rai Publishing Company
10. S. Ramamrutham, Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company

CVWE0039: WATER RESOURCES ENGINEERING

(4 credits — 60 hours)

Objectives: *This course comprehensively offers a broad coverage of pertinent topics concerning water resource engineering and combines the fundamentals of hydrology and hydraulic structures, river engineering and river training works together with a basic insight into water power engineering.*

Module I (20 hours)

a) Introduction: Fields of water resources engineering; problems of water resources engineering, economics in water resources engineering, Social aspects of water resources engineering, planning of water resources projects, the future of water resources engineering.
b) Reservoirs: Purpose, physical characteristics of reservoir, storage capacity determination from the site, reservoir site selection, life storage capacity by mass curve method, reservoir sedimentation, trap efficiency, distribution of sediment in a reservoir, useful life of reservoir, reservoir operation, reservoir sedimentation control, reservoir yield, economic height of a dam, reservoir working table
c) Dams and embankments: Elements of gravity, arch and earth dams, selection of sites, stability analysis, embankments – materials of construction, typical sections, effectiveness and side effects.

Module II (20 hours)

a) Introduction to River Engineering: Types of rivers-Perennial, flushy and virgin rivers; incised, boulder, flood plain, delta and tidal rivers; aggrading, degrading, meandering and braided rivers.
b) Sediment transport: Sediments – bed load, suspended load and wash load; riverbank erosion, incipient motion, mode of sediment transport – rolling, sliding, saltation and suspension; introduction to theories of sediment transport including Shield's Theory.
c) Regimes of flow: Definition, description of regimes of flow: plane bed, ripples, dunes, transition and anti-dunes; prediction of regimes of flow
d) River training: Definition, objectives, classification – high water, low water and mean water river training; river training works – marginal embankment, spurs, guide bank, porcupines, bank pitching and revetment, cut off, pitched island, sills and bottom paneling, bandalling

Module III (20 hours)

a) Introduction to Water Power Engineering: Energy, work and power; water energy, hydropower and other powers, their relative merits, comparison of hydro, thermal and nuclear power
b) Estimation of available power: Flow and power duration curves, firm power, secondary power, dump power, load distribution – base load, peak load factor, capacity factor, pondage, storage, mass curve – determination of reservoir yield and capacity.
c) Types of hydropower plants: High, medium and low head plants; runoff river plants, storage plants, diversion canal plants, pumped storage plants, tidal power plants; base load and peak load plants; concentrated fall and divided fall developments, components of hydropower schemes, general layout of hydropower plan with all its components
d) Water Conveyance: Intakes – types, trash rack, control gates; canals, fore bay, tunnels, pipes
e) Penstock: Design criteria, economic diameter, anchor, blocks, water hammer analysis – Alleviels equation, resonance
f) Surge Tanks: Functions, types, design criteria, stability analysis
g) Power House: Components, general layout – surface and underground power houses

COURSE /LEARNING OUTCOMES

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

CO1: Understand the basic fundamental concepts of water resources engineering with respect to a wide range of interdisciplinary subjects like hydrology, river engineering and hydraulicstructures.
CO2: Understand the different forces, moments and stresses acting on hydraulic structures, compute the reservoir storage and yields as well as comprehend the stresses that mobilize sediment transport.

CO3: Apply the standard design methodologies to design the hydraulic structures,apply the analytical and graphical concepts of mass curve for reservoir storage and yields as well as apply the established theories that mobilize sediment transport.

CO4: Analyze the different stability criteria of hydraulic structures

CO5: Synthesize the theoretical results from detailed design of hydraulic structures and combine those outputs to carry out an organized design of such structures. They also learn to apply the theory of flow and power duration curves for hydroelectricpower generation as well as preliminary application of benefit cost theories with respect to water resources projects.

CO6: Evaluate the safe and economical design of various water resources projects, compute electrical power in reservoirs from storage and yield criteria.

Suggested Readings

1. Larry W. Mays, Water Resources Engineering, Wiley India Pvt Ltd
2. P.N. Modi, Irrigation Water Resources and Water Power Engineering 7th Edition, Standard Publishers Distributors
3. K R Arora, Irrigation Water Power And Water Resource Engineering, Standard Publishers Distributors
4. B. C. Punmia, Irrigation and Water Power Engineering, Laxmi Publications
5. S. K. Garg, Hydrology and Water Resources Engineering, Khanna Publishers

CVCM0040: CONSTRUCTION MANAGEMENT

(2 credits — 30 hours)

Objectives: *The main aim of this paper is to give the students basic knowledge about management related to execution of civil engineering projects, contracts, work networks, equipment, etc. which are very essential from a practical point of view.*

Module I (5 hours)

Introduction to construction management: Construction industry and its practices. Civil Engineering and management as business management, construction management and sustainability, methodology of system design and techniques in construction

Module II (15 hours)

Construction Planning and Management: Introduction to bar charts and its limitations, Time, Cost and research management of projects for planning, Scheduling, Control and forecasting using networks with CPM/PERT, Probabilistic assessment of project completion time, introduction to risk management and safety engineering in construction

Module III (10 hours)

Role of equipment in modern construction industries: Selection, Planning and Cost of equipment, Earthmoving, Excavating, Hauling, Compacting, Drilling and Blasting, Grouting, Conveying and Dewatering equipment, intensive constructions, typical and special equipment for civil engineering structures such as-roads, bridge, multistoried buildings and towers

COURSE /LEARNING OUTCOMES

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

CO1: Recognize the different construction projects and its practices , define different stages and functions in a construction project , importance of managing and organizing different categories of employees working together, their safety, cost and time management in completion of a construction project.

CO2: Understand how to manage a company to its goal by following different procedures such as planning, scheduling, organizing, controlling etc. The different stages through which a project should pass such as conception, design, realization. Importance of safety, different equipments used such as crawlers, cranes, draglines etc.

CO3: Understand how to manage the different personnel at various levels as per their expertise.Use of different techniques for planning, scheduling and controlling of a project. Importance of safety equipments, Correlate the work and to solve any dispute if arises among different parties such as owner, engineer and workers and differentiate and compare the different techniques and adopt the best suitable one.

CO4: Use different network techniques which are effective tools for the execution of a civil engineering project such as CPM (Critical Path Method), PERT (Program Evaluation and Review Technique) and implement the bar chart and their limitations.

CO5: Give an overview of the whole construction process. How to maximize the resource efficiently through procurement of labour, material and equipment. They develop an understanding of effective leadership skills and management of employees, areas of technical expertise and interest.

CO6: Determine the best possible approach and technique to carry out the project, how to manage the work and the importance of supervising the work regularly, handle situations of disputes which may arise for smooth working and completion of the project within the specified time and the stipulated cost.

Suggested Readings

1. B. M. Dhir and P.S. Gahlot, Construction Planning and Management, P. S. New Age International Publisher
2. Prof. Harbhajan Singh, Construction Project Management, ISBN: 978818247386; Jain Book Agency
3. Dr. B.C. Punmia, Project Planning And Control With PERT And CPM; Laxmi Publications
4. M. R. Sharma, Fundamentals of Construction Planning and Management; S.K. Kataria and Sons
5. D. Lal, Construction Management and P.W.D. Accounts; S.K. Kataria and Sons

CVDM0041: DISASTER MANAGEMENT

(3 credits-45 hours)

Objective: *This course provides the students with a broad understanding of various disasters which they will come across throughout their engineering career and to familiarize them with the role of Civil Engineers in tackling the disasters for avoiding catastrophe.*

Module I (12 hours)

a) Definition and description of disaster, hazard, emergency, vulnerability, risk and disaster management; Identification and description of the types of natural and manmade disasters, important phases of Disaster Management Cycle
b) Natural Hazards: causes, distribution pattern, consequences and mitigation measures for earthquake, tsunami, cyclone, flood, landslide, drought
c) Man-made hazards: causes, consequences, mitigation measures for various industrial hazards/disasters
d) Inter-relationship between Disasters and Development: Factors affecting vulnerabilities, Impacts (including social, economic, political, environmental, health, psychosocial); Differential impacts - in terms of caste, class, gender, age, location, disability; impact of development projects such as dams, embankments, changes in land-use, etc.

Module II (24 hours)

Construction of infrastructure with high natural disaster resistance

a) Flooding resistance: Water tight building construction, building elevation, dry flood proofing, wet flood proofing and use of flood walls

b) Earth quake resistance: Use of energy dissipating devices, Braced structure frames, Moment resisting frames, Base Isolation
c) Hurricane and Typhoon resistance: Use of hurricane straps to strengthen connections, Impact resistant doors and windows, Braced roof trusses and cables
d) Land-slide resistance: Soil reinforcement using geosynthetic materials, construction channels, drainage systems, deflection systems, deflection walls
e) Retrofitting of structures in post disaster situation: Retrofit of non-engineered building, historic buildings, bridges and buildings

Module III (4 hours)

Case Studies: Lessons and experiences from various important disasters with specific reference to Civil Engineering

Module IV (5 hours)

Preparedness for natural disasters in urban areas, Disaster planning in public health

COURSE /LEARNING OUTCOMES

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

CO1: Develop an understanding of the key concepts, definitions and key perspectives of all disaster management.
CO2: Understanding foundations of hazards, disasters and associated natural/social phenomena.
CO3: Develop a basic understanding of Prevention, Mitigation, Preparedness, Response and Recovery.
CO4: Distinguish between the different approaches needed to manage pre- during and post- disaster periods.
CO5: Affirm the usefulness of integrating management principles in disaster mitigation work.
CO6: Experience conducting independent Disaster Management study including data search, analysis and presentation of disaster case study.

Suggested Readings

1. Dr. Indu Prakash, 1994, Disaster Management, Rastriya Prahari Prakashan, Sahibabad, Ghaziabad.
2. Dr. Jagbir Singh, Disaster Management Future Challenges and Opportunities, I.K. International
3. Arvind Kumar, Disaster Management-Recent Approaches, Anmol Publications
4. V. K. Sharma (Editor), 1995, Disaster Management, Indian Institute of Public Administration, New Delhi.
5. U.R. Rao, Space Technology for Sustainable Development, Tata McGraw Hill.
6. S.B. Verma, Risk Management, Jain Book Depot
7. Mohiuddin Ali Khan, Earthquake-Resistant Structures: Design, Build, and Retrofit. Butterworth- Heinemann.

CVAF0042: ADVANCED FOUNDATION ENGINEERING

(3 credits - 45 hours)

Objective: *This subject is in continuation with the courses of geotechnical engineering offered in the previous semester and mainly deals with the geotechnical proportioning as well as structural design of various deep and shallow foundation structures as per the Indian Standard Codal provisions.*

Module I Foundation Design-General Principles (5 Hours)

Types of foundations and selection of type of foundation, basic requirements of a foundation, computation of loads, design steps

Module II Shallow Foundation (20 Hours)

a) Determination of allowable bearing pressure of footings in clay and sand soil, Proportioning of single isolated footing, considerations for proportioning of groups of footings for equal settlements, Structural design of strip footings, isolated footings, combined footings: rectangular and trapezoidal
b) Raft in clay and sand, Suitability for raft, determination of safe bearing capacity and allowable bearing pressure, Structural design of raft by conventional (rigid) method as per IS: code of practice

Module III Pile Foundation (12 Hours)

Determination of allowable load on single pile and pile groups in clay and sand, pile group proportioning, Structural design of pile, pile groups and pile cap, Introduction to micro piles and laterally loaded piles

Module IV Elements of Bridge Substructure (8 Hours)

Forces on bridge substructure (IRC and IRS specification), well foundation with components only, design considerations for different components of a well foundation

Suggested Readings

1 S. Saran, Analysis and Design of Foundations, IK International Pvt. Ltd. New Delhi
2. P. C. Varghese, Design of Reinforced Concrete Foundations, Phi Learning Private Ltd.
3. Satyendra Mittal, Pile Foundations Design and Construction 1st Edition, CBS Publisher
4. Joseph E. Bowles, Foundation Analysis and Design, McGraw-Hill education India Pvt. Ltd - New Delhi

CVBC0043: BASICS OF COMPUTATIONAL HYDRAULICS

(3 Credits – 45 hours)

***Objectives**: This course introduces the governing equations describing the flow and transport in surface and subsurface water systems, the application of finite difference methods for the solution of these governing equations and introduction to other numerical methods.*

Module I: Introduction to the governing equations of fluid flow (15 hours)

Concept of control volume and control mass/ system; Reynold's Transport Theorem; Derivation of continuity equation, momentum equation (Navier-Stokes equations) and energy equation for finite control volume and infinitesimally small fluid element fixed in space; Derivation of one-dimensional St. Venant equation to model open-channel flow; Derivation of flow equation in groundwater; Derivation of generalized contaminant transport equation in groundwater for both reactive and non-reactive transport.

Module II: Introduction to finite difference, finite volume and finite element methods (16 hours)

Classification of partial differential equations- hyperbolic, parabolic and elliptic differential equations; General behavior of different classes of partial differential equation; Finite difference methods: difference equations, explicit and implicit approaches, error and stability analysis of explicit and implicit techniques; Finite Volume

Methods: Philosophy, discretization procedure; Finite element method: Rayleigh-Ritz, Collocation and Galerkin methods.

Module III: Application of Finite difference methods in CFD and fundamentals of modeling (14 hours)

a) Application of Crank Nicholson technique, The Lax-Wendorff Technique and McCormack's Technique for the solution of Navier-Stokes equations and contaminant transport equation in groundwater and surface water
b) Introduction to model calibration, validation and concept of coupled model, Introduction to numerical computation software.

COURSE /LEARNING OUTCOMES

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

CO1: Explain the one, two and three-dimensional flow equations and know when to use their approximations.
CO2: Classify partial differential equations (PDEs) and determine the nature of a given PDE.
CO3: Implement finite difference, finite volume and finite element methods to solve partial differential equations.
CO4: Analyze a numerical scheme for numerical diffusion, dispersion, stability and convergence.
CO5: Implement different numerical schemes for hydraulics related problems appearing in civil engineering.

Suggested Readings

1. J. D. Anderson, (1995), "Computational Fluid Dynamics - the Basics with applications", McGraw-Hill, Inc., New York.
2. J. D. Hoffman (2001), "Numerical methods for engineers and scientists", Marcel Dekker, Inc., New York.
3. F. M. White (2008) "Fluid Mechanics", Tata McGraw Hill.

CVTF0044: TRAFFIC ENGINEERING AND MANAGEMENT

(3 credits – 45 hours)

Objective: *This elective course is designed to familiarize the students with the concepts of traffic engineering by providing general concepts of planning, functional design, traffic operation and management of road transportation. Forecasting of traffic, probabilistic approach towards traffic flow theory, highway capacity and study of road accidents has been introduced in detail.*

Module I: Traffic Forecast and Transportation Demand Management (12 hours)

Traffic Forecast: General travel forecasting principles, Different methods of traffic forecast - Mechanical and Analytical methods, Demand relationships, Methods for future projection; Design Hourly Volume for Varying Demand Conditions: Concept of Design vehicle units and Determination of PCU under mixed traffic conditions, Price-volume relationships, Demand functions. Determination of design hourly volume; Critical Hour concept

Module II: Highway Capacity and Level of Service (7 hours)

Highway Capacity: Factors affecting capacity, level of service; Capacity studies - Capacity of different highway facilities including unsignalised and signalised intersections. Problems in Mixed Traffic flow; Case studies

Module III: Accident Studies (8 hours)

Accident Analysis: Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors influencing traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions.

Module IV: Traffic Flow Theory and Simulation (18 hours)

Traffic Flow Theory: Fundamental flow relationship and their applications, Traffic flow theories and applications; Shock waves; Queuing theory and applications; Probabilistic Aspects of Traffic Flow: Vehicle arrivals, distribution models, gaps and headway distribution models; gap acceptance merging parameters, delay models, applications; Simulation: Fundamental principle, application of simulation techniques in traffic engineering - formulation of simulation models, Case studies.

COURSE /LEARNING OUTCOMES

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

CO1: State the different methods of traffic forecasting.
CO2: Classify the various types of levels of service and their importance.
CO3: Compute the parameters of traffic flow as well as use them to simulate the traffic flow models.
CO4: Compare the various factors influencing traffic accidents.
CO5: Assemble the probabilistic and deterministic approach of traffic flow.
CO6: Evaluate and design hourly traffic volume to use for the geometric design of roads.

Suggested Readings

1. L.R. Kadiyali, “Traffic Engineering and Transport Planning”, Khanna Publication.
2. C.J. Khisty and B.K. Lall, “Transportation Engineering: An Introduction” Prentice Hall Publication
3. G.V. Rao, “Transportation Engineering”, Tata McGraw Hill.
4. S.K. Khanna and C.E.G. Justo, “Highway Engineering”, Nem Chand and Bros, Roorkee.

CVED6002: ENGINEERING DRAWING II

(2 credits)

Objectives: *After understanding and practice of the basic elements of Engineering Drawing in the first semester, students are needed to be exposed to various aspects graphics in order to make them competent for drawing as well as understanding as needed in real life situation*

Module I Orthographic Projection

First Angle and Third Angle Projection of Standard Solids Castings of various shapes. Symbols for methods of projection. Conversion of Pictorial Views into Orthographic Views. B.I.S. code of practice.

Module II Projection of Solids

Projection of Simple Solids such as tetrahedron, cube, right regular prism, pyramid, cylinder, cone etc. with the axis parallel to both the planes, axis perpendicular to the H.P., axis perpendicular to the V.P., axis inclined to one of the reference planes and parallel to other.

Module III Isometric Projection

Isometric axes, lines and planes. Isometric scale, Isometric Projection and Isometric View. Isometric Projection of Standard Plane Figures and Solids.

Module IV Perspective Projection

Visual ray method, Vanishing point method, Perspective projection of simple objects.

Module V Computer Aided drafting (using any drafting package)

Basic operation of drafting package, use of various commands for drawing, dimensioning, editing, saving and printing/plotting. Application of the package to produce two dimensional figures and three dimensional solids.

Term work

The term work shall consist of four A4 (420x594) or half imperial size drawing sheets and two computer outputs using any drafting package as detailed below:

1. Sheet no 1: Orthographic projections: Three problems on 1st angle projection and 1 problem on 3rd angle projection
2. Sheet no 2: Projection of solids: two problems on projection of solids
3. Sheet no 3: Isometric projection: Three problems on isometric projections of different types of solids.
4. Sheet no 4: Perspective projections: Two problems on visual ray method and two problems on vanishing point method.
   a) Computer aided drafting assignment no 1: Basic operations of drafting package, use of various commands for drawing. Application of the package to produce basic elements/components of two dimensional figures and three dimensional solids.
   b) Computer aided drafting assignment no. 2: construction of two dimensional figures and three dimensional solids.

COURSE/LEARNING OUTCOMES

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

CO1: Know the theory and drawing methodology of standard solid castings of various shapes, identify the symbols used for drawing projections, and learn the BIS code of practice; learn the theory and drawing methodology for drawing complex solids, concept of isometric scale, projection and views; visual ray method and vanishing point method for drawing perspective projection of simple 1, 2 and 3D figures, learn the application and functionalities of computer aided drafting software like QCAD and AUTOCAD.

CO2: Understand the method of drawing orthographic projections of solid castings as per BIS design specifications, isometric projection, perspective projection and the functionalities and commands for the application of computer aided drafting software like QCAD and AUTOCAD.

CO3: Practically apply the theoretical knowledge of engineering drawing to draw precise, accurate, neat and unambiguous drawings following the proper dimensioning specifications and drawing methodology.

CO4: Analyse the first angle orthographic projection of complex solids, drawing methodology for drawing solids in orthographic projection or solids in perspective projection, interpret the pictorial views into orthographic views and identify the functionalities and potentiality of computer aided drafting with software like QCAD and AUTOCAD.

CO5: Synthesize the first angle orthographic projection of complex solids, drawing methodology for drawing solids in orthographic projection or solids using isometric scale in isometric projection, simple 1,2and 3D figures in perspective projection and identify the functionalities and potentiality of computer aided drafting with software like QCAD and AUTOCAD.

CO6: Judiciously evaluate the concept of drawing 1, 2 and 3 D figures in orthographic, isometric and perspective projections in line with BIS design and drawing specifications and also interpret the manual drawings to produce workable schematic drawings using CAD softwares such as QCAD and AUTOCAD.

Suggested Readings

1. Bhatt N.D, Panchal V.M., Engineering Drawing, Charotar Publishing Housing, Anand (India)
2. Shah M.B., Rana B.C., Engineering Drawing, Pearson Education.
3. Narayan K.L.,and Kannaiah P., Engineering Graphics, Tata Mc Graw Hill
4. Luzzader Warren J., Fundamentals of Engineering Drawing, Prentice Hall of India
5. Jolhe D.A., Engineering Drawing, Tata Mc Graw Hill
6. Frederick E. Giesecke, Alva Mitchell and others, Principles of Engineering Graphics, Maxwell McMillan
7. Siddique A.N., Khan Zahid and Ahmed Mukhter, Engineering Drawing, Prentice Hall of India.

CVCE6003: CONSTRUCTION ENGINEERING AND MANAGEMENT SOFTWARE LABORATORY

(2 Credits)

Objectives: *To provide a foundation for understanding the application of construction engineering and management by giving students an opportunity to experience the construction engineering and management softwares through hands-on experience in this laboratory course.*

Drawing building plans (2D), elevation, section and isometric views, Road work - longitudinal and cross section, plan including drainage, culvert detailing etc., Structural Detailing of a building and foundation, column, beam, slab, stair case etc. - longitudinal and cross section using AUTOCAD, Elastic analysis, Non-linear analysis, contact surface problems analysis, Dam analysis and Soil structure interaction analysis using STAAD Pro. and ABAQUS, project management using MS Project/MS Visio/Primavera.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recall Basic Engineering drawings, drainage, road cross section, building details. Structural detailing using IS Codes in foundation, beam, columns, slab, stair case etc. 2D, 3D drawings using AutoCAD, Structural analysis using ABAQUS, STAAD pro, MS project/Prima Vera/Viso etc.

CO2: Handle any project assigned independently, justify theoretical background from the IS Code and practical knowledge using various software.

CO3: Use the software like PrimaVera/MS project, AutoCAD, ABAQUS and Staad pro to a given various examples.

CO4: Analyse working drawings at the work site such as 2D, 3D drawing plan, elevation and section. Structural detailing in foundation, beam, columns, slab, staircase etc. Detailing of roadwork, water retaining structure, drainage etc.

CO5: Summarise the most cost effective project by implementing time, and duration management using project management software MS project/Visio/ Primavera. Basic knowledge of analysis in Staadpro, Abaqus,assemble the theoretical results synthesized from structural analysis and combine those outputs to carry out an organized structural design of a building; conclude the structural design with approximate solution.

CO6: Verify and validate the results obtained from the various analyses with the field results.

CVCT6004: CONCRETE TECHNOLOGY LAB

(2 credits)

1. Tests on cement
   i) Standard consistency of cement
   ii) Initial and final setting time of cement
   iii) Compressive strength of cement
   iv) Fineness of cement
2. Tests on aggregates (Fine aggregate and coarse aggregate)
   i) Particle size distribution and grading
   ii) Fineness modulus, bulk density, void ratio and porosity
   iii) Bulking of fine aggregate
   iv) Specific gravity and water absorption test of aggregate
3. Tests on fresh concrete
   i) Slump test
   ii) Compaction factor test
   iii) Vee- bee test
   iv) Flow test
4. Tests on hardened concrete
   i) Compressive strength of concrete
   ii) Flexural Strength of Concrete (UTM)
5. Tests on bricks
   i) Compressive strength of burnt bricks
   ii) Water absorption tests on bricks
6. Test on steel
   i) Tensile strength of steel (UTM test)

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able

CO1: Recall Basic Engineering drawings, drainage, road cross section, building details. Structural detailing using IS Codes in foundation, beam, columns, slab, stair case etc. 2D, 3D drawings using AutoCAD, Structural analysis using ABAQUS, STAAD pro, MS project/Prima Vera/Viso etc.

CO2: Handle any project assigned independently, justify theoretical background from the IS Code and practical knowledge using various software.

CO3: Use the software like PrimaVera/MS project, AutoCAD, ABAQUS and Staad pro to a given various examples.

CO4: Analyse working drawings at the work site such as 2D, 3D drawing plan, elevation and section. Structural detailing in foundation, beam, columns, slab, staircase etc. Detailing of roadwork, water retaining structure, drainage etc.

CO5: Summarise the most cost effective project by implementing time, and duration management using project management software MS project/Visio/ Primavera. Basic knowledge of analysis in Staadpro, Abaqus, assemble the theoretical results synthesized from structural analysis and combine those outputs to carry out an organized structural design of a building; conclude the structural design with approximate solution.

CO6: Verify and validate the results obtained from the various analyses with the field results.

CVED6005: CIVIL ENGINEERING DRAWING

(2 credits)

Objectives: *Preparation of structural drawings with regard to civil engineering structures is a mandatory requirement for not only expressing an idea or plan on paper, but also indispensable for executing any construction activity. This course deals with hands on training to focus on the fundamental aspects to be considered for preparing civil engineering drawings.*

1. Details of Doors, windows: Glazed and paneled doors standard sizes. Glazed and paneled windows standard sizes, special windows and ventilators.
2. Stair case: Drawings of dog-legged, open well RCC staircase for an office residence building; plan and elevation of straight run, quarter turn, dog-legged and open well RCC stair cases.
3. Foundation: Spread foundation for walls, and columns of brick masonry, footing for an RCC Column.
4. Roofs and Trusses: Types of sloping roofs, lean-to roofs; pitched roofs (showing gabled ends and hipped ends); Kingpost and Queen post trusses.
5. Building Drawing: A simple two-roomed official building and multi-storeyed residential building plan, front and sectional elevations.
6. Use of Computer Aided Software Packages: Building drawing Assignments.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Gain practical knowledge of civil engineering design drawing and understand and complete architectural floor plan.
CO2: Produce geometric construction, multiview, sectional view, dimensioning and detail drawings of typical 2-D engineered objects.
CO3: Understand and complete structural framing plan.
CO4: Understand and complete typical reinforced concrete structural and steel members detailing.
CO5: Understand and know how to apply computer software to prepare civil engineering drawing.
CO6: Carry out the practical applications of learned civil engineering concepts and theories on site and/or laboratory.
CO7: Comprehend architectural, electrical, and mechanical drawings to produce civil engineering drawings.
CO8: Carry out and finalize a civil engineering study/project by showing professional ethics.

CVEM6006: ENGINEERING MECHANICS LAB

(2 credits)

The following experiments are to be performed:

1. Determination of co-efficient of friction between two given surfaces
2. Determination of the position of the centroid of the given areas
3. Determination of moment of inertia of the fly wheel
4. Verification of triangle law of forces
5. Verification of polygon law of forces
6. Determination of efficiency of screw jack
7. Worm and worm wheel experiment
8. To verify the law of moment of force for a simply supported beam
9. To determine the bending moment at a section for a simply supported beam

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Use scalar and vector techniques for analyzing forces in determinate structures.

CO2: Apply concepts of engineering mechanics to analyze practical problems.

CO3: Apply the theories of mathematics and physics to understand real world problems related to mechanics.

CVFM6007: FLUID MECHANICS LAB

(2 credits)

1. Study of Fluid Pressure distribution on immersed bodies.
2. Determination of Meta-Centric Height and Stability of floating bodies.
3. Experimental verification of Bernoulli's Equation.
4. Study of Discharge through Orifices using Orifice meter Apparatus.
5. Study of Discharge over Different Notches.
6. Study of different types of pipe-flow using Reynolds's Apparatus.
7. Determination of Friction Factor in pipes using pipe friction apparatus.
8. Study of Impact of Jet on Vanes.
9. Study of flow in Open Channels using Open Channel Tilting Flume, Flow over Weirs, Hydraulic jump

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Perform experiments in different pipe-flow and open-channel flow related apparatus.(*Knowledge*)

CO2: Analyze different fluid-flow instruments and utilize concepts of fluid mechanics in design. (*Analysis*)

CO3: Handle practical problems related to fluid mechanics in industries.(*Application*)

CVES6008: ENGINEERING SURVEY LAB I

(2 credits)

1. Direct Ranging and Indirect Ranging.
2. Chain Triangulation.
3. Closed compass traversing to plot the existing layout of a built-up area.
4. Fly leveling to determine elevation difference between two well separated points.
5. Profile and Cross-sectional leveling with Levelling Instrument.
6. Plane table traversing.
7. Direct Contouring using Indian Tangent Clinometer and Plane Table.
8. Indirect Contouring by the method of Grids.
9. Measure the horizontal angle using a Theodolite, by the method of repetition.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recognize the different equipment required for surveying; list out the various procedures of ranging, traversing, countering, levelling etc.; state their functionalities and define the various classes of field operations. (*Knowledge*)

CO2: Differentiate between open and closed traversing, direct and indirect contouring; explain the suitability of auto level and theodolite; classify the different traversing and levelling equipment and illustrate the applicability of triangulation, levelling, contouring and traversing. (*Comprehension*)

CO3: Apply the theoretical concepts of surveying operations; compute the elevation of different points; predict the area, volume of earthwork required for a new civil engineering project. (*Application*)

CO4: Analyze different field operations of surveying; identify the errors the errors in those procedures; and point out the corrections. (*Analysis*)

CO5: Assemble the filed observations and combine the same to produce maps and charts; conclude the survey principle of working from whole to part. (*Synthesis*)

CO6: Evaluate the plan and elevation drawings of the surveyed area; assess the feasibility of an economical civil engineering project. (*Evaluation*)

CVEG6009: ENGINEERING GEOLOGY LAB

(2 credits)

1. Megascopic study of minerals including ore minerals.
2. Megascopic study of rocks-Igneous, sedimentary and metamorphic.
3. Study of crystal systems with the help of crystal models.
4. Microscopic study of mineral specimens.
5. Microscopic study of rock specimens.
6. Exercises in geological maps: drawing sections, and interpretation of geological structures. Dip and strike problems.
7. Use of Clinometer compass and Brunton compass for measurement of dip and strike of formations.
8. Field trip and field report – 10% weightage.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Study of physical properties and identification of minerals referred under theory. (*Knowledge*)

CO2: Categorize rocks and minerals by their origin and engineering properties. (*Comprehension*)

CO3: Identify the various rocks, minerals depending on geological classifications. (*Comprehension* and *Evaluation*)

CO4: Apply geological principles to rock masses and discontinuities for use in engineering design e.g. rock slopes, foundation. (*Application*)

CO5: Interpret geological maps showing tilted beds, faults, uniformities etc.(*Analysis*)

CO6: Measure strike and dip of the bedding planes. (*Application and Evaluation*)

CVRS6010: RESEARCH SEMINAR - MTECH

(4 credits)

Objectives: *Students will acquire a clear concept of the work they will be doing in the last two semesters in their project work. Students may select a topic for their seminar preferably in the same area as that of their project. Seminar includes review of literatures related to the project, recent development and line of action. Seminar will be evaluated by their report, presentation and Viva Voce.*

COURSE/LEARNING OUTCOMES

At the end of the Research Seminar students will be able to:

CO1: Acquire, organize and apply knowledge about various aspects of the specialization linked to the research seminar.

CO2: Present a scientific data from different literature review.

CO3: Critically evaluate a set of data of a particular problem related to Civil Engineering.

CO4: Develop a research plan with a clearly formulated problem definition, using one or more methods and techniques suitable for the research in the specific field of specialization.

CO5: Execute tasks in a scientifically, socially and ethically responsible manner.
CO6: Critically assess research of oneself and of others and report on research choices and progress in a clear manner, with the help of ICT skills.

CVMP6011: PROJECT PHASE I - MTECH

(12 credits)

Objectives: *During this phase the student will start a research project applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of analyses and design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department during the semester.*

COURSE/LEARNING OUTCOMES

At the end of Project Phase I students will be able to:

CO1: Explain the significance of the project in the context of the literature, the problem which the project solves, and the implications of what has been learned in conducting the project.
CO2: Demonstrate mastery of the underlying theory of the project subject matter and analysis techniques.
CO3: Plan, manage and execute a substantial project.
CO4: Demonstrate or explain the underlying theory of the project subject matter and analysis techniques.
CO5: Demonstrate mastery of a non-trivial technical skill in a scientific or engineering field.
CO6: Analyse and interpret the results of the project.
CO7: Communicate the project objectives, process and results to practising engineers and scientists in written and verbal form.

CVMP6012: PROJECT PHASE II - MTECH

(16 credits)

Objectives: *During this phase the student will carry forward and complete the work that they have started in Phase I. It is expected that the student will publish at least one research paper in a well-known journal to augment their work during this phase. Published papers will carry extra weightage during evaluation. The mode and components of evaluation and the weightages attached to them shall be published by the Department at the beginning of the semester.*

COURSE/LEARNING OUTCOMES

At the end of Project Phase II students will be able to:

CO1: Explain the significance of the project in the context of the literature, the problem which the project solves, and the implications of what has been learned in conducting the project.
CO2: Demonstrate mastery of the underlying theory of the project subject matter and analysis techniques.
CO3: Plan, manage and execute a substantial project.
CO4: Demonstrate or explain the underlying theory of the project subject matter and analysis techniques.
CO5: Demonstrate mastery of a non-trivial technical skill in a scientific or engineering field.
CO6: Analyse and interpret the results of the project.
CO7: Communicate the project objectives, process and results to practising engineers and scientists in written and verbal form.

CVGE6013: GEOTECHNICAL ENGINEERING LAB

(2 credits)

1. Liquid Limit test of soil by Cone Penetrometer Apparatus and Casagrande Apparatus.
2. Plastic limit of soil
3. Sieve analysis of soil
4. Moisture content of by oven dry method.
5. Dry Density of soil by sand replacement method.
6. Dry Density of soil by core cutter method.
7. Direct shear test of soil.
8. Unconfined compression test of soil.
9. Proctor's Compaction test of soil.
10. Permeability test of soil.
11. Consolidation test of soil.
12. Triaxial test of soil.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Gather basic knowledge to carry out field investigations and to identify soils in geotechnical engineering practice.
CO2: Identify and classify soil based on standard geotechnical engineering practice;
CO3: Perform laboratory compaction and in-place density tests for fill quality control.
CO4: Perform and interpret laboratory tests for evaluating subgrade performance and for pavement design.
CO5: Design and conduct experiments as well as analyze and interpret data.
CO6: Tackle various criticalities that are encountered while testing of soil in the laboratory.
CO7: Perform laboratory tests needed to determine soil design parameters.
CO8: Develop and implement laboratory procedures to test geotechnical engineering concepts.

CVES6014: ENGINEERING SURVEY LAB II

(2 credits)

1. Measurement of angle by method of repetition and reiteration using theodolite
2. Traversing with theodolite – open and closed traverse
3. Setting out of circular curve using chain and tape
4. Setting out of circular curve using theodolite – one theodolite and two theodolite method
5. Trigonometric levelling
6. Route alignment of an open traverse
7. Introduction to total station

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Define advanced surveying equipment like total station, theodolite etc.; name the different types of levelling, traversing, setting out works, and state the methods applicable for these works.
CO2: Differentiate between open and closed traverse; explain the measurement of horizontal and vertical angles using theodolite, and illustrate the setting out of circular curves for highway/railway projects.
CO3: Apply advanced methods of surveying using total station; construct traverse maps and levelling charts, and find out RLs and heights of different stations/objects.

CO4: Identify the methods of repetition and reiteration for calculation of angles between points/objects using theodolite and compare the results with conventional methods.
CO5: Assemble the field observations and combine those results to summarize the final charts and maps.
CO6: Examine the field book data and determine the adjustments required for correcting the observational and instrumental errors.

