# ACADEMIC REGULATIONS
# COURSE STRUCTURE
# AND
# DETAILED SYLLABUS

## ELECTRICAL AND ELECTRONICS ENGINEERING

## B.Tech Four Year Degree Course

(Applicable for the batches admitted from 2020-21)


## GUDLAVALLERU ENGINEERING COLLEGE

(An Autonomous Institute with Permanent Affiliation to JNTUK, Kakinada)

**Seshadri Rao Knowledge Village**

**GUDLAVALLERU - 521 356, Krishna District, Andhra Pradesh**

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## VISION & MISSION OF THE COLLEGE

### Vision

To be a leading institution of engineering education and research, preparing students for leadership in their fields in a caring and challenging learning environment.

### Mission

- To produce quality engineers by providing state-of-the-art engineering education.
- To attract and retain knowledgeable, creative, motivated and highly skilled individuals whose leadership and contributions uphold the college tenets of education, creativity, research and responsible public service.
- To develop faculty and resources to impart and disseminate knowledge and information to students and also to society that will enhance educational level, which in turn, will contribute to social and economic betterment of society.
- To provide an environment that values and encourages knowledge acquisition and academic freedom, making this a preferred institution for knowledge seekers.
- To provide quality assurance.
- To partner and collaborate with industry, government, and R and D institutes to develop new knowledge and sustainable technologies and serve as an engine for facilitating the nation's economic development.
- To impart personality development skills to students that will help them to succeed and lead.
- To instil in students the attitude, values and vision that will prepare them to lead lives of personal integrity and civic responsibility.
- To promote a campus environment that welcomes and makes students of all races, cultures and civilizations feel at home.
- Putting students face to face with industrial, governmental and societal challenges.

## VISION & MISSION OF THE DEPARTMENT

### Vision

To be a pioneer in electrical and electronics engineering education and research, preparing students for higher levels of intellectual attainment, and making significant contributions to profession and society.

### Mission

- To impart quality education in electrical and electronics engineering in dynamic learning environment and strive continuously for the interest of stake holders, industry and society.

- To create an environment conducive to student-centered learning and collaborative research.
- To provide students with knowledge, technical skills, and values to excel as engineers and leaders in their profession.

## III. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- Graduates will have technical knowledge, skills and competence to identify, comprehend and solve problems of industry and society.
- Graduates learn and adapt themselves to the constantly evolving technology to pursue higher studies and undertake research.
- Graduates will engage in lifelong learning and work successfully in teams with professional, ethical and administrative acumen to handle critical situations.

## IV. PROGRAM OUTCOMES (POs)

**Engineering Graduates will be able to:**

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## V. PROGRAM SPECIFIC OUTCOMES (PSOs)

**Students will be able to**

* Apply the knowledge of circuit design, analog & digital electronics to the field of electrical and electronics systems.
* Analyze, design and develop control systems, industrial drives and power systems using modern tools.

## VI. ACADEMIC REGULATIONS

Applicable for the students of B.Tech. from the Academic Year 2020-21.

**1. UG – B.Tech. Programs**

The following B.Tech. Programs are offered at present

i. Civil Engineering (CE)
ii. Electrical and Electronics Engineering (EEE)
iii. Mechanical Engineering (ME)
iv. Electronics and Communication Engineering (ECE
v. Computer Science and Engineering (CSE)
vi. Information Technology (IT)
vii. Artificial Intelligence and Data Science (AI&DS)
viii. Internet of Things (IoT)

**2. Duration of the Program**

The duration of the program is four academic years consisting of eight semesters. However, a student is permitted to complete the course work of B.Tech. program in the stipulated time frame of **EIGHT** years from the date of joining. Students admitted into third semester of B.Tech. program directly, through Lateral Entry (LE), shall have to complete the course work of B.Tech. program in the stipulated time frame of **SIX** years from the date of joining.

**3. Minimum Instruction Days**

Each semester consists of a minimum of ninety instruction days.