CVMI6015: MINI PROJECT

(2 credits)

Objectives: *Mini Projects are assigned to students individually or in groups by the department under the supervision of designated faculty members. The primary objective of the Mini Project is to enable students to have a thorough understanding of the theoretical principles learnt in earlier four semesters through a prolonged practical experience. Collectively the students will get to know about multiple areas of Civil Engineering analysis and design procedures and the methods of reporting in standard format.*

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Acquire practical knowledge within the chosen area of Civil Engineering for project development.
CO2: Identify, analyze, formulate projects with a comprehensive and systematic approach.
CO3: Apply theoretical knowledge in practical through experiments.
CO4: Analyse the experimental data to identify critical parameters influencing the characteristics of different building materials.
CO5: Contribute as an individual or in a team in development of technical projects.
CO6: Develop effective communication skills for presentation of project related activities.

CVTE6016: TRANSPORTATION ENGINEERING LAB

(2 Credits)

1. To determine the IMPACT VALUE of coarse aggregates by use of IMPACT MACHINE.
2. To determine the ABRASION VALUE of coarse aggregates by use of LOS ANGELES MACHINE.
3. To determine the Flakiness Index and Elongation Index of coarse aggregates.
4. To determine the MARSHALL STABILITY of Bitumen mix.
5. To determine the SOFTENING POINT of Bitumen.
6. To determine the DUCTILITY of Bitumen.
7. To determine the Specific Gravity of Bitumen.
8. To determine the Penetration of Bitumen.
9. To determine the CALIFORNIA BEARING RATIO of soil.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Recall the properties and testing procedures of pavement materials.
CO2: Assess the quality of various pavement materials and their suitability in highway construction.

CVEE6017: ENVIRONMENTAL ENGINEERING LAB

(2 Credits)

1. To determine the pH of a water sample
2. To determine the turbidity of a water sample
3. To determine the hardness of a water sample
4. To determine the chloride of a water sample
5. To determine the alkalinity of a water sample
6. To determine the total solids of a water sample
7. Jar test for coagulation studies
8. To determine the DO and BOD of a water sample
9. To determine the COD of a water sample

Suggested Readings

1. Clair N. Sawyer, Chemistry for Environmental Engineering and Science, Tata McGraw Hill Education Private Limited.

COURSE/LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1: Perform common environmental experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problems.
CO2: Understand the impact of water and wastewater treatment on people and the environment. Understand and apply ethical issues associated with decision making and professional conduct in the laboratorial and field environment.
CO3: Statistically analyze and interpret laboratorial results.
CO4: Apply the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions.
CO5: Demonstrate the ability to write clear technical laboratorial reports.
CO6: Demonstrate the ability to work in groups.

CVCS6018: COMPREHENSIVE SURVEYING CAMP

(2 Credits)

Objectives: *The purpose of Comprehensive Surveying Camp is to enable students to undergo rigorous field exercises. All the theories and practices of earlier semesters will be integrated to make students confident of handling any real life surveying and mapping tasks.*

COURSE/LEARNING OUTCOMES

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

CO1: Consolidate and update their practical and theoretical knowledge in engineering surveying in the actual field conditions with practical problems.
CO2: Apply different surveying, modern instruments, computational practices and ways of presentation of their final reports.

CVMN6019: MINOR PROJECT

(2 credits)

Objectives: *This is in continuation with the minor project in last semester where students will be given some field related analysis and design work to give them exposure towards real use of their acquired knowledge. Collectively the students will get to know about multiple areas of Civil Engineering analysis and design procedures and the methods of reporting in standard format.*

CVCA6020: COMPUTER APPLICATIONS IN CIVIL ENGINEERING

(2 credits)

Objectives: *This laboratory course is introduced to familiarize the students with a number of Civil Engineering software packages so as to equip them with necessary know-how for their use in actual field. Students will also be able to use this knowledge in carrying out their minor and major projects.*

In this course the students will be exposed to different tools to acquire hands-on experience for:

- 3D model generation, analysis and multi-material design of any type of structure including buildings, water tanks, culverts, petrochemical plants, tunnels, bridges, foundations, airport hangers and much more. All the steps involved in structural analysis and design of concrete and steel will be covered.
- Elementary features of solving slope stability and related geotechnical and geo-environmental analyses.
- Geospatial raster data processing to prepare, display and enhance digital images for mapping use in geographic information system (GIS) or in computer-aided design (CAD) software and to perform numerous operations on an image and generate an answer to specific geographical questions.

COURSE/LEARNING OUTCOMES

At the end of this Minor Project students will be able to:

CO1: Demonstrate computer literacy skills in both standard applications and discipline specific applications.
CO2: Recognize and apply basic modeling principles to the analysis, design, and evaluation of civil engineering problems.
CO3: Analyse the limitations, constraints, and applicability of various field and laboratory data collection methods.
CO4: Apply spreadsheets to solution of engineering problems.
CO5: Demonstrate Design, construction, and load test of a reinforced concrete beam.
CO6: Evaluate and compare the model results with the calculated values.

CVTS6021: TRAINING SEMINAR

(2 credits)

Objectives: *During the semester break at the end of the third year, the students are required to undergo an industrial training. The purpose of the industrial training is to expose students to real-life industry situations, so that they may be able to able to apply the engineering knowledge and skills that they have gained through classroom teaching and lab activities, in an on-the-job situation. After the period of training, students are required to present their experience in the form of reports and seminar presentations. Students will be evaluated on the seminar, viva-voce examination and written reports.*

COURSE/LEARNING OUTCOMES

At the end of Training Seminar students will be able to:

CO1: Incorporate and emphasize the lessons learned in a class room in to real world experience set in a professional practice oriented environment.
CO2: Develop professional skills such as team work, effective communication and social interaction.
CO3: Handle latest software to analyze problems related to Civil Engineering.
CO4: Acquire exposure to software and equipments as per the industrial requirements.

CO5: Identify, formulate and model problems and find engineering solution based on a system.
CO6: Become updated with latest changes in technological world.

CVMP6022: MAJOR PROJECT (PHASE I)
(4 credits)

Objectives: *To develop the capacity of the students to convert theoretical knowledge base to practical systems for performing creative tasks and analysis and hence suggest solutions to problems pertaining to civil engineering. Each student group consisting of not more than 5 members is expected to plan, analyse and design a multi-storeyed building and verify the work with a design and analysis software package.*

During the first phase of the Major Project students will identify and plan a multi-storeyed building, prepare the drawings and perform gravity analysis followed by seismic analysis. There will be two progress seminars - after the planning and after the seismic analysis, which will be evaluated by a panel of internal examiners.

COURSE/LEARNING OUTCOMES

At the end of Major Project I students will be able to:

CO1: Demonstrate a sound technical knowledge on planning an civil Engineering project.
CO2: Undertake problem identification, formulation and solution.
CO3: Calculate the load carrying capacity of structural members.
CO4: Conduct an engineering project.
CO5: Communicate with engineers and the community at large in written an oral forms.
CO6: Demonstrate the knowledge, skills and attitudes of a professional engineer.

CVMP6023: MAJOR PROJECT (PHASE II)
(8 credits)

Objectives: *During the second phase of the Major Project, students will compile the analyses performed in the first phase. They will work out the design details, and design the load carrying members of the frame with detailing. This will be followed by verification of the analysis and design using a software package. The project work will be concluded with quantity estimation and preparation of report. The internal assessment shall be evaluated by the DPEC and the external assessment shall be done by the external examiner(s) assisted by the DPEC and the supervisor. The modality and components of the internal assessment and their weightages shall be notified at the beginning of each semester.*

Project implementation and documentation: 70
Viva voce examination: 20
Seminar presentation: 10

COURSE/LEARNING OUTCOMES

At the end of Major Project II students will be able to:

CO1: Identify the design philosophy to be applied to a particular project.
CO2: Compile all the analysis results for the design of different members.
CO3: Carry out design of different members in an optimized manner.
CO4: Use design software for different types of structures.
CO5: Get exposure in real life engineering practices.
CO6: Evaluate the strength or load carrying capacity of a structure.

CVED6024: ENGINEERING GRAPHICS AND DESIGN

(3 credits) (L-T-P:1-0-4)

Objective: *This course is designed to teach the basics of engineering drawing and drafting utilizing free hand sketching as well as computer aided modeling. The fundamental principles of projections and dimensioning as well as the overview of computer graphics, customizations, annotations, layering and other functions of computer aided designs viz. geometric and topological designs of engineered components are taught.*

Module I: Introduction to Engineering Drawing (5 hours)

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only), Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales

Module II: Orthographic Projections (5 hours)

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes

Module III: Projection of Solids (5 hours)

a) Projections of Regular Solids: Solids inclined to both the Planes- Auxiliary Views, simple annotation, dimensioning and scale
b) Sections and Sectional Views of Right Angular Solids: Prism, Cylinder, Pyramid, Cone – Auxiliary Views, development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone, sectional orthographic views of geometrical solids

Module IV: Floor Plan Drawings (5 hours)

Floor plans that include windows, doors, and fixtures such as WC, bath, sink, shower, etc., objects from industry and dwellings (foundation to slab only)

Module V: Isometric Projections (5 hours)

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions, Isometric Views of lines, Planes, Simple and compound Solids, Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions

Module VI: Overview of Computer Graphics (5 hours)

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]

Module VII: Customisation and CAD Drawing (5 hours)

Consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically, producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles

Module VIII: Annotations, layering and other functions (5 hours)

Application of dimensions to objects, application of annotations to drawings; Setting up and use of layers, layers to create drawings, create, edit and use customized layers; changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface, Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views, Spatial visualization exercises, dimensioning guidelines, tolerancing techniques; dimensioning and scale multiviews of dwelling

Module IX: Team design project demonstrating geometry and topology of engineered components (5 hours)

Creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids, meshed topologies for engineering analysis and tool-path generation for component manufacture, geometric dimensioning and tolerancing, Use of solid-modeling software for creating associative models at the component and assembly levels, floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling, Introduction to Building Information Modelling (BIM).

COURSE/LEARNING OUTCOMES

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

CO1: Students will be able to prepare the orthographic projections of points and straight lines placed in various quadrants and learn the application and functionalities of computer aided drafting software like QCAD and AUTOCAD. (*Knowledge*)

CO2: Students will be able to demonstrate the ability to draw orthographic projections of various solids and use the commands for the application of computer aided drafting software like QCAD and AUTOCAD. (*Comprehension*)

CO3: Students will be able to draw and interpret the sectioned views of solids thus represent the workable drawings that may be easily and universally interpretable in the factory or at construction site. (*Application*)

CO4: Students will be able to analyse isometric view and perspective views of various solids; interpret the pictorial views into orthographic views and identify the functionalities and potentiality of computer aided drafting with software like QCAD and AUTOCAD. (*Analysis*)

CO5: Students will be able to synthesize the concept of drawing the first angle projection of points, lines and planes, the various drawing methodology for conic and cycloidal curves, engineer's or graphical scales for drawing complex curves and drawing 1,2 or 3 dimensional figures, complex solids; identify the functionalities and potentiality of computer aided drafting with software like QCAD and AUTOCAD. (*Synthesis*)

CO6: Students will be able to Judiciously evaluate quantity of products to be fabricated, from the drawings and also to optimize the dimensions by free hand sketching as well as by CAD. (*Evaluation*)

Suggested Readings

1. N. D. Bhatt, V. M. Panchal, P. R. Ingle (2014), Engineering Drawing, Charotar Publishing House
2. M. B. Shah and B. C. Rana (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. B. Agrawal and C. M. Agrawal (2012), Engineering Graphics, TMH Publication
4. K. L. Narayana and P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. Corresponding set of CAD Software Theory and User Manuals

SCHOOL OF COMMERCE AND MANAGEMENT

DEPARTMENT OF MANAGEMENT

MTOB0001: ORGANIZATIONAL BEHAVIOUR

(4 credits– 60 hours)

Objective: *The objective of this paper is to provide the students an insight into the principles of organizational behaviour and its relation to other activities in an organization, and to introduce the student to the techniques of organisational behaviour used as a management tool.*

Module I: Introduction to Organizational Behaviour (8 Hours)

Defining Organisational Behaviour, historical background: the Hawthorne Studies; early development, conceptual development; the nature of people; theoretical frameworks; explaining and predicting behaviour; OB in the global context.

Module II: Cognitive processes of organizational behavior (12 Hours)

Nature and importance of Perception and attribution; perception and individual decision making; values, nature and dimensions of attitudes and job satisfaction; personality; aptitude; interests; learning; intelligence, motivation - theories of motivation.

Module III: Group Dynamics (14 Hours)

a) Understanding group dynamics, types of groups, group goals, group cohesiveness, group pressure and norms, teamwork; group structure - formal leadership, roles and norms; group member resources - abilities, personality, characteristics, stages in group development.
b) Leadership : Theories - trait, behavioural, contingency, attributional, charismatic, transactional vs. transformational.
c) Power and politics: Contrasting leadership and power; power in groups; power tactics; politics-power in action.

Module IV: Communication and Decision Making (12 Hours)

Role of communication; Communication media and technology, communication networks - formal vs. informal; barriers to effective communication; communication skills; feedback information; persuasion in communication; active listening; participative decision making techniques; group vs. the individual; group think and group shift; the decision making process

Module V: Organizational culture and Work Stress (14 Hours)

a) Definition of organizational culture; cultural typologies; organizational culture vs. national culture; functions of culture; formation of cultures; potential sources of stress - environmental factors, organizational factors; individual differences - perception, job experience, social support, locus of control, hostility; Stress – the emergence of stress, causes of stress; stress consequences - physiological symptoms, psychological symptoms, behavioural symptoms, stress management strategies - individual approaches, organizational approaches.
b) Conflict and negotiation : Definition of conflict; the conflict process; conflict in intergroup relations; creating functional conflicts; bargaining strategies; role of personality traits in negotiation; third party negotiations; intergroup relations and factors affecting intergroup relations.

COURSE/LEARNING OUTCOMES

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

CO1: Define the meaning of organization behavior. (*Knowledge*)

CO2: Explain the models and the theory of learning and the foundations of individual behaviour. (*Comprehension*)

CO3: Establish the relationship between the various theories of motivation and workplace behaviour. (*Application*)

CO4: Differentiate between leadership and management and the different leadership theories. (*Analysis*)

CO5: Formulate different types of leadership strategies. (*Synthesis*)

CO6: Evaluate the various conflict resolution strategies. (*Evaluation*)

CO7: Describe various ways of managing stress at workplace. (*Comprehension*)

Suggested Readings

1. Fred Luthans, Organisational Behaviour, 10th Edition, McGraw Hill India
2. Stephen P Robbins, Organizational Behaviour, 11th Edition, Prentice Hall of India Pvt. Ltd., New Delhi
3. Gilmer, Industrial Psychology, McGraw Hill.
4. Ghiselle and Brown, Personnel and Industrial Psychology, McGraw Hill.
5. Keith Davis, Human Relations at Work, Tata McGraw Hill.
6. Leavitt, Managerial Psychology, University of Chicago Press.
7. BM Bass, Leadership Psychology and Organizational Behaviour, Harper International.
8. Litterer, Analysis of Organizations, John Wiley.

MTAF0002: ACCOUNTING AND FINANCIAL MANAGEMENT

(4 credits-60 hours)

Objective: *The objective of this paper is to make the students familiar with the basic accounting and financial management concepts. This takes into account the knowledge of accounting that a student may require when faced with the task of developing or maintaining any package for any business/financial institutions as well as for non-profit organisations*

Module I: Introduction to Accounting (14 Hours)

Utility of Accounting in business enterprises, Double entry system of accounting, accounting equation, accounting principle concepts and conventions, journal, ledger, trial balance, cash book (single, double and triple column.

Module II: Final Accounts and Statements (16 Hours)

a) Distinction between capital and revenue expenditure, construction of trading, profit and loss accounts and balance sheet of sole proprietorship concerns with adjustments, manufacturing account, simple problems on final accounts of companies.
b) Preparation of Income and Expenditure account and balance sheet (from receipts and payments account) with common adjustments for non trading institutions.

Module III: Techniques of costing (10 Hours)

Definition of costing and cost accounting, classification of cost, Marginal costing – Basic concepts, break-even analysis, construction of break-even chart, problems on marginal costing, application of marginal costing in decision-making.

Module IV: Financial management (12 Hours)

Financial Statement Analysis- Ratio Analysis – Meaning, Advantages, limitations and types of ratios and their usefulness, simple problems on current ratio, liquid ratio, debt-equity ratio, inventory turnover ratio, gross profit ratio, net profit ratio, earnings per share, return on investment. Fund Flow Analysis- preparation of statement of changes in working capital, preparation of fund flow statement.

Module V: Budget (8 Hours)

Budget: Different types of budget, Theoretical concept, preparation of flexible budgets and cash budgets.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the term financial management (*Comprehension*)
CO2: State the different tools and techniques of financial management (*Knowledge*)
CO3: Describe in detail about budget and budgeting (*Comprehension*)
CO4: Not only explain what capital budgeting is but also the types of capital budgeting methods (*Comprehension*)
CO5: Define Internal Rate of Return. (*Comprehension)*
CO6: Illustrate investment analysis. (*Knowledge)*
CO7: illustrate with example the concept of cost and its type (*Application*)
CO8: Define marginal cost. (*Knowledge*)
CO9: Estimate marginal cost. (*Application*)
CO10: Define cost analysis for marginal decision (*Knowledge*)
CO11: Estimate break-even point and explain what is break even analysis (*Application*)
CO12: Estimate margin of safety (*Application*)
CO13: Prepare journals, ledger, Trial Balance (*Synthesis*)
CO14: Prepare and evaluate financial statement. (*Synthesis*, *Evaluation*)

Suggested Readings

1. Dr. Jawahar Lal, Accounting for Management, Himalaya Publishing House, Mumbai.
2. C. Mohan Juneja, R.C. Chawla, K.K.Saksena, Double Entry Book Keeping, Kalyani Publishers, Ludhiana.
3. S.P .Jain, K.L. Narang, Cost Accounting, Kalayani Publishers, Ludhiana.
4. Shukla, Grewal, Gupta, Advanced Accounts, S Chand & Sons, Delhi.
5. Jain, Narang, Advanced Accountancy, Kalyani Publishers, Ludhiana.

MTEC0068: ECONOMICS FOR ENGINEERS

(2 credits – 30 hours)

Objective: *The objective of this course is to make the students of engineering aware of the basic concepts in Economics, introduce them to the preliminary techniques of quantitative analysis in Economics and finally to certain relevant concepts of the stock market. The purpose of this course is to increase the all round knowledge of the engineer and enhance his/her professional competence in the work field.*

Module I (9 hours)

a) Definition of Economics: Subject matter, scope, principal division of Economics – Microeconomics and Macroeconomics.
b) Theory of Demand: Meaning of Demand and Supply, The law of demand, meaning of utility, marginal utility and total utility, law of diminishing marginal utility, Indifference curve approach, Consumer's Equilibrium, elasticity of demand- determinants, types and measurement, exceptions to the law of demand.
c) Theory of Production: Meaning of Production function, production function with one variable input – Law of Variable Proportions, production function with two variable inputs – Law of Returns to Scale, Cobb-Douglas production function. Economic concept of cost- short-run and long-run.
d) Market Structure: Market Classification- perfect competition, monopoly, monopolistic competition. Concepts of Revenue - Average Revenue, Marginal Revenue and Total Revenue. The firm- objectives and constraints, Equilibrium of the firm- TR-TC approach, MR-MC approach.

Module II (10 hours)

a) Macroeconomic concepts and aggregates: Circular flow of income, National Income- GDP, GNP, Meaning and relation between: consumption, saving, investment. Aggregate demand and aggregate supply - Saving and Investment functions, Multiplier Mechanism.
b) Money: Definition of money, functions of money, Money Supply- M1M2M3M4, Inflation- meaning, types, control of inflation- monetary policy, fiscal policy.
c) Banking: Central Banks, Commercial Banks, creation of credit.
d) Trade Cycles: Meaning of Trade Cycle, Various phases of Trade Cycle.
e) International Trade: Balance of Payments, Devaluation, Exchange Rate, Special Drawing Rights (SDR), IMF, WTO, concept of Globalization, Role of MNCs, Regional Economic Integration.

Module III (6 hours)

a) Quantitative Analysis in Economics: Profit Maximization problems, break-even analysis, demand estimation.
b) Introduction to Statistics: Data, diagram, Data Interpretation problems, Measures of Central Tendency, Measures of Dispersion, dispersion, Index numbers.

Module IV (5 hours)

a) Introduction to Stock Market: Stock Markets - Meaning, NSE, BSE, NYSE, Stock Market Indices - SENSEX, NIFTY, DOW. Bull Market and Bear Market, Role of SEBI in stock market, FDIs and FIIs, Role of FIIs in stock market.
b) Basic terms related to stock market: Shares, equity shares, bonus shares, preference shares, buyback shares, splitting of shares, trading - intraday trading, commodity trading, futures, hedging, arbitrage.
c) Mutual Funds: Meaning of Mutual funds, Types of Mutual Fund.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the subject matter of Economics. (*Comprehension*)
CO2: Define and comprehend the meaning of demand and supply. (*Knowledge & Comprehension*)
CO3: Describe the factors of production (*Comprehension*)
CO4: Distinguish between different market forms (*Knowledge)*
CO5: Compute cost, revenue and profit of firms(*Comprehension)*
CO6: Explain how money is circulated in an economy. (*Comprehension*)
CO7: Outline the different concepts of national income. (*Analysis*)
CO8: Describe the banking system of an economy. (*Comprehension)*
CO9: Apply the statistical concepts to interpret different forms of data. (*Application*)
CO10: Construct price index. (*Synthesis*)
CO11: Interpret and evaluate the functioning of stock market. (*Evaluation*)

Suggested Readings

1. H.L. Ahuja, Modern Economics, S. Chand & Co. Ltd., New Delhi
2. Dr. K.K Dewett and M.H. Navalur, Modern Economic Theory, S. Chand & Co. Ltd., New Delhi
3. Manab Adhikary, Business Economics, Excel Books.
4. Madhu Vij, International Financial Management, Excel Books.
5. Koutsoyiannis, Modern Microeconomics, Palgrave MacMillan, 2003, 2nd Revised edition
6. Dominik Salvatore, Microeconomic Theory, Schaum’s Outline series, TMH.
7. Bradley Schiller, Essentials of Economics, Tata Mcgraw Hill.
8. Atmanand, Managerial Economics, Excel Books.
9. M S Loganathan and B Nandhakumar, Dictionary for Economics, Excel Books.
10. Sheetal Thomas, Dictionary of Finance, Excel Books.

MTOB0069: INTRODUCTION TO ORGANISATIONAL BEHAVIOUR

(2 credits – 30 hours)

Objective: *This course is designed to give students the basic knowledge of human behavior needed to provide a more effective organizational environment. The basic elements of the course will be the behavior of individuals in organizations, group behavior in organizations, and how these behaviors affect the overall performance of organizations. Particular emphasis is placed on individual difference, attitude, motivation, job satisfaction, communication, leadership, stress, change, and organizational culture.*

Module I (5 hours)

The Study of Organizational Behaviour (OB): Learning objectives, Definition and Meaning, Why Study OB, Models in OB, New Challenges for OB Manager. Learning – Nature of Learning, How Learning occurs, Learning and OB. Case Analysis

Module II (7 hours)

Foundations of Individual Behaviour: Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB. Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation– Nature and Importance, Hertzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations. Case Analysis

Module III (10 hours)

a) Organizational Behaviour Process: Communication – Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving Interpersonal Effectiveness. Groups in Organizations - Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision making Managerial Implications, Effective Team Building.

b) Leadership – Leadership and Management, Theories of Leadership – Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Followership, How to be an effective Leader. Conflict – Nature of Conflict and Conflict Resolution. An Introduction to Transactional Analysis (TA). Case Analysis

Module IV (8 hours)

Organization: Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management – Selection, Orientation, Training and Development, Performance Appraisal, Incentives; Organizational Change – Importance of Change, Planned Change and OB techniques. International Organizational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective. Case Analysis

Suggested Readings

1. VSP Rao, Organizational Behaviour, Excel Books.
2. Stephen P Robbins, Organizational Behaviour, PHI Learning, New Delhi
3. JW Newstorm and K. Davis, Organizational Behaviour: Human Behaviour at Work, MGH, New Delhi
4. K. Aswathappa, Organizational Behaviour, Himalaya Publishing House, New Delhi
5. PN Khandawalla, Organizational Behaviour, McGraw Hill, New Delhi.

COURSE/LEARNING OUTCOMES

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

CO1: Define the meaning of organization behavior (*Knowledge*)
CO2: Explain the models and the theory of learning and the foundations of individual behavior. (*Comprehension*)
CO3: Establish the relationship between the various theories of motivation and workplace behavior. (*Application*)
CO4: Differentiate between leadership and management and the different leadership theories. (*Analysis*)
CO5: Formulate different types of leadership strategies. (*Synthesis*)
CO6: Evaluate the various human resource management functions. (*Evaluation*)

MTFP0070: FUNCTIONAL PRINCIPLES OF MANAGEMENT

(2 credits – 30 hours)

Objective: *This course aims at imparting the students with relevant knowledge, principles, and practices of management so as to groom them as competent contributors in the workforce, ready to occupy managerial and administrative positions in various organizations.*

Module I: General Principles and Practices of Management (6 hours)

a) Theories of Management: Contribution of Management Thinkers – Taylor, Fayol, Elton Mayo, different schools of management thought- classical, scientific, contingency.
b) Functions of Management: Planning, Organizing, Staffing, Leading and Controlling.

Module II: Marketing Management (8 hours)

a) Introduction to Marketing: Concepts, Nature, Importance, Marketing Mix.
b) Capturing Customer insights: Marketing Research, Customer Behavior, and Market Segmentation.
c) Building Brand Loyalty: Product Strategies, Branding Strategies, Pricing Strategies.
d) Promotional Mix: Advertising and Distribution Strategies.

Module III: Strategic Management (8 hours)

a) Concepts of Strategic Management: Defining Strategy, Strategic Management Process – Formulation, Implementation and Evaluation.
b) Strategic Analysis: Core Competence, Corporate-level strategy, Business-unit level strategy, generic level strategy.
c) Current Strategies in Business Management: Knowledge Management, Corporate Governance, E-commerce- virtual value chain, Technology Management.

Module IV: Quantitative Techniques for Managerial Decisions (8 hours)

a) Introduction: Methods of Data Collection and Sampling Fundamentals.
b) Simulation Techniques: Markov Analysis, Monte Carlo Simulation.
c) Decision Theory: Decision tree, Decision making under Risk (EMV criteria) and Uncertainty.

COURSE/LEARNING OUTCOMES

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

CO1: Enumerate the general principles and practices of management. (*Knowledge*)
CO2: Explain the concepts of marketing management. (*Comprehension*)
CO3: Determine the strategic management process. (*Application*)
CO4: Analyse the various levels of strategy and current strategies in business management. (*Analysis*)
CO5: Formulate methods of data collection (*Synthesis*)

CO6: Evaluate simulation techniques and decision theory for business decision making. (*Evaluation*)

Suggested Readings

1. Harold Koontz & Heinz Weihrich, Essentials of Management, Tata Mc Graw Hill.
2. Stoner, Freeman, Gilbert Jr., General Management, Prentice Hall.
3. Philip Kotler & Gary Armstrong, Principles of Marketing, 15th edition, Prentice Hall.
4. Kotler, Keller, Koshi and Jha, Marketing Management – A South Asian Perspective, 13e, Pearson.
5. V. S. Ramaswamy & S. Namakumari, Marketing Management, Macmillan.
6. Wheeler, T.L. Hunger, J.D., and Rangarajan K., Concepts in Strategic Management & Business Policy, 11th edition, Pearson Education.
7. Ranjan Das, Crafting the Strategy: Concepts & Cases in Strategic Management, Tata Mc Graw Hill.
8. J. K. Sharma, Operations Research Theory & Applications, MacMillan.
9. Srivastava, Sharma & Shenoy, Quantitative Techniques for Managerial Decision Making, Sultan Chand & Co.
10. N. D. Vohra, Quantitative Techniques in Management, Tata Mc Graw Hill.
11. Pradip Kr. Sinha & Sanchari Sinha, Current Trends in Management, Nirali Prakashan.

MTOM0071: PRODUCTION AND OPERATIONS MANAGEMENT

(2 credits – 30 hours)

Objective: *This course aims at acquainting the students with the functions of production and operations management and basic issues and tools of managing production and operation functions of an organization. The course also intends to provide the students a system theoretic view on project management and helps develop an understanding on why today's organizations are cultivating a formal project management process to gain competitive advantage. The syllabus has an in-depth coverage of the most critical topics found in PMBOK (Project Management Body of Knowledge) Guide.*

Module I: Introduction and Work Study (7 hours)

a) Introduction to Production and operations management
b) Meaning and scope, subdivisions of work study – Method/Motion study and Work Measurement
c) Method/ Motion study- its meaning and scope, steps in method/motion study, Tools and techniques of method/motion study, Principles of motion economy
d) Micro-motion study – Meaning and scope, therbligs, use of motion camera in micro-motion study
e) Work measurement – concept of observed time, rating/leveling factor, average worker and standard time for jobs. Use of stop watch and work sampling techniques in the determination of standard time.

Module II: Plant Location and layout (7 hours)

a) Objectives, Locational factors, Economics of plant location
b) Meaning, objectives and types of plant layout and their relevance to mass, batch and job-order production systems.
c) Systematic Layout Planning (SLP) procedure
d) Use of computers for layout design
e) Group Technology (GT), Flexible manufacturing systems (FMS) and Computer integrated manufacturing (CIM)
f) Assembly Line Balancing (ALB) - meaning and objective, Heuristic methods for solution of ALB problems.

Module III: Product design and Development and PPC (10 hours)

a) Meaning of product, Product life cycle (PLC) and Product mix
b) Decisions to be taken during product development and design
c) Procedure for product development and design
d) Value of a product – its meaning, Value Analysis (VA) – its objectives, procedure and example, Simplification and Standardization.
e) Meaning and Objectives of PPC, Effects of types of production
f) Steps in PPC primarily stressing the needs of marketing research, Demand forecasting, process planning/routing, scheduling of flow-shop and job-shop productions, Use of Gantt chart, Machine loading, Make/Buy decision and Break-even analysis, Master production schedule, MRP and MRP-II, Capacity planning, Inventory management.
g) Production control – monitoring, expediting and re-planning, Planning and control of batch production. TOC, Use of L.P in Production Management, Product and service Reliability.

Module IV: Project Management (6 hours)

a) Project management framework, Scope management.
b) Project management processes, Cost and Time management, Project integration management, Project risk management, Project Quality management, Project communication management.

COURSE/LEARNING OUTCOMES

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

CO1: Define a production system. (*Knowledge*)
CO2: Distinguish between production and operations. (*Comprehension*)
CO3: Use the tools and techniques to measure work study, motion study. (*Application*)
CO4: Apply the concepts of work sampling techniques in the determination of standard time. (*Application*)
CO5: Comprehend the significance of plant location and prepare systematic layout planning procedure. (*Synthesis*)
CO6: Explain product life cycle and product mix. (*Comprehension*)
CO7: Demonstrate the procedure for product development and design. (*Application*)
CO8: Compare between make or buy decision. (*Analysis*)
CO9: Apply various tools of demand forecasting. (*Application*)
CO10: Determine inventory and inventory control techniques. (*Application*)
CO11: Synthesize project management framework. (*Synthesis*)
CO12: Compute project completion time and analyze and evaluate project risk management techniques. (*Application*, *Analysis & Evaluation*)

Suggested Reading

1. M. Telsang, Industrial Engineering, S. Chand & Company Ltd.
2. Kanishka Bedi, Production and Operations Management, Oxford University Press.
3. O. P. Khanna, Industrial Engineering and Management, Dhanpat Rai & Sons.
4. M. Mahajan, Industrial engineering, Dhanpat Rai & Company.
5. L. Krajewski, L. Ritzman and M. Malhotra, Operations Management, Pearson Education.
6. Adam, Ebert, Production and Operations Management, PHI.
7. R. Panneerselvam, Production and Operations Management, PHI.
8. K. Aswathappa & K. Shridhara Bhat, Production and Operations Management, Himalaya Publishing

MTQM0072: QUALITY MANAGEMENT SYSTEMS

(2 credits – 30 hours)

Objective: *This course is introduced with the objective of analyzing the relevance of total quality management in the engineering profession in the light of its increased involvement in company practices. It provides an insight on the various techniques of quality control and presents a broad picture of TQM and explains why it is considered as a major thrust for future competitiveness.*

Module I: Introduction (5 hours)

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

Module II: TQM Principles (6 hours)

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDCA Cycle, 5S, JIT, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

Module III: Statistical Process Control (SPC) (8 hours)

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, DMAIC, Lean Six sigma.

Module IV: TQM Tools (6 hours)

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

Module V: Quality Systems (5 hours)

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing and Reviewing, CMMI, ISO 14000 – Concept, ITIL, CMMI Services, TL9000, ISO 20000 Requirements and Benefits.

COURSE/LEARNING OUTCOMES

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

CO1: Define quality and its various dimensions. (*Knowledge*)
CO2: State the various principles of TQM. (*Comprehension*)
CO3: Apply the seven tools of quality control and statistical process control. (*Application*)
CO4: Determine control charts for variables and attributes. (*Application*)
CO5: Describe benchmarking process. (*Comprehension*)
CO6: Illustrate Quality Function Deployment (QFD). (*Application*)
CO7: Explain Six Sigma Concept in TQM. (*Comprehension*)
CO8: Compare and contrast between various quality systems. (*Analysis*)

Suggested Readings

1. Rajaram, Total Quality Management, Wiley India.
2. Montgomery, Introduction to Statistical Quality Control, 4th Ed, Wiley India.
3. Dale H. Besterfiled, et al., Total Quality Management, Pearson Education, Inc. 2003.

4. Amitava Mitra, Fundamentals of Quality Control and Improvement, Pearson Education.
5. Shailendra Nigam, Total Quality Management an integrated approach, Excel books.
6. G Nagalingappa and Manjunath V S, Total Quality Management Text and Cases, Excel Books.
7. James R. Evans and William M. Lindsay, The Management and Control of Quality, (5^{th} Edition), South-Western (Thomson Learning), 2002
8. Feigenbaum. A.V., Total Quality Management, McGraw Hill.
9. Oakland J.S., Total Quality Management Butterworth – Heinemann Ltd., Oxford.
10. Narayana V. and Sreenivasan N.S., Quality Management – Concepts and Tasks, New Age International.

MTFC0073: FINANCIAL MANAGEMENT AND ACCOUNTING

(3 credits - 45 hours)

Objective: *The objective of the course is to provide a broad exposure to the basic terminology, tools, and techniques of financial management and accounting which will enable the students to understand accounting issues as they arise in either the financial press or in the workplace. The knowledge gained through this subject can also be helpful in operational and strategic decision making.*

Module I (8 hours)

a) Introduction: Financial Management, Financial Planning and Capitalization- definitions, objectives, changing roles and functions, Financial Decision.
b) Capital Budgeting: Nature of Investment decision, Importance of Capital Budgeting, The Capital. Budgeting Process - Investment criterion, Pay-back period, Accounting, ROR (Rate of Return) Method, Discounting Cash flow method, Net - present value method, IRR (Internal Rate of Return) method, The benefit-Cost Ratio method.