**4. Award of B.Tech. Degree**

i) Each discipline of the B.Tech. program is designed to have a total of **160** credits and the student shall have to complete the four year course work and earn all the **160** credits for the award of B.Tech. Degree.

il) Students, who fail to complete their four years' course of study within eight years from the year of their admission or fail to acquire the **160** credits within this period shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

iii) Students joining the B.Tech. program into the II year 1st semester directly through Lateral Entry (LE) Scheme shall have to complete the three year course work and earn **120** credits for the award of B.Tech. degree.

iv) Students, who fail to complete their three years course of study within six years from the year of their admission or fail to acquire the **120** credits for the award of degree within this period shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

v) **Award of B. Tech. (Honors) / B. Tech. (Minor):** B. Tech. with Honors or a B.Tech. with a Minor will be awarded if a student earns 20 additional credits as per the regulations/guidelines. Registering for Honors / Minor degree is optional.

## 5. Duration and Pattern of the Program

i) The duration of the program is four academic years consisting of eight semesters for regular students and three academic years consisting of six semesters for lateral entry students.

ii) Each semester consists of a minimum of ninety instructional days.

iii) Three week induction program is mandatory for all the first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.

iv) A student has to register for all the courses in a semester.

v) Grade points, based on percentage of marks awarded for each course will be the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

vi) Award of division shall be based on the CGPA acquired.

vii) A pool of interdisciplinary, skill development courses, industry internship, socially relevant projects etc., which are relevant to the industry are integrated into the curriculum of the branch of engineering concerned.

viii) As a mandatory rule, all the students shall be registered for the mandatory non-credit courses as per AICTE/UGC/APSCHE guidelines.

## 6. Attendance Regulations

i) A student is eligible to write the semester end examinations if he acquires a minimum of 40% attendance in each subject and a 75% of attendance in aggregate of all the subjects.

ii) Condoning of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester will be considered for genuine reasons, such as on medical grounds and participation in co-curricular and extra-curricular activities and shall be granted only after the approval by a committee duly appointed by the college. For medical reasons, the student should submit application for medical leave along with medical certificate from a registered medical practitioner within three days from the day of reporting to the classwork after the expiry of the Medical Leave. In the case of participation in co-curricular and extra-curricular activities, either within the college or in other colleges, students must take prior permission in the written form from HoD concerned and should also submit the certificate of participation from the organizers of the event within three days after the completion of the event. Only such cases will be considered for condoning attendance shortage.

iii) A student shall be eligible to claim for condonation of attendance shortage for a maximum of two times during the four year (eight semesters) course work of B.Tech. (Regular) / three year (six semesters) course work of B.Tech. (Lateral).

iv) A student will not be promoted to the next semester unless he satisfies the attendance requirement of the current semester. He may seek re-admission for that semester when offered within 4 weeks from the date of commencement of classwork.

v) Shortage of Attendance below 65% in aggregate shall in *NO* case be condoned.

vi) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end-examinations of current semester and their registration shall stand cancelled.

vii) A fee stipulated by the college shall be payable towards condonation of attendance shortage.

viii) A student is required to put up a minimum of 75% of attendance in the mandatory non-credit courses for getting the satisfactory grade. However, condonation of the shortage of attendance upto 10% shall be applicable for all mandatory non credit courses and a fee stipulated by the college shall be payable towards condonation fee.

## 7. Distribution and Weightage of marks - Evaluation

The distribution of Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) marks for each course is given in the table:

| Sl.No. | Components | Internal | External | Total |
|---|---|---|---|---|
| 1 | Theory / Integrated Theory and Laboratory/ Project Based Theory | 30 | 70 | 100 |
| 2 | Engineering Graphics/ Design/ Drawing | 30 | 70 | 100 |
| 3 | Practical / Skill Development Courses | 15 | 35 | 50 |
| 4 | Community Service Project / Internship | - | 100 | 100 |
| 5 | Project Work | 60 | 140 | 200 |
| 6 | Mandatory Non-Credit Courses | | | |
| | i) Environmental Studies and Constitution of India | 30 | 70 | 100 |
| | ii) Sports & Games/ Cultural and NSS/Fine Arts /Yoga /Self Defence | 100 | - | 100 |

### (i) Continuous Internal Evaluation

**Theory Courses:**

a) For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination(OE) consisting of 20 multiple choice questions for 10 marks for a duration of 20 minutes (ii) one descriptive examination(DE) consisting of 3 descriptive questions for 5 marks each a total of 15 marks for a duration of 90 minutes and (iii) one assignment(AT) for 5 marks.

b) First mid-term examination(Mid-I) shall be conducted from first 50% of the syllabus and second mid-term examination(Mid-II) shall be conducted from the rest of the 50% of syllabus.

c) The total marks secured by the student in each mid-term examination are evaluated for 30 marks. The final marks of each mid-term examination shall be displayed in the respective department notice boards within 10 days of completion of last examination.

d) Internal marks can be calculated with the sum of the 80% marks of better scored mid-term examination and 20% marks of less scored mid-term examination .

**Example:**

**Mid-1 marks** = Marks secured in (online examination-1 + descriptive examination-1 + one assignment-1)

**Mid-2 marks** = Marks secured in (online examination-2 + descriptive examination-2 + one assignment-2)

**Final internal Marks** = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

e) *For subjects like Functional English and Professional Communication, the pattern of mid-term examination is given along with the syllabus of the respective subject.*

**Integrated Theory and Lab Courses**

For the integrated theory and laboratory course, the distribution of 30 marks for internal evaluation shall be, 15 marks for theory based on two descriptive examinations and 15 marks for laboratory. The pattern for the descriptive examination is as same as the pattern for the regular theory courses. Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered. Of the 15 marks for the laboratory, 5 marks for the day-to-day performance, 5 marks for record and 5 marks for the semester end internal examination.

**Project Based Theory Courses**

For the project based theory course, the distribution of 30 marks for internal evaluation shall be, 15 marks for the theory based on two descriptive examinations and 15 marks for project. The pattern for descriptive examination is as same as the pattern for the regular theory courses. Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered. 15 marks for project shall be awarded by the department review committee based on the project report and the performance in oral presentation.

**Drawing / Design Courses**

For the subjects such as Engineering Graphics, Engineering Drawing, Building Planning and Drawing, Estimation, Costing & Valuation, Design & Drawing of

Steel Structures etc., the distribution of 30 marks for internal evaluation shall be, 15 marks for day-to-day work, and 15 marks based on two descriptive examinations. The pattern for the descriptive examination is as same as the pattern for regular theory courses. Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered.

**Practical Courses**

For the practical courses the distribution of 15 internal marks shall be, 5 marks for day-to-day performance, 5 marks for record and 5 marks for an internal laboratory test conducted at the end of a semester.

**Skill Development Courses**

Each student shall register for seven skill development courses (total 10 credits) offered by the department concerned. The distribution of 15 internal marks shall be 10 marks for day-to-day performance, and 5 marks for an internal examination conducted at the end of a semester.

For courses like Logic Building and Basic Coding Principles, Logic Building and Algorithmic Programming and Programming for corporate distribution of 15 internal marks shall be 10 marks for day-to-day performance(these marks will be awarded by taking no. of assignments completed, no. of quizzes attempted and amount of time spent in learning each topic on the LMS prescribed) and 5 marks for an internal laboratory test (internal Lab examination will be conducted on the assessment portal) conducted at the end of a semester.

**Project Work**

Of the 60 internal marks for a project work, 30 marks shall be awarded by the supervisor based on the student's involvement and 30 marks shall be awarded by the project review committee consisting of a supervisor, a senior faculty member and the HoD concerned based on the performance in Viva-Voce examination at the end of the semester.

**Mandatory Non-Credit Courses**

a) Each student shall register for four mandatory non-credit courses like Environmental Studies, Constitution of India, Sports & Games/Cultural and NSS/Fine arts/Yoga/Self Defense offered by the respective departments as per the course structure.

b) For courses like Environmental Studies and Constitution of India, two descriptive examinations shall be conducted for 30 marks each along with the mid-term examinations of regular theory courses.

c) Each descriptive examination consists of 3 descriptive questions for 10 marks each with a total of 30 marks for a duration of 90 minutes.

d) Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered.

e) For courses like Sports & Games/Cultural and NSS/Fine arts/Yoga/Self Defense, 100 marks for continuous internal evaluation shall be awarded by the respective class teacher based on the day-to-day participation and performance in the activities organized under each event.

**II) Semester End Examinations – Evaluation:**

**Theory/ Drawing/ Integrated theory and laboratory/ Project based theory Courses**

i) For all Theory/Drawing/Integrated theory and laboratory/Project based theory Courses, the semester end examination shall be conducted for 70 marks consisting of five internal choice questions (i.e "either" "or" choice), carrying 14 marks each. There will be two questions from each unit and the student should answer either of the two questions.

ii) There will not be any external assessment for laboratory and project components for integrated theory and laboratory course and project based theory course respectively.

iii) For design courses like Estimating, Costing & Valuation, Design of steel structures, Design of RC structures, Design of Irrigation structures, etc., the pattern for the semester end examination is given along with the syllabus of the respective subject.

iv) *For subjects like Functional English, Professional Communication, etc, the pattern of semester end examination is given along with the syllabus of the respective subject.*

**Practical Courses:**

The semester end examination shall be conducted for 35 marks by the teacher concerned and an external examiner appointed by the controller of examinations.