Module II (10 hours)

a) Management of Working Capital: Various concepts, Elements, Classification, Financing and importance of working capital, Investment analysis, Cash flow determination, cost of capital, capital budgeting methods.
b) Budgeting Control Technique: Concepts of Budget, budgeting and budgetary control, Objectives, Functions, Uses, Advantages, Limitations; Master Budget and Report.

Module III (8 hours)

Cost - Volume - Profit Analysis: Classification of costs, Allocation, apportionment and absorption, Cost centers, different costing systems, Cost analysis for managerial decisions, Meaning of Linear CVP analysis, Objectives, Assumptions, Break - Even analysis, determining the Break-Even point profit, Volume graph profit, Volume ratios margin of Safety.

Module IV (9 hours)

a) Introduction to Accounting: basic accounting concepts, important definitions, uses, limitations, advantages; types of accounting, financial statements, introduction to journal accounting; different types of vouchers, double entry bookkeeping, different types of transactions related to financial accounting.
b) Financial Control: An Introduction to cash book,Posting of Ledgers and preparation of trial balance, preparation of balance sheet and profit and loss accounts, controlling other departments by financial accounting.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the term financial management (*Comprehension*)
CO2: State the different tools and techniques of financial management. (*Knowledge*)

CO3: Describe in detail about budget and budgeting. (*Comprehension*)

CO4: Not only explain what capital budgeting is but also the types of capital budgeting methods (*Comprehension*)

CO5: Define Internal Rate of Return (*Knowledge*)

CO6: Illustrate investment analysis (*Application*)

CO7: Illustrate with example the concept of cost and its type (*Application*)

CO8: Define marginal cost (*Knowledge*)

CO9: Estimate marginal cost (*Application*)

CO10: Define cost analysis for marginal decision (*Knowledge*)

CO11: Estimate break-even point and explain what break even analysis is. (*Application*)

CO12: Estimate margin of safety (*Application*)

CO13: Prepare journals, ledger, Trial Balance (*Synthesis*)

CO14: Prepare and assess financial statement (*Synthesis*, *Evaluation*)

Suggested Readings

1. P.K. Jain, Financial Management and Accounting, S. Chand and Co.
2. R.K. Sharma and S.K. Gupta, Management and Accounting: Principles and Practice, Kalyani Publishers.
3. R.S. Kaplan and A.A. Atkinson, Advanced Management Accounting, PHI.
4. Van Horne, Fundamentals of Financial Management, Pearson

DEPARTMENT OF COMMERCE

CMFA0001: FINANCIAL ACCOUNTING

(4 Credits - 60 hours)

Objective: *The objective of this course is to help students to acquire conceptual knowledge of financial accounting and to impart skills for recording various kinds of business transactions.*

Module I: Theoretical Framework, Accounting Process, Financial Accounting Standards (10 Hours)

a) Theoretical Framework: Accounting as an information system, the users of accounting information and their needs. Qualitative characteristics of accounting, Functions, advantages and limitations of accounting; accounting principles: Basic concepts and conventions, branches of accounting. Bases of accounting: cash basis and accrual basis.

b) Accounting Process : Double entry bookkeeping system - Basic accounting equation, accounting cycle; Recording of a business transaction: Journal, Ledger and preparation of trial balance including adjustments, Capital and Revenue expenditure and receipts, Profit and Loss Account and Balance Sheet (Sole Proprietorship only). Rectification of Errors, Depreciation Accounting.

c) Financial Accounting Standards: Concept, benefits, procedure for issuing accounting standards in India. International Financial Reporting Standards (IFRS): Need and procedures, Convergence to IFRS, Distinction between Indian Accounting Standards (IASs) and Accounting Standards (ASs).

Module II: Accounting for Hire Purchase and Installment System (12 Hours)

Meaning of Hire Purchase and Installment Purchase System - Journal entries and ledger accounts in the books of Hire Vendors and Hire purchasers for large value items including default and repossession, stock and debtors system. Difference between Hire Purchase and Installment Purchase: Important Definitions, Hire Purchase Agreement, Hire Purchase Price, Cash Price, Hire Purchase Charges, Net Hire Purchase Price, Net Cash Price, Calculation of Interest, Calculation of Cash Price, Journal Entries and Ledger Accounts in the books of Hire Purchaser and Hire Vendor (Asset Accrual Method only).

Module III: Branch and Departmental Accounting (16 Hours)

a) Meaning, objectives, need of Branch Accounting; classification of Branches; Accounting treatment of Branch Accounting – synthetic or Debtors System, Analytical or stock and debtor for system. Final Account system including accounting treatment for independent Branch.
b) Departmental accounting; introduction, methods and techniques, allocation of expenses, inter departmental transfer, preparation of departmental Trading, Profit and Loss account and balance sheet.

Module IV: Royalty Accounts (12 Hours)

Meaning and definition, Technical Terms, Royalty, Landlord, Tenant, Minimum Rent, Short Workings, Recoupment of Short Workings under (Fixed Period) restrictive and non-restrictive (Floating Period), Recoupment within the Life of the Lease, Treatment of Strike and Stoppage of work, Accounting Treatment in the books of lessee and lessor, journal entries and Ledger Accounts including minimum rent account.

Module V: Accounting for Partnership Firm (10 Hours)

Partnership Accounts: Essential characteristics of partnership, Partnership deed, Final accounts, adjustments after closing the accounts, Fixed and fluctuating capital,Goodwill, Joint Life Policy, Change in Profit Sharing Ratio. Reconstitution of a partnership firm: Admission of a partner, Retirement of a partner, Death of a partner, Amalgamation of partnership firm; Dissolution of a partnership firm: Modes of dissolution of a firm, Accounting entries, Insolvency of partners, Sale of firm to a company, Gradual realization of assets and piecemeal distribution.

COURSE/LEARNING OUTCOMES

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

CO1: Define the qualitative characteristics of accounting. (*Knowledge*)
CO2: Explain the double entry system of bookkeeping and accountancy. (*Comprehension*)
CO3: Apply Accounting Standards' in financial statement preparation. (*Application*)
CO4: Enumerate hire purchase system. (*Comprehension*)
CO5: Distinguish between hire and installment purchase system. (*Analysis*)
CO6: Imitate branch and departmental accounting. (*Knowledge*)
CO7: Describe departmental trading, profit and loss account. (*Comprehension*)
CO8: Generate royalty account. (*Synthesis*)
CO9: Prepare and evaluate trading, profit & loss account and balance sheet (*Evaluation*)

Suggested Readings

1. Gupta, RL and Radhaswamy, M: Financial Accounting; Sultan Chand and sons, New Delhi.
2. Monga JR, Ahuja Girish and Sehgal Ashok: Financial Accounting; Mayur Paper Back, Noida.
3. Ramchandran, N and Kakani, RK, Financial Accounting for Management, Tata McGraw Hill.
4. Gautam HC, Dam BB, Kakati PC, Chakraborty D, and Barman JK, Financial Accounting, Capital Publishing Company, Bhangaghor, Guwahati
5. Edmonds T, McNair, F and Olds P, Fundamental Financial Accounting Concepts, Tata McGraw Hill.
6. Jain SP, and Narang KL, Financial Accounting, Kalyani Publishers, New Delhi.
7. Gautam HC, and Sikidar S, Financial Statement Analysis; New Central Book Agency (P) Ltd, Kolkata

CMME0002: MICRO-ECONOMICS

(4 credits – 60 Hours)

Objective: *This course introduces economic analysis of individual, business, and industry choices in the market economy. Students will learn how markets establish price, production, wage and employment levels, and the likely consequences of government attempts to alter market outcomes. Students will also learn optimization strategies for profit-seeking businesses in a variety of product market environments. Upon completion, students should be able to identify and evaluate consumer and business alternatives in order to achieve economic objectives efficiently.*

Module I: Theory of Demand and Consumer Behavior (20 Hours)

a) Demand and Supply: Determinants of demand, movements vs. shift in demand curve, Law of Demand, Demand Function, Demand Equation, Determination of Market Demand Curve.
b) Elasticity of demand.
c) Utility Approach: Cardinal Utility, Law of Diminishing Marginal Utility, Ordinal Utility theory, Indifference curve approach, Budget line, Consumer's equilibrium; Income and substitution effect; Price consumption curve, Criticisms of the law of demand.
d) Consumer's Preferences: Revealed Preference Theory, Consumer's Surplus.

Module II: Theory of Production and Costs (12 Hours)

a) Supply: Concept, Determinants of Supply, Movement along a supply curve vs. shift in supply curve; Market equilibrium and price determination, Elasticity of Supply.
b) Production: Concept of Production function, Law of variable proportions, Isoquants, Returns to scale, Economies and Diseconomies of scale.
c) Production Costs: Costs in the short run, costs in the long run, cost minimization.

Module III: Theory of Firms and Market Structures (18 Hours)

a) Concept of Revenue: Revenue, Revenue Maximization, Profit Maximization, Equilibrium of the firm.
b) Market Structures: Perfect Competition- Equilibrium of Firm and Industry under Perfect Competition, Monopoly - Price determination under Monopoly, Price Discrimination, Monopolistic Competition - Price and Output determination under Monopolistic Competition, Oligopoly.

Module IV: Theory of Distribution (10 Hours)

a) Theory of Distribution: Concept of Productivity - marginal productivity, Marginal Revenue Productivity (MRP), pricing of factors, Euler's Theorem
b) Factor pricing: Labor Supply and Wage Determination, Theory of Rent, Interest, Profit.

COURSE/LEARNING OUTCOMES

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

CO1: State the difference between demand and supply. (*Knowledge*)
CO2: Outline the determinants of demand. (*Knowledge*)
CO3: Estimate elasticity of demand. (*Application*)
CO4: Explain the concept of utility and relate it with the theory of demand. (*Comprehension*)
CO5: Describe consumer's equilibrium and explain the effects of changes in consumer's equilibrium w.r.t. changes in income and prices. (*Comprehension*)
CO6: Outline the determinants of supply and estimate elasticity of supply. (*Knowledge*)
CO7: Summarize the concept of production function and relate it with economies and diseconomies of scale. (*Comprehension)*
CO8: Explain the various kinds of production functions. (*Comprehension*)
CO9: Estimate cost of production of firms. (*Application*)

CO10: Illustrate the different concepts of revenue. (*Application*)
CO11: Compute revenue maximization and profit maximization of firms. (*Application*)
CO12: Differentiate between various market forms and explain price determination under these market forms. (*Analysis*)

Suggested Readings

1. M Hirschey, Fundamental of Managerial Economics, Cengage Learning.
2. A Koutsoyiannis, Modern Microeconomics, Macmillan
3. DN Dwivedi, Managerial Economics, Vikas Publication.
4. HL Ahuja, Modern Micro Economics, S Chand and Co., New Delhi.
5. Dominic Salvatore, Outline of Theory and Problems of Microeconomic Theory, McGraw-Hill, International Edition, New Delhi.
6. HR Varian, Intermediate Microeconomics: A Modern Approach, Affiliated East-West Press, New Delhi.
7. KK Dewett and MH Navalur, Modern Economic Theory, S Chand and Co., New Delhi.
8. Craig H Peterson, W Cris Lewis, Sudhir K Jain, Managerial Economics, Pearson.

CMPM0003: PRINCIPLES OF MANAGEMENT

(4 Credits - 60 hours)

Objective: *This course aims at imparting to students relevant knowledge, principles and practices of management so as to groom them to become competent contributors in the workforce, ready to occupy managerial and administrative positions in various organisations.*

Module I: Management and Evolution of Management Thought (15 Hours)

Meaning and definition, nature, purpose, scope, importance and functions of Management, Management as art, science and profession, Management as a social system, distinction between management, administration and organization, Principles of management, Scientific Management. Contribution of FW Taylor, Henri Fayol, Elton Mayo, Chester Barnard and Peter Drucker to management thought. Various approaches to management (i.e. Schools of Management Thought), Indian management thought.

Module II: Functions of Management (25 Hours)

a) Planning: Meaning, Significance, Types, Nature, Elements of Objectives, Policies, Rules, Procedures, Strategies and Decision Making Process
b) Organizing: Meaning, Nature and Purpose of organization, Theories of organization, principles of organization, Forms of organization: Line, Functional and Line and Staff, Formal and informal organization, Delegation, Span of Management: Factors Determining effective span.
c) Directing: Motivation - Meaning, Nature, Importance, Types, Theories of Motivation - Mc. Gregor, Maslow and Herzberg. Leadership - Meaning, Nature, Styles, Managerial grid, Likert system, Theories - Trait, Behavioural, Situational.
d) Controlling: Meaning, nature, importance, scope, principles, prerequisites, steps, limitations and techniques

Module III: Management Techniques and Departmentation (6 Hours)

a) Management by Objectives (MBO): Meaning, Process, Benefits, Weaknesses; Boston Consulting Group (BCG) matrix.
b) Departmentation: Definition, function, Territory, Product/service, Customer group; matrix organization; Decentralisation and Departmentation.

Module IV: Authority and Staffing (14 Hours)

a) Definition of authority, types, responsibility and accountability; delegation: definition, steps in delegation, obstacles to delegation and their elimination, decentralization vs centralization, determinants of effective decentralization.

b) Meaning of staffing, nature and functions of Human Resource Management (HRM), Manpower management, factors affecting staffing, Recruitment, Selection, Training and Development, Performance appraisal: need and process. Coordination-Principles and Techniques, Difference between coordination and cooperation.

COURSE/LEARNING OUTCOMES

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

CO1: State the functions, principles and theories of management. (*Knowledge*)
CO2: Explain the functions of management with relevant examples. (*Comprehension*)
CO3: Apply the various management techniques in business situations. (*Application*)
CO4: Differentiate the key management concepts in terms of their nature, functions, role and importance. (*Analysis*)
CO5: Design strategies of manpower planning as per business needs. (*Synthesis*)
CO6: Evaluate the staffing functions, its principles and techniques. (*Evaluation*)

Suggested Readings

1. SP Robbins, and MK Coulter, Management, Pearson Education Inc., New Delhi.
2. Gupta, Meenakshi, Principles of Management, PHI Learning Pvt. Ltd., New Delhi.
3. H Koontz, H Weihrich, AR Aryasri, Essentials of Management, Tata MCGraw-Hill, New Delhi.
4. K Aswathapa, Essential of Business Administration, Himalaya Publishing House, Mumbai.
5. J Stoner, R Freeman and D Gilbert, Management, Prentice Hall of India.
6. H Koontz, Principles of Management (Ascent series), Tata Mc Graw Hill Publishing.
7. SP Robbins and D Decenzo, Fundamentals of Management: Essential Concepts and Applications, Pearson Education.

CMCA0004: INTRODUCTION TO COMPUTER APPLICATIONS

(2 credits – 30 hours)

CMCA6001: COMPUTER APPLICATIONS LAB

(2 credits)

Objectives: *The objectives of these courses are*

- *To learn the basic computer applications required in the field of commerce.*
- *To learn and do basic calculations required in Commerce using a spreadsheet application.*

The lab course shall be closely associated with the theory course and shall familiarise the students with the application of all the aspects of the syllabus outlined below.

Module I: Introduction to Computers and Word Processing (20 hours)

a) Introduction to Computers: Characteristics of computers, the computer system, parts of a computer; Computer hardware setup, configuration, networking, wireless networking; Operating System - Introduction to operating systems, an overview of various types of operating systems and their applications (UNIX / Linux, DOS, Windows, Android, windows mobile, iOS etc).
b) Word processor: meaning, features, advantages; structure of a word processor window; creating a document, saving opening and printing, find and replace, inserting images, charts; creating and formatting a table; protection of documents - password for documents.

Module II: Presentations (15 hours)

a) Presentation Package: Creating presentations in a presentation package,text, tables, charts, animation, running a slide show and setting timing, saving the slides, and printing presentations and notes. Hyperlink to other document/presentation or media file.

b) Introduction to Internet service on cloud.

Module III: Spread Sheet (15 hours)

Creating a workbook, Rearranging Worksheet, Cell, rows and columns; Range, Creating, saving opening and printing a spreadsheet, creating tables, charts and graphs. Mail merge - main document, data source and merging .

Module IV: Advanced Spreadsheet Functions (40 hours)

a) Ranges, functions and formulae: mathematical, statistical financial functions such as NPV (net present value), future value, IRR (internal rate of return), EMI (equated monthly installments, compounding yearly, periodic and monthly) - auto calculate using names in a formula, formula editing, sorting and filtering.

b) Data Analysis: Consolidate data in multiple worksheets, WHAT-IF analysis, goal seek scenario manager, solver, lookup function - sub totals, nested-IF, Statistical Analysis

c) Data Validation and Protection: Create a drop-down list from a range of cells, apply data validation to cells, copy data validation settings, remove data validation, find cells that have data validation; protect cell data, using password to protect sheet and workbook, use validation to create dependent list; pivot table reports and pivotchart reports. Using spreadsheet for data analysis and reporting; using spreadsheet for following purposes and making reports:

- Loan and Lease statement
- Ratio Analysis.
- Payroll statements
- Capital Budgeting
- Depreciation Accounting
- Graphical representation of data
- Frequency distribution and its statistical parameters
- Correlation and Regression

COURSE/LEARNING OUTCOMES

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

CO1: Distinguish between Operating Systems software and Application Systems software.
CO2: Describe commonly used operating systems.
CO3: Identify the primary functions of an Operating System.
CO4: Describe the “boot” process.
CO5: Identify Desktop and Windows features.
CO6: Use Utility programs.
CO7: Discuss the pros and cons of the three major operating systems.

Suggested Readings

1. Rajaraman, V. Introduction to Information Technology, Second Edition. PHI.
2. http://phindia.com/bookdetails/introduction-to-information-technology-rajaraman-v--isbn-978-81-203-4731-1
3. Sinha, Pradeep K. and Preeti Sinha. Foundation of Computing, First Edition. BPB Publication.
4. http://www.bpbonline.com/foundation-of-computing.html ISBN-10: 8176566636
5. Rajaraman, V. Analysis and design of information Systems. Third Edition, PHI.
6. http://phindia.com/bookdetails/analysis-and-design-of-information-systems-rajaraman-v--isbn-978-81-203-4384-9
7. Sadagopan, S. Management Information Systems. Second Edition, PHI.
8. http://phindia.com/bookdetails/management-information-systems-sadagopan-s--isbn-978-81-203-4892-9

9. LibreOffice Team, Getting Started with LibreOffice, Shroff Publication, ISBN (13) 9789351107903
10. LibreOffice Team, Impress Guide - Working with Presentations (English) 1st Edition, Shroff Publication, ISBN (13) 9789351107910
11. LibreOffice Team, Writer Guide - Word Processing with Style (English) 1st Edition, Shroff Publication, ISBN (13) 9789351107927
12. LibreOffice Team, Calc Guide - Working with Spreadsheets (English) 1st Edition, Shroff Publication, ISBN (13) 9789351107897
13. https://www.libreoffice.org/get-help/documentation/

CMMA0005: MANAGEMENT ACCOUNTING

(4 credits - 60 hours)

Objective*: This course is intended to familiarize students with the process of using financial, costing and other relevant information for the purpose of managerial planning, control and decision making.*

Module I: Introduction to Management Accounting (5 hours)

Meaning, objectives, scope and functions of management accounting; role of management accounting in decision making; management accounting vs. financial accounting and cost accounting, tools and techniques of management accounting.

Module II: Analysis of Financial Statement (15 hours)

Meaning & types of financial statements; Meaning, objectives and significance of financial statement analysis. Ratio analysis: Advantages of ratio analysis; limitations of accounting ratios, classification of ratios -profitability ratios, solvency ratios, liquidity ratios and turnover ratios.

Module III: Standard Costing and Variance Analysis (15 hours)

Meaning of standard cost and standard costing; advantages and application; variance analysis – material, labour and overhead variances.

Module IV: Absorption and Marginal Costing (15 hours)

Meaning, difference between absorption costing & marginal costing. Cost – volume - profit analysis. Application of marginal costing technique: pricing, shut down decision, selection of profitable product mix, make or buy, profit planning, exploring new market.

Module V: Responsibility Accounting (10 hours)

Concept and Significance, Different Responsibility Centres: Cost Centre, Profit Centre and Investment Centre.

COURSE/LEARNING OUTCOMES

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

CO1: Explain the nature and the processes of businesses and how management accounting plays important roles in their decision-making scenarios.

CO2: Define and explain cost accounting terminologies and methods, their rationale of classification, and their relevance to business decisions.

CO3: Apply management accounting ideas and practices in making short- term/on-going decisions in businesses.

CO4: Define and explain inventory management ideas and methods (including Just-in-Time) and their uses in business decisions.

CO5: Apply management accounting ideas and practices in making strategic/long-term business decisions.

Suggested Readings

1. Baig, Nafees : Management Accounting & Control, Ashish Publishing House, New Delhi.
2. Arora M.N: Cost Accounting-Principles and Practices; Vikas Publishing House, New Delhi.
3. Arora M.N: Management Accounting, Himalaya Publishing House, New Delhi.
4. Jain S.P. & Narang K.L: Cost Accounting; Kalyani Publisher, New Delhi
5. Horngren, Charles, Foster and Datar et al: Cost Accounting - A Managerial Emphasis; Prentice Hall , New Delhi.
6. Khan M.Y. and Jain P.K: Management Accounting; Tata McGraw Hill, New Delhi.
7. Kaplan R.S. and Atkinson A.A.: Advanced Management Accounting; Prentice Hall India, New Delhi.
8. S.K. Gupta, R.K. Sharma, Management Accounting, Kalyani Publishers, New Delhi.
9. Lal Jawahar, & Srivastava. Seema. Cost Accounting, McGraw Hill Publishing, New Delhi.
10. Jhamb, H.V. Management Accounting, ANE Publishing House, New Delhi.

CMOE0006: MACRO-ECONOMICS

(4 credits – 60 Hours)

Objective: *This course gives an understanding on how an economy behaves at the aggregate level. Upon successful completion of the course a student will be able to*

- *Understand the basics of national income accounting.*
- *Understand why household, business and government determine the aggregate demand and why the behavior of businesses and the rest of the world determine the aggregate supply of goods and services.*
- *Understand the forces determining macroeconomic variables such as economic growth, inflation, unemployment, interest rates, exchange rate and free market movements.*

Module I: Theory of Income Determination (23 Hours)

a) National Income Accounting: Meaning of National Income, Circular flow of Income, Concepts of National Income.
b) Determination of National Income – Keynesian Theory: Aggregate Demand, Aggregate Supply, Determination of Equilibrium Level of National Income – Principle of Effective Demand.
c) Consumption Function: Propensity to Consume, Propensity to Save, Determinants of Propensity to Consume, Keynes' Psychological Law of Consumption, Post Keynesian theories of Consumption.
d) Investment Demand: Meaning of Investment, Determinants of Investment, Marginal Efficiency of Capital, Accelerator Theory of investment, Concept of Investment Multiplier.
e) Unemployment and Full Employment: Meaning, Types, Keynes' view on involuntary unemployment.

Module II: Theory of Monetary Demand and Supply (13 Hours)

a) Nature and Functions of Money: Definition, Function, Importance, Its Role in Economic Development
b) Money Supply and its Determinants: Concept, Measures, Deposit Multiplier, Money Multiplier, Factors determining Money Supply in India.
c) Banking System: Principle of Central banking, Its Functions, and Methods of Credit Control, Commercial Banks – Its Functions, Credit Creation by Commercial Banking System.
d) Demand for Money: Its Motives, Keynes' Liquidity Preference Theory of Interest, Friedman's Theory of Demand for Money.

Module III: Pricing, Inflation and Macroeconomic Policy (12 Hours)

a) Inflation: Nature, Causes, Effects, Inflation and Unemployment – Philips Curve.
b) Business Cycle: Phases, Features, Theories.
c) Fiscal Policy: Discretionary Fiscal Policy, Non-discretionary Fiscal Policy, Fiscal Policy to control Inflation.
d) Monetary Policy: Its tools, How Expansionary Monetary Policy works, Liquidity Trap

Module IV: Open Economy Macroeconomics (12 Hours)

a) Balance of Payments and Trade: Definition, Balance of Payments on Current Account and Capital Account, Equilibrium in the Balance of Payments, causes of disequilibrium in the Balance of Payments.
b) Foreign Exchange: Foreign Exchange and Foreign Exchange Market, Floating vs Fixed Exchange Rate System, Appreciation and Depreciation of Currencies, Foreign Exchange Rate and Balance of Payments.
c) Foreign Investment: Introduction, Foreign Portfolio Investment (FII), Foreign Direct Investment (FDI), Merits of FDI, Role of Multi-national Corporations (MNCs).

d) GATT and WTO: General Agreement on Tariffs and Trade (GATT), World Trade Organization (WTO): Status, Administration and Functions, Principles.

COURSE/LEARNING OUTCOMES

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

CO1: Describe how money is circulated in an economy. (*Knowledge*)
CO2: Outline the different concepts of National Income. (*Knowledge*)
CO3: Compute National Income Accounting. (*Application*)
CO4: Explain Keynesian National Income Determination by using Aggregate Demand and Aggregate Supply concept. (*Comprehension*)
CO5: Summarize Consumption Function and determinants of propensity to consume. (*Comprehension*)
CO6: Determine Investment Function and investment multiplier. (*Application*)
CO7: Relate the concept of money and money supply with economic development. (*Analysis*)
CO8: Estimate deposit multiplier and money multiplier. (*Application*)
CO9: Explain the functioning of the banking system and categorizing the banking system in India. (*Analysis*)
CO10: Illustrate the various theories of Interest. (*Comprehension*)
CO11: Summarize and evaluate fiscal policy and monetary policy to control inflation. (*Synthesis*)
CO12: Describe Balance of Payments and its various components. (*Comprehension*)
CO13: Outline and evaluate various Open macro-economic concepts like foreign exchange system, foreign investment, functioning of GATT, WTO, and FTA. (*Evaluation*)

Suggested Readings

1. Mankiw N. Gregory, Macroeconomics, McMillan Worth Publishers, New York.
2. Dornbusch Rudiger and Stanley Fisher, Macroeconomics, McGraw Hill.
3 Deepashree, Vanita Agarwal, Macro Economics, Ane Books Pvt Ltd, New Delhi
4 H. L. Ahuja, Modern Economics, S. Chand & Co.
5. Dr. K.K. Dewett and M.H Navalur, Modern Economic Theory, S. Chand & Co.

CMIE0007: INTRODUCTION TO IT AND E-COMMERCE

(4 credits-60 hours)

Objective: The objective of this course is to enable students to

- *Understand the fundamentals of Information Technology, E-Commerce and* *different types of business models.*

- *Comprehend the underlying IT mechanism for E-Commerce.*

Module I: Introduction to Information Technology, Internet and Business – An Overview (15 hours)

a) Concepts of data, information and computer based information system.

b) Internet - Meaning of Internet, Concepts of Internet Intranet and Extranet, IP Address (IPv4, IPv6), URL, Domain name System; Internet Protocols - TCP/IP, UDP, FTP, TELNET(brief ideas only), HTML, DHTML AND XML.(concepts only); The World Wide Web, The Internet and the Web Features; Applications of Internet,

c) Business Information systems, types of information needed by Organisations, management structure and their information needs, Impact of information technology on business (business data processing, intra-organisational and inter-organisational communication by using network technology).

Module II: Overview of E-Commerce (8 hours)

Meaning, Importance in the context of today's business, Advantages of E-Commerce (as compared with traditional system of commerce)and disadvantages of E-Commerce, E-Commerce system architecture, difference between E-Commerce and E-business, types of E-Commerce, Internet and its relation to E- commerce and E-Business.

Module III: Categories of E-Commerce Models (10 Hours)

a) Key elements of a Business model

b) Business to Consumer (B to C) model – Basic idea, major activities, major challenges, Models of B to C [portals, e-tailer, content provider, transaction broker]

c) Business to Business (B to B) model – Basic idea, major activities, types of B to B market [independent, buyer oriented, supplier oriented, vertical and horizontal e-marketplace]

d) Other models – Business to Government (B to G), Consumer to Consumer (C to C), Consumer to Business (C to B).

Module IV: E-Payment (7 hours)

Types of payment systems, types of E-Payment – Payment card [credit card and debit card], Electronic or digital cash, electronic or digital wallet, stored value card [smart card]; Basic idea of online banking.

Module V: Online Services, E-Commerce Portals and Supply Chain Management (20 Hours)

a) Procedure of registering Internet domain, establishing connectivity to Internet, tools and services of Internet, procedure of opening e-mail accounts on internet, Online Booking systems - online Booking procedure of railways, airlines, tourist and religious places, hotels and entertainment industry, requirements of e-payment systems, transactions through Internet for Online banking.

b) Portal business and types of E-Commerce Portals.

c) Concept of supply chain, features, Types of supply chain, E-Supply chain components, E-supply chain process

COURSE/LEARNING OUTCOMES

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

CO1: Demonstrate an understanding of the foundations and importance of E-commerce.

CO2: Demonstrate an understanding of retailing in E-commerce by: analyzing branding and pricing strategies.

CO3: Analyze the impact of E-commerce on business models and strategy.

CO4: Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.

CO5: Describe the infrastructure for E-commerce.

CO6: Describe the key features of Internet, Intranets and Extranets and explain how they relate to each other.

CO7: Discuss legal issues and privacy in E-Commerce.

Suggested Readings

1. Kenneth C. Laudon, E-Commerce : Business, Technology, Society, Pearson
2. V. Rajaraman, Introduction to Information Technology, PHI Learning Private Limited, Delhi
3. S. J. Joseph, E-Commerce: an Indian perspective, PHI
4. Gary Schneider, Electronic Commerce, Thomson Publishing.
5. Pandey, Srivastava and Shukla, E-Commerce and its Application, S. Chand
6. Bharat Bhaskar, Electronic Commerce, TMH
7. Turban, King, Viehland & Lee, Electronic Commerce- A Managerial Perspective, Pearson.
8. Ravi kalakota & A.B. Whinston, Electronic Commerce- A Manager's Guide, Pearson.

CMCB0008: CORPORATE AND BUSINESS LAW

(3 credits - 45 hours)

Objective: *The Objective of this course is to introduce students to essential corporate and business laws and important provisions of the companies Act. Relevant case studies will be taken up to clarify the applications of these laws.*

Module I: Introduction to Corporate and Business Law (5 hours)

a) Introduction to Law, Categories of Laws and Law and ethics in business.
b) Company: Introduction, classes of companies, conversion of company, incorporation of company, memorandum of association, articles of association and doctrine of indoor management,.
c) Administration of Company Law [including National Company Law Tribunal (NCLT), Appellate Tribunal (NCLAT)

Module II: The Indian Contract Act, 1872 (11 hours)

a) Contract – meaning, characteristics and kinds
b) Essentials of valid contract - Offer and acceptance, consideration, contractual capacity, free consent, legality of objects.
c) Void agreements
d) Discharge of contract – modes of discharge including breach and its remedies.
e) Contingent contracts
f) Quasi – contracts

Module III: Mercantile Law (9 hours)

a) The Sale of Goods Act, 1930: Formation of the contract of sale, conditions and warranties, transfer of ownership and delivery of goods, unpaid seller and his rights.
b) The Limited Liability partnership Act, 2008: Introduction – covering nature and scope, essential features, characteristic of LLP, incorporation and differences with other forms of organization/business.

Module IV: The Information Technology Act 2000 (10 hours)

a) Definitions under the Act
b) Digital signature
c) Electronic governance
d) Attribution, acknowledgement and dispatch of electronic records
e) Regulation of certifying authorities
f) Digital signatures certificates
g) Duties of subscribers
h) Penalties and adjudication
i) Appellate Tribunal
j) Offences

Module V: Certain Provisions of the Companies Act, 2013 (6 hours)

a) Company Meetings: Meetings of shareholders and board; types of meeting, convening and conduct of meetings. Requisites of a valid meeting- notice, agenda, chairman, quorum, proxy, resolutions, minutes; postal ballot, meeting through video conferencing, e-voting.

b) Winding Up of a Company: Concept and modes of winding up, Liquidator, National Company Law Tribunal (NCLT), Appellate Tribunal (NCLAT), Special Courts.

Module VI: Goods and Services Tax (GST) Act, 2016 (4 hours)

a) Meaning, Definition of GST, Scope.

b) Levy of, and exemption from, tax- Levy and collection of central/state Goods and Services Tax, Composition Levy, Taxable person, Power to grant exemption from tax.

COURSE/LEARNING OUTCOMES

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

CO1: Explain what a company is and how it is formed. (*Comprehension*)

CO2: Illustrate the concepts related to The Indian contract Act, 1872. (*Comprehension*)

CO3: Explain the concepts related to the contract of sale. (*Comprehension*)

CO4: Describe Limited Liability Partnership and its difference with a company and Partnership. (*Comprehension*)

CO5: Illustrate the definitions under the Information Technology Act, 2000. (*Comprehension*)

CO6: State the meaning, definition and scope of the Goods and Services Act. (*Knowledge*)

Suggested Readings

1. Singh, Avtar, The Principles of Mercantile Law, Eastern Book Company, Lucknow.
2. Kuchhal M C, Business Laws, Vikas Publishing House, New Delhi
3. Tulsian P.C., Business Law, Tata McGraw Hill, New Delhi.
4. Sharma, J.P. and Sunaina Kanojia, Business Laws, Ane Books Pvt. Ltd., New Delhi.
5. Sharma, J.P. and Sunaina Kanojia, Vyavsayik Sanniyam, Delhi University Hindi Cell. Chadha P R Business Law, Galgotia Publishing Company, New Delhi
6. Maheshwari & Maheshwari, Business Law, National Publishing House, New Delhi.
7. Information Technology Rules 2000 with Information Technology Act 2000, Taxmann Publications Pvt. Ltd., New Delhi.
8. Gowar, LCB, Principles of Modern company Law, Stevens & Sons, London.
9. Hanningan, Brenda, Company Law, Oxford University Press, U.K.
10. Kuchhal M C, Corporate Laws, Shri Mahaveer Book Depot, New Delhi.
11. Sharma, J.P., An Easy Approach to Corporate Laws, Ane Books Pvt. Ltd., New Delhi
12. Ramaiya, A Guide to Companies Act, LexisNexis, Wadhwa and Buttersworth.
13. Kannal, S., & V.S. Sowrirajan, Company Law Procedure, Taxman's Allied Services (P) Ltd., New Delhi.
14. Singh, Harpal, Indian Company Law, Galgotia Publishing, Delhi.
15. Companies Act and Corporate Laws, Bharat Law House Pvt Ltd, New Delhi.
16. http://www.finmin.nic.in/reports/ModelGSTLaw_draft.pdf
17. https://www2.deloitte.com/content/dam/Deloitte/in/Documents/tax/in-tax-gst-in-india-taking-stock-noexp.pdf
18. http://www.cbec.gov.in/resources//htdocs-cbec/gst/draft-model-gst-law-25-11-2016.pdf;jsessionid=7AE09278F173096E0699162029F556B2
19. http://www.cbec.gov.in/htdocs-cbec/gst
20. http://www.cbec.gov.in/htdocs-servicetax/st-rules-home
21. http://www.lawcrux.com/goods-and-service-tax-gst.aspx
22. http://www.gstindia.com/gearing-up-for-gst-2017/

CMST0009: BUSINESS STATISTICS

(4 credits – 60 Hours)

Objective*: The objective of this course is to frame business problems in appropriate statistical terms in order use data to make better decisions. The course intends to develop critical and integrative thinking among students in order to communicate the results of the analysis clearly in the context of the problem.*

Module I: Introduction to Statistics (8 Hours)

a) Statistics: Meaning, Scope, Importance, Describing Characteristics by numbers, Information and Data, Processing information and use of statistical procedures, Statistical variables: Qualitative and Quantitative

b) Frequency Distribution and Graphs: Frequency, Frequency Distributions, Data Grouping: Discrete and Continuous, Introduction to Graphs, Graph for Qualitative variables, Graph for Quantitative variables, various types of graphs and diagrams.