**Skill Development Courses:**

The semester end examination shall be conducted for 35 marks along with the practical examinations in the presence of an external and an internal examiner (course instructor or mentor).

For courses like Logic Building and Basic Coding Principles, Logic Building and Algorithmic Programming and Programming for corporate, semester end examination paper shall consists of 3 sets of questions and student has to choose any one set of Questions. Each set shall have three questions with three levels of complexity and evaluated for a total of 35 marks.

**Community Service Project**

i) Every student should put in a minimum of **180 hours** for the community service project during the summer vacation.
ii) Each class/section shall be assigned with a mentor.
iii) Departments shall concentrate on their major areas of respective departments concerned. For example, Dept. of Computer Science can take up activities related to computer Literacy to different sections of people like - youth, women, housewives, etc
iv) A log book to record the activities undertaken / involved shall be maintained by every student.
v) The log book has to be countersigned by the mentor concerned.
vi) A report shall be submitted by each student at the end of the semester.
vii) Based on the report and active participation of the student the semester end examination for 100 marks shall be awarded by a committee consisting of a mentor and a senior faculty member of the department.

**Internship:**

i) It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of specialization of the UG programme.
ii) Students shall pursue this course during summer vacation just before it is offered as per course structure. The minimum duration of this course is at least 6 weeks.
iii) A supervisor shall be allotted to each batch of students to guide and for taking up the summer internship. The supervisor shall monitor the attendance of the students during the internship. Attendance requirements are as per the norms of the college.
iv) After successful completion, students shall submit a summer internship technical report to the department concerned.
v) A certificate from industry / skill development centre shall be included in the report.
vi) Semester end examination for 50 marks shall be conducted by a committee consisting of an external examiner, head of the department and supervisor for the internship. The report and the oral presentation shall carry 40% and 60% weightage respectively.

**Project Work:**

i) The major project work shall be carried out during the IV year 2nd semester.
ii) The project evaluation and semester end Viva–Voce examination for 140 marks shall be awarded by the committee consisting of an external examiner, head of the department and the supervisor of the project based on the report submitted and performance in Viva-Voce examination.

iii) The evaluation of project work shall be conducted at the end of the fourth year second semester.

**Mandatory Non-Credit Courses**:

i) For courses like Environmental Studies and Constitution of India, semester end examination shall be conducted by the respective departments internally for 70 marks.

ii) The pattern for examination is same as the regular theory courses.

iii) There is no semester end examination for courses, such as Sports & Games/ Cultural and NSS/Fine arts/Yoga/Self Defense.

**Massive Open Online Courses (MOOCs):**

i) Each student shall register for one Massive Open Online Course (MOOC) as per the course structure.

ii) A student shall register for MOOC offered by NPTEL, CISCO, MICROSOFT and SAYLOR or any other agency with a prior approval from the departmental committee.

iii) The duration of the course shall be a minimum of 12 weeks.

iv) The Head of the Department shall appoint one mentor for each course.

v) The courses should be other than those offered under regular curriculum and are to be approved by the departmental committee consisting of the head of the department, mentor and one/two senior faculty members before the commencement of each semester.

vi) During the course, the mentor monitors the students' assignment submissions given by the agency.

vii) Students need to submit all the assignments given and need to take final exam at the proctor centre.

viii) The required credits shall be awarded on submission of certificate from the approved agency.

ix) In case if student does not qualify in the chosen subject, the same or an alternative equivalent subject may be registered again in the next semester with the recommendation of the HoD concerned and shall pass.

**8. Criteria for Passing a Course, Award of Grades and Award of Division:**

**i) Criteria for Passing a Course:**

a) A candidate shall be declared to have passed in individual theory / integrated theory and laboratory / project based theory / drawing course/design course/ practical/ mini project/main project, if he/she secures a minimum of 40% aggregate marks (continuous internal evaluation & semester end examination marks put together), subject to securing a minimum of 35% marks in the semester end examination.

b) A candidate shall be declared to have passed in skill development courses/ industrial internship/socially relevant project if he/she secures a minimum of 40% marks in the semester end examination.

c) For non-credit mandatory courses, like environmental studies and constitution of India, the student has to secure minimum 40% aggregate marks (continuous internal evaluation & semester end examination marks put together) for passing the course. For courses like Sports & Games/Cultural and NSS/Fine arts/ Yoga/Self Defense, student shall be declared to have passed in the courses if he/she secures a minimum 40% of marks in continuous internal evaluation. No marks or letter grade shall be printed in the grade cards for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified. A student has to repeat the course whenever it is offered; if he does not get satisfactory grade or does not fulfill the attendance requirements in each non-credit course for getting the degree awarded.

d) On passing a course of a program, the student shall earn the credits assigned to that course.

**ii) Method of Awarding Letter Grade and Grade Points for a Course:**

a) A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range A+ to E as given below.

b) Letter grade 'F' in any course implies failure of the student in that course and no credits earned. Absent is also treated as no credits earned.

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

| Marks Range Theory (Max - 100) | Marks Range Lab (Max. - 50) | Level | Letter Grade | Grade Points |
|---|---|---|---|---|
| $\geq 90$ | $\geq 45$ | Outstanding | A+ | 10 |
| $\geq 80$ & $\leq 89$ | $\geq 40$ & 44 | Excellent | A | 9 |
| $\geq 70$ & 79 | $\geq 35$ & 39 | Very Good | B | 8 |
| $\geq 60$ & 69 | $\geq 30$ & 34 | Good | C | 7 |
| $\geq 50$ & 59 | $\geq 25$ & 29 | Above Average | D | 6 |
| $\geq 40$ & 49 | $\geq 20$ & 24 | Average | E | 5 |
| $< 40$ | $< 20$ | Fail | F | 0 |
| | | Absent | AB | 0 |

**iii) Calculation of Semester Grade Point Average (SGPA)* for Semester:**

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as given below:

**SGPA =** $\frac{\sum(CR \, X \, GP)}{\sum CR}$ for each semester.

where CR = Credits of a course
GP = Grade Points awarded for a course

* SGPA is calculated for a candidate who passed all the courses in that semester.

**Illustration of SGPA:** Let us assume there are 6 subjects in a semester. The grades obtained as follows:

| Course | Credits (CR) | Grade Point (GP) | CR x GP |
|---|---|---|---|
| Subject 1 | 3 | 8 | 24 |
| Subject 2 | 2 | 9 | 18 |
| Subject 3 | 4 | 7 | 28 |
| Subject 4 | 3 | 6 | 18 |
| Subject 5 | 3 | 9 | 27 |
| | **∑CR=15** | | **∑CR x GP = 115** |

**iv) Calculation of Cumulative Grade Point Average (CGPA) for Entire Program:**

The CGPA is calculated as given below:

**CGPA =** $\frac{\sum (CR\ X\ GP)}{\sum CR}$ for entire program.

$SGPA = \frac{\sum CRxGP}{\sum CR} = \frac{115}{15} = 7.67$

where CR = Credits of a course
GP = Grade points awarded for a course

**Illustration of CGPA:**

| Semester1 | Semester2 | Semester3 | Semester4 | Semester5 | Semester6 | Semester7 | Semester8 |
|---|---|---|---|---|---|---|---|
| Credits:15 | Credits:22 | Credits:24 | Credits:22 | Credits:23 | Credits:21 | Credits:20 | Credits:20 |
| SGPA:7.67 | SGPA:7.86 | SGPA:7.87 | SGPA:8.67 | SGPA:8.78 | SGPA:8.50 | SGPA:8.60 | SGPA:9.00 |

$$CGPA = \frac{(15x7.67) + (22x7.86) + (24x7.87) + (22x8.67) + (23x8.78) + (21x8.50) + (20x8.60) + (20x9.00)}{(15 + 22 + 24 + 22 + 23 + 21 + 20 + 20)} = 8.38$$

**v) Award of Division:**

After satisfying the requirements prescribed for the completion of the program, the student shall be eligible for the award of B.Tech. Degree and shall be placed in one of the following grades:

| Class of Award | CGPA to be Secured | Remarks |
|---|---|---|
| First Class with Distinction | ≥ 7.75 (Without any Supplementary Appearance) | From the CGPA secured from 160 Credits |
| First Class | ≥ 6.75 | |
| Second Class | ≥ 5.75 & < 6.75 | |
| Pass Class | ≥ 5.00 & < 5.75 | |