Module II: Measures of Central Tendency and Dispersion (14 Hours)

a) Statistical Average: Mean, Median and Mode, Weighted Average, Geometric Mean, Harmonic Mean, Relative merits of Mean, Median and Mode in a distribution, Mean of two or more means

b) Measures of Dispersion: Range, Co-efficient of Range, Quartiles, Inter-Quartile Range and Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation.

Module III: Skewness, Kurtosis, Correlation and Regression (18 Hours)

a) Skewness and Kurtosis: Measures of Skewness - Absolute and Relative, Co-efficient of Skewness - Karl Pearson's, Bowley's and Kelly's; Moments and Moments based measures of Skewness (β_1)and Kurtosis (β_2)

b) Correlation: Introduction to Correlation, Karl Pearson's Co-efficient of Correlation, Interpretation of Correlation Co-efficient, Rank correlation coefficient.

c) Regression: Uses of Regression Analysis, Regression line and regression equations , Explained and Unexplained Variation, standard error of estimate, Multiple Regression

Module IV: Analysis of Time- Series and Index numbers (20 Hours)

a) Time Series: Definition and Distinction, Components of Time Series, Measurement of Trend – Free-hand, semi-average, moving average method, method of least square, measurement of seasonal variations.

b) Index Numbers: Definition, uses, Problems in the construction of index numbers, methods of construction index numbers – Simple Aggregative Method, Simple Average of Price relative Method, Weighted Index Numbers, Laspeyre's Method, Paasche's Method, Dorbish and Bowley's Method, Fisher's Ideal Index, Tests of Adequacy of Index Number Formulae.

COURSE/LEARNING OUTCOMES

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

CO1: Define the meaning and importance of Statistics. (*Knowledge*)

CO2: Distinguish between statistical variables – quantitative and qualitative. (*Knowledge*)

CO3: Investigate the properties of a data set presented as a histogram or a frequency polygon. (*Analysis*)

CO4: Compute different kinds of Statistical Averages like mean, median, mode. (*Application*)

CO5: Analyze the measures of dispersion and relate its significance in terms of averages. (Analysis)

CO6: Explain skewness and kurtosis and compute the same. (*Comprehension*)

CO7: Differentiate between correlation and regression and how to draw inferences out of the same. (*Analysis*)

CO8: Comprehend the difference between cross-section data and time-series data. (*Application*)

CO9: Summarize the different components of time-series and compute trend by using different methods of trend estimation. (*Synthesis*)

CO10: Prepare Price Indices and interpret the various methods of construction of price index. (*Evaluation*)

Suggested Readings

1. J. K. Sharma, Business Statistics, Pearson Education.
2. S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.
3. S.P. Gupta, Statistical Methods, Sultan Chand and Sons, New Delhi.
4. P.L. Hazarika, A Text Book of Business Statistics- Sultan Chand and Sons, New Delhi
5. Richard Levin and David S. Rubin, Statistics for Management, Prentice Hall of India, New Delhi.
6. M.R. Spiegel, Theory and Problems of Statistics, Schaum's Outlines Series, McGraw Hill Publishing Co.

CMAC0010: CORPORATE ACCOUNTING

(4 credits - 60 hours)

Objective: *The objective of this course is to acquire a conceptual background of the company form of accounts through corporate accounting and to understand the various techniques used for preparing various accounting and financial statements*

Module I: Introduction to Corporate Accounting (5 hours)

a) Concept of company and statutory account books.

b) Shares: Types of shares, structure of share capital, issue, forfeiture and re-issue of shares, issue of right shares and bonus shares and buy back of shares.

c) Debentures: Issue and redemption of debentures, redemption of preference shares.

Module II: Valuation and Reconstruction of a Company (15 Hours)

a) Valuation of goodwill and valuation of shares.

b) Accounting for internal reconstruction: meaning, alteration of share capital, reduction of share capital, accounting entries (excluding inter-company holdings and reconstruction schemes).

Module III: Accounting related to Amalgamation (15 hours)

a) Meaning and types of amalgamation; amalgamation in the nature of purchase and amalgamation in the nature of merger.

b) Methods of accounting for amalgamation - pooling of interest method and purchase, method, consideration, accounting treatment in the books of transferor and transferee companies as per accounting standard (as)-14.

Module IV: Accounting for Holding and Subsidiary Company (15 hours)

a) Preparation of consolidated balance sheet with one subsidiary company.

b) Relevant provision of accounting standard- 21(ICAI).

Module V: Final accounts (10 hours)

a) Preparation of trading and profit & loss account of a company

b) Profit and loss appropriation account and balance sheet of a company in accordance with the provisions of companies act, 2013.

COURSE/LEARNING OUTCOMES

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

CO1: Write the meaning and types of shares. (*Knowledge*)

CO2: Summarize the procedure of forfeiture and re-issue of company's shares. (*Comprehension*)
CO3: Solve redemption of company's debenture accounts. (*Application*)
CO4: Explain the valuation of goodwill and shares of a company. (*Comprehension*)
CO5: Outline the alteration and reduction of company's share capital. (*Analysis*)
CO6: Compute accounting problems related to amalgamation of companies. (*Application*)
CO7: Use methods of accounting for amalgamation of companies. (*Application*)
CO8: Prepare consolidated balance sheet of holding and subsidiary Companies. (*Synthesis*)
CO9: Formulate and evaluate trading, profit & loss account, profit & loss appropriation account and company's balance sheet. (*Synthesis*, *Evaluation*)

Suggested Readings

1. Monga, J. R. Fundamentals of Corporate Accounting, Mayur Paper Backs, New Delhi.
2. Maheshwari, S.N. & Maheshwari. S.K. Corporate Accounting, Bikash Publishing House, New Delhi.
3. Shukla, M.C. , Grewal, T.S. & Gupta, S.C. Advanced Accounts Volume-II, S. Chand & Co., New Delhi.
4. Ahmed. Naseem. Corporate Accounting, ANE Books Pvt. Ltd, New Delhi.
5. Gupta, Nirmal. Corporate Accounting, Sahitya Bhawan, Agra, UP
6. Jain. S.P. & Narang, K.L. Corporate Accounting, Kalyani Publishers New Delhi.
7. Gupta, R.L. & Radhaswamy. M. Advanced Accountancy Vol-II, S. Chand & Co., New Delhi.
8. Gupta, R.L. & Radhaswamy. M. Corporate Accounting Volume-I& II, S. Chand & Co., New Delhi.

CMMK0012: MARKETING MANAGEMENT

(4 credits – 60 Hours)

Objective: *This course addresses the management challenge of designing and implementing the best combination of marketing actions to carry out a firm's strategy in its target markets. Specifically, this course seeks to develop the students' skills in applying the analytic perspectives, decision tools, and concepts of marketing to decisions involving segmentation, targeting and positioning, product offering, pricing, distribution channels and marketing communications.*

Module I: Introduction (9 hours)

a) Introduction to marketing management: Nature, scope and importance of marketing, evolution of marketing concepts.
b) Marketing mix: Meaning, importance, marketing environment - macro and micro environmental factors.

Module II: Consumer Behaviour and Market Segmentation (12 hours)

a) Consumer Behaviour: Consumer buying process, factors influencing consumer buying decisions - an overview.
b) Market segmentation: Concept, importance and basis; target market selection; positioning concept - importance and basis; product differentiation vs. market segmentation.

Module III: Product (12 Hours)

a) Product: Meaning and importance; product classifications; concept of product mix; product life-cycle; new product development.
b) Product Specifications: Branding, packaging and labeling; after-sales services.

Module IV: Pricing and Distribution (13 Hours)

a) Pricing: Significance; Factors affecting price of a product; pricing policies and strategies.
b) Distribution: Channels of distribution - meaning and importance; types of distribution

channels; wholesaling and retailing; factors affecting choice of distribution channel; distribution logistics - meaning, importance and decisions.

Module V: Promotion and Recent Developments in Marketing Management (14 Hours)

a) Promotion: Nature and importance of promotion; promotion tools: advertising, personal selling, public relations and sales promotion – concept and their distinctive characteristics, communication process; promotion mix, factors affecting promotion mix decisions.

b) Recent developments in marketing: Social marketing; online marketing; direct marketing; services marketing; green marketing.

COURSE/LEARNING OUTCOMES

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

CO1: Enumerate the meaning and concept of management accounting. (*Knowledge*)
CO2: Paraphrase and apply accounting rations for analysis purpose. (*Comprehension*)
CO3: Apply the techniques of standard costing in variance analyses. (*Application*)
CO4: Distinguish between absorption and marginal costing. (*Application*)
CO5: Use marginal costing techniques for various decisions in business like- make or buy, own or lease, profit planning, shut down decision and exploring profitable market. (*Evaluation)*
CO6: Discriminate between cost, profit and investment centers of an organization. (*Analysis*)

Suggested Readings

1. Kotler, Philip & Gary Armstrong, 'Principles of Marketing', Prentice Hall.
2. Kotler, Keller, Koshi, Jha, 'Marketing Management – A South Asian Perspective', Pearson.
3. Ramaswamy, V. S. & S. Namakumari, 'Marketing Management', Macmillan.
4. Majaro, Simon, 'The Essence of Marketing', Prentice Hall, New Delhi.

CMFS0013: INDIAN FINANCIAL SYSTEM

(4 Credits-60 Hours)

Objective: *This course primarily deals with the Financial System of India. It will enable students to acquire a basic understanding of the structure, organisation and functioning of the financial system and will give an exposure to different financial instruments and their implications in the existing regulatory framework.*
The aims of this course are:

- *To understand and develop knowledge about evolution of the structure and constituents of the Indian Financial System*
- *To understand the role of different financial markets*

Module I: Financial System (10 hours)

Introduction to financial system, institutions, financial system design; market structure and its components, functions and economic significance; reforms in the financial system.

Module II: Financial Markets (15 hours)

a) Money Markets: Meaning, objectives, importance and characteristics.

b) Role of Reserve Bank of India and Commercial Banks in the Indian money market.

c) Capital Markets: Meaning, classification of capital markets, growth of stock exchange, functions of stock exchange, SENSEX, NIFTY, OTCEI (Over the Counter Exchange of India) and depositories.

d) Primary Market; Secondary Market; Derivatives Market; Debt Market.

Module III: Financial Instruments (10 hours)

a) Basic financial instruments; general issue, functional categories, maturity, currency, and type of interest rate
b) Proposed functional category and instrument breakdown
c) Investment, type of investments, assets, liabilities
d) IAS 32 financial instruments

Module IV: Financial Institutions (10 hours)

Development Financial Institutions: IDBI, IFCI, SIDBI, NABARD, NEDFi; management of NPAs, changes in NPAs provisioning norms, BASEL III norms; Mutual Fund and insurance; financial regulatory authorities.

Module V: Financial Services (10 hours)

Investment banking; depositories and custodians; credit rating; factoring and forfaiting; housing finance; leasing and hire purchase; merchant banking.

COURSE/LEARNING OUTCOMES

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

CO1: Outline the importance of Financial System for national economy. (*Knowledge*)
CO2: Explain financial system design and market structure. (*Comprehension*)
CO3: Distinguish between the financial systems structures of different nations. (*Analysis*)
CO4: Describe the role of Money Markets and Capital Markets. (*Comprehension*)
CO5: Comprehend the role of Reserve Bank of India in the Indian Financial System. (*Comprehension*)
CO6: Distinguish between different financial instruments and investment types. (*Analysis*)
CO7: Outline the functioning of development financial institutions. (*Analysis*)
CO8: Outline the BASEL III norms and the regulatory framework in the financial system. (*Analysis*)
CO9: Explain the functions of financial intermediaries. (*Comprehension*)

Suggested Readings

1. Pathak, Bharati; Indian Financial System, Pearson India
2. Gupta, Shashi K.; Aggarwal, Nisha & Gupta, Neeti, Indian Financial System, Kalyani Publishers-New Delhi
3. Vohra,M, Indian Financial System, Anmol Publication
4. Gordon, Natrajan, Financial Markets and Services, Himalaya Publication House, New Delhi.
5. Khan, M. Y; Indian Financial System,

CMBI0014: PRACTICE OF BANKING AND INSURANCE

(4 Credits: 60 Hours)

Objective: *The course is aimed at helping the students to get exposure in the operational environment in Banking, Insurance and other related firms in the financial service sector. The aims of this course are:*

- *To create professionals who are able to handle various financial activities associated with banking and insurance sector*
- *Exposure to banking and insurance products*

Module I: Banking (10 hours)

a) Introduction to Banking: concepts, definition, functions and types
b) RBI: Role of RBI and its functions
c) Commercial banks: Origin and Growth, Banking sector reforms, Global financial crisis and India’s banking sector
d) NBFCs, PDs, FIs,

e) Credit guarantee institutions

Module II: New Dimensions and Products in Banking (10 hours)

a) Operations of Banking: Cheques crossing, types and rules of crossing
b) Banks Advances: Types of advances and deposits in banks, secured versus unsecured advances, advance against various securities
c) Bank's Products: Credit cards, debit cards and smart cards, ATM card, stored-value card

Module III: E-banking (10 hours)

a) Era of Internet banking, Mobile Banking, Virtual Banking, Electronic Clearing System(ECS)
b) E-Payments, Plastic Money, Electronic Fund Transfer(EFT), E-money, Electronic Purse, Digital Cash
c) Critical Comparison of traditional banking methods and E-banking

Module IV: Introduction to Insurance (15 hours)

a) Insurance: Meaning and nature, purpose and need, principles of insurance, types of insurance, new insurance products, present state of insurance industry in India.
b) Legal Framework: Types of insurance- life and non-life, re-insurance, risk and return relationship, Essential Feature of Insurance Contracts and Salient Features of Insurance Act 1938 , IRDA Act 1999, Bancassurance

Module V: Risk (15 hours)

a) Basic concept of Risk – Kinds of Business Risks; Assessment and Transfer
b) Basic Principles – Principle of utmost Good faith Interest, Indemnity, Economic function,
c) Proximate Cause, Subrogation and Contribution; Types of Insurance; Reinsurance
d) Risk and Return Relationship; Need for Coordination

COURSE/LEARNING OUTCOMES

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

CO1: State and Describe the role of Commercial Banks. (*Knowledge*, *Comprehension*)
CO2: Explain the role of Credit Guarantee Institutions. (*Comprehension*)
CO3: Outline the new dimensions of banking. (*Analysis*)
CO4: Comprehend the operations of banking instruments. (*Comprehension*)
CO5: Differentiate between traditional banking and E-Banking. (*Analysis*)
CO6: Comprehend the concept of Insurance and Contract theory. (*Comprehension*)
CO7: Outline the rules of Insurance. (*Analysis*)
CO8: Explain the concept of risk. (*Comprehension*)

Suggested Readings

1. Agarwal, O.P, Banking and Insurance: Himalaya Publishing House
2. Saxena, GS. Legal Aspects of Banking Operations, Sultan Chand and Sons
3. Gupta, P.K. Insurance and Risk Management, Himalaya Publishing House
4. Suneja, H.R., Practical and Law of Banking, Himalaya Publishing House
5. Gupta, Shashi K.; Aggarwal, Nisha & Gupta, Neeti, Indian Financial System, Kalyani Publishers-New Delhi

CMTX0015: TAXATION

(4 Credits-60 Hours)

Objective: *This course is designed to enable students to gain knowledge of the provisions of tax laws and to apply it to various situations in actual practice.*

Module I: Tax Concept and Residential Status (7 hours)

a) Basic concepts: Income and Income Tax, person, assessee, assessment year, previous year, Permanent Account Number (PAN).

b) Residential status: Residential status of different types of companies, individual and firm.

Module II: Tax Planning and E-Filing (8 hours)

a) Tax planning: Concept of tax planning, types of tax planning, tax management, tax evasion, tax avoidance and difference between tax planning, tax evasion & tax avoidance.
b) E- Filing: Concept of e-filing, procedure of e-filing of returns, tools used in e-filing.

Module III: Computation of Income under Different Headings (20 hours)

a) Computation of income under the heading salaries and income from house property.
b) Computation of income under the heading profits and gains of business and profession, capital gains and income from other sources.

Module IV: Computation of Tax under GST (15 hours)

a) GST: Concept of GST, person liable to pay tax in GST, migration of the persons registered under earlier laws in GST.
b) Supply: Value of supply, place of supply, determination of supply in the course of inter-state trade or commerce or intrastate supplies.

Module V: Indirect Tax Laws (10 hours)

a) Central Excise Act, 1944 and the related rules, circulars and notifications, Central Excise Tariff Act, 1985 and the related rules.
b) Customs Act, 1962 and the related rules, circulars and notifications, Customs Tariff Act, 1975 and the related rules.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the concept of tax and residential status of different types of companies, individual and firm. (*Comprehension*)
CO2: State and Explain the concept of tax planning, tax evasion and tax avoidance. (*Knowledge*, *Comprehension*)
CO3: Demonstrate the procedure of e-filling of income tax returns. (*Application*)
CO4: Compute the total income of individual, HUF and company under different heads of income. (*Application*)
CO5: Estimate the concept of GST and the person liable to pay tax in GST. (*Application*)
CO6: Determine the value of supply under GST in course of inter-state trade. (*Application*)
CO7: Analyze the rules of Central Excise Act 1994, Central Excise Traffic act 1985 and Custom Act 1962. (*Analysis*)

Suggested Readings

1. Haldia, Arpit. GST Made Easy: Answer to all Your Queries on GST, Taxman's PVT. Ltd. New Delhi.
2. Singhania, Vinod K. and Monica Singhania. Students' Guide to Income Tax, University Edition. Taxmann Publications Pvt. Ltd., New Delhi.
3. Ahuja, Girish and Ravi Gupta. Systematic Approach to Income Tax. Bharat Law House, Delhi.
4. Pagare, Dinkar. Law and Practice of Income Tax. Sultan Chand and Sons, New Delhi.
5. V.S. Datey. Indirect Tax Law and practice, Taxmann Publications Pvt. Ltd., Delhi, Latest edition.

CMFR0016: FINANCIAL REPORTING

(4 Credits-60 Hours)

Objectives: This course is designed to

- *gain ability to analyze financial statements and financial reports of various types of entities.*
- *gain ability to apply valuation principles.*
- *familiarize with recent developments in the area of financial reporting.*

Module I: Indian Accounting Standards, IFRS & US GAAP (10 hours)

a) Accounting standards and its necessity; interpretations of accounting standards and guidance notes on various accounting aspects issued by the ICAI and their applications; understanding of US GAAP and applications of IFRS (International Financial Reporting Standards) and US GAAP.

b) Overview of International Accounting Standards (IAS)/International Financial Reporting Standards (IFRS), interpretations by International Financial Reporting Interpretation Committee (IFRIC) and significant differences vis-a-vis Indian Accounting Standards.

Module II: Corporate Financial Reporting and Reporting of Financial Instruments (10 hours)

a) Corporate Financial Reporting - Issues and problems with special reference to published financial statements.

b) Accounting and Reporting of Financial Instruments: Meaning, recognition, de-recognition, offset and measurement of financial instruments.

Module III: Financial Reporting by Mutual funds and Share Based Payments (10 hours)

a) Financial reporting by mutual funds, Non-Banking Finance Companies, merchant bankers, stock and commodity market intermediaries.

b) Share based payments and its role in financial reporting: Meaning, equity settled transactions, transactions with employees and non- employees.

Module IV: Valuation in Financial Reporting (15 hours)

a) Valuation of tangible fixed assets and valuation of intangible assets including brand valuation and valuation of goodwill.

b) Valuation of liabilities, shares and business.

Module V: Developments in Financial Reporting (15 hours)

Value Added Statement (VAS); Economic Value Added (EVA), Market Value Added (MVA), Shareholders' Value Added (SVA); Human resource reporting; Inflation accounting.

COURSE/LEARNING OUTCOMES

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

CO1: Define accounting standard (*Knowledge*)

CO2: Define IFRS (*Knowledge*)

CO3: State the importance of accounting standards and its interpretations in the field of accounting and reporting (*Comprehension*)

CO4: Describe in short the corporate financial reporting. (*Comprehension*)

CO5: Define financial instrument and its implications in the field of accounting and reporting. (*Knowledge*, *Comprehension*)

CO6: Describe recognition and de-recognition of financial instrument. (*Comprehension*)

CO7: State the methods of valuation of tangible fixed assets and intangible assets including brand valuation. (*Comprehension*)

CO8: State the principles and benefits of an effective performance management framework (*Knowledge*)

Suggested Readings

1. Vijay Kumar, M P. First Lessons in Financial Reporting, Snowwhite Publisher, Mumbai, Maharashtra.
2. Sekar, G. and Prasath, Saravana, Financial Reporting, Wolters Kluwer (India) Pvt. Ltd. Mohali – Chandigarh.
3. Sharma, Praveen. And Bhalla, Kapileshwar, Financial Reporting, Pooja law house, Delhi.
4. Tulsian, P.C. and Tulsian, Bharat, Financial Reporting, Paperback, New Delhi.
5. Sarada, Pawan. and Sharma, D. G. Financial Reporting, Paperback, New Delhi.

CMAA0017: AUDIT AND ASSURANCE

(4 Credits- 60 Hours)

Objectives: To understand the concept of audit and auditing and its practical application in the field of business. The learning outcome is to enable students to gain working knowledge of generally accepted audit and auditing procedures and principles, techniques and skills needed to apply them in audit and attestation engagements.

Module I Fundamental concepts of Audit (15 hours)

Nature of auditing; basic concepts in auditing: auditor's independence, true and fair, audit evidence, types of audit evidence, audit procedure to obtain audit evidence, accounting policies; preparation of audit: audit engagement, audit documentation and audit sampling.

Module II Internal Control (15 hours)

Meaning and definition of internal control; types of control and audit approach, impact of control, regulations of international financial control; internal audit; appointment of internal auditor; audit risk; audit in automated environment: key features, impact of IT related risk.

Module III Vouching in Audit (15 hours)

Meaning and definition; audit of cash transactions; general considerations in vouching; internal control in respect of trading transactions; international control in respect of service; cut off arrangements in audit and balance sheet audit; verification of assets and liabilities; special audit of government expenditure.

Module IV Company Audit (15 hours)

Audit of shares; eligibility, qualifications and disqualifications of auditors; appointment of auditors; removal of auditors; remuneration of auditors; powers and duties of auditors; branch audit; joint audit.

Companies Act 2013: reporting requirements, other provisions relating to audit and auditors, audit of banks: statutory and internal; audit of other entities.

COURSE/LEARNING OUTCOMES

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

CO1: Define audit and auditing. (*Knowledge*)
CO2: Describe audit evidence (*Comprehension*)
CO3: Enumerate the types of audit evidence (*Knowledge*)
CO4: State the procedure to obtain audit evidence (*Comprehension*)
CO5: State the accounting policies for audit (*Comprehension*)
CO6: Explain in brief the audit engagement (*Comprehension*)
CO7: Illustrate with example the audit documentation (*Application*)
CO8: Define internal control of audit and its type. (*Knowledge*)
CO9: State the regulations of international financial control (*Knowledge*)
CO10: Describe with example about vouching in audit (*Comprehension*)
CO11: Differentiate between internal and external audit (*Application*)

CO12: State the procedure of appointment and removal of auditors; (*Knowledge*)
CO13: Differentiate between audit risk and business risk (*Analysis*)
CO14: Demonstrate with example the IT related risk in auditing (*Application*)
CO15: Demonstrate with an example about the Companies Act 2013: reporting requirements, and other provisions relating to audit and auditors. (*Application*)

Suggested Readings

1. Garg, Pankaj, Auditing & Assurance, Taxmann Publications Pvt. Ltd.
2. Bansal, Surbhi, Auditing and Assurance, Bestword Publication.
3. Garg, Kamal, "Professional Approach to Advanced Auditing", Bharat Law House Pvt Ltd.
4. Garg, Kamal, "Systematic Approach to Auditing & Assurance", Bharat Law House Pvt Ltd.
5. Oswal, Vikash, "Simplified Approach to Auditing And Assurance", A Wolters Kluwer Business.

CMGR0018: GOVERNANCE, RISK AND ETHICS

(4 Credits- 60 Hours)

Objectives: To make the students competent in their respective professional fields and make them ethical in their approach and globally acceptable. The learning outcomes include:

- *To identify issues usually addressed by corporate governance structures in India.*
- *To identify the other drivers of governance, such as government, legislation etc.*

Module I Governance and Corporate Governance (12 Hours)

a) Meaning of governance, need for governance, basic features of good governance, role of codes in ensuring good governance.
b) Meaning of corporate governance, identify the need for corporate governance, its features, good corporate governance practices.

Module II Principles and theories of Corporate Governance (10 Hours)

Corporate Governance Code, Principles of Corporate Governance, Theories of Corporate Governance, Corporate Governance in India, Corporate Governance and its obligations towards stakeholders.

Module III Understanding Business Risk (10 Hours):

The concept of business risk, risk vs uncertainty, types of risk and its management, risk and reward, approaches to risk.

Module IV Risk Management and Control (13 Hours)

Risk management and its objectives, risk management by individuals, process of risk management by individuals, risk management process; Legislative framework for control of risk.

Module V Introduction to Ethics (15 Hours)

a) Fundamentals of ethics and morality, moral standards, moral development and moral reasoning; goal conflict: personal and organizational.
b) Concepts of human values and professional ethics; importance of human values at workplace, meaning of professional ethics and personal ethics, significance of professional ethics.
c) Concepts of business ethics; principles and perspectives of business ethics.

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:
CO1: Define governance, corporate governance, risk and ethics. (*Knowledge*)
CO2: Explain the features of good governance practices, risk management & its objectives (*Comprehension*)

CO3: Describe the principles and theories of corporate governance and business ethics. (*Comprehension*)

CO4: Analyze the risk management and control methods; concepts of business ethics (*Analysis*)

CO5: Formulate approaches to risk, moral development and moral reasoning (*Synthesis*)

CO6: Evaluate legal framework for control of risk and importance of human values at work place. (*Synthesis*)

Suggested Readings

1. Dr. S.S. Khanka; Business Ethics and Corporate Governance; 1st edition, published by S. Chand.
2. Paul Hopkin, Fundamentals of Risk Management: Understanding, Evaluating and Implementing
   a. Effective Risk Management, 4th edition, published by Kogan Page Limited, U.K.
3. James M. Childs; Ethics in Business: Faith at Work;
4. William H. Shaw, Vincent Barry; Moral Issues in Business, 13th Edition; Published by Cengage Learning.

CMFG0019: FINANCIAL MANAGEMENT

(4 Credits- 60 Hours)

Objectives: To familiarize the students with the principles and practice of financial management.

- *Apply the fundamental concepts and tools of finance.*
- *Apply financial management concepts and tools to the decisions faced by a manager in investment decisions.*
- *Appraise the risk profile of firms; specifically, estimate the costs of capital, including debt and equity capital, using financial data. And the learning outcomes include,*
- *Apply and critically evaluate finance and investment theory. Apply and critically evaluate corporate finance techniques;*
- *Apply and critically evaluate theories of financial statements and related analysis.*
- *Identify, define and analyse problems and identify and create process to solve them;*
- *Exercise critical judgement in creating new understanding.*

Module I Fundamentals of Financial Management (10 hours)

Introduction to financial management, Scope of finance, Profit maximisation vs Wealth maximization; Time value of money: Determination of present value for - annuity, single cash flow, growing cash flow; Present value of an uneven cash flow; Concept of Net Present value (NPV); Concept of Internal Rate of Return (IRR); NPV vs IRR.

Module II Capital budgeting (8 hours)

Nature of Investment decision, Importance of Capital Budgeting, Capital Budgeting Process – Investment criterion, Pay-back period, Rate of Return(ROR), Discounting Cash Flow method, Cost-benefit ratio method.

Module III Financial Statement Analysis (20 hours)

Introduction to financial analysis; Nature of financial analysis; Liquidity ratios; Leverage ratios; Efficiency ratios; Profitability ratios; DuPont Analysis; Limitations of ratio analysis; management of retained earnings; Case study: Inter-firm analysis.

Module IV Valuation of Equity (14 hours)

Introduction to equity valuation; Capital Asset Pricing Model (CAPM); Beta estimation; Cost of equity; Cost of debt; Weighted average cost of capital (WACC); Valuation models – Discounted Cash Flow model, Dividend discount model; Case Study: Initiation coverage report of a stock exchange traded company.

Module V Valuation of Bonds (8 hours)

Introduction to bonds; Features of a bond; Bond values and Yield; Factors affecting bond yield; Yield to maturity; Present value of a bond; Introduction to term structures of interest rates.

COURSE/LEARNING OUTCOMES

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

CO1: Differentiate between the concepts of Profit maximisation and Wealth maximisation. (*Analysis*)

CO2: Apply the concept of Time Value of Money to solve for Present Value and Future Value of a series of Cash Flow. (*Application*)

CO3: Calculate the Net Present Value and Internal Rate of Return for investment projects. (*Application*)

CO4: Apply different capital budgeting methods to evaluate the suitability of an investment proposal. (*Evaluation*)

CO5: Calculate various financial ratios to perform a thorough financial analysis of a publicly listed company. (*Application*)

CO6: Apply *the* Discounted Cash Flow method to formulate the valuation of a publicly listed company. (Synthesis)

CO7: State and comprehend the features of a Bond. (*Knowledge*, *Comprehension*)

CO8: Compute the Present Value of a Bond. (*Application*)

Suggested Readings

1. Khan, M.Y. and P.K. Jain, Financial Management: Text and Problems, Tata McGraw Hill
2. Horne, Van; James C., John Wachowicz, Fundamentals of Financial Management, Pearson Education
3. Singh, Surender and Kaur Rajeev. Basic Financial Management, Mayur Paper Book Noida
4. Singh, J.K. Financial Management-text and problems, 2 nd edition, Dhanpat Rai and Company, Delhi
5. Rustagi, R.P., Financial Management, Galgotia Publishing Company
6. Pandey, I M. Financial Management, Vikas Publications

CMBL0020: BANKING LAW AND PRACTICE

(4 credits-60 hours)

Objectives: To familiarize the students with the banking laws and best practices in the banking industry and to navigate the various overlapping legal and regulatory regimes applying to banks and bank holding companies. The learning outcomes include

- *Able to critically compare the bank regulatory system operating in India with other countries.*
- *To develop a clear understanding and knowledge about the functioning of a Commercial bank.*
- *To develop their understanding and expertise in various matters relating to operations of a commercial bank in India and other countries.*

Module I Overview of Banking system and regulatory framework (15 hours)

Indian banking system; Reserve Bank of India; Commercial Banks; Co-operative banking system; Reserve Bank Act 1934; Reserve Bank Act 1949; Setting up a new bank; New Bank licensing policy 2013; Brach Licensing; Cash Reserve Ratio; Statutory Liquidity Ratio(SLR); Corporate governance in Banks; Prevention of Money laundering Act, 2002: Fraud- Classification and Reporting.

Module II Aspects of Banking operations (15 hours)

Legal aspects of a Cheque, Definition of a Cheque, Different Types of Cheques, Crossing of a Cheque; Safe Deposit Locker/Safe Custody Article Facility; Principles of Lending, Credit Worthiness of Borrowers, Collection of Credit information, Cash Credit, Overdrafts, Bills Finance, Term Loans, Bank Guarantee, Bank Guarantee: Precautions; Letters of Credit; Categories Under Priority Sector

Module III International Banking management (15 hours)

International Banking Overview; Evolution of International Banking, Bretton Woods Conference; Bank for International Settlement (BIS); Basel norms; Legal Issues in international Banking Transactions, Syndicated Credit – Important Features; International Laws – Application in international Banking Scenario; International Banking Operations Management; Risk Management in international Banking, FOREX Markets – Features & Issues; Special Issues: Technology and international Banking, Globalization and International Banking: Important aspects, Financial Innovations in International Banking

Module IV Ethics and Corporate Governance in Banks (15 hours)

Ethics – An Overview, Ethical and Unethical Issues; Business Ethics; Code of Ethics; Ethical aspects in Human Resource Management; Ethical aspects in Marketing Management; Ethical aspect in Financial Management; Desired Ethical Practices and Corporate Governance; Corporate Social; Responsibility in the Financial Sector ; Role of the Board of Directors; Role of Chairman and/or CEO; Compliance officer

COURSE/LEARNING OUTCOMES

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

CO1: Define and explain the bank regulatory system operating in India. (*Comprehension*)
CO2: Explain the functioning of the Reserve Bank of India and the key Acts related to it. (*Comprehension*)
CO3: Describe the functions of Commercial Banks and Co-operative Banks. (*Comprehension*)
CO4: Define and comprehend the different banking instruments like Cheques, Overdrafts, Letter of Credit. (*Knowledge*, *Comprehension*)
CO5: Explain the principles of lending. (*Comprehension*)
CO6: Describe the functions of the Bretton Woods Institutions. (*Comprehension*)
CO7: Comprehend the applicable International Laws in banking transactions. (*Comprehension*)
CO8: Outline the ethical issues and their implications in Banking. (*Analysis*)

Suggested Readings

1. M.L.Tannan, revised by : Banking Law and Practice, Wadhwa & Company, Nagpur C.R. Datta & S.K.Kataria
2. A.B. Srivastava and : Seth's Banking Law, Law Publisher's India (P) Limited K. Elumalai
3. R.K. Gupta : BANKING Law and Practice in 3 Vols.Modern Law Publications.
4. Prof. Clifford Gomez : Banking and Finance - Theory, Law and Practice, PHI Learning Private Limited
5. J.M. Holden : The Law and Practice of Banking, Universal Law Publishing.

CMCA0021: COST ACCOUNTING

(4 Credits-60 Hours)

Objectives: To understand the basic concept of cost, costing and cost accounting, its tools and techniques used to determine costs and production cost. Also, the learning outcomes are

- *To be able to interpret cost accounting statements.*
- *To be able to analyze and evaluate information for cost ascertainment, planning, control and decision making.*

- *To enable students to understand and interpret the cost related information provided in the accounting statement for key decision making purpose.*

Module I Introduction to Cost Accounting (15 hours)

Meaning and definition- cost, costing, cost accounting; classification of costs; scope and objectives of cost accounting; advantages and disadvantages of cost accounting; installation of costing system; difference between cost control and cost reduction; difference between cost accounting, management accounting and financial accounting.

Module II Ascertainment of Costs (15 hours)

Material cost- procurement and procedures in respect of receipts and issue of stock, stock verification, techniques of inventory control.

Labour cost- attendance and payroll procedures, Charging of labour cost, work orders remuneration systems, incentive schemes; direct expenses; overhead expenses; elements of cost; preparation of cost sheet.

Module III Methods of Costing (15 Hours)

Single output/unit costing; job costing- meaning of job costing, job cost cards and databases, collecting direct costs of each job, attributing overhead costs to jobs, applications of job costing; activity based costing; batch costing; contract costing- contract costing progress payments, escalation clause, contract accounts, accounting for material, accounting for plant used in a contract, contract profit and balance sheet entries; process/operational costing and costing of service sector.

Module IV Standard Costing and Budgetary Control (15 Hours)

Standard costing- setting up of standards, types of standards; variance analysis- material cost variance, labour cost variance; overhead variance; break-even analysis, budget and budgetary control- meaning of budget, essential of budget, budget manual, budget setting process, preparation of budgets and monitoring procedures, use of budget in planning and control, flexible budget preparation of functional budget for operating and non operating functions, cash budget, master budget, zero based budgeting, Bureau of Industrial cost and price.

COURSE/LEARNING OUTCOMES

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

CO1: Enumerate different types of cost. (*Knowledge*)
CO2: Differentiate between cost control & cost reduction. (*Comprehension*)
CO3: Compute material, labour and overhead expenses. (*Application*)
CO4: Describe different methods or techniques used in costing. (*Comprehension*)
CO5: Outline the concept of material, labour and overhead variances. (*Analysis*)
CO6: Prepare and evaluate different types of budgets like – cash, functional, master and zero based budget. (*Synthesis*, *Evaluation*)

Suggested Readings

1. Jain, S and Narang, K., “Advanced Cost Accounting”, Kalyani Publisher.
2. Saxena, V and Vashist, C.(4th ed), “Advanced Cost & Management Accounting’, Sultan Chand & Sons.
3. Inamdar, S. M. (14th ed), “Cost & Management Accounting”, Everest.
4. Kishore, R. M. (4th ed), “Cost & Management Accounting”, Taxman Allied Service.
5. Jawahar, Lal(3rd ed), “Cost Accounting”, TMH.

CMED0022: ENTREPRENEURSHIP DEVELOPMENT

(3 Credits-45 Hours)

Objectives: To introduce the students to the concept and characteristics of entrepreneurship, define entrepreneurial skills and their use in a variety of situations, examine the personal skills of the students. The learning outcome, is to enable students, to define the concept of entrepreneurial opportunity and help them to develop criteria to judge which situation would turn to be as an opportunity worth developing into a venture and explain the formal venture planning process and preparation of business plans considering the market, technical, financial and legal requirements

Module I Introduction to entrepreneurship (10 hours)

a) Meaning and qualities of an entrepreneur, entrepreneurship: meaning and factors influencing entrepreneurship, entrepreneurship and economic development, Intrapreneurship and entrepreneurship, Cultural entrepreneurship, international entrepreneurship, netpreneurship, ecopreneurship, and social entrepreneurship.
b) Evolution and theories of entrepreneurship development, entrepreneurial competencies influencing an Entrepreneur,

Module II Entrepreneurial Opportunities and Assessment Tools (12 hours)

a) Entrepreneurial opportunities; entrepreneurial opportunities in a number of commercial and non-commercial situations. Case analysis. Assessment tools for an entrepreneur: Achievement Motivation Training, Self-Rating, Thematic Apperception Test.
b) Idea generation – sources and methods, environmental scanning and SWOT analysis, Innovation and creativity in entrepreneurship.
c) Concept of business groups and role of business houses and family business in India.The contemporary role models in Indian business: their values, business philosophy and behavioural orientations.

Module III Project Analysis and Appraisal (10 hours)

a) Preliminary Project appraisal methods - Selecting the right opportunity, market survey and research, techno-economic feasibility, financial feasibility- sources of finance – identify various sources of capital, ways to access the capital, role of government and government agencies.
b) Designing business processes, location, layout, operation, planning & control; preparation of project report (various aspects of the project report such as size of investment, nature of product, market potential etc. may be covered). Project submission/ presentation and appraisal thereof by external agencies, such as financial/non-financial institutions

Module IV (5 hours)

Creating the business model: business plan preparation. Small Enterprises – definition, classification – characteristics, forms of business ownership structures and determining situations beneficial from each type of ownership. Case analysis

Module V Strategy for Development of Business Plans (8 hours)

a) Mobilizing resources for start-up: Accommodation and utilities. Preliminary contracts with the vendors, suppliers, bankers, principal customers and the aspects of contract management. Basic startup problems
b) Break-even analysis, recognize the common causes of failure of business ventures, how to deal with seven business crisis- planning for survival and growth.
c) Corrective Measures – government policy and schemes for small scale enterprises – growth strategies in small industry: expansion, diversification, joint venture, merger and sub-contracting.
d) Final outcome: feasibility report preparations

COURSE/LEARNING OUTCOMES

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

CO1: Define the meaning of entrepreneurship and its relation with problem-solving. (*Knowledge*)
CO2: Identify and explain entrepreneurial opportunities. (*Comprehension*)
CO3: List various entrepreneurial opportunities in a number of commercial and non-commercial situations. (*Knowledge*)
CO4: Construct various preliminary project appraisal methods like market survey, techno-economic feasibility, and financial feasibility. (*Synthesis*)
CO5: Identify the types of regulatory systems and predict their effects on the creation of entrepreneurial venture. (*Analysis*)
CO6: Create the business model and prepare business plans. (*Application*, *Synthesis*)
CO7: Recognize and assess the expected life of a venture and use of break-even analysis. (*Evaluation*)
CO8: Recognize the common causes of failure of business ventures. (*Analysis*)
CO9: Summarize how to deal with seven business crisis and planning for survival and growth. (*Synthesis*)

Suggested Readings

1. John Legge and Kevin Hindle, "Entrepreneurship- Context, vision and planning", Palgrave Macmillan.
2. Entrepreneurship Development Institute of India, "Handbook for New Entrepreneurs", Oxford University Press.
3. V. G. Patel, "When the Going Gets Tough – Strategic responses to Business Crisis", Tata McGraw Hill Publishing Company Limited.
4. Dr.Vasant Desai, "Small scale industries and entrepreneurship", Himalayan Publishing House.
5. Dr.Vasant Desai, "Management of small scale industries", Himalayan Publishing House.
6. William Bolton, "The University Handbook on Enterprise Development", Columbus.

CMES0023: ENTREPRENEURSHIP (AUDIT COURSE)

Objective: *The objective of the course is to introduce students to the concept of entrepreneurship, entrepreneurial skills and their use in a variety of situations. The students are examined on the personal skills to help them define entrepreneurial opportunity and are taught to develop a criteria to judge a situation to develop into a venture, plan and prepare business plans considering the market, technical, financial and legal requirements.*
The various topics that are generally covered in the course are:

- *Meaning of entrepreneur and entrepreneurship and its relation with problem-solving, characteristics of an entrepreneur, factors influencing entrepreneurship*
- *Identify and explain entrepreneurial opportunities, generating a list of entrepreneurial opportunities in a number of commercial and non-commercial situations*
- *Preliminary Project appraisal methods - Selecting the right opportunity, market survey and research, techno-economic feasibility, financial feasibility- sources of finance – identify various sources of capital, ways to access the capital. Legal environment – identify the types of the regulatory systems and predict their effects on the creation of the entrepreneurial venture, role of government and government agencies.*
- *Creating the business model – business plan preparation.*
- *Recognize and assess the expected life of a venture, break-even analysis, recognize the common causes of failure of business ventures, how to deal with seven business crisis- planning for survival and growth.*

CMHR0024: FUNDAMENTALS OF HUMAN RESOURCE MANAGEMENT

(4 Credits- 60 hours)

Objectives: This course aims at imparting to students relevant knowledge, principles and practices of human resource management so as to make them competent contributors in the workforce, ready to occupy managerial and administrative positions in various organisations.

Module I Introduction to HRM (12 Hours)

Human Resource Management: concept, nature, importance and functions; competencies of HR manager; organization of HR department; HR policies; evolution of HRM; emerging challenges of human resource management like workforce diversity, downsizing, work life balance, virtual organization and outsourcing.

Module II Introduction to Staffing (12 Hours)

Meaning of staffing, nature and functions of human resource management, manpower planning, concept, importance and process of staffing, factors affecting staffing, job description, job specification, Job analysis, and job evaluation.

Module III Acquisition and Development of Human Resource (12 Hours)

Selection, training and development, placement and induction process, compensation and maintenance of employees, retention management, career planning and development, promotion, transfer.

Module IV Introduction to Performance Management and Performance Appraisal (12 Hours)

Performance Management: Definition, evolution, aims, purpose, challenges and differentiation of terms related to performance management, importance, linkage of performance management to other HR processes.

Performance Appraisal: concept, definition, purpose, characteristics, importance and challenges; process of performance appraisal.

Module V Introduction to Compensation Management and Human Relations (12 Hours)

Compensation Management: Meaning of compensation, wage and salary, wage and salary administration, incentive plans and fringe benefits.

Human Relations: Human Relations: definition, objectives and approaches to human relations, employee grievances and discipline.

COURSE/LEARNING OUTCOMES

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

CO1: Develop, implement, and evaluate organizational development strategies aimed at promoting organizational effectiveness.

CO2: Collaborate with others, in the development, implementation, and evaluation of organizational and health and safety policies and practices.

CO3: Present and evaluate communication messages and processes related to the human resources function of the organization.

CO4: Facilitate and communicate the human resources component of the organization's business plan.

Suggested Readings

1. V S P Rao, Human Resources Management, Excel Publication
2. C B Mamoria Personnel Management , Himalaya Publication
3. Singh, K. and Duggal, B.R. Human Resource Management, Sun India Publications, Delhi. Chhabra, T.N. Human Resource Management, Dhanpat Rai & Co., Delhi.
4. De Cenzo D.A. and Robin S.P, Personnel/Human Resource Management, McGraw Hill.
5. Ashwatappa, K., Human Resource Management, TMH,

6. Parweek, U. and Rao T.V,, Designing and Managing Human Resource Systems, Anmol Publishers.
7. Dessler, G. Human Resource Management, Pearson Publications
8. Patnayak, B., Human Resource Management, PHI 3IE.

CMCO0025: CAPITAL MARKET OPERATIONS

(4 Credits-60 Hours)

Objectives:

- *To provide expert knowledge in the legislations, rules and regulations governing the capital market.*
- *To provide the basic ideas about the functioning of primary and secondary financial markets in India.*

Module I: Securities Laws (12 Hours)

Objectives of the SCR Act, Rules and Regulations made there under; Rules relating to Public Issue and Listing of Securities under Securities Contracts (Regulation) Rules, 1957; Securities and Exchange Board of India Act, 1992: Objective; Powers and functions of SEBI; Securities Appellate Tribunal; Penalties and appeals; Depositories Act.

Module II: Primary Market (18 Hours)

Capital Market Investment Institutions-Domestic Financial Institutions(DFI), Qualified Institutional Buyers(QIB), Foreign Portfolio Investors (FPI), Private Equity, Venture Capital, Capital Market Instruments- Equities, Preference Shares, Shares with Differential Voting Rights, Corporate Debt, Non-Convertible Debentures(NCD), Partly, Fully and Optionally Convertible Debentures, Bonds, Foreign Currency Convertible Bonds(FCCB), Foreign Currency Exchangeable Bonds (FCEB); Indian Depository Receipts (IDR), Global Depository receipts(GDRs).

Module III: Secondary Market (15 Hours)

Development of Stock market in India; Stock market & its operations, Trading Mechanism, Block and Bulk deals, Grouping, Basis of Sensex, Nifty; Suspension and Penalties; Risk management in Secondary market, Impact of various Policies on Stock Markets such as Credit Policy of RBI, Fed Policy, Inflation index, CPI, WPI.

Module IV: Securities Market Intermediaries (15 Hours)

Primary Market and Secondary Market Intermediaries: Role and Functions; Merchant Bankers, Stock Brokers, Syndicate Members, Registrars and Transfer Agents, Underwriters, Bankers to an Issue, Portfolio Managers, Debenture Trustees, Investment Advisers, Research Analysts, Market Makers, Credit Rating Agencies; Internal Audit of Intermediaries by Company Secretary in Practice.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the securities laws related to capital market.
CO2: Explain the domestic and qualified financial institutions.
CO3: Compare the primary and the secondary market.

Suggested Readings

1. Gordon, E & Natarajan, K., "Capital Market in India", Himalaya Publishing House", Mumbai.
2. Aggarwal, Sanjeev., "Guide to Indian Capital Market", Bharat Law House, New Delhi.
3. Khan, M. Y, " Indian Financial System", Tata McGraw Hill, New Delhi.
4. Gupta, S. K. & Agarwala, N.," Financial Institutions and Markets ; Kalyani Publishers', New Delhi.

CMPI0026: FINANCIAL PLANNING AND INVESTMENT

(3 Credits-45 hours)

Objective: *This course introduces to give knowledge on Setting financial goals and develop a financial plan to apply time value of money principles to personal financial decisions to Prepare a personal budget o Choose a financial institution appropriate for.*

Module I: Introduction to Financial Planning (10 hours)

The process financial planning, Client interactions, Time value of money applications, Personal financial statements, Cash flow and debt management, planning to finance education

Module II: Risk Analysis & Insurance Planning (8 hours)

Risk management and insurance decision in personal financial planning, Various Insurance Policies and Strategies for General Insurance, Life Insurance, Motor Insurance, Medical Insurance.

Module III: Investment Planning (15 hours)

Risk Return Analysis, Mutual Fund, Derivatives, Asset Allocation, Investment strategies and Portfolio construction and management.

Module IV: Tax Planning (12 hours)

Income-tax computation for Individuals, Companies, Trusts and other bodies. Statutory provisions pertaining to Capital Gains and indexation, House Property, Deduction and Allowances, Non Resident Indian tax laws, and Tax Management Techniques

COURSE/LEARNING OUTCOMES

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

CO1: Demonstrate a general understanding of the business environment (including business management, marketing, accounting, financial planning and investment).

CO2: Apply functional knowledge of financial planning and investment to conduct investment planning, estate planning and for an individual client.

Suggested Readings

1. Singhanar V.K: Students' Guide to Income Fax; Taxmann, Delhi.
2. Prasaci, Bhagwati: Income Tax Law & Practice: Wiley Publication, New Delhi,
3. Girish Ahuja and Ravi Gupta: Systematic approach to income tax: Sahitya Bhawan Publications, New Delhi.
4. Ranganathan and Madhumathi: Investment Analysis and Portfolio Management: Pearson,New Delhi
5. George Rejda: Principles of Risk Management and Insurance: Pearson, New Delhi

SPECIALISATION: INTERNATIONAL ACCOUNTING AND FINANCE

CMRP0027: CORPORATE REPORTING

(4 Credits- 60 Hours)

Objectives: *The Objectives of this course*

- *To know the use and application of Indian and international accounting standards.*
- *To learn the accounting treatment of different business combination situation.*
- *To learn the external reporting of financial institutions.*

Module I: Evolution and Convergence of International Accounting Standards (5 Hours)

GAAP in India, Hierarchy of GAAP in India; International Financial Reporting Standards (IFRSs); Relative view of AS and IFRSs; Accounting Standards (AS) – applicability, Interpretation, scope and compliance.

Module II: Accounting for Business Combinations (As Per Indian As) (10 Hours)

Relevant Terms, Types of merger, methods of accounting, treatment of Goodwill arising on merger, Purchase consideration and settlement; Accounting in books of vendor/ transferor company; Accounting for investment in subsidiary; Corporate financial restructuring; Reconstruction schemes, De-merger.

Module III: Group Financial Statements (15 Hours)

Consolidation of foreign - holding Company, Subsidiary Company and Associate Company including multiple sub subsidiaries; Consolidation procedures - Minority interest, Goodwill, Treatment Pre - acquisition profit and Post -acquisition profit and concept of Fair value at the time of acquisition; Treatment of investment in associates in consolidated financial statements.

Module IV: Sustainability Reporting and Share Based Payments (15 Hours)

Concept of Triple Bottom Line Reporting; Global Reporting Initiative (GRI); International Federation of Accountants (IFAC) .

Share Based Payments: Meaning, Equity settled transactions, Transaction with employees and non-employees; Determination of fair value of equity instruments; Vesting conditions, Modification, cancellation and settlement, Disclosures.

Module V: Accounting and Reporting of Financial Instruments and Other External Reporting (15 Hours)

Meaning, recognition, de-recognition and offset, compound financial instruments; Measurement of financial instruments; External Reporting under capital market regulations, Disclosures; Annual Reports - Statutory requirement and External report, Preparation of Financial Information.

COURSE/LEARNING OUTCOMES

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

CO1: Outline the different accounting standards.
CO2: Distinguish different types of merger and acquisition.
CO3: Formulate the consolidated financial statement.

Suggested Readings

1. Stolowy, H., “Corporate Financial Reporting”, Thompson Business, New Work.
2. Lodha, R., “Corporate Financial Reporting”, Lowpoint Publications, New Delhi.
3. Tulsian, P. C., “Corporate Financial Reporting”, S Chand & Co.”, New Delhi.

CMAY0028: BUSINESS ANALYSIS

(4 credits– 60 hours)

Objective: *The objective of this course is to make the students learn the basic concepts in Business Analysis. The course will increase the all round knowledge of the students and enhance their understanding of the business environment and build their professional competence in the workplace.*

Module I: Business Environment: Concept, Components and Importance (8 Hours)

Business Environment: Concept, Components and importance; Indian Business Environment; Economic trends (overview): National Income, sector wise analysis.

Module II: Government and Business (12 Hours)

Govt. budget and its impact on business; influence of inflation, interest, money supply and level of savings on business activities. The interrelationship between government and business, Role of the Government as a regulator, promoter, entrepreneur, educator of business ideas; Government’s role in changed environments. Government policies on business-Industrial Policy Resolutions and statement; Industrial Development and

Regulation Act 1951; Industrial licensing-Critical analysis; Fiscal and monetary policy; Public Private Partnership Model.

Module III: International Business Environment (12 Hours)

a) Role of multinational companies, WTO, IMF and World Bank in world economy; Tariffs, Subsidies and Import quotas; Government Intervention in Formulating Trade policies - International trade relations;

b) International trading environment (overview); Trends in world trade and problems of developing countries; Foreign trade and economic growth; International/ Regional economic institutions: SAFTA, SAARC, ASEAN.

Module IV: Foreign Trade Policies and Investment (12 Hours)

Foreign trade-policies and plans; Control of foreign trade; EXIM policy and other recent export promotional measures; foreign investment-need and importance; types of foreign investment; its implication on domestic economy; foreign investment policy in India, technical foreign collaboration.

Module V: Business Scenario in North East Region (12 Hours)

Special package for economic development of north eastern region; DONER and its role in economic development; infrastructure and industry; North East Industrial Policy-promotional measures for cross-border trade; Role of NEC and NEDFI; Problems and prospects of the industry in Assam, Brief study of the tea industry, paper industry, food processing industry, silk industry and bell metal industry; tourism industry; industrial and investment policies in NE.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the concept of business environment.
CO2: Explain the interrelationship between government and business.
CO3: Describe the constituents of International Business Environment.
CO4: Explain foreign trade policies and need and importance of foreign investment.
CO5: Evaluate the business scenario of North East Region.

Suggested Readings

1. A. N. Agarwal, Indian Economy, New Age International, New Delhi
2. Francis Cherunilam, Business Environment, Himalaya Publishing
3. P. Subba Rao, International Business Text and Cases, Himalaya Publishing House.
4. Francis Cherunilam, International Business Environment, Himalaya Publishing House.
5. Swabera Islam & Kharkongor; Business Environment, Taxman's Publication, New Delhi.
6. S.K. Misra, V.K. Puri; Indian Economy, Himalaya Publishing House, Mumbai.
7. Deepashree, Indian Economy, Tata McGraw Hill, New Delhi

CMSP0029: ACCOUNTING FOR SERVICE AND PUBLIC FINANCE

(4 Credits-60 Hours)

Objectives:

- *To be acquainted with the government accounting rules related to service sector accounting such as defence accounts and postal accounts.*
- *To impart knowledge about the functioning of public finance mechanism.*

Module I: Government Accounting Rules (10 Hours)

Provisions of Government Accounting Rules,1990-Chapter 1-Introductory, Chapter 2–General Outlines of the System of Accounts, Chapter 3- Basic Structure of the Form of Accounts; List of Major and Minor Heads of Accounts of Union and States (LMMH).

Module II: Defence Account and Audit (15 Hours)

Budgetary process for Defence Service Expenditure; Manual of Audit Department - Vol I Part B -Chapter 18 –(Accounts Section); Defence Accounts Code; Classification Hand Book of Defence Services Receipts and Charges, Debt and Remittances heads with code numbers.

Module III: Postal Accounts (10 Hours)

Introduction of General system of Accounts; Organization and control; Postal Accounts Workbook and Compilation; Remittance; Annual Accounts of Central Government; Transfer Entries Journal and ledger; Cost Calculation; Capital Accounts; Checking of receipts; Internal check; inspections.

Module IV: Public Finance (12 Hours)

Introduction to Public Finance; Role of Public Finance in Economic Development; Public Revenue: Main Sources of Public Revenue; Classification and canons of Public Expenditure; Effects of Public expenditure on Production, Distribution and Economic Growth.

Module V: Federal Finance, Local Finance, Budgets and Fiscal Policy (13 Hours)

Financial Issues in a Federal set up; Principles of efficient division of financial resources between Central and States; The Finance Commission; NITI Aayog; Local bodies and their Financial responsibilities; Sources of Local Finance; Local Taxation; Classification of Budgets; Budgets and Planning; Budget and National Accounts; Objectives of Fiscal Policy; Deficit Financing.

COURSE/LEARNING OUTCOMES

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

CO1: Outline different government accounting rules related to service sector.
CO2: Express budgetary process of government service.
CO3: Define general system of postal accounts.

Suggested Readings

1. Ghosh, A., “Public Finance”, Prentice Hall India Learning Private Limited, New Delhi.
2. Jha, Raghbendra.,”Modern Theory of Public Finance”, New Age International Private Limited, New Delhi.
3. Singha, S.K., “Public Finance in Theory & Practice”, S Chand & Company, New Delhi.
4. Government Accounting Rules 1990 published by Controller General of Accounts.
5. Manual of Audit Department.
6. Defence Accounts Code.
7. Classification Hand Book of Defence Services Receipts and Charges.
8. Defence Audit Code (Chapter 18).

SPECIALISATION: FINANCE AND INVESTMENT

CMIB0030: INVESTMENT BANKING

(4 credits – 60 hours)

Objective: The main objective of the course is to provide students with the necessary theoretical and conceptual tools used in investment banking. This course will provide an introduction and general understanding of investment banking activities and the mechanics *and financial analysis required to value, negotiate and successfully close transactions.*

Module I: Comparable Companies Analysis (15 hours)

Comparable companies analysis steps; Selecting the universe of comparable companies; Identifying key characteristics of target; Spread key statistics, ratios and trading multiples; Benchmarking comparable companies; Valuation implied by EV/EBITDA; Valuation implied by P/E; Pros and cons of comparable analysis.

Module II: Discounted Cash Flow Analysis (15 hours)

Summary of Discounted Cash Flow (DCF) analysis steps; Studying the target and its key performance drivers; Forecasting Free Cash Flow; Calculating Weighted Average Cost of Capital; Determining Terminal Value; Calculating present value; Determination of Valuation; Pros and cons of DCF analysis.

Module III: Leveraged Buyouts (15 hours)

Meaning and objective of Leveraged Buyout (LBO); Key participants; Characteristics of a strong LBO candidate; Economics of LBO; Exit and Monetizing strategies; LBO financing.

Module IV: Mergers and Acquisitions (15 hours)

Introduction to Mergers and Acquisitions (M&A); Auctions; Organization and Preparation; First Round in M&A process; Second Round in M&A process; Negotiations; Closing the deal; Financing the deal; Negotiated Sale.

COURSE/LEARNING OUTCOMES

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

CO1: Apply the technique of comparable company analysis for valuation of companies.
CO2: Build a Discounted Cash Flow model to value a subject company.
CO3: Understand the basics of a Leveraged Buyout Transaction.
CO4: Understand the steps involved in the Mergers and Acquisition process.
CO5: Gain practical experience in business valuation.

Suggested Readings

1. Rosenbaum and Pearl: Investment Banking, Wiley Finance.
2. E. Soubeiga:Mastering Financial Models, McGraw Hill.
3. J. Tija:Building Financial Models, McGraw Hill.

CMIM0031: INVESTMENT MANAGEMENT

(4 credits – 60 hours)

Objective: The objective of the course is to Learn about Financial markets and instruments, investment strategies. Apply standard models of financial economics to problems of portfolio optimization, diversification, immunization, and risk management.

Module I: Introduction to Investment Management (15 hours)

Meaning and objectives; Portfolio Perspective on Investing: Diversification, Risk Aversion, Composition, Downside Protection, Modern Portfolio Theory; Investment Clients; Steps in Investment Management Process; Pooled Investments: Mutual Funds, Types of Mutual Funds, Other Investment Products.
Case Study analysis I.

Module II: Investment Risk and Return I (15 hours)

Investment Characteristics of Assets: Return; Return measures and their applications, Variance and Covariance of Returns, Historical Risk and Returns, Other Investment Characteristics; Risk Aversion and Portfolio Selection; Portfolio Risk; Efficient frontier; Investor's Optimal Portfolio.
Case Study analysis II.

Module III: Investment Risk and Return II (15 hours)

Capital Market Theory; Pricing of Risk: Systematic Vs Non-systematic Risk, Interpretation and Calculation of Beta; Capital Asset Pricing Model: Assumptions, Security Market Line, Applications, Limitations, Extension.

Case Study analysis III.

Module IV: Investment Planning (15 hours)

Investment Policy Statement (IPS): Components, Gathering Client Information; Capital Market Expectations; Strategic Asset Allocation; Investment Instruments: Equity, Fixed Income, Mutual Funds, Real Estate, Insurance Investments.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the Portfolio Perspective to Investing.
CO2: Describe the steps in the Investment Management process.
CO3: Calculate and Interpret major return measures of an investment.
CO4: Describe the characteristics of the major asset classes that an investor should consider.
CO5: Describe the risk and return objectives and how they may be developed for a client.

Suggested Readings

1. Zvi Bodie, Essentials of Investment, McGraw Hill.
2. Reilly and Brown, Analysis of Investments and Management of Portfolios, Cengage.
3. Prasanna Chandra, Investment Analysis and Portfolio Management, McGraw Hill.

CMCF0032: CORPORATE FINANCE

(4 credits – 60 hours)

Objective: *The aim of the course is to give understanding the various areas of corporate finance and also to develop the sources of finance and investment.*

Module I: Introduction to Corporate Finance (15 hours)

Objective of Corporate Finance; Role of finance manager in corporations; types of firms; stock markets; financial institutions; Financial Statement Analysis: Balance Sheet analysis, Income Statement analysis, Cash Flow statement; Case Study - Enron.

Module II: Investment Decisions (10 hours)

Net Present Value (NPV) rule; Payback rule; Internal Rate of Return (IRR) rule; Modified Internal Rate of Return; Choosing between projects; Capital Budgeting process; Forecasting Incremental Earnings; Break even Analysis; Scenario analysis; Options in Capital Budgeting – Delay, Expand, Abandon.

Module III: Risk and Return in Capital Markets (20 hours)

Variance and volatility of returns; Tradeoff between risk and return; Arithmetic Average returns Vs Compound Annual returns; Normal Distribution; Systematic Risk Vs Equity Risk; Measuring Systematic risks; Beta; Capital Asset Pricing Model (CAPM); Cost of Capital: Weighted Average Cost of Capital (WACC), Cost of Debt, Cost of Equity, Using WACC to value a project.

Module IV: Long Term Financing (15 hours)

Equity financing for Private Companies; Initial Public Offerings (IPO); Case Study – Google's IPO; Debt Financing: Private Debt and Public Debt, Bond Covenants, Repayment Provisions; Capital Structure: Capital Structure Choices, Capital Structure in Perfect Capital Markets, Modigliani and Miller (MM) Model, Debt and Taxes.

COURSE/LEARNING OUTCOMES

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

CO1: Explain the basic tools and concepts necessary to understand modern financial theory and its application in corporations.
CO2: Apply capital budgeting tools for evaluating investments.
CO3: Analyse the relationship between capital structure, risk and shareholder value, using the Modigliani Miller Theorems.

Suggested Readings

1. Berk and DeMarzo : Corporate Finance, Pearson.
2. Brealey, Richard/ Myers, Stewart C. / Allen, Franklin :Principles of Corporate Finance, McGraw Hill.
3. Aswath Damodaran : Investment Valuation, John Wiley.

CMFN0033: ADVANCED FINANCIAL MANAGEMENT

(4 credits – 60 hours)

Objective: *To apply advance knowledge and skills in taking various decisions relating to the financial management of an organization.*

Module I: Role of senior financial adviser in the multinational organization (15 Hours)

Financial executive/advisor; financial strategy formulation; Ethical and governance issues; management of international trade and finance; strategic business and financial planning for multinational organizations; dividend policy in multinationals and transfer pricing.

Module II: Advanced Investment Appraisal (15 Hours)

Discounted cash flow techniques; option pricing theory; Impact of financing: investment decisions, adjusted present values; Valuation and the use of free cash flows; International investment and financing decisions.

Module III: Acquisitions and mergers (15 Hours)

Acquisitions and mergers versus other growth strategies; valuation for acquisitions and Mergers; Regulatory framework and processes; Financing acquisitions and mergers; corporate reconstruction and reorganization- financial reconstruction, business reorganisation.

Module IV: Treasury and advanced risk management techniques (15 Hours)

Treasury function in multinationals; hedging using financial derivatives: forex and interest rate risk.

COURSE/LEARNING OUTCOMES

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

CO1: Explain and evaluate the role and responsibility of the senior financial executive or advisor in multinational organizations in taking financial decisions.
CO2: Evaluate potential investment decisions and assessing their financial and strategic consequences.

Suggested Readings

1. Nelson, A., “Advances in Financial Management”, McGraw Hill.
2. Kishor, R, M., “Financial Management”, Taxmann’s.
3. Advance Financial Management, ACCA, Kaplan Publisher.

CMFS0034: FINANCIAL SECURITIES AND DERIVATIVES
(2 credits – 30 hours)

Objectives: This course presents and analyses derivatives, such as forwards, futures, and options. The course defines the main kind of derivatives, shows how they are used to achieve various hedging and speculating objectives, introduces a framework for pricing derivatives, and studies several applications of derivative-pricing techniques outside derivative markets.

Module I: Derivatives Markets (10 hours)

Exchange traded markets; Over the counter markets; Forward contracts; Futures contract; Options; Types of Traders; Hedgers; Speculators; Arbitrageurs; Dangers of Derivative Markets.

Module II: Futures (10 hours)

Specifications of futures contracts; convergence of futures price and spot price; operation of margins; Forward vs Futures contracts; Hedging using futures: Basis risk, cross hedging, stock index futures.

Module III: Options (10 hours)

Types of Options; Option Positions; Underlying Assets; Specification of Stock options; Trading; Commissions; Margins; Options price: Factors, Upper and lower bounds, put-call parity, effect of dividends; Trading strategies using Options.

COURSE/LEARNING OUTCOMES

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

CO1: Understand the structural differences among options, forwards and futures.
CO2: Understand how the above derivative securities are traded in exchanges and/or over-the-counter markets.
CO3: Understand how to price each of the above derivative securities with different pricing models and know model assumptions.

Suggested Readings

1. John C. Hull: Options, Futures and Other Derivatives, Prentice Hall.
2. SL Gupta: Financial Derivatives: Theory, concepts and Problems, PHI Learning.

SPECIALISATION: INTERNATIONAL ACCOUNTING AND FINANCE

CMPT0035: ADVANCED PERFORMANCE MANAGEMENT
(4 credits – 60 hours)

Objective*: To apply relevant knowledge, skills and exercise professional judgement in selecting and applying strategic management accounting techniques in different business contexts and to contribute to the evaluation of the performance of an organisation and its strategic and operational development.*

Module I: Strategic planning and control (12 Hours)

Strategic management accounting; Impact of external factors on performance management; Performance hierarchy; Performance management and control of the organisation; Changes in business structure and management accounting; Other environmental and ethical issues; Comparison between planning and control, between the strategic and operational levels within a business entity; changing role of the management accountant in today's business environment.

Module II: Impact of risk and uncertainty on organisational performance (12 Hours)

Impact of risk and uncertainty on performance management; the impact of the different risk appetites of stakeholders on performance management; evaluate how risk and uncertainty play an important role in long term strategic planning and decision making; apply different risk analysis techniques in assessing business performance.

Module III: Performance measurement systems and design (12 Hours)

Performance management; information systems; Sources of management information; Recording and processing methods; Management reports.; evaluating the compatibility of management accounting objectives and the management accounting information systems; integration of management accounting information within an overall information system, use of enterprise resource planning systems; evaluate the external and internal factors which influence the design and use of a management accounting system. Benchmarking.

Module IV: Strategic Performance Measurement (12 Hours)

Strategic performance measures in the private sector; Divisional performance and transfer pricing issues; Strategic performance measures in not-for-profit organisations; Non-financial performance indicators; The role of quality in management information and performance measurement systems; Performance measurement and strategic human resource management issues; Other behavioural aspects of performance measurement. Labour Productivity.

Module V: Performance evaluation and corporate failure (12 Hours)

Alternative views of performance measurement and management; Strategic performance issues in complex business structures; Predicting and preventing corporate failure; evaluate the 'balanced scorecard' approach as a way in which to improve the range and linkage between performance measures; evaluate the application of activity-based management; application of value-based management approaches to performance management. Human Resource Audit.

COURSE/LEARNING OUTCOMES

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

CO1: Use strategic planning and control models to plan and monitor organizational performance.
CO2: Assess the impact of risk and uncertainty on organisational performance.
CO3: Identify and evaluate the design features of effective performance management information and monitoring systems.
CO4: Apply appropriate strategic performance measurement techniques in evaluating and improving organisational performance.
CO5: Advise clients and senior management on strategic business performance evaluation and on recognising vulnerability to corporate failure.

Suggested Readings

1. Eoin McGettigan, Advanced Performance Management: An International Perspective, Chartered Accountants Ireland.
2. ACCA P5 Advanced Performance Management: Study Text, Kaplan Publishing.
3. HakanButune, Systematic Strategic Planning: A Comprehensive Framework for Implementation,Control, and Evaluation, Auerbach Publications.

CMAT0036: ADVANCED TAXATION

(4 credits – 60 hours)

Objective: The major objective of the course to make them aware about the advance tax system of India and how it works along with GST.

Module I: Advance Direct Tax Laws (15 Hours)

a) Assessment of income and Computation of tax liability of Various Entities: Individual including non-resident, Company, Trust, Mutual Association, Tax Management, Return.
b) Tax Management, Return and Assessment Procedure: Return of Income, Assessment Procedure, Interest and fees, Survey, Search, Seizure & Raids, Refund, demand and recovery; Voluntary disclosures & amnesty.

Module II: Business Restructuring & PMLA Act (15 Hours)

a) Amalgamation; Demerger; Slump sale; Conversion of sole proprietary business to company; Conversion of firm into company; Conversion of private limited company / unlisted public company into LLP.
b) Black Money Act, 2015: Introduction to Black Money Act; Highlights of Black Money Act. (PMLA Act)

Module III: International Taxation (15 Hours)

Double Taxation and Avoidance Agreements [Sec. 90, 90A and 91]; Transfer Pricing - Transfer Pricing including specified domestic transactions; Application of Generally Accepted Cost Accounting Principles and Techniques for determination of Arm's Length Price.

Module IV: Goods and Services Tax (GST) Laws (15 Hours)

Levy and collection of CGST and IGST, Application of CGST/IGST law; Time and value of supply; Input tax credit; Computation of GST liability; Registration; Tax invoice; Credit and Debit Notes; Electronic way bill; Returns; Payment of tax including reverse charge

COURSE/LEARNING OUTCOMES

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

CO1: Gather knowledge about the advance tax system exists in India.
CO2: Provide information about Black Money Act, 2015. [PML Act, 2005]
CO3: Calculate the input tax credit under GST

Suggested Readings

1. Bangar, V. &Bangar, Y., "Advance Tax Laws and Practice", AadhyaPrakashan.
2. Mundhar, V., "Advance Tax Laws and Practice", Lawpoint Publication.
3. Pandab, S. K., "Advance Tax Laws and Practice", Lawpoint Publication.
4. Gour, M. Jain, N. & Doshi, S., "Advance Tax Laws and Practice: Part B: Indirect Tax Laws", Carvinowledge Press.
5. Haldia, A., "GST: Made Easy", Taxmann's Publication.