**9. Grade Card and Consolidated Grade Card**

i) A grade card shall be issued for each semester separately both for regular and supplementary examinations irrespective of passing the examination.

ii) A grade card consists of a letter grade and credits earned for all courses of that semester along with SGPA and CGPA.

iii) A consolidated grade card consisting of all semesters' courses with the letter grade and credits secured for each course, CGPA and award of division shall be issued if he/she fulfills the academic regulations B.Tech. program.

**10. Supplementary Examinations**

Supplementary examinations will be conducted twice in a year at the end of odd and even semesters.

**11. Conditions for Promotion**

i) A student shall be eligible for promotion to next Semester of B.Tech. program, if he satisfies the conditions as stipulated in Regulation 6.

ii) The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in Regulation 6 for promotion into III Year I semester and IV year I semester.

**a) 4 Year B.Tech Program:**

i) A student shall be promoted from II year to III year only if he acquires the academic requirement of a minimum of 40% credits up to second year second semester as shown below.

1.Two regular and two supplementary examinations of I year I semester,

2.Two regular and one supplementary examinations of I year II semester,

3.One regular and one supplementary examinations of II year I semester

4.One regular examination of II year II semester,

irrespective of whether the candidate takes the examination or not.

ii) A student shall be promoted from III year to IV year only if he acquires the academic requirement of a minimum of 40% credits upto third year second semester as shown below.

1. Three Regular and three supplementary examinations of I year I sem.,

2. Three Regular and two supplementary examinations of I year II sem.,

3.Two Regular and two supplementary examinations of II year I semester,

4.Two Regular and one supplementary examinations of II Year II semester,

5.One Regular and one supplementary examinations of III Year I semester,

6.One regular examination of III Year II semester,

irrespective of whether the candidate takes the examination or not.

**b) 3 Year B.Tech Program under Lateral Entry Scheme:**

i) A student shall be promoted from III to IV year only if he acquires the academic requirement of a minimum of 40% credits up to third year second semester as shown below.

1. Two regular and two supplementary examinations of II year I semester,
2. Two Regular and one supplementary examinations of II year II semester,
3. One regular and one supplementary examinations of III year I semester
4. One regular examination of III year II semester,

irrespective of whether the candidate takes the examination or not.

**12. Revaluation**

i) Students can apply for revaluation of his/her answer script(s) of theory course(s) as per the notification issued by the Controller of Examinations.

ii) The Controller of Examinations shall arrange for revaluation of such answer script(s).

iii) An examiner, other than the first examiner, shall revaluate the answer script(s).

iv) If the variation in marks of two evaluations is less than 15% of total marks, the best mark of two evaluations shall be taken into consideration.

v) If the variation in marks of two evaluations is more than 15% of total marks, there shall be third evaluation by an examiner other than the first two examiners. The best marks of two evaluations (which are nearer) shall be taken into consideration.

vi) There is no revaluation for practical/ Mini Project/ Skill Development Courses/ Social relevant Project/ Main Project courses.

**13. Re-admission Criteria**

i) A candidate, who is detained in a semester due to the lack of attendance has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling the required norms stipulated by the college and by paying the required tuition fee and special fee in addition to paying an administrative fee of Rs.1,000/-.

ii) A candidate who is not promoted either to III year or IV year due to lack of required credits can seek admission into III / IV year in subsequent years after obtaining the required credits as stipulated in regulation 11 by paying the required tuition fee & special fee in addition to paying an administrative fee of Rs.1000/-

**14. Break in Study**

Student, who discontinues the studies for what-so-ever reason, can get readmission into appropriate semester of B.Tech program only with the prior permission of the Principal of the College, provided such candidate shall follow the transitory regulations applicable to the batch he joins. An administrative fee

of Rs.2,000/- per each year of break in study in addition to the prescribed tuition fee and special fees should be paid by the candidate to condone his break in study.

**15. Transitory Regulations**

When a student is detained due to lack of credits or shortage of attendance, he/she may be readmitted into the same semester in which he/she has been detained. However, the academic regulations under which the detained student was first admitted shall continue to be applicable to him/her.