CMAU0037: ADVANCE AUDIT AND ASSURANCE

(4 credits-60 hours)

Objective: *To understand the objective and concept of audit and auditing and its practical application in the field of business and its management. Also to understand how the frauds and errors are identified and prevented through audit process.*

Module I (10 hours)

International regulatory frameworks for audit and assurance services: need for laws, regulations, standards and other guidance relating to audit, assurance and related services; legal and professional framework including: public oversight of audit and assurance practice, the impact of corporate governance, principles on audit and assurance practice, the role of audit committees and impact on audit and assurance practice.

Module II (10 hours)

Money laundering: definition, international methods for combating money laundering; scope of criminal offences of money; ethical guidance in this area; system to prevent and detect money laundering including record keeping and reporting of suspicion to the appropriate regulatory body; reasons, the basic elements of an anti-money laundering program.

Module III (10 hours)

Laws and regulations: Comparison and contrasting the respective responsibilities of management and auditors concerning compliance with laws and regulations in an audit of financial Statements; auditors' considerations of compliance with laws and regulations and plan audit procedures when possible noncompliance is discovered; Code of Ethics for Professional Accountants

Module IV (10 hours)

Fraud and error: Identification and developing an appropriate response to circumstances which indicate a high risk of error, irregularity, fraud or misstatement in the financial statements or a given situation; Comparison of respective responsibilities of management and auditors for fraud and error; procedures to be carried out to investigate actual and/or potential misstatements in a given situation.

Module V (10 hours)

Professional liability: circumstances of legal liability and the criteria for legal; factors of determining auditor is negligent and auditor's potential liability in given situations; compare and contrast liability to client with liability owed to third parties (ie contract vs establishing a duty of care).

Module VI (10 hours)

Practice Management:Quality control: principles and purpose of quality control of audit and other assurance engagements; elements of a system of quality control relevant to a given firm; Selection and justification of quality control procedures that are applicable to a given audit Engagement; Advertising, publicity, obtaining professional work and fees in Recognise situations in which specified advertisements are acceptable; procedures that an audit firm/professional accountant should carry out before accepting a specified new client/engagement or continuing with an existing engagement, including

a) client acceptance
b) engagement acceptance
c) establish whether the preconditions for an
d) audit are present
e) agreeing the terms of engagement.

COURSE/LEARNING OUTCOMES

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

CO1: Explain generally accepted audit and auditing procedures and principles,
CO2: Apply techniques and skills needed in audit and attestation engagements.
CO3: Analyse how the assurance be given for internal control of an accounting system.

Suggested Readings

1. Institute of Chartered Accountants of India: ''Auditing and Assurance Standards'', ICAI, New Delhi.
2. F Gupta, Kamal, and Ashok Arora: "Fundamentals of Auditing," Tata McGraw Hill Publishing Co. Ltd., New Delhi

SPECIALISATION: FINANCE AND INVESTMENT

CMFX0038: COMMODITIES AND FOREX MANAGEMENT

(4 credits – 60 hours)

Objectives: *The objectives of the course are to-*

- *To introduce the students to the concept of Forex management*
- *To make them aware about the risks associated with Foreign exchange*
- *To introduce the students to the concept of commodities management·*

Module I: Forex Management (15 Hours)

a) Nature, Significance and Scope of Forex Management; Foreign Exchange Market and its Structure
b) Foreign Exchange Rates and its Determination; Types of Exchange Rates, Spot and Forwards Exchange Rates; Forex Trading;
c) Currency Futures and Options, Foreign Exchange Risk Exposures and their Management; Exchange Rate Forecasting; Risk in Foreign Exchange Business
Case Study

Module II: Foreign exchange Risk Management (15 Hours)

a) Conceptual Overview; Nature and Exposure (Economic, Transaction and Translation)
b) Hedging and Speculation.
c) Framework of Managing Exposures, Accounting Implications of Forex Transactions

Module III: Derivatives and Exposure Management (15 Hours)

a) Currency Forwards; Currency Options; Currency Futures; Currency Swaps
b) Interest Risk Management

Module VI: Commodities Management (15 Hours)

a) Introduction to commodity derivatives, commodity exchanges and commodity contracts
b) Pricing commodity Forward, Futures and options
c) Agricultural Price Risk Management
d) Crude Oil and Base metal derivatives; Gold and Electricity Price Risk Management; Weather and Carbon Derivatives
Case Study on commodities management

COURSE/LEARNING OUTCOMES

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

CO1: Construct their own wealth management and financial planning.
CO2: Distinguish between good and bad investment, to build a good portfolio, understanding the economy – sector and industries, understanding stock market basics, understanding risk management, understanding money management.

Suggested Readings

1. M.Y. Khan & P.K. Jain, Financial Management – Text and Problems, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Prasanna Chandra , Financial Management – Theory & Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. R.P. Rustagi, Strategic Financial Management ,Taxmann Publication Pvt. Ltd
4. Neil C. Schofield, Commodity Derivatives: Markets and Applications
5. PrabinaRajib, Commodity Derivatives and Risk Management

CMPF0039: PORTFOLIO MANAGEMENT

(4 credits – 60 hours)

Objectives:*The course objective is to acquaint students with the theoretical foundation of modern portfolio theory, the major groups of investors and their investment objectives and constraints, and to master practical skills in investment management, forming capital market expectations and forecasting markets activity to justify major investment portfolio management strategy for equity and fixed-income instruments.*

Module I: Portfolio Management Process (15 hours)

Portfolio Management Process; Steps in Portfolio Management; Investment Objectives and Constraints; Dynamics of the Process; Managing Individual Investor Portfolio: Investor Characteristics, Investment Policy Statement, Asset Allocation concepts; Regulations for Portfolio Management Companies(PMCs).

Module II: Capital Market Expectations and Asset Allocation (15 hours)

Economic Analysis: Business Cycle Analysis, Economic Growth Trends, International Interactions; Asset Allocation: Strategic Asset Allocation in relation to Systematic Risk, Strategic vs Tactical Asset Allocation; Asset Allocation and Investor's Risk and Return objectives; Selection of Asset Classes; Optimisation Approaches; Implementing Strategic Asset Allocation.

Module III: Equity Portfolio Management (15 hours)

Role of Equity Portfolio; Approaches to Equity Investment; Passive Equity Investments; Active Equity Investments; Semi-active Equity Investments; Equity Portfolio Managers: Identifying, Selecting and Contracting; Structuring Equity Research and Security Selection.

Module IV: Fixed Income Portfolio Management (15 hours)

Managing Funds against a Bond Market Index; Managing Funds against liabilities: Dedication Strategies, Cash Flow matching strategies; Other Fixed Income Strategies: Combination strategies, Leverage, Derivatives enabled strategies; International Bond Investing: Active vs Passive Management, Currency Risk, Emerging Market debt.

COURSE/LEARNING OUTCOMES

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

CO1: Understand the theoretical foundations of the Portfolio Theory.
CO2: Understand the investment process scope and stages.
CO3: Form market expectations and build strategic asset allocation.
CO4: Select the optimal investment strategy.

Suggested Readings

1. John L. Maginn, Donald L. Tuttle, Dennis W. McLeavey, Jerald E. Pinto: Managing Investment Portfolios – A dynamic process, John Wiley & Sons.
2. ZviBodie: Essentials of Investment, McGraw Hill.
3. Reilly and Brown: Analysis of Investments and Management of Portfolios, Cengage.

CMAL0040: ALTERNATIVE INVESTMENTS

(4 credits – 60 hours)

Objectives: The purpose of this course is to explore the world of alternative investments such as investments on hedge funds, private equity, venture capital funds, and commodities, either directly or through funds of funds.

Module I: Hedge Funds (15 hours)

Hedge Funds: Scope and objectives; Establishing a Hedge Fund Investment Program; Selecting a Hedge Fund Manager; Due Diligence for Hedge Funds; Risk Management in Hedge Funds; Regulations in Hedge Funds.

Module II: Commodity and Managed Futures (15 hours)

Investing in Commodity Futures: Economic Rationale, Commodities and Business Cycle, Event Risk, Commodity Futures as an Asset Class; Commodity Futures Index, Sources of Index Returns; Comparison of Commodity Futures Indices.

Module III: Venture Capital (15 hours)

History of Venture Capital; Role of a venture capitalist; Business Plans; Intellectual Property Rights; Prior Operating History; Structure of Venture Capital Industry; Sources of Venture Capital Financing; Venture Capital Investment Vehicles; Specialisation in the Venture Capital Industry.

Module IV: Leveraged Buyouts (LBOs) (15 hours)

History of LBOs; Rational for LBOs; Unlocking an Entrepreneurial Mindset; Buy and Build Strategies; LBO Turnaround Strategies; LBO Fund Structures; Risks of LBOs; Corporate Governance and LBOs; Dismantling of conglomerates; Merchant Banking.

COURSE/LEARNING OUTCOMES

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

CO1: Understand the risk-return characteristics of alternative investments.
CO2: Understand the economic appeal behind alternative investments.
CO3: Explain the Leveraged Buyout Model.

Suggested Readings

1. Mark J. P. Anson: Handbook of Alternative Assets, John Wiley & Sons.
2. John L. Maginn, Donald L. Tuttle, Dennis W. McLeavey, Jerald E. Pinto: Managing Investment Portfolios – A dynamic process, John Wiley & Sons.

CMOT0041: ORGANISATIONAL THEORY AND BEHAVIOUR

(4 credits– 60 hours)

Objective: *The objective of this paper is to provide the students an insight into the principles of organizational behaviour and its relation to other activities in an organization, and to introduce the students to the techniques of organisational behaviour used as a management tool.*

Module I: Introduction to Organizational Behaviour (8 Hours)

Defining Organisational Behaviour, historical background: the Hawthorne Studies; early development, conceptual development; the nature of people; theoretical frameworks; explaining and predicting behaviour; OB in the global context.

Module II: Cognitive processes of organizational behavior (12 Hours)

Nature and importance of Perception and attribution; perception and individual decision making; values, nature and dimensions of attitudes and job satisfaction; personality; aptitude; interests; learning; intelligence, motivation - theories of motivation.

Module III: Group Dynamics (14 Hours)

a) Understanding group dynamics, types of groups, group goals, group cohesiveness, group pressure and norms, teamwork; group structure - formal leadership, roles and norms; group member resources - abilities, personality, characteristics, stages in group development.

b) Leadership Theories - trait, behavioural, contingency, attributional, charismatic, transactional vs. transformational.

c) Power and politics: Contrasting leadership and power; power in groups; power tactics; politics-power in action.

Module IV: Communication and Decision Making (12 Hours)

Role of communication; Communication media and technology, communication networks - formal vs. informal; barriers to effective communication; communication skills; feedback information; persuasion in communication; active listening; participative decision making techniques; groups vs. the individual; groupthink and group shift; the decision making process

Module V: Organizational culture and Work Stress (14 Hours)

a) Definition of organizational culture; cultural typologies; organizational culture vs. national culture; functions of culture; formation of cultures; potential sources of stress - environmental factors, organizational factors; individual differences - perception, job experience, social support, locus of control, hostility; Stress – the emergence of stress, causes of stress; stress consequences - physiological symptoms, psychological symptoms, behavioural symptoms, stress management strategies : individual approaches, organizational approaches.

b) Conflict and negotiation : Definition of conflict; the conflict process; conflict in intergroup relations; creating functional conflicts; bargaining strategies; role of personality traits on negotiation; third party negotiations; intergroup relations and factors affecting intergroup relations.

COURSE/LEARNING OUTCOMES

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

CO1: Explain the concepts of Organisational Behaviour (OB), Hawthorne studies and OB in the global context.

CO2: Explain the Cognitive processes of organizational behavior and its application in workplace.

CO3: Understand group dynamics, leadership theories, power & politics in terms of its application in workplace.

CO4: Analyse the importance of communication and decision making techniques for improving productivity of employees.

CO5: Evaluate Organizational culture, work stress and Conflict & negotiation in various workplace settings.

Suggested Readings

1. Fred Luthans, Organisational Behaviour, 10th Edition, McGraw Hill India, 2005
2. Stephen P Robbins, Organizational Behaviour, 11th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004
3. Gilmer, Industrial Psychology, McGraw Hill.
4. Ghiselle and Brown, Personnel and Industrial Psychology, McGraw Hill.
5. Keith Davis, Human Relations at Work, Tata McGraw Hill.
6. Leavitt, Managerial Psychology, University of Chicago Press.
7. BM Bass, Leadership Psychology and Organizational Behaviour, Harper International.
8. Litterer, Analysis of Organizations, John Wiley.

CMBD0042: BUSINESS STATISTICS AND DECISIONS

(4 credits-60 hours)

Objective: *The objective of this course is to familiarize students with the applications of statistical techniques in business decisions. This purpose of this course is to provide students with statistical tools needed by managers. The course emphasizes understanding the process* *associated with statistical decisions, defining and formulating problems, analyzing the data, and using the results in decision making.*

Part A: BUSINESS STATISTICS

Module I: Uni-variate Analysis (15 hours)

Measures of Central Tendency including Arithmetic mean, Geometric mean and Harmonic mean:

properties and applications; Mode and Median. Partition values - quartiles, deciles, and percentiles. Measures of Variation: absolute and relative. Range, quartile deviation and mean deviation; Variance and Standard deviation: calculation and properties.

Module II: Bi-variate Analysis (10 hours)

Simple Linear Correlation Analysis: Meaning, and measurement. Karl Pearson's coefficient and

Spearman's rank correlation. Simple Linear Regression Analysis: Regression equations and estimation. Relationship between correlation and regression coefficients.

Module III: Time-based Data: Index Numbers and Time Series Analysis(15 hours)

Meaning and uses of index numbers; Construction of index numbers: Aggregative and average of relatives – simple and weighted, Tests of adequacy of index numbers, Construction of consumer price indices.

Components of time series; additive and multiplicative models; Trend analysis: Finding trend by moving average method and Fitting of linear trend line using principle of least squares.

Part B: BUSINESS DECISION

Module IV (10 hours)

Course introduction. Introduction to Evidence Based Management. Introduction to measurement theory and statistical inference. Simple decision tools; Rational choice, limited rationality and biases; Modern test theory. Rapid evidence assessment. Academic Survey design and testing.

Module V (10 hours)

Multiple-person decision making. Exploratory data analysis; Forecasting; roadmaps Optimisation; Big data, inference and dimension reduction. Forecasting, roadmaps.

COURSE/LEARNING OUTCOMES

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

CO1: Demonstrate understanding of statistical thinking and data analysis.
CO2: Demonstrate techniques for decision-making under uncertainty.
CO3: Define, explain and illustrate, from theoretical and practical perspectives, decision making concepts and processes in business settings.
CO4: Describe and evaluate research concepts and methods in a business setting.

Suggested Readings

1. J. K. Sharma, Business Statistics, Pearson Education.
2. S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.
3. S.P. Gupta and Archana Gupta, Elementary Statistics, Sultan Chand and Sons, New Delhi.
4. Richard Levin and David S. Rubin, Statistics for Management, Prentice Hall of India, New Delhi.
5. M.R. Spiegel, Theory and Problems of Statistics, Schaum's Outlines Series, McGraw Hill Publishing

CMFY0043: FINANCIAL STATEMENT ANALYSIS

(4 credits – 60 hours)

Objective: The course introduces to provide the knowledge of decision makers information about a business enterprise for use in decision-making and to evaluate the economic situation of the firm and predicting its future course based on the financial statements.

Module I: Introduction to Financial Statement Analysis (10 hours)

Scope of Financial Statement Analysis; Financial Statements and other information sources; Financial Statement Analysis Framework; Classification of Business Activities; Financial Reporting Standards; Regulatory Authorities; International Financial Reporting Standards Framework (IFRS); Comparison of IFRS with other Reporting Standards.

Module II: Analysis of Income Statement (15 hours)

Components and format of Income Statement; Revenue Recognition; Expense Recognition; Non-recurring and Non-operating items; Earnings Per Share(EPS) : Simple Vs complex capital structure, Basic EPS, Diluted EPS; Analysis of Income Statement: Common size analysis, Income Statement Ratios.

Case Study I

Module III: Balance Sheet (10 hours)

Components and format of Balance Sheet; Measurement Bases of Assets and Liabilities; Equity: Components, Statement of Changes in Shareholders Equity; Uses and Analysis of Balance Sheet: Common size analysis, Balance Sheet Ratios.

Case Study II

Module IV: Cash Flow Statement (15 hours)

Components and format of Cash Flow Statement; Linkages and Preparation: Cash Flow Statement with Income Statement and Balance Sheet, Preparation of Cash Flow Statement, Conversion from Indirect to Direct method; Cash Flow Statement Analysis: Evaluation of Sources and Uses of Cash, Common size analysis, Free Cash Flow to Firm and Free Cash Flow to Equity, Cash Flow Ratios.

Case Study III

Module V: Financial Statement Analysis Techniques (10 hours)

Financial Analysis Process; Analysis tools and techniques; Common Ratios: Activity Ratios, Liquidity Ratios, Solvency Ratios, Profitability Ratios; Integrated Financial Ratio Analysis.

Case Study IV

COURSE/LEARNING OUTCOMES

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

CO1: Describe the role of Standard Setters and Regulators in Financial Reporting.

CO2: Describe the Information provided by Balance Sheet, Income Statement and Cash Flow Statement.

CO3: Identify and compare cash flow classifications of operating, investing and financing activities.

CO4: Explain links between Income Statement, Balance Sheet and Cash Flow Statement.

CO5: Identify and Interpret ratios used to analyse a company's liquidity, profitability, solvency and efficiency.

Suggested Readings

1. Thomas R. Robinson and Elaine Henry: International Financial Statement Analysis, Wiley.
2. Charles H. Gibson:Financial Statement Analysis, Cengage.
3. K. R. Subramanyam and John J. Wild:Financial Statement Analysis, McGraw Hill.

CMMG0044: MANAGERIAL ECONOMICS

(4 Credits-60 Hours)

***Objective**: The objective of the course is to acquaint students with the basic principles of micro and macroeconomics for developing the understanding of theory of the firm, markets and the macro environment. This will help them in managerial decision making processes.*

Module I: Managerial Economics (10 Hours)

Introduction to Managerial Economics; Economic factors influencing decisions, Functions Role and Responsibilities of Managerial Economist; Principles in Managerial decision analysis; Micro-Macro Economics, Paradox of Micro Economics, Distinction between Micro and Macro Economics.

Module II: Demand Analysis (10 Hours)

Theories in Demand, Derivation of demand, types, Environment influencing demand; Elasticity of Demand; Advertising or promotional Elasticity; Demand forecasting ; Demand forecasting for new products, Demand Estimation for consumer durables and non-consumer durables.

Module III: Production And Cost Analysis (15 Hours)

Production Function; Law of variable proportions, Production with two variable inputs; Cost Analysis: concept, importance, types – Real opportunity, Money, Fixed, variable, Direct, indirect, Explicit, implicit, past, feature, controllable and uncontrollable, Escapable, inescapable, urgent, potable cost, Replacement and Historical cost, Total Average and Marginal cost in short Run – and Long Run curve; Revenue - Concepts, definition, types-Total, Average, Marginal and relationship with AR and MR

Module IV: Market Structure (13 Hours)

Concept, meaning and classification of Market; Perfect competition-features and price determination; Monopoly – definition, features, types and price determination; Monopolistic competition-meaning, concept, types, price determination and defects; Pricing - types, cost pulls, going rate, Intuitive, Imitative, Marginal cost, Pioneering, Transfer pricing; Price discrimination – Definition, Concept, meaning, types, conditions, Dumping and socio – economic consideration in pricing; Firm objectives, staff, sales and growth Maximization.

Module V: Business Cycle (13 Hours)

Business cycle–cobweb, Hick's Samuelson Theories of Trade cycle; Measures to control Business Cycle; Inflation; Deflation; Economic effects on production distribution and employment, remedies demand full v/s cost push Inflation; Monetary and fiscal policies objectives, role and impact on economic development, Concept of sustainable development, consumption and its inclusive growth.

COURSE/LEARNING OUTCOMES

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

CO1: Understand the scope of managerial economics.
CO2: State the difference between demand and supply.
CO3: Outline the determinants of demand.
CO4: Outline the determinants of supply and estimate elasticity of supply.
CO5: Summarize the concept of production function and relate it with economies and diseconomies of scale.
CO6: Explain the various kinds of production functions.
CO7: Estimate cost of production of firms.
CO8: Summarize and evaluate fiscal policy and monetary policy to control inflation.
CO9: Describe Balance of Payments and its various components.
CO10: Outline various Open macro-economic concepts

Suggested Readings

1. Koutsyiannis, A., Modern Microeconomics, Macmillan Press Ltd.
2. Varian, Micro-Economic Analysis , Norton.
3. Pindyck Robert S., Daniel L. Rubinfeld and Prem L. Mehta, Micro Economics, Pearson Education Asia, New Delhi.
4. Branson William H., Macro Economics Theory and Policy, First East – West Press.
5. Dornbusch, R. and S. Fischer Macro Economics , Publisher Tata McGraw Hill.
6. Oliver Blanchard ,Macro Economics, Pearson Education, LPE.

CMAG0045: COST AND MANAGEMENT ACCOUNTING

(4 credits-60 hours)

Objectives:

- *To understand the different concepts of cost, costing and cost accounting and their practical application in real world scenario.*
- *To provide in-depth knowledge of the detailed procedure and documentation involved in cost ascertainment systems.*

Module I: Introduction to Cost and Management Accounting (10 Hours)

Concepts of Costs; Classifications and Elements of Cost; Cost Centre and Cost Unit; Methods and Techniques of Costing; Installation of a Costing System.

Module II: Management Accounting (10 Hours)

Tools and Techniques of Management Accounting; Relationship of Cost Accounting, Financial Accounting, Management Accounting and Financial Management; Conflicts in Profit Vs Value Maximisation Principle; Role of Management Accountant in Decision Making.

Module III: Material Cost (10 Hours)

Materials Control – Concept and Techniques; Stock Verification; Methods of Pricing of Material: FIFO, LIFO, Simple Average, Weighted Average; Inventory Management: Techniques of fixing of minimum, maximum and reorder levels, Economic Order Quantity, ABC Analysis ; Stock Verification and Perpetual Inventory.

Module IV: Activity Based Costing (Abc) And Cost Records (10 Hours)

ABC Vs Traditional Costing; Uses and Limitations; Cost Ledgers – Integrated Accounts and Non-Integrated Accounts; Reconciliation of Cost and Financial Accounts.

Module V: Costing Systems (20 Hours)

Unit and Output Costing; Job Costing: Job Cost Cards, Collecting Direct Costs; Batch Costing: Features and Applications; Contract Costing: Features, Distinction between Job and Contract Costing, Contract Accounts, Accounting for Material, Accounting for Plant Used in a Contract; Process Costing: Features, Applications and Types of Process Costing; Joint Products, By-Products; Service Costing: Features and Applications; Unit Costing and Multiple Costing.

COURSE/LEARNING OUTCOMES

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

CO1: Define the meaning of cost, costing and cost accounting.
CO2: Express the concept of management accounting.
CO3: Illustrate Activity Based Costing (ABC).

Suggested Readings

1. Arora, M. N., "Cost and Management Accounting", Vikash Publishing House, New Delhi.
2. Zad, N. S., " Cost and Management Accounting", Taxman, New delhi.
3. Aggarwal, P., "Cost and Management Accounting", Bharat Law House, New Delhi.
4. Banarjee, H., "Cost and Management Accounting", Prentice Hall India Pvt, Ltd, New Delhi.

CMRC0046: RESEARCH METHODOLOGY IN COMMERCE

(4 credits-60 Hours)

Objective: This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.

Module I: Introduction to research (10 Hours)

Concept and nature, objectives, criteria of a good research, social science research, business research, approaches to research-qualitative and quantitative research, types of research; case study research, research methodology, difficulties of social science research in India.

Module II: Research design (8 Hours)

features of a good research design; research problem: definition, Components, selection and formulation of research problem; formulation of hypothesis, research design: types, research design for experimental exploratory and descriptive research.

Module III: Sampling design (8 Hours)

Meaning, significance; sampling process; principles of sampling essentials of a good sample, methods of sampling; determination of sample size.

Module IV: Data collection (8 Hours)

Meaning, types, methods; Sources of data-Use of secondary data-Methods of collecting primary data-Observation-Interviews-Questionnaires and Schedules.

Module V: Processing and Analysis of Data (8 Hours)

Processing Operations –Types of Analysis-Presentation and Interpretation of Data-Editing, Classification and Tabulation-Interpretation.

Module VI (8 Hours)

Preparation of a Report-Types of Report-Research Report-Format-Principles of Writing Reports-Documentation-Foot noters and Bibliography.

Module VII (10 Hours)

Quantitative Tools-Measures of Central Tendency-Dispersion-Measures of Correlation-Simple and Multiple Correlation-testing of Hypothesis-Tests based on t-P, Z and Chi square-Time Series Analysis-Trend Measurement-Moving Averages.

COURSE/LEARNING OUTCOMES

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

CO1: Develop critical core competencies and skills required to carry out such an enquiry.
CO2: Set appropriate research objectives.
CO3: Study design that incorporates research objectives and budgetary constraints.
CO4: Distinguish secondary and primary data collection and instruments.
CO5: Use sampling and analysis methods.
CO6: Effectively report results.

CO7: Explain the importance of ethical conduct in executing research in both a domestic and in international business contexts.

Suggested Readings

1. C.R Kothari, Research Methodology: Methods and Techniques, New Age International,
2. Srivastava, S. C. : Foundation of Social Research and Economics Techniques, Himalaya Publishing House, 1990.
3. Sharma H.D. and Mukherji S. P: Research Methods in Economics and Business, New York : The Macmillan Company, 1992.
4. M Saunders, Philip Lewis and Adrian Thornhill, Research Methodology for business students, Pearson Education
5. V.P Michael, Research Methodology in Management, Himalaya Publishing House

CMBE0047: BUSINESS ENVIRONMENT

(3 credits– 45 hours)

Objective: *To apply relevant knowledge, skills and exercise professional judgement in understanding the macro environment in which a business organisation operates. The course would also make the students capable of analysing and understanding policies of the government implemented from time to time and assess their impact on business*

Module I: Business Environment (9 classes)

Concept, Components and importance; Indian Business Environment; Cultural, social, political, technological, economic and legal environment; scanning techniques of environmental forecasting; SWOT- Internal environment -their impact on policy formulation.

Module II: Economic trends (9 classes)

Economic reforms in India –Liberalization, privatization and globalization; Competitive Strength of Indian industry; Impact of liberalization policy on different sectors; Foreign Investments policy in India.

Module III: Multinational Corporations (8 classes)

Multinational corporations and their participation in India; strategies of multinational corporations; competitive strengths policies and performance.

Module IV: Business Ethics and Social Responsibilities (9 classes)

Business ethics and social responsibilities; relationship between business and society; Corporate power

social accountability; Ethical issues and values in business; Corporate Social policies - issues and challenges; Ecological and environmental issues.

Module VI: Economic Development of North Eastern Region (10 classes)

Special package for economic development of north eastern region; DONER and its role in economic development, infrastructure and industry; North East Industrial Policy-promotional measures for cross-border trade, Role of NEC and NEDFI.

Problems and prospects of the industry in Assam, Brief study of the tea industry, paper industry, food processing industry, silk industry and bell metal industry; tourism industry.

COURSE/LEARNING OUTCOMES

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

CO1: Learn about the various concepts of business environment.

CO2: Understand the economic trends which have an impact on the business environment.

CO3: Evaluate the role and functions of multi-national corporations in Indian business environment.

CO4: Understand the importance of business ethics, social responsibilities and government social policies.

CO5: Learn about the economic development of North Eastern Region.

Suggested Readings

1. Wheelen, Concepts of Strategic Management and Business policy, Pearson Education, New Delhi.
2. Swabera Islam & Kharkongor; Business Environment, Taxman's Publication, New Delhi.
3. S.K. Misra, V.K. Puri; Indian Economy, Himalaya Publishing House, Mumbai.
4. Deepashree, Indian Economy, Tata McGraw Hill, New Delhi.
5. Rnddar Dutta and KPM Sundaram, S. Chand & Co. Ltd., New Delhi.
6. A.N. Agarwal, Indian Economy, New Delhi.
7. Kazhmi Azhar , Business Policy,
8. Gupta, Liberalisation - its impact on Indian Economy, Macmillan.

CMBL0048: BUSINESS LAW

(3 Credits- 45 hours)

Objectives: *The objectives of this course is to enable students have a detailed understanding of the Indian Contract Act, 1872, The Companies Act, The partnership act. The course also aims at giving the students in depth knowledge about the Negotiable Instruments Act 1881.*

Module I: The Indian Contract Act, 1872

a) Proposal- its communication, acceptance and revocation; Agreement vis-à-vis contract, void agreement & voidable contract
b) Consideration – essential elements, exception to rule- No consideration no contract; privity of contract and consideration
c) Capacity to contract; Free consent – coercion, undue influence, misrepresentation, fraud; Mistake – of fact and of law
d) Legality of object – agreements opposed to public policy and in restraint of marriage, trade & legal proceedings; Contingent contracts
e) Performance of contract–liability of joint promisor; Consequences of breach of contract–liquidated damages and penalty
f) Quasi contract; Indemnity and guarantee–surety's liability
g) Bailment–Duties and liabilities of bailor and bailee, bailment of pledges;
h) Agency–types of agency, agents duty to principal and vice-versa, ratification and revocation of agent's authority

Module II: The Companies Act, 1956

a) Meaning, characteristics and kinds; Lifting the corporate veil; Registration and incorporation; Memorandum of Association–alteration therein
b) Doctrine of Ultra Vires–consequences of ultra vires transaction
c) Articles of Association–alteration therein, its relation with memorandum of Association; Rule of constructive notice; Doctrine of Indoor Management; Prospectus- liability for misstatement, statement in lieu of prospectus
d) Shares–statutory restrictions, kinds of share capital; Debentures
e) Directors- Position, Appointment, Removal, Power & Duties, their responsibility for offence under N.I. Act & I.T.Act,2000
f) Meetings; Majority Powers and Minority Rights; Prevention of Oppression and Mismanagement
g) Winding up-liability under N.I.Act, Winding up by order of court and subject to its supervision; Voluntary winding up; Conduct of winding up

Module III: The Partnership Act, 1932

a) Nature of Partnership; Relation of partners-inter se; Relation of partners to third parties; Incoming and outgoing partners

b) Dissolution of Firm; Registration of Firms-effect of non-registration
c) Offences by Firm-liability under N.I. Act & I.T. Act, 2000

Module IV: The Negotiable Instruments Act, 1881 - As Amended by The Negotiable Instruments(Amendment and Miscellaneous Provisions) Act, 2002

a) Notes, Bills and Cheques-Promissory notes, Bills of exchange and cheques (Demand drafts, payment orders etc.);Drawer, Drawee, Acceptor, Holder, Holder in due course, payment in due course
b) Endorsement-Endorsement in blank and endorsement in full, conversion of endorsement in blank into endorsement in full and its effects
c) Negotiation; Presentment-At sight, on presentment, after sight, presentment for payment; Maturity-Calculating its period; Noting and protest-Protest for better security; Presumption as to negotiable instruments-and estoppel; Cross Cheques-Cheques crossed generally and specially;Of penalties in case of Dishonour of certain cheques for insufficiency of funds etc.; Offences by companies

COURSE/LEARNING OUTCOMES

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

CO1: Deal with the legal environment that is influencing business functioning
CO2: Acquire proper perspective about legal environment for better decision making.

Suggested Readings

1. A.K. Majumdar & G.K. Kapoor ,Company Law & Practice, Taxmann Publication
2. Vijay Gupta, K.C. Garg ,Company Law, Kalyani Publishers
3. Auter, Company Law- Singh, Eastern Book Company, Lucknow.

CMFI0049: CORPORATE FINANCE

(4 credits – 60 hours)

Objectives: The main objective of the course is to provide the conceptual background for corporate financial analysis from the point of corporate value creation. The course develops theoretical framework for understanding and analysing major financial problems of modern firm in the market environment.

Module I: Introduction to Corporate Finance (15 hours)

Objective of Corporate Finance; Role of finance manager in corporations; types of firms; stock markets; financial institutions; Financial Statement Analysis: Balance Sheet analysis, Income Statement analysis, Cash Flow statement; Case Study - Enron

Module II: Investment Decisions (10 hours)

Net Present Value (NPV) rule; Payback rule; Internal Rate of Return (IRR) rule; Modified Internal Rate of Return; Choosing between projects; Capital Budgeting process; Forecasting Incremental Earnings; Break even Analysis; Scenario analysis; Options in Capital Budgeting – Delay, Expand, Abandon

Module III: Stock Valuation (20 hours)

Models of Stock Valuation; Dividend Discount Model; Discounted Cash Flow Model; Comparable Companies Analysis; Systematic Risk vs Equity Risk; Measuring Systematic risks; Beta; Capital Asset Pricing Model (CAPM); Cost of Capital: Weighted Average Cost of Capital (WACC), Cost of Debt, Cost of Equity, Using WACC to value a project.

Module IV: Long Term Financing (15 hours)

Equity financing for Private Companies; Initial Public Offerings (IPO); Case Study – Google's IPO; Debt Financing: Private Debt and Public Debt, Bond Covenants, Repayment Provisions; Capital Structure: Capital Structure Choices, Capital Structure in Perfect Capital Markets, Modigliani and Miller (MM) Model, Debt and Taxes .

COURSE/LEARNING OUTCOMES

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

CO1: Explaiin the basic tools and concepts necessary to understand modern financial theory and its application in corporations.

CO2: Apply capital budgeting tools for evaluating investments.

CO3: Analyse the relationship between capital structure, risk and shareholder value, using the Modigliani Miller Theorems.

Suggested Readings

1. Berk and DeMarzo : Corporate Finance, Pearson.
2. Brealey, Richard/ Myers, Stewart C. / Allen, Franklin :Principles of Corporate Finance, McGraw Hill.
3. Aswath Damodaran : Investment Valuation, John Wiley.

CMPG0050: PRINCIPLES OF MARKETING

(4 credits – 60 hours)

Objective: *To apply relevant knowledge, skills and exercise professional judgement in selecting and applying marketing principles and concepts in different business contexts and to contribute to the evaluation of the performance of an organisation and its strategic and operational development.*

Module I: Introduction to Marketing (12 classes)

Marketing in the Twenty-First Century; The Impact of the New Economy; Change in Customers; Changes in Business Scenario; Marketing Objectives; Marketing Environment; Marketing Mix; Elements of Marketing Mix, Product Mix, Price Mix, Promotion/Communication Mix, Place Mix/Distribution Mix; Significance of Marketing Mix; Factors Affecting Marketing Mix; Growth & Future of marketing in India.

Module II: Product, and Product Brand Management (12 hours)

Definition, Features, Characteristics and Classification of Product; Product Life Cycle definitions, Stages of the Product Life Cycle; Implications of the Product Life Cycle Concept; Types of New Products; Challenges to New Product Development; Steps in the Development of the New Product; Introduction, Objectives, Problems and Process of Test Marketing; Introduction to Product Brand, Definition of Product Branding, Purpose of Branding, Features of Good Brands, Significance and Importance of Branding, Branding in a new economy.

Module III: Pricing and Promotion Decision (12 Classes)

a) Pricing Decisions; Concept of Price; Significance of Pricing; Factors Affecting Pricing Decisions; Major Pricing Methods; Pricing Policies and Strategies; Geographical Pricing, Product Line Pricing, Discounts and Rebates.
b) Meaning and Nature of Promotion, Importance of Promotion, Communication Process, Concept of Integrated Marketing Communication, Meaning of Promotion Mix, Elements of Promotion Mix (Methods of Promotion), Factors Influencing Promotion Mix Decisions, Promotion Mix Strategies, Communication Planning and Control.

Module IV: Distribution and Retailing (12 Classes)

a) Channels of Distribution: Meaning of a Channel of Distribution, Importance of Channels of Distribution, Types of Distribution Channels, Choice of a Channel of Distribution, Functions of Distribution Middlemen, Distribution Strategies, Wholesaling.
b) Meaning of Physical Distribution, Importance of Physical Distribution, Elements of Physical Distribution, Marketing Logistics Decisions.

c) Meaning of Retailing, Functions and Services of Retailers, Types of Retailing; Malls and major markets; FDI in retail market; Management of Retailing Operations: An Overview, Retailing in India – Changing Scenario.

Module IV: Rural Marketing, Consumer Protection and Developments In Marketing (12 Classes)

a) Growing Importance of Rural Markets, Distinguishing Characteristics of Rural Markets, Understanding Rural Consumer and Rural Markets, Marketing Mix Planning for Rural Markets.
b) Consumer Protection, Need for Consumer Protection, Measures for Consumer Protection, Consumerism – Evolution, Meaning and Approaches, Laws to Protect Interests of Consumers.
c) Recent Developments in Marketing, Social Marketing, Direct Marketing, Online Marketing, Relationship Marketing, Green Marketing, Marketing Ethics, Sustainable Marketing, Marketing of Services.

COURSE/LEARNING OUTCOMES

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

CO1: Use marketing mix models in workplace and contribute to organisational growth.
CO2: Assess the impact of product and brand management decisions on organisational performance.
CO3: Identify and evaluate the effectiveness of pricing and promotion decisions.
CO4: Apply appropriate distribution and retailing strategies in improving organisational performance.
CO5: Examine and understand the Rural Marketing initiatives and Developments In Marketing

Suggested Readings

1. C.B. Gupta, Principles of Marketing, Sultan Chand & Sons.
2. Philip Kotler, Marketing Management, Pearson Education, New Delhi.
3. S. A. Sherlekar, Marketing Management, Himalaya Publishing House, Mumbai.
4. A. Kumar & Meenakshi, Marketing Management, Vikas Publishing House, New Delhi.
5. R. Saxena, Marketing, Himalaya Publishing House, Mumbai.

CMBS0051: INTERNATIONAL BUSINESS

(4 credits – 60 hours)

Objective: This course provides an overview of the environment, concepts, and basic differences involved in international business.

Module I: Introduction to Global Business (15 hours)

Global Business: Scope, Global Linkages today; Culture and Global Business: Elements of culture, Training Challenge; Global Trade and Investment Theory: Mercantilism, Classical Trade Theory, Factor Proportion Theory, International Trade and Product cycle theory, Theory of International Investments; Structure of Indian Foreign Trade: Composition & direction; EXIM Bank; Exit Policy of India; Regulation and Promotion of Foreign Trade.

Module II: Global Financial Markets (15 hours)

Foreign exchange markets; Fixed and Floating Foreign exchange rates; Significant monetary events; Exchange rates, interest rates and economic policy; Economic Integration; Government Trade Policies.

Module III: Global Business Environment (15 hours)

Private International Law; Public International Law; Risk to Global Business; Doctrine of Sovereign Immunity; Doctrine of Eminent Domain; Labour Law Differences; Theoretical foundations of International Business; Balance of Payments; International Liquidity;

International Economic; Accounting and Tax differences; Multinational Corporations; Foreign Direct Investment.

Module IV: International Finance (15 hours)

Financing exports and imports; International Capital and Cash Management; Capital Structure: International Dimensions; International Capital Markets; International Banking and Security Markets; IMF; World Bank; IFC; ITA; ADB; WTO.

COURSE/LEARNING OUTCOMES

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

CO1: Describe the foundation of international business.
CO2: Describe international organizations and multinational corporations.
CO3: Define forms of foreign involvement.
CO4: Discuss international trade theory.

Suggested Readings

1. Rakesh Mohan Joshi: International Business, Oxford University Press.
2. FRANCIS CHERUNILAM: International Business: Text and Cases, PHI Learning.

CMAS6002: ACCOUNTING SOFTWARE LAB

(3 credits)

Objectives: To give an opportunity to the undergraduate student to get acquainted with Tally accounting software and, the learning outcome is enabling students to learn the practical application of Tally.ERP9 and apply those in the practical field in the business organisation

Module I Introduction to Tally (5 hours)

Accounting Package: Why Tally, Leadership, Various versions of tally

Module II Tally.ERP9 (15 hours)

Tally.ERP9: meaning, salient features, shut company, select company, company features and company configuration; Introducing the Tally.ERP 9 software, creation of company, various reports (accounts and inventory), Backup and restore.

Creation of Chart of accounts: creation of groups and subgroups, creation, alteration and deletion of ledgers, backup and restore; report: Balance Sheet , Trial Balance

Module III Bill Allocation and report (8 hours)

Opening bill allocation; accounting entry with online creation; party payment/ receipt with advance payment/receipt; Report: Day book with zooming, cash/bank book

Module IV Cost centre, cost category and vouchers (8 hours)

Cost centre and cost category, predefined cost centre, BRS, asset purchase, sale of assets with depreciation

Vouchers class, non-accounting vouchers, budgeting and control

Project on Tally Accounting

Module V Goods and Service Tax (GST) (10 hours)

GST: Meaning, benefits, registration process, GST components, input tax credit, payment of GST, Return filing, consequences of non- compliances in GST

GST Activation, Master creation-GST related, purchase and sale of goods (local), purchase and sale of goods (Interstate),

Project on GS

COURSE/LEARNING OUTCOMES (Not available)

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

CO1: Use Tally.ERP9 in the practical field in the business organization.

DEPARTMENT OF ECONOMICS

ENME0001: MICRO-ECONOMICS I

(6 Credits – 75 Hours) (L-T-P: 5-1-0)

Objective: *This course introduces economic analysis of individual, business, and industry choices in the market economy. Students will learn how markets establish price, production, wage and employment levels, and the likely consequences of government attempts to alter market outcomes.*

Module I: Basic Concepts (25 hours)

Scarcity and Choice; Production possibility frontier, Positive and normative economics; constructing a model, scientific method; concepts of opportunity cost, rate of growth, and of total, average and marginal functions.

Demand and Supply: Market demand, elasticity, shifts and movements, Applications of Demand, Supply and elasticity, Revenue and Expenditure, elasticity and marginal revenue; income elasticity of demand; consumer surplus

Module II: Consumer Choice (30 hours)

Cardinal theory, derivation of demand in case of one or more goods; Ordinal theory: Budget sets and Preferences under different situations. Indifference curves: the rate and elasticity of substitution. Consumer equilibrium; effects of change in prices and income; Engels curve, Derivation of demand curve. Income and substitution effects: Hicks and Slutsky, Applications of indifference curves to other economic problems, Revealed preference theory of demand.

Module III: Production (15 hours)

Production functions: single variable - average and marginal product, variable proportions, stages of production. Two variables - isoquants, returns to scale and to a factor; factor prices; cost minimization and output maximization; Elasticity of substitution. Expansion path and the cost function.

Module IV: Cost (10 hours)

Concept of economic cost; Short run and long run cost curves; increasing and decreasing cost industries; envelope curve; L-shaped cost curves; economies of scale. Prices as parameters: Firm equilibrium and profit; short and long-run supply function; taxes and subsidies.

Suggested Readings

1. Dr. Robert E. Hall and Dr. Marc Lieberman, Microeconomics- Principles and applications
2. Joseph E. Stiglitz and Carl E. Walsh: Principles of Microeconomics
3. Arthur O'Sullivan and Steven M. Sheffrin, Micreconomics- Principles, Applications and Tools (for Application Purposes)
4. Varian, Hal R., Intermediate Microeconomics
5. Mankiw, Gregory N., Principles of Economics
6. Pindyck, Robert S. &Rubinfeld, Daniel L., Microeconomics, PHI
7. Browning, Edgar K. &Zupan, Microeconomic Theory and Applications

ENQM0002: QUANTITATIVE METHODS IN ECONOMICS I

(6 Credits-75 Hours) (L-T-P: 5-1-0)

Objective: The objective of this course is to accustom the students with the concepts of mathematical techniques and their applications which are used to elucidate the problems of economic theory and help in better choices.

Module I: Basic Concepts (17 Hours)

Variables, Sets, Functions, Limit and Continuity of a Function, Equations, Identities, Systems of simultaneous equations, Homogeneous function

Module II: Matrix And Determinants (17 Hours)

Various types of matrices, Matrix operations-addition, subtraction and multiplication, Scalar Multiplication, transpose of a matrix, Rank of a matrix, Determinants, Matrix inversion, Solution of Simultaneous equation system, Cramer's rule, Application to partial equilibrium market model, simple national income model.

Module III: Differential Calculus (25 Hours)

Differentiation of a Function, Basic rules of differentiation, derivatives of higher order, maximum and minimum values of a function, order condition for maximum-minimum values, partial and total differentiation, chain rule of differentiation.

Module IV: Applications Of Simple Derivatives (16 Hours)

Differential coefficient, elasticity of demand, total, average and marginal cost curves – minimum average cost, cost function in cubic form, maximum total revenue, conditions for profit maximization, effects of taxation and subsidy on monopoly, Relation between AC and MC, Application to Comparative static analysis of Market Model and National Income Model.

Suggested Readings

1. Chiang, A.C & Wainwright, K., Fundamental Methods of Mathematical Economics, McGraw Hill Education.
2. J.M. Henderson and R.E. Quandt, Micro – Economic Theory – A Mathematical Treatment, McGraw Hill.
3. R.G.D. Allen, Mathematical Economics for Economists, Biblio Bazaar.
4. Sydsaeter, Knut & Hammond, Peter J., Mathematics for Economic Analysis, Pearson Education.

ENMB0003: MONEY, BANKING AND FINANCE

(6 Credits-75 Hours) (L-T-P: 5-1-0)

Objectives: This course exposes students to the theory and functioning of the monetary sectors of the economy. Banking sector reforms and monetary policy with special reference to India are also covered. This course also introduces the students to Financial Economics.

Module I: Money (10 Hours)

Nature and Functions of money, Concept, measurement; Demand for money and Keynes' Liquidity preference theory of interest

Module II: Money and Prices (18 Hours)

Value of money and price level, Fisher's transactions approach, quantity theory of money, Fisher's equation of exchange, Cambridge Cash-balance approach, Other monetarist's view; Keynes' Monetary theory; Friedman's Modern Quantity Theory of Money.

Module III: Banking System (17 Hours)

a) Balance sheet and portfolio management, credit and commercial banking; Indian banking system: Changing role and structure; banking sector reforms
b) Functions, goals, targets, indicators and instruments of monetary control; monetary management in an open economy; current monetary policy of India.

Module IV: Deterministic cash-flow streams (20 Hours)

a) Interest Rates determination; sources of interest rate differentials; theories of term structure of interest rates; interest rates in India.
b) 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 interest rates; yield curves; spot rates and forward rates.

Module V: Capital Asset Pricing Model (CAPM) (10 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.

suggested Readings

1. F. S. Mishkin and S. G. Eakins, Financial Markets and Institutions, Pearson Education,
2. F. J. Fabozzi, F. Modigliani, F. J. Jones, M. G. Ferri, Foundations of Financial Markets and Institutions, Pearson Education
3. L. M. Bhole and J. Mahukud, Financial Institutions and Markets, Tata McGraw Hill.
4. M. Y. Khan, Indian Financial System, Tata McGraw Hill
5. Various latest issues of R.B.I. Bulletins, Annual Reports, Reports on Currency and Finance and Reports of the Working Group, IMF Staff Papers.
6. David G. Luenberger, Investment Science, Oxford University Press.
7. Richard A. Brealey and Stewart C. Myers, Principles of Corporate Finance.

ENSM0006: STATISTICAL METHODS FOR ECONOMICS

(6 Credits-75 Hours) (L-T-P: 5-1-0)

Objectives: This is a course on statistical methods for economics. It begins with some basic concepts and terminology that are fundamental to statistical analysis and inference. It then develops the notion of probability, followed by probability distributions of discrete and continuous random variables and of joint distributions. This is followed by a discussion on sampling techniques used to collect survey data. The course introduces the notion of sampling distributions that act as a bridge between probability theory and statistical inference. The semester concludes with some topics in statistical inference that include point and interval estimation.

Module I: Introduction and Overview (10 hours)

The distinction between populations and samples and between population parameters and sample statistics; the use of measures of location and variation to describe and summarize data; population moments and their sample counterparts.

Module II: Elementary Probability Theory (12 hours)

Sample spaces and events; probability axioms and properties; counting techniques; conditional probability and Bayes' rule; independence.

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; covariance and correlation coefficients.

Module V: Sampling (15 hours)

Principal steps in a sample survey; methods of sampling; the role of sampling theory; properties of random samples.

Module VI: Point and Interval Estimation (8 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 and Morris L. Marx, An Introduction to Mathematical Statistics and its Applications, Prentice Hall, 2011.
4. William G. Cochran, Sampling Techniques, John Wiley, 2007.

ENMC0007: MACRO-ECONOMICS I

(6 Credits-75 Hours) (L-T-P: 5-1-0)

Objective: *This course gives an understanding on how an economy behaves at the aggregate level. Upon successful completion of the course a student will be able to:*

- *Understand the basics of national income accounting.*
- *Understand why household, business and government determine the aggregate demand and why the behavior of businesses and the rest of the world determine the aggregate supply of goods and services.*

Module I: Theory of Income Determination (35 Hours)

a) National Income Accounting: Meaning of National Income, Circular flow of Income, Concepts of National Income.

b) Determination of National Income – Keynesian Theory: Aggregate Demand, Aggregate Supply, Determination of Equilibrium Level of National Income – Principle of Effective Demand.

c) Consumption Function: Propensity to Consume, Propensity to Save, Determinants of Propensity to Consume, Keynes' Psychological Law of Consumption, Post Keynesian theories of Consumption.

d) Investment Demand: Meaning of Investment, Determinants of Investment, Marginal Efficiency of Capital, Accelerator Theory of investment, Concept of Investment Multiplier.

e) Unemployment and Full Employment: Meaning, Types, Keynes' view on involuntary unemployment.

Module II: Theory of Monetary Demand and Supply (25 Hours)

a) Nature and Functions of Money: Definition, Function, Importance, Its Role in Economic Development

b) Money Supply and its Determinants: Concept, Measures, Deposit Multiplier, Money Multiplier, Factors determining Money Supply in India.

c) Demand for Money: Its Motives, Keynes' Liquidity Preference Theory of Interest, Friedman's Theory of Demand for Money.

Module III: Pricing and Inflation (15 Hours)

a) Inflation: Nature, Causes, Effects, Inflation and Unemployment – Philips Curve.

b) Business Cycle: Phases, Features, Theories.

Suggested Readings

1. D'Souza, E. (2008), Macroeconomics, Pearson Education: New Delhi.
2. Blanchard, O. (2006), Macroeconomics, Pearson Education, New Delhi.
3. N. Gregory Mankiw (2006), Macroeconomics, Worth Publishers
4. Dornbusch Rudiger, Fischer Stanley and Startz Richard (2004), Tata McGraw-Hill
5. Froyen (2013): Macroeconomics, Theories and Policies Pearson, New Delhi

6. Government of India (GOI) (Latest Year), Economic Survey‖, Ministry of Finance: New Delhi.

ENIM0008: INDIAN MONETARY SYSTEM

(6 Credits-75 Hours) (L-T-P: 5-1-0)

Objective: *The course intends to give an extensive exposure to the students to the concept of money and money supply and distinguish the different forms of money markets in India. The course also gives a theoretical perspective on determination of money supply through the various theories of demand.*

Module I: Introduction to Money (15 Hours)

Meaning, components of supply of money, measures of money supply; features of a developed money and capital market; functions of commercial banks and pre-requisites of a sound commercial banking system; brief review of the measures taken in India to liberalize the financial system.

Module II: Theories on Money (12 Hours)

Theories of demand for money –Post Keynesian Theories of Demand for money; the H theory of money supply; Money multiplier process, determinants of money multiplier; income theory of money.

Module III: Financial Institutions in India (23 Hours)

Functions & growth of financial institutions in India; Functions and objectives of central bank; instruments of credit control; role of non-banking financial institutions in India – mutual funds, LIC, Investment companies, venture capital; role of regulatory authorities – SEBI and IRDA.

Module IV: Money Market (15 Hours)

The structure of financial markets – call money, treasury bills and commercial bills; the stock market and market for gilt edged securities; unregulated credit markets; financial sector reforms in India.

Module V: Foreign exchange market (15 Hours)

Foreign exchange; foreign exchange rate, foreign exchange market – concept of spot exchange rate and forward exchange rates; determination of exchange rates under fixed & flexible exchange rate regime and role of hedging in the determination of exchange rates; Euro-Dollar market – its role & significance.

Suggested Readings

1. Gupta, S.B., Monetary Economics, S. Chand & Company, New Delhi
2. Mitra, S., Money & Banking, Random House, New York
3. Chandler, L.V. & S.M. Goldfield , The Economics of Money and Banking, Harper & Row, New York
4. Sayers, R.S. Modern Banking, Oxford University Press, New Delhi
5. Smith, P.F. ,Economics of Financial Institutions & Markets, Prentice Hall
6. Gupta, S.B., Monetary planning for India, S. Chand & Company, New Delhi
7. Grabble, J.O., International Financial Markets, Elsevier, New York

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS

MADM0002: DISCRETE MATHEMATICS

(4 credits – 60 hours)

Objective: *The objective of this course is to introduce the student of Computer Applications to the principles of Discrete Mathematics and Probability Theory which have applications in Computer Science and the development of logical thinking. Discrete Mathematics exposes the student to algebraic structures, combinatorial mathematics and graph theory. The necessary abstract mathematical content is to be dealt with and explained in the context of its application to computer science to present to the students the foundations of many basic computer related concepts.*

Module I: Sets, Relations and Functions (13 Hours)

Sets, set operations; binary relations, types of relations, partitions; partial order relations, Hasse and lattice diagrams for posets; functions, types of functions, composition of functions, Congruences, Chinese Remainder theorem

Module II: Algebraic Structures (20 Hours)

Semi groups, products and quotients of semi groups; groups, cosets, normal subgroups, quotient groups, Lagrange's Theorem, products of groups; use of groups in coding of binary information and error detection, decoding and error correction.

Module III: Combinatorics and Recurrence Relations (12 hours)

Permutation and combination, principles of counting and enumeration; recurrence relations, the fibbionacci sequence, solutions of recurrence relations by substitution and generating functions, solution of non-recurrence relations by conversion to linear recurrence relations.

Module IV: Introduction to Graph Theory (15 hours)

Introduction to graphs, representation of graphs, graph isomorphisms, subgraphs, directed and undirected graphs; Euclerian paths and circuits; Hamiltonian paths and circuits; change of sequence - coloring of graphs; trees.

COURSE / LEARNING OUTCOMES

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

CO1: Learn and understand the basic concept associated with Set theory, Group theory, Graph theory and combinatorics and develop their logical thinking. (Knowledge)
CO2: Interpret these concepts in a practical manner apart from having conceptual understanding of the already mentioned concepts. (*Comprehension*)
CO3: Apply these concepts in various theories of computer science like coding theory etc. (*Application*)
CO4: Analyze methods to obtain the solution. (*Analysis*)
CO5: Solve those problems by using the basic concept and logical thinking. (*Synthesis*)
CO6: Use mathematical concepts and logic in theory of computer science. (*Evaluation*)

Suggested Readings

1. Kolman, R.C. Busby and S.C. Ross, Discrete Mathematical Structures, Prentice Hall of India, New Delhi, 2002.
2. Trembly and P. Manohar, Discrete Mathematical Structures With Applications to Computer Science, McGraw Hill.

3. J.L. Mott, A. Kandel and T.P. Baker, Discrete Mathematics for Computer Scientists and Mathematicians, Prentice Hall of India, New Delhi, 2004.
4. Somasundaran, Discrete Mathematical Structures, Prentice Hall of India, New Delhi, 2003.

E-resource for learning
Scilab,, www.spoken-tutorial.org

MALA0003: LINEAR ALGEBRA AND RANDOM PROCESSES

(3 credits - 45 hours)

Objective: *The purpose of this course is to lay down the basic Mathematical concepts and tools required to work with signals and communications in the field of Electronics and Communication.*

Section A: Linear Algebra

Module I: Vector Space

Binary operations on a set, Definitions of Group and Field; Definition and properties of vector space, vector sub-space; Algebra of subspaces; basis of a vector space; finite dimensional vector space; homomorphism of vector space; Isomorphism of vector space; Disjoint subspaces

Module II: Linear Transformations

Linear transformation, operator; range and null space of a linear transformation; rank and nullity of a linear transformation; Linear transformations as vectors; product of linear transformations; Invertible linear transformation; Singular and non-singular transformation; Matrices- definition, representation by transformation, trace of a matrix, trace of a linear matrix; Determinant of a linear transformation

Module III: Inner Product Spaces

Definition, Euclidean and unitary space; Schwartz's inequality; Orthogonally; Orthonormal set; Complete orthonormal set; Gram-Schmit orthogonalization.

Section B: Random Processes

Module IV: Probability

Sample space, definition of probability, conditional probability, Baye's theorem, Bernouli's trials, Asymptotic theorems, Poison's theorem and random points.

Module V: Random Variables and Random Processes

a) Definition, Continuous and discrete random variable, Probability distribution and density functions; Conditional distribution
b) Random variable - Mean, variance, moments, characteristic functions; Two random variables - Joint distributions, Mean, variance, moments, characteristic functions; Moments and conditional statistics; Transformation of random variables
c) Random processes - Mean, Correlation and Covariance; Stationarity; transmission of a random process through a linear filter, power spectral density, Gaussian process

Suggested Readings

1. K. Hoffman and R. Kunze, Introduction to Linear Algebra, PHI
2. Matrix Analysis, R. Horn and C. Johnson, Cambridge U.P
3. Probability, Random Variables and Stochastic Processes, A. Papoulis, McGraw-Hill
4. Probability, Random Variables and Estimation Theory for Engineers, H. Stark and J.W. Woods, PHI

MANM0004: NUMERICAL METHODS

(3 credits - 45 hours)

Objective: *To enable the students to develop efficient algorithms for solving problems in science and engineering. This course gives a complete procedure for solving different kinds of problems that occur in engineering numerically.*

Module I (5 Hours)

Matrices - Definition, representation by transformation, trace of a matrix, trace of a linear matrix, determination of a linear transformation

Module II (10 Hours)

Numerical differentiation and integration: Differentiation using interpolation formulae – Numerical integration by trapezoidal and Simpsons' 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulae – Double integrals using trapezoidal and Simpsons' rules

Module III (15 Hours)

Initial value problems for ordinary differential equations, Single step methods: Taylor series method, Euler method for first order equation, Fourth order Runge, Kutta method for solving first and second order equations, Multistep methods: Milne's and Adam's predictor and corrector methods

Module IV (15 Hours)

Boundary value problems in ordinary and partial differential equations -Finite difference solution of second order ordinary differential equation, Finite difference solution of one dimensional heat equation by explicit and implicit methods, One dimensional wave equation and two dimensional Laplace and Poisson equations

COURSE / LEARNING OUTCOMES

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

CO1: Learn and understand the fundamental methods associated with numerical integration and differentiation, matrices. (*Knowledge*)
CO2: Gain the knowledge regarding the efficiency of the numerical methods via computing the error. (*Comprehension*)
CO3: Use these concepts in various problems occurring in civil engineering especially those involving numerical computations. (*Application*)
CO4: Analyze and adopt the method suitable for that problem. (*Analysis*)
CO5: Classify problems which are solvable by a certain numerical method.(*Synthesis*)
CO6: Decide the implementation of a certain physical model by virtue of its mathematical output upto the degree of accuracy. (*Evaluation*)

Suggested Readings

1. M.K. Holmes, "Introduction to Numerical Methods in Differential Equations", Springer India Private Limited (2007)
2. S. K. Gupta, "Numerical Methods for Engineers", New Age International Pvt. Ltd.
3. K. Hoffman and R. Kunze, "Introduction to Linear Algebra", PHI Learning
4. R. Horn and C. Johnson, "Matrix Analysis", Cambridge U.P

MARM0005: RESEARCH METHODOLOGY AND STATISTICAL TOOLS

(2 credits - 30 hours)

Objective: *Research is a tool which helps the manager to identify, understand and solve management problems. Research improves the decision making ability of the manager. The objective of the subject is to create scientific attitude towards solving a management problem and impart knowledge about tools available for carrying out research.*

Module I: Research methodology (15 Hours)

a) Meaning, Objectives and motivation in Research, Types of Research, Research Approaches, Research Methods vs methodology, Research Process, validity and reliability in research, Obstacles in accepting research, Problem Formulation, Hypothesis formulation, types of hypothesis, characteristics of good hypothesis. Meaning and Significance of Research designs, features of a good research design, types of research design
b) Census vs Sample survey, Steps in sample design, determining the size of sample, .Types of Sampling – probability (systematic, stratified, cluster and simple random)and non probability (convenience, snowball judgement and quota) sampling
c) Data, measurement and scaling techniques- Types of Data, Sources of Data, Primary and secondary data, methods of collecting data, Testing the validity of data, measurement and scaling techniques, sources of error in measurement, tests of sound measurement, scaling and scale construction techniques
d) Questionnaire, presentation and report writing, steps in questionnaire design, characteristics of good questionnaire, Presentation, processing and analysis and interpretation of data, Report writing, layout of a research report, characteristic of a good research report

Module II: Statistical Tools (15 Hours)

a) Measures of central tendencies, Dispersion and asymmetry, Simple numerical Calculations, for understanding the characteristic values
b) Linear correlation and linear regression, 2 Variables
c) Association of Attributes, 2 Attributes only
d) Testing of hypothesis, large Sample tests, z test, t-test, F- test,Chi squared test
e) Simulation Techniques

Suggested Readings

a) CR Kothari, "Research Methodology Methods and Techniques", New Age International
b) SP Gupta, "Statistical Methods", Sultan Chand New Delhi
c) William G Zikmund, "Business Research Methods", Thomson South-Western
d) Mark Balnaves and Peter Caputi, "Introduction to Quantitative Research Methods", Sage Publications

E-resource for learning

Scilab, www.spoken-tutorial.org

MABM0006: BASIC MATHEMATICS

(4 credits – 60 hours)

Objective: *The primary objective of this course is to introduce students some of the mathematics through which they can develop some mathematical maturity, that is enhance their ability to understand and create mathematical arguments. The secondary objective of this course is to prepare students for mathematical oriented courses in computer science such as discrete mathematics, database theory, analysis of algorithms, etc.*

Module I: Determinants and Matrices (12 Hours)

a) Determinants: Definition, minors, cofactors, properties of determinants
b) Matrices: Definition, types of matrices, addition, subtraction, scalar multiplication and multiplication of matrices, adjoint, inverse, Cramer's Rule, rank of matrix, linear dependence of vectors, Eigenvectors of a matrix, Cayley-Hamilton Theorem.

Module II: Limits and Continuity (15 Hours)

Limit of a function at a point, properties of limit, computation of limits of various types of functions, continuity of a function at a point, continuity over an interval, Intermediate value theorem

Module III: Differentiation (18 Hours)

Derivative of a function, derivatives of sum, difference, product and quotient of functions, chain rule, derivatives of composite functions, Rolle's theorem, mean value theorem, expansion of functions (Maclaurin's and Taylor's), indeterminate forms, L'Hospital's rule, maxima and minima.

Module IV: Integration (15 Hours)

Indefinite integrals, methods of integration: substitution, by parts, partial fractions; Integral as the limit of a sum, fundamental theorem of calculus.

COURSE / LEARNING OUTCOMES

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

CO1: Systematically understand the fundamental concepts of calculus and matrix theory (*Knowledge*)
CO2: Understand the practical implementations of these concepts. (*Comprehension*)
CO3: Effectively apply these notion to various aspects of computer science. (*Application*)
CO4: Analyze every problem, be it theoretical or computational in terms of its corresponding mathematical formulation. (*Analysis*)
CO5: Able to segregate those problems by virtue of a set of hypothesis. (*Synthesis*)
CO6: Determine suitable methods, first to formulate the problem and then to solve the same. (*Evaluation*)

Suggested Readings

a) B.S. Grewal, "Elementary Engineering Mathematics", 34th Ed., 1998.
b) Shanti Narayan , "Integral Calculus", S. Chand and Company, 1999
c) H.K. Dass, "Advanced Engineering Mathematics", S. Chand and Company, 9th Revised Edition, 2001.
d) Shanti Narayan, "Differential Calculus", S.Chand and Company, 1998.

MAPT0008: PROBABILITY THEORY

(3 credits – 45 hours)

Objective: *The objective of this preliminary course in Probability Theory is to introduce the students of Computer Applications to the elementary principles of Probability Theory, random variables and probability distributions which have applications in the theory of Computing.*

Module I: Introduction to Probability Theory (11 Hours)

Sample space and events, probabilities of events and combinations of events, conditional probability, stochastic independence, Baye's theorem.

Module II: Random Variables (10 hours)

Random Variables, Discrete and continuous random variables, properties of random variables – expectation, mean, variance, moments

Module III: Probability Distributions (11 Hours)

Probability distributions – binomial, Poisson and hyper-geometric distributions; normal distribution, properties, examples, relation to Poisson approximation

Module IV: (13 hours)

a) Random sampling – sampling with and without replacement, sample mean, sample variance
b) Confidence intervals for a single population – parameters and statistics, confidence intervals for means, confidence intervals for variances.
c) Hypothesis tests for a single population – testing of hypothesis about parameters, hypothesis tests for means, hypotheses tests for variances.

Suggested Readings

1. Seymour Lipschutz and John Schiller, Introduction to Probability and Statistics, Tata McGraw-Hill Edition, 2005
2. William Feller, An Introduction to Probability Theory and its Applications, Vol 1, Wiley Eastern Pvt. Ltd., New Delhi, 1972.
3. E. Parzen, Modern Probability Theory and Its Applications, Wiley Eastern University Edition, California, 1960.
4. Papoulis, Probability and Statistics, Prentice Hall, 1990.

MAEM0009: ENGINEERING MATHEMATICS III

(4 credits – 60 hours)

Module I: Partial differential equations (20 hours)

First order PDE, solution of linear and non-linear first order PDEs; classification of second order PDEs; boundary and initial value problems involving heat and wave equations - one-dimensional and two-dimensional; Laplace equation and solution by method of separation of variables (Cartesian, polar, spherical and cylindrical coordinates).

Module II: Fourier analysis (18 hours)

Fourier series: convergence and sum of Fourier series, even and odd functions, Cosine and Sine Fourier series; Fourier Integrals: Fourier Cosine and Sine integrals; Fourier Transforms: Fourier Cosine and Sine transforms, convolution theorem. Solution of PDEs using Fourier Transforms.

Module III: Complex analysis (22 Hours)

1. Limit, continuity and differentiability of complex functions, analytic functions, conformal mappings. Complex integration. Cauchy's Theorem Cauchy's integral formulae.
2. Taylor's and Laurent's series; residue theorem, evaluation of real integrals.

COURSE / LEARNING OUTCOMES

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

CO1: Understand the basic concepts associated with complex analysis, partial differential equation etc. (*Knowledge*)
CO2: Interpret these concepts in a practical manner apart from having conceptual understanding of the already mentioned concepts. (*Comprehension*)
CO3: Use these concepts in various engineering problems involving circuit problems, fluid flow to name a few and whereby solving these problems. (*Application*)
CO4: Analyze the situation by approaching the solution. (*Analysis*)
CO5: Form a common hypothesis that works for problems of a certain type whereby prescribing a common solution. (*Synthesis*)
CO6: Predict which method suits a certain problem the most. (*Evaluation*)

Suggested Readings

1. E Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley, 1999.
2. BV Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
3. B.S. Grewal, Higher Engineering Mathematics, 40th Edition, Khanna Publishers, New Delhi
4. R.K. Jain, R.K. and S.R.K. lyengar, Advanced Engineering Mathematics, Narosa Publishing House, New Delhi.
5. M.R.Spiegel, Theory and Problems of Complex Variable, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2005.
6. M.R.Spiegel, Fourier Analysis With Application to Boundary Value Problems, Tata

McGraw-Hill Publishing Company Ltd., New Delhi, 2005.
7. James Ward Brown, Ruel V. Churchill, Complex Variables and Applications, McGraw Hill International.

MAEM0010: ENGINEERING MATHEMATICS IV

(4 credits – 60 hours)

Module I (9 hours)

a) Numerical Integration – Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule; Finding Eigenvalues by iteration

b) Numerical solution of Ordinary Differential Equation by Taylor's series, Modified Euler's method, Runge-Kutta methods.

Module II (18 hours)

Linear Programming: Formulation, graphical solution, simplex method, duality theory, dual simplex method; formulation and solution of engineering problems of planning and scheduling - transportation problem and assignment problem.

Module III (20 hours)

a) Sample space and events, probabilities of events and combinations of events, conditional probability, stochastic independence, Baye's theorem.

b) Random Variables, Discrete and continuous random variables, properties of random variables – expectation, mean, variance, moments.

c) Probability distributions – binomial, Poisson and hypergeometric distributions; normal distribution, properties, examples, relation to Poisson approximation; joint distribution and its properties

Module IV (13 hours)

a) Random sampling – sampling with and without replacement, sample mean, sample variance

b) Confidence intervals for a single population – parameters and statistics, confidence intervals for means, confidence intervals for variances.

c) Hypothesis tests for a single population – testing of hypothesis about parameters, hypothesis tests for means, hypotheses tests for variances.

COURSE / LEARNING OUTCOMES

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

CO1: Learn and understand the basic methods associated with numerical integration and differentiation, probability theory etc. (*Knowledge*)

CO2: Gain the knowledge regarding the advantages and limitations of these methods. (*Comprehension*)

CO3: Use these concepts in various engineering problems involving signal processing etc. to get the solution up to certain accuracy. (*Application*)

CO4: Analyze various possible methods to obtain the solution. (*Analysis*)

CO5: Predict the efficiency of one method over the other whereby relating various problems for which such methods are applicable. (*Synthesis*)

CO6: Determine the suitability of a certain method for a certain problem. (*Evaluation*)

Suggested Readings

1. BV Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
2. E Kreyszig, Higher Engineering Mathematics, 8th Edition, John Wiley, 1999.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.
4. R.K. Jain, R.K. and S.R.K. lyengar, Advanced Engineering Mathematics, Narosa Publishing House, New Delhi.