**Transfer candidates (from an Autonomous College affiliated to JNTUK)**

A student who has secured the required credits up to previous semesters as per the regulations of other Autonomous Institutions shall only be permitted to be transferred to this college. A student who is transferred from the other Autonomous colleges to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree shall be equal to 160 for regular students and 120 for lateral entry students.

**16. Withholding of Results**

If the student has not paid the dues, if any, to the College or if any case of indiscipline is pending against him, the result of such student will be withheld. His degree will also be withheld in such cases.

**17. Malpractices and Punishments**

i) Every student appearing for the Examinations is liable to be charged with committing malpractice(s), if he/she is observed as committing any one or more of the acts mentioned in of examination malpractices and punishments.

ii) The Principal shall refer the cases of malpractices in internal assessment tests and semester end examinations to a malpractice enquiry committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the erring students based on the recommendations of the committee.

iii) Any action by the candidate trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder.

## DISCIPLINARY ACTION FOR MALPRACTICES/IMPROPER CONDUCT IN EXAMINATIONS

| | Nature of Malpractices / Improper conduct | Punishment |
|---|---|---|
| **If the candidate** | | |
| 1.a | Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination.) | Expulsion from the examination hall and cancellation of the performance in that subject only. |
| b | Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through Cell phones with any candidates or persons in or outside the exam hall in respect of any matter. | Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him. |
| 2. | Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester.<br>The hall ticket of the candidate shall be cancelled. |

| | | |
|---|---|---|
| 3. | Impersonates any other candidate in connection with the examination. | The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for the examinations of the remaining subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he will be handed over to the police and a case is registered against him. |
| 4. | Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 5. | Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks. | Cancellation of performance in that subject. |

| | | |
|---|---|---|
| 6. | Refuses to obey the orders of the Chief Superintendent/Assistant Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in or around the examination hall or organises a walkout or instigates others to walkout or threatens the officer-in-charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the Officer-in-charge or any person on duty in or outside the examination hall of any of his relations or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the Officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination. | In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them. |
| 7. | Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. |
| 8. | Possess any lethal weapon or firearm in the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. |

| | | |
|---|---|---|
| 9 | If student of the college who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat.<br>Person(s) who do not belong to the college will be handed over to the police and a police case is registered against them. |
| 10. | Comes in a drunken condition to the examination hall. | Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. |
| 11. | Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny. | Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester examinations. |
| 12. | If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be referred to the Chief Superintendent of Examinations for future action towards suitable punishment. | |

**iv) Malpractices identified at spot centre during valuation**

The involvement of the staff, who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents related to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and appropriate disciplinary action will be taken after thorough enquiry.

**18. Other Matters**

i) Physically challenged candidates who have availed additional examination time and a scribe during their Intermediate/EAMCET examinations will be given similar concessions on production of relevant proof/documents. Students who are suffering from contagious diseases are not allowed to appear either for internal or semester end examinations.

ii) The students who participated in coaching / tournaments held at State / National / International levels through University / Indian Olympic Association during semester end external examination period will be promoted to subsequent semesters as per the guidelines of University Grants Commission Letter No. F.1-5/88 (SPE/PES), dated 18-08-1994.

iii) The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Heads of the Departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the Departments shall be reported to the Academic Council for ratification.

**18. General**

i) The Academic Council may, from time to time, revise, amend or change the regulations, schemes of examination and /or syllabi.

ii) The academic regulations should be read as a whole for the purpose of any interpretation.

iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

iv) Wherever the word he, him or his occurs, it will also include she, her and hers.

# Honors Degree Guidelines

## I. Introduction

The goal of introducing B.Tech. (Honors) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research. All the students pursuing regular B.Tech. with prerequisite CGPA are eligible to register Honors degree course. A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the B.Tech. Honors degree. The additional courses shall be advanced subjects in the concerned department/discipline. The department concerned will determine required courses for award of Honor degree. The subjects in the Honor degree would be a combination of core (theory and lab) and some electives.