5. A.M. Natarajan, P Balasubramaniam, A. Tamilarasi, Operations Research, Pearson Education, New Delhi.
6. Seymour Lipschutz and John Schiller, Introduction to Probability and Statistics, Tata McGraw-Hill Edition, 2005
7. William Feller, An Introduction to Probability Theory and its Applications, Vol 1, Wiley Eastern Pvt. Ltd., New Delhi, 1972.
8. E. Parzen, Modern Probability Theory and Its Applications, Wiley Eastern University Edition, California, 1960.
9. Papoulis, Probability and Statistics, Prentice Hall, 1990

MABS0011: BUSINESS MATHEMATICS

(4 credits – 60 hours)

Objective: *This course in Business Mathematics is intended as an initial introduction of Mathematical tools for students of Commerce or Management. While concepts of Compound Interest and Annuities have direct application to commercial transactions, topics in Progressions, Differentiation, Integration and Matrices and Determinants have applications to different aspects of Economics, Commerce and Management.*

Module I: Arithmetic and Geometric Progressions (6 hours)

Introduction to AP and GP, nth term and sum to n terms of an AP and GP, simple examples.

Module II: Compound Interest and Annuities (10 hours)

Calculation of compound interest and amount with different types of interest rates; types of annuities, present value and amount of an annuity, including the case of continuous compounding; valuation of simple loans and debentures; problems relating to sinking funds.

Module III: Differentiation (13 hours)

Differentiation of simple functions (trigonometrical functions, not required); differentiation of the sum, product and quotient of two functions, successive differentiation, differentiation of implicit functions; applications of differentiation to commerce and management – rates of change, maxima and minima.

Module IV: Integration (18 hours)

Integration as anti-derivative process; methods of integration – by substitution, by parts, use of partial fractions; definite integration, fundamental theorem of integral calculus (statement only); application of integration to commerce and economics – consumer and producer surplus and annuities.

Module V: Matrices and Determinants (13 hours)

Definition of a matrix, types of matrices, algebra of matrices; Determinants - properties of determinants, calculation of values of determinants upto third order; adjoint of a matrix, finding the inverse of a matrix using adjoint matrix; solution of a system of linear equations having unique solution and involving not more than three variables using Cramer's rule.

COURSE / LEARNING OUTCOMES

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

CO1: Familiarize themselves with the basic concepts and methodologies associated with commerce. (Knowledge)

CO2: Conceive the relationship between mathematical laws and commercial arithmetic. (Comprehension)

CO3: Apply these mathematical concepts in various theories of commerce as for instance, derivative and marginal cost, integration and total cost. (Application)

CO4: Analyze outcomes of a commercial problem depending upon the rules of calculus and basic algebra. (Analysis)

CO5: Depending upon such analysis, a student will be able to narrate which mathematical law is applicable in which commercial problem. (Synthesis)

CO6: Evaluate various commercial problems by means of mathematical laws avoiding tedious calculations. (Evaluation)

Suggested Readings

1. Sancheti DC and Kapoor VK, Business Mathematics, Sultan Chand and Sons, Delhi.
2. Dowling, Edward T, Mathematical Methods for Business and Economics, Schaum Series, McGraw Hill, London.
3. Soni, RS, Business Mathematics, Pitamber Publishing House, Delhi
   Veena GR, Comprehensive Business Mathematics, New Age International Publishers, New Delhi.

MACL0012: MATHEMATICS I - CALCULUS AND LINEAR ALGEBRA

(4 credit-60 hours) (L-T-P:3-1-0)

Objective: The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate differentiation and linear algebra. It aims to equip the students with standard concepts and tools from an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Module I: Differential and Integral Calculus (23 hours)

a) Rolle’s theorem, mean value theorems, Taylor’s and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; maxima and minima.

b) Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; maxima, minima and saddle points; method of Lagrange multipliers.

c) Evolutes and involutes; evaluation of definite and improper integrals; beta and gamma functions and their properties; applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module II: Sequence and Series (11 hours)

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: half range sine and cosine series, Parseval’s theorem.

Module III: Linear Algebra (11 hours)

Vector space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, inverse of a linear transformation, rank nullity theorem, composition of linear maps, matrix associated with a linear map.

Module IV: Matrices (15 hours)

Matrices, linear systems of equations, linear independence, rank of a matrix, determinants, Cramer’s rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination. eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigenbases. diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Suggested Readings

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002.

2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

MAIN0013: MATHEMATICS II-MULTIPLE INTEGRALS, NUMERICAL METHODS AND DIFFERENTIAL EQUATIONS

(4-credit-60 hours) (L-T-P:3-1-0)

Objective: *The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and numerical techniques. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.*

Module I: Multiple Integrals (12 hours)

Gradient, curl and divergence ,multiple integration: Double and triple integrals (cartesian and polar), change of order of integration in double integrals, change of variables (cartesian to polar), applications: areas and volumes by (double integration) Center of mass and gravity (constant and variable densities). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, simple applications involving cubes, sphere and rectangular parallelepipeds.

Module II: Numerical Methods (23 hours)

Solution of polynomial and transcendental equations – bisection method, Newton-Raphson method and Regula-Falsi method. finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. numerical differentiation, numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. partial differential equations: finite difference solution two dimensional Laplace equation and Poission equation, implicit and explicit methods for one dimensional heat equation

Module III: Ordinary Differential Calculus (15 hours)

Exact, linear and Bernoulli's equations, Euler's equations, equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type .second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

MODULE IV: Introduction to Partial Differential Equations (10 hours)

First order partial differential equations, solutions of first order linear and non-linear PDEs. solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral methods.

Suggested Readings

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

DEPARTMENT OF PHYSICS

PSPT0038: PHYSICS FOR TECHNOLOGISTS

(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Objective: *This course is intended to strengthen the understanding of the basic physical concepts which are essential to the branches of electrical, electronics and computer science engineering. The course is divided into four modules which deal with optics, electromagnetic theory, relativity, quantum physics and semiconductor physics and their applications. Emphasis shall be laid upon the solution of numerical problems.*

Module I: Wave Optics (10 hours)

a) Interference and diffraction: Huygen's principle, superposition of two waves, coherent sources, Young's double slit experiment, intensity distribution; Newton's rings and applications. Fresnel and Fraunhofer diffraction, Fraunhofer diffraction due to a single slit, plane transmission grating; zone plates. Polarization of transverse waves, plane, circular, and elliptically polarized light; polarization by reflection, refraction and scattering.

b) Photonics: spontaneous and stimulated emission, fundamentals of laser action, ruby Laser, He-Ne laser, applications of lasers. Elements of fibre optics, types of optical fibres, numerical aperture. Principles of holography.

Module II: Electromagnetic Theory (18 hours)

a) Electromagnetism: basic idea of divergence and stokes theorems, Gauss's law and its applications, electrostatic potential, Poisson's and Laplace's equation, work and energy, dielectric polarization bound charges, electric displacement (D); magnetic induction (B), magnetic intensity (H), Biot-Savart's Law, Ampere's circuital law; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Faraday's law of electromagnetic induction, displacement current, Maxwell's equations in differential and integral forms.

b) Electromagnetic waves: Electromagnetic energy densities, Electromagnetic wave equations for E and B, transverse nature and speed of electromagnetic waves, Poynting vector, Poynting theorem.

Module III: Quantum Physics and Applications (14 hours)

a) Quantum physics: historical overview; particle aspect of radiation – blackbody radiation, photoelectric effect, Compton scattering; wave aspect of particles – de Broglie's hypothesis, matter waves; Heisenberg's uncertainty principle; transition from deterministic to probabilistic states of a system – wave functions, probability density, superposition principle; observables and operators, expectation values. Schrodinger wave equation.

b) Application of quantum mechanics: solutions of one dimensional problem, infinite deep potential well – energy eigenvalues, eigenfunctions, potential barrier – tunneling.

Module IV: Semiconductor Physics (18 hours)

a) Free electron theory, density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), energy bands in solids, E-k diagram, direct and indirect bandgaps, types of electronic materials: metals, semiconductors, and insulators, density of states, occupation probability, Fermi level, effective mass, phonons.

b) Intrinsic and extrinsic semiconductors, dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), carrier generation and recombination, carrier transport: diffusion and drift, p-n junction, metal-semiconductor junction.

c) Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; joint density of states, density of states for photons, transition rates (Fermi's golden rule), optical loss and gain; photovoltaic effect, exciton, drude model.

Suggested Readings

1. S. Dey, Physics for Engineers and Technologists, Eastern Book House.
2. Halliday, Resnick and Walker, Fundamentals of Physics (Extended), Wiley.
3. H. D. Young and R. A. Freedman, Sears and Zemansky's University Physics, Pearson Education.
4. A. Ghatak, Optics, Tata Mcgraw Hill.
5. D. J. Griffiths, Introduction to Electrodynamics, Pearson, Prentice Hall.
6. A. Beiser, Concepts of Modern Physics, McGraw Hill.
7. L. I. Shiff, Quantum Mechanics, McGraw Hills.
8. E. Merzbacher, Quantum Mechanics, Wiley.
9. G. Aruldas, Quantum Mechanics, PHI Iearning.
10. H. Goldstein, Classical Mechanics, Addison-Wesley.
11. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw Hill.
12. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley.
13. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India.

PSEP0039: ENGINEERING PHYSICS: MECHANICS

(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Objective: *The objective of this syllabus is to impart the knowledge of mechanics, an important segment of physics, to the students of civil engineering. Emphasis shall be laid upon the solution of numerical problems.*

Module I: Vector Mechanics of Particles (20 hours)

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates; Potential energy function; F = - Grad V; Conservative and non-conservative forces; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits; Application: Satellite manoeuvres; Non- inertial frames of reference; Rotating coordinate system: Five-term acceleration formula — Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum; Harmonic oscillator; Damped harmonic motion; Forced oscillations and resonance.

Module II: Planar Rigid Body Mechanics (10 hours)

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples; Introduction to three-dimensional rigid body motion — only need to highlight the distinction from two- dimensional motion in terms of (a) Angular velocity vector, and its rate of change and (b) Moment of inertia tensor; Three-dimensional motion of a rigid body wherein all points move in a coplanar manner: e.g. Rod executing conical motion with center of mass fixed — only need to show that this motion looks two-dimensional but is three-dimensional, and two-dimensional formulation fails.

Module III: Statics (10 hours)

Free body diagrams with examples on modelling of typical supports and joints; Condition for equilibrium in three- and two- dimensions; Friction: limiting and non-limiting cases; Force- displacement relationship; Geometric compatibility for small deformations; Illustrations through simple problems on axially loaded members like trusses.

Module IV: Mechanics of solids (20 hours)

Concept of stress at a point; Planet stress: transformation of stresses at a point, principal stresses and Mohr's circle; Displacement field; Concept of strain at a point; Plane strain: transformation of strain at a point, principal strains and Mohr's circle; Strain RoseOe; Discussion of experimental results on one- dimensional material behaviour; Concepts of elasticity, plasticity, strain hardening, failure (fracture / yielding); Idealization of one- dimensional stress-strain curve; Generalized Hooke's law with and without thermal strains for isotropic materials; Complete equations of elasticity; Force analysis — axial force, shear force, bending moment and twisting moment diagrams of slender members (without using singularity functions); Torsion of circular shafts and thin-walled tubes (plastic analysis and rectangular shafts not to be discussed)

Suggested Readings

1. M. K. Harbola, Engineering Mechanics.
2. M. K. Verma, Introduction to Mechanics.
3. D. Kleppner and R. Kolenkow, An Introduction to Mechanics.
4. J. L. Synge and B. A. Griths, Principles of Mechanics.
5. J. P. Den Hartog, Mechanics.
6. J. L. Meriam, Engineering Mechanics – Dynamics.
7. J. P. Den Hartog, Mechanical Vibrations.
8. W. T. Thomson Theory of Vibrations with Applications.
9. S. H. Crandall, N. C. Dahl & T. J. Lardner, An Introduction to the Mechanics of Solids.

10. J. L. Meriam, Engineering Mechanics: Statics.
11. E. P. Popov, Engineering Mechanics of Solids.

PSET0040: ENGINEERING PHYSICS: ELECTROMAGNETIC THEORY

(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Objective: *The objective of the course is to impart the knowledge electromagnetism including electromagnetic waves to the students of mechanical engineering. Emphasis shall be laid upon the solution of numerical problems.*

Module I: Electrostatics in Vacuum (10 hours)

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Practical examples like Farady's cage and coffee-ring effect; Boundary conditions of electric field and electrostatic potential; method of images; energy of a charge distribution and its expression in terms of electric field.

Module II: Electrostatics in a Linear Dielectric Medium (8 hours)

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

Module III: Magnetostatics (9 hours)

Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Module IV: Magnetostatics in a Linear Magnetic Medium (7 hours)

Magnetization and associated bound currents; auxiliary magnetic field ; Boundary conditions on and . Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and feromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Module V: Faraday's law (8 hours)

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.

Module VI: Maxwell's equations (9 hours)

Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time dependent electric field; calculating magnetic field due to changing electric fields in quasistatic approximation. Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples. Qualitative discussion of momentum in electromagnetic fields.

Module VII: Electromagnetic Waves (9 hours)

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a nonconducting medium-vacuum interface for normal incidence.

Suggested Readings

1. David Griffiths, Introduction to Electrodynamics.
2. Halliday and Resnick, Physics.
   W. Saslow, Electricity, Magnetism and Light.

PSTC6016: PHYSICS LAB FOR TECHNOLOGISTS

(2 credits) (L-T-P:0-0-4)

At least 10 experiments to be performed from the following.

1. To determine the frequency of an Electrical maintained tuning fork by Melde's experiments
2. Determination of surface tension by capillary rise method.
3. Determination of wavelength of light by Newton's ring method.
4. Determination of grating element of a diffraction grating.
5. Determination of wavelength of laser source by diffraction grating method.
6. Study of photoemission.
7. Determination of Rigidity modulus by static method.
8. Determination of acceleration due to gravity by Bar pendulum.
9. Determination of thermal conductivity by Lee's method
10. Plotting of characteristic curve of a PN junction diode.
11. Determination of Young's modulus by Searle's method.
12. Study of RC circuit.

PSEG6017: PHYSICS LAB FOR ENGINEERS

(1 credit) (L-T-P:0-0-2)

At least 10 experiments to be performed from the following.

1. To determine the frequency of an Electrical maintained tuning fork by Melde's experiments
2. Determination of surface tension by capillary rise method.
3. Determination of wave length of light by Newton's ring method.
4. Determination of grating element of a diffraction grating.
5. Determination of wavelength of laser source by diffraction grating method.
6. Study of photoemission.
7. Determination of Rigidity modulus by static method.
8. Determination of acceleration due to gravity by Bar pendulum.
9. Determination of thermal conductivity by Lee's method
10. Plotting of characteristic curve of a PN junction diode.
11. Determination of Young's modulus by Searle's method.
12. Study of RC circuit.

DEPARTMENT OF CHEMISTRY

CHES0002: ENVIRONMENTAL STUDIES

(2 Credits - 30 Hours)

Objective: *This course is designed to enhance knowledge skills and attitude to environment. It will help a student to get a broad exposure to problems facing our environment.*

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

Definition, scope and importance, need for public awareness.

Module II: Natural Resources (3 hours)

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 hours)

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 hours)

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 hours)

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 hours)

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 hours)

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. Erach Bharucha; Textbook for Environmental Studies, UGC, New Delhi
2. S. Somvanshi and R. Dhupper; Fundamentals of Environmental Studies, S.K. Kataria and Sons Publisher.
3. A.K. De; Environmental Chemistry, New age publishers.
4. J.P. Sharma; Environmental Studies, University Science Press
5. K.G. Bhattacharyya and A. Sarma; Comprehensive Environmental Studies, Narosa Publishing House Pvt, Ltd.
    1. g, 1991.
    2. Cann, M. C. & Connelly, M. E., Real World Cases in Green Chemistry, ACS, , 2000.

CHEC0027: ENGINEERING CHEMISTRY

(4 Credits - 60 Hours) (L:3, T:1, P:0)

Objective: *This course of Engineering Chemistry enables the student to gain knowledge on atomic and molecular structure, application of some important spectroscopic techniques, thermodynamics, periodic properties, structure of organic molecules as well as main types of organic reaction used in the synthesis of molecules.*

Module I: Atomic and molecular structure (10 hours)

Schrodinger equation, Particle in a box solutions, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations, Equations for atomic and molecular orbitals, Energy level diagrams of diatomic, Pi-molecular orbitals of butadiene and benzene and aromaticity, Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties, Structure of Solids, Band structure of solids and the role of doping on band structures.

Module II: Spectroscopic techniques and applications (8 hours)

Principles of spectroscopy and selection rules, Electronic spectroscopy, Fluorescence and its applications in medicine, Vibrational and rotational spectroscopy of diatomic molecules, Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques, Diffraction and scattering.

Module III: Use of free energy in chemical equilibria (7 hours)

Thermodynamic functions: energy, entropy and free energy, Free energy and emf, Cell potentials, the Nernst equation and applications., Acid base, oxidation reduction and solubility equilibria, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

Module IV: Intermolecular forces and Periodic properties (8 hours)

a) Ionic, dipolar and van Der Waals interactions.
b) Effective nuclear charge, penetration of orbitals, variations of s, p, d orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases.

Module V: Stereochemistry (6 hours)

Representations of three dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis, Isomerism in transitional metal compounds.

Module VI: Organic reactions and synthesis of a drug molecule (6 hours)

Introduction to reactions involving substitution, addition, elimination, oxidation and reduction, Synthesis of a commonly used drug molecule – Aspirin and Paracetamol.

COURSE / LEARNING OUTCOMES

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

CO1: Recall fundamental concepts they got in 10+2 level in physical, organic and inorganic chemistry. (*Knowledge*)

CO2: Comprehend the microscopic chemistry in terms of atomic and molecular orbitals, intermolecular forces, basics of thermodynamics, electromagnetic spectrum, periodic properties and types of major chemical reactions. (*Comprehension*)

CO3: Interpret the energy level diagram for different transition metal ion, explain the conducting behaviour of solids, apply the knowledge spectroscopy to the practical field, interpret the thermodynamics of systems, interpret the variation of periodic properties of atoms, structure of organic molecules and their reaction path. (*Application*)

CO4: Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces, rationalise bulk properties and processes using thermodynamic considerations, distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques, rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity, list major chemical reactions that are used in the synthesis of molecules. (*Analysis*)

CO5: Understand atomic and molecular structure, electromagnetic spectrum, thermodynamics of different system, variation of periodic properties, structure and reaction mechanism of organic molecules. (*Synthesis*)

CO6: Apply the knowledge of atomic and molecular structure to evaluate the energy level diagram in the atomic and molecular level, explain the conducting properties of solids, apply spectroscopic techniques in practical field, use thermodynamics in different system and propose the mechanism of organic reactions. (*Evaluation*)

Suggested Readings

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

CHCE6006: ENGINEERING CHEMISTRY I LAB

(1 Credit) (L:0, T:0, P:2)

Objective: This course consists of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

List of experiments –

1. Determination of Water Hardness with EDTA.
2. Estimation of Calcium in Limestone.
3. Determination of dissolve Oxygen in given Water Sample by Winkler's Method.
4. Determination of Surface Tension of a given Liquid by Stalagmometer.
5. To determine the co-efficient of Viscosity of a given liquid or solution with the help of Ostwald's Viscometer.
6. Adsorption of Acetic Acid by Charcoal.
7. Determination of Chloride Content of Water.
8. To determine the Strength of Magnesium Ions in Magnesium Sulphate solution by Complexometric Method.
9. Determination of Partition Coefficient of a substance between two immiscible liquids.
10. Determination of Free Carbon Dioxide in given Water sample.
11. To determine the Alkalinity of given water Sample.
12. Determination of Ferrous Ion in Mohr's Salt by KMnO4.
13. To determine the Acidity of the given water sample.
14. Determination of the Cell Constant and Conductance of solution.
15. Determination of Sodium Hydroxide and Sodium Carbonate in mixture.

CHCE6007: ENGINEERING CHEMISTRY II LAB

(2 Credits) (L:0, T:0, P:4)

Objective: This course consists of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

List of experiments –

16. Determination of Water Hardness with EDTA.
17. Estimation of Calcium in Limestone.
18. Determination of dissolve Oxygen in given Water Sample by Winkler's Method.
19. Determination of Surface Tension of a given Liquid by Stalagmometer.
20. To determine the co-efficient of Viscosity of a given liquid or solution with the help of Ostwald's Viscometer.

21. Adsorption of Acetic Acid by Charcoal.
22. Determination of Chloride Content of Water.
23. To determine the Strength of Magnesium Ions in Magnesium Sulphate solution by Complexometric Method.
24. Determination of Partition Coefficient of a substance between two immiscible liquids.
25. Determination of Free Carbon Dioxide in given Water sample.
26. To determine the Alkalinity of given water Sample.
27. Determination of Ferrous Ion in Mohr's Salt by $KMnO_4$.
28. To determine the Acidity of the given water sample.
29. Determination of the Cell Constant and Conductance of solution.
30. Determination of Sodium Hydroxide and Sodium Carbonate in mixture.

COURSE / LEARNING OUTCOMES

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

CO1: Recall fundamental concepts they got in 10+2 level in physical, organic and inorganic chemistry that they applied in the practical field. (*Knowledge*)

CO2: Understand the laboratory course which consists of experiments illustrating the principles of chemistry relevant to the study of science and engineering. (*Comprehension*)

CO3: Estimate rate constants of reactions from concentration of reactants/products as a function of time, measure molecular/system properties such as surface tension, viscosity, conductance of solutions, chloride content of water, water hardness etc. (*Application*)

CO4: Analyse practical utility of different theories chemical kinetics, surface tension, viscosity, conductance, water quality analysis etc. (*Analysis*)

CO5: Verify theories in the laboratory. (*Synthesis*)

CO6: They would learn to apply the knowledge of practical classes such as estimation of rate constants of reactions from concentration of reactants/products as a function of time, measure of molecular/system properties such as surface tension, viscosity, conductance of solutions, chloride content of water, water hardness etc. in the solution of problem in the day to day life. (*Evaluation*)

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF LANGUAGE STUDIES

LSCE0001: COMMUNICATIVE ENGLISH I

(2 credits – 30 hours)

Objective: *The objective of this course is to equip the learners with the basic skills of effective communication in English language in all real life contexts, with a reasonable fluency and clarity.*

The course is intensely practice oriented and it specifically attempts to:

- *Familiarize the students with the basic tools of oral communication.*
- *Teach the students to use grammar in meaningful contexts.*
- *To enable the students to communicate in English confidently.*

Module I: Essential grammar of English: An Introduction (10 hours)

Parts of speech; Basic sentence structures; Articles; Prepositions; Person and number; Tenses and their uses; Subject –verb agreement; Vocabulary building; Common idioms and phrases

Module II: Basic tools of oral communication in English (4 hours)

a) Syllables, stress –pattern and intonation
b) Consonants, vowels and diphthongs
c) Differences between spoken and written English

Module III: Functional English: Situational Conversation Practice (7 hours)

a) At the post office, bank, hotel
b) At the doctors', At the chemists, In the library
c) At the market, Tailors', At the garage
d) In the kitchen, With a close friend , At a wedding
e) Greetings, small talk, congratulations, condolences, offers, invitations

Module IV: Functional English: Structural Conversation Practice (6 hours)

Telephone conversation, Interviewing a film star; At a travel agent's, An interview; Buying, Hiring a taxi, buying a motor cycle; Agreement, disagreement; Hypothetical conditions, likelihood; Public speaking: Speeches of great men; Interjection, exclamation, emotion emphasis; Expressions of hope, disappointment, surprise, concern, worry; Willingness, wish, intention; Commands, requests, advice, promise, threat.

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

1. The Blind Dog - RK Narayan
2. The Gift of the Magi - O Henry
3 The End of the Party - Graham Greene
4. Civility is all that Counts - SJ Duncan
5. The Herb Seller - Yengkhom Indira
6. Nothing Gold Can Stay - Robert Frost
7. Night of the Scorpion - Nissim Ezekiel

COURSE / LEARNING OUTCOMES

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

CO1: State the different parts of speech.
CO2: Define stress and intonation, vowel and consonant sounds.
CO3: Differentiate between exclamation and interjection.
CO4: Identify the accentual patterns in English words.
CO5: Generalise the basic sentence structures in English grammar.
CO6: Determine the intonation patterns in sentences.
CO7: Critically evaluate a piece of English poetry.
CO8: Summarise the plot development of a short story.

Suggested Readings

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

LSCE0002: COMMUNICATIVE ENGLISH II

(2 credits – 30 hours)

Objectives:

1. *To develop an awareness in the students about writing as an exact and formal skill*
2. *To equip them with the components of different forms of writing*
3. *To enable the students to study academic subjects with greater facility through the theoretical and practical components of their text books.*
4. *To develop the study skills and communication skills necessary in formal and informal situations.*
5. *To prepare them to face interviews and group discussions*

Module I: Basics of Business Communication (6 hours)

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

Module II: Business Letters (5 hours)

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

Module III: Telecommunication (3 hours)

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

Module IV: Internal communication (5 hours)

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

Module V: Persuasive communication (4 hours)

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

Module VI: Visual and oral communications (4 hours)

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

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

1. Engine Trouble - RK Narayan
2. The Mouse - HH Munro
3. The Rocking-Horse Winner - DH Lawrence
4. Travel the Road - Mamang Dai
5. Haflong Hills - Kallol Choudhury
6. Self-Portrait – A.K. Ramanujan
7. The Solitary Reaper – William Wordsworth

COURSE / LEARNING OUTCOMES

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

CO1: Define the basics of effective Communication
CO2: Classify the different kinds of business letters
CO3: Apply the structure of conveying messages
CO4: Analyse the factors and impacts of telecommunications
CO5: Summarise aspects of publicity materials
CO6: Examine the characteristics of any good writing

Suggested Readings

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

LSBC0003: BUSINESS COMMUNICATION I

(2 credits – 30 hours)

Objective: *The objective of this course is to equip the students of Business and Commerce with the basic skills of effective communication in English language in all relevant real life contexts, with a reasonable fluency and clarity.*

The course is intensely practice oriented and it specifically attempts to:

- *Familiarize the students with the basic tools of oral communication.*
- *Teach the students to use grammar in meaningful contexts.*
- *To enable the students to communicate in English confidently.*

Module I: Essential grammar of English: An Introduction (10 hours)

Parts of speech; Basic sentence structures; Articles; Prepositions; Person and number; Tenses and their uses; Subject –verb agreement; Vocabulary building; Common idioms and phrases

Module II: Basic tools of oral communication in English (4 hours)

a) Syllables, stress –pattern and intonation
b) Consonants, vowels and diphthongs
c) Differences between spoken and written English

Module III: Functional English: Situational Conversation Practice (7 hours)

a) At the post office, bank, hotel
b) At the doctors', At the chemists, In the library
c) At the market, Tailors', At the garage
d) In the kitchen, With a close friend , At a wedding
e) Greetings, small talk, congratulations, condolences, offers, invitations

Module IV: Functional English: Structural Conversation Practice (6 hours)

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

Module V: Non-Detailed Study: Reading and Comprehension (3 hours)

Short stories and poems

a. The Blind Dog - RK Narayan
b. The Gift of the Magi - O Henry
c. The End of the Party - Graham Greene
d. Nothing Gold Can Stay - Robert Frost
e. Night of the Scorpion - Nissim Ezekiel

Suggested Readings

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

LSBC0004: BUSINESS COMMUNICATION II

(2 credits – 30 hours)

Objectives:

1. *To develop an awareness in the students about writing as an exact and formal skill*
2. *To equip them with the components of different forms of writing*
3. *To equip the students to study academic subjects with greater facility through the theoretical and practical components of their text books.*
4. *To develop the study skills and communication skills necessary in formal and informal situations.*
5. *To prepare them to face interviews and group discussions*

Module I: Basics of Business Communication (6 hours)

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

Module II: Business Letters (5 hours)

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

Module III: Telecommunication (3 hours)

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

Module IV: Internal communication (5 hours)

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

Module V: Persuasive communication (4 hours)

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

Module VI: Visual and oral communications (4 hours)

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

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

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

Suggested Readings

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

LSEH0017: ENGLISH

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

Objective: *The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.*

Module I: Vocabulary Building (6 hours)

The concept of Word Formation
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
Synonyms, antonyms, and standard abbreviations.

Module II: Basic Writing Skills (6 hours)

a) Sentence Structures
b) Use of phrases and clauses in sentences
c) Importance of proper punctuation
d) Creating coherence
e) Organizing principles of paragraphs in documents
f) Techniques for writing precisely

Module III: Identifying Common Errors in Writing (5 hours)

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

Module IV: Nature and Style of sensible Writing (6 hours)

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion

Module V: Writing Practices (7 hours)

Comprehension, Précis Writing, Essay Writing

Suggested Readings

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

LSCE6001: COMMUNICATION PRACTICE LABORATORY I

(1 credit)

The following are some of the tasks that a student should be able to perform.

1. Take passages of descriptive, expressive and social functions and analyze them.
2. Expressive (exposing feeling) language in English and your mother tongue.
3. Make a list of sexist language (e.g. poetess, chairman)
4. Say formulaic expressions (Thank you, sorry, hello, that's right, etc.) with proper intonation.
5. Make a list of words which should be avoided because they sound pompous. Which words would you use instead of them?
6. Take similar vowels and consonants and practice them in pairs of words.
7. Practice stress and intonation in connected speech.
8. Conversation practice in familiar situations (Play the role of a tailor and customer, for example)
9. Ask for specific information (Can you tell me where the railway station is?)
10. Making a request (Can I borrow your scooter, please?)
11. Asking for permission (Do you mind if I smoke?)
12. Say the following pairs of words: beg, bag, full, fool, sit, seat, etc. and collect fifty such pairs.
13. Collect words which are used as nouns, verbs and adjectives and pronounce them correctly according to their context: progress, object, record, perfect, etc.
14. Collect words and pronounce them with correct stress (education, examination, village, etc.)

Practice the following in the Language Lab with audio-visual aids:

- Listening, repeating, recording and comparing consonant sounds and vowel sounds in the English Language
- Pronunciation of mono-syllabic and multi-syllabic words with proper stress pattern
- Pronunciation of two or three-worded phrases with proper stress and intonation
- English conversation in various contexts

LSEC0018: ENGLISH COMMUNICATION

(2 Credits- 30 Hours)

Objective:

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions.The present course hopes to address some of these aspects through an interactive mode of teaching-learning process and by focusing on various dimensions of communication skills.

Module I: Introduction

Theory of Communication, Types and modes of Communication

Module II: Language of Communication:

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

Monologue, Dialogue, Group Discussion
Effective Communication/ Mis- Communication
Interview, Public Speech

Module IV: Reading and Understanding

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. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul,Dr Brati Biswas

LSCE6002: COMMUNICATION PRACTICE LABORATORY II

(1 credit)

The following are some of the tasks a student should be able to perform:

1. Write a paragraph with the topic sentence "Protection of environment should not be at the cost of development". Identify the supporting details and sentence connectors.
2. Make notes from a given passage.
3. Prepare a short bibliography on the list of books prescribed in this course.
4. Write a letter complaining to a firm which supplied defective computers.
5. Write a functional CV of your own.
6. Prepare an agenda of a mock meeting.
7. Imagine that you are chairing a meeting. How would you go about it?
8. How would you propose a vote of thanks?
9. Make an oral presentation on a new product your company has brought out/ make seminar presentations.
10. Make a checklist for preparing for an interview.
11. Hold a mock job interview.
12. Prepare an agenda for a meeting you are organizing.
13. Prepare a report of a field visit.
14. Prepare minutes of a meeting that you attended.
15. Read the following chart and describe the information.
16. Arrange a group discussion on the topic "Globalization and India".

Practice the following in the language lab with the help of audio-visual aids:
- Soft skills – introduction with video lessons
- Conducting and facing mock-interviews with examples of video lessons
- Public speaking: students are asked to speak on certain topics
- Writing reports, applications and CVs
- Conducting Group discussions on familiar subjects
- Correction of errors in sentences

LSBC6003: BUSINESS COMMUNICATION PRACTICE LAB

(1 credit)

The following are some of the tasks that a student should be able to perform.

1. Take passages of descriptive, expressive and social functions and analyze them.
2. Expressive (exposing feeling) language in English and your mother tongue.
3. Make a list of sexist language (e.g. poetess, chairman)
4. Say formulaic expressions (Thank you, sorry, hello, that's right, etc.) with proper intonation.
5. Make a list of words which should be avoided because they sound pompous. Which words would you use instead of them?
6. Take similar vowels and consonants and practice them in pairs of words.
7. Practice stress and intonation in connected speech.
8. Conversation practice in familiar situations (Play the role of a tailor and customer, for example)
9. Ask for specific information (Can you tell me where the railway station is?)
10. Making a request (Can I borrow your scooter, please?)
11. Asking for permission (Do you mind if I smoke?)
12. Say the following pairs of words: beg, bag, full, fool, sit, seat, etc. and collect fifty such pairs.
13. Collect words which are used as nouns, verbs and adjectives and pronounce them correctly according to their context: progress, object, record, perfect, etc.
14. Collect words and pronounce them with correct stress (education, examination, village, etc.)

Practice the following in the Language Lab with audio-visual aids:
- Listening, repeating, recording and comparing consonant sounds and vowel sounds in the English Language
- Pronunciation of mono-syllabic and multi-syllabic words with proper stress pattern
- Pronunciation of two or three-worded phrases with proper stress and intonation
- English conversation in various contexts

LSOC6004: ORAL COMMUNICATION PRACTICE LAB

(1 Credit) (L-T-P:0-0-2)

(This unit involves interactive practice sessions in Language Lab)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

Suggested Readings

1. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
2. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

DEPARTMENT OF PHILOSOPHY

PYTW0021: THOUGHTS THAT SHAPED THE WORLD

(2 credits - 30 hours)

Objective: *The aim of this comprehensive course is to introduce the student of Technology to the different ideas that have shaped the world and continue to shape it. It gives an introduction to different Philosophical schools, thoughts on religion and thoughts on ethics and social issues. It is expected that this course will help to shape an emerging engineer holistically.*

Module I: Philosophy - Thoughts on Mind, Body, Matter, Will (11 hours)

Philosophy, Science and Religion; Prominent philosophers and their ideas on these issues – Plato, Aristotle, Rene Descartes, David Hume, Berkeley, Vivekananda, Radhakrishnan, Krishnamurthy; Recent developments in Existentialism, inter-cultural philosophy.

Module II: Religion - Thoughts on Life, Soul, Conscience, Life after Death, Reincarnation, Morality, Natural Law (8 hours)

The Hindu view; The Buddhist View; The Christian View; The Muslim View

Module III: Society - Thoughts on Ethics and Social Issues (11 hours)

a) Right and Wrong, the idea of Conscience; Individual and Social Morality
b) Applied Ethics: Sexual Morality: The Libertarian View (For and Against); Abortion: (for and Against); Euthanasia: (For and Against); Capital Punishment: (For and Against); Social Justice: (For and Against); Environmental Ethics (For and Against) and Eco-philosophy

Suggested Readings

1. J. Perry and M. Bratman, Introduction to Philosophy: Classical and Contemporary Readings, Oxford University Press, 1999.
2. B. Russell, A History of Western Philosophy, Routledlge, 1992.
3. I. Copi and C. Cohen, Introduction to Logic, Macmillan, 1986.
4. J. N. Mohanty, Reason and Tradition in Indian Thought, Clarendon Press, 1992.
5. Colin McGinn, The Character of Mind: An Introduction to the Philosophy of Mind, Oxford University Press, 1997.
6. M. M. Agrawal, Ethics and Spirituality, Indian Institute of Advanced Studies, 1998.
7. Daya Krishna, Special issue on Historiography of Indian Civilizations, The Journal of Indian Council of Philosophical Research, Vol. 8, No.3 & 4, 1996.

Our Vision

"To mould intecllectually 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 personalized education."

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