## II. Objectives

The objectives of initiating the B.Tech. (Honors) degree certification are:

a) To encourage the under graduates towards higher studies and research
b) To prepare the students to specialize in core Engineering streams
c) To attain the high-level competence in the specialized area of under graduate programme
d) To learn the best educational and professional skills in the specialized area after the completion of his under graduate courses.
e) To provide the opportunity to learn the post graduate level courses in the specified under graduate programme

## III. Eligibility

a) The following departments are offering B.Tech. (Honors);
   - Civil Engineering
   - Electrical and Electronics Engineering
   - Mechanical Engineering
   - Electronics and Communication Engineering
   - Computer Science and Engineering

b) B. Tech students (both Regular and Lateral Entry) pursuing a major degree programme can register for Honors degree at their choice in the same department offering major degree from IV semester onwards.

c) Students registering for Honors degree shall select the subjects from same branches/department based on the recommendations of BoS committee. For example, if a student pursuing major degree in Electrical and Electronics Engg. shall the selects subjects in Electrical and Electronics Engg. only and he/she will get major and Honors degree in Electrical and Electronics Engineering.

d) Students registered for honors shall not be permitted to register for B. Tech (Minor).

e) Students who have a CGPA of 8.00 or above, without any backlogs, up to III semester for regular students and only III semester for lateral entry students will be permitted to register for honors degree.

f) CGPA of more than 8.00 has to be maintained in the subsequent semesters of regular degree and also 8.00 GPA has to be maintain in Honors degree to keep the Honor degree registration active.

g) Student registered for Honors degree in a discipline must register and pass in all subjects with a minimum CGPA of 8.0 that constitute requirement for award of Honors degree.

h) The subjects completed under Honors degree programme shall not be considered as equivalent subjects in case the student fails to complete the major degree programme.

**IV. Registering for Honor degree**

a) Total number of seats offered for a Honors programme shall be a maximum of 35% of sanctioned intake of major degree programme.

b) There is no fee for registration of subjects for Honors degree programme

c) The department offering the honors degree will declare courses offered before the start of the semester.

d) The eligible list of students shall be displayed in the respective department notice board before the start of the semester.

e) The eligible interested students shall submit a registration form to the HoD of concerned department and the department shall maintain the record of students pursing the Honors degree. The process of registration should be completed within one week before the start of every semester.

f) If the student wishes to withdraw, he/she shall inform the same to HoD of concerned department within two weeks after registration of the Honors degree.

**V. Attendance Requirements**

a) The overall attendance in each semester of regular B. Tech courses and Honors courses shall be computed separately.

b) A student shall maintain an overall attendance of 75% in all registered courses of Honors to be eligible for attending semester end examinations. However, condonation for shortage of attendance up to 10% may be given as per college norms. On the recommendations of College Academic Committee, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee of Rs. 500/-.

c) Student having less than 65% attendance in Honors courses shall not be permitted for end semester examinations.

d) A student detained due to lack of attendance in major B. Tech programme shall not be permitted to continue Honors programme.

e) If a student is detained due to lack of attendance in Honors degree courses, he/she shall not be permitted to continue Honors programme.

**VI. Credits requirement**

a) Honors degree shall not be awarded at any circumstances without completing the regular major B.Tech. programme in which a student got admitted.

b) A Student will be eligible to get Honors degree along with major degree engineering, if he/she gets an additional 20 credits offered through Honors degree courses.

c) Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses of Honors degree, with four courses(both theory and lab), each carrying 4 credits. The remaining 4 credits must be acquired with two courses through online from platforms like NPTEL, etc., which shall be domain specific, each with 2 credits and with a minimum duration of 12 weeks as recommended by the Board of Studies.

d) Students shall produce a certificate issued by the online platforms like NPTEL, etc. as a proof of credit attainment.

e) Transfer of credits from a particular Honors to regular B.Tech. and Vice-Versa shall not be permitted.

f) If a student fails in any registered course of the Honors degree, he/she shall not be eligible to continue the B.Tech. Honors degree. However, the additional credits and grades thus far earned by the student shall be included in the separate grade card but shall not be considered to calculate the CGPA.

**VII. Examinations**

a) The examination for the Honors courses offered shall be conducted along with regular B.Tech. programme.

b) The pattern of internal and semester end examinations for Honors degree courses will be similar to regular B.Tech. courses.

c) A separate grade card shall be issued for the Honors subjects passed in each semester.

d) There is no supplementary examination for the failed subjects in a Honors programme.

e) Examination Fee to be paid will be as per the college norms.

**Note:** ***In the event of any tie during the seat allotment for a Honors degree, the concerned major degree department offering Honors shall conduct a test on the prerequisite subjects of Honors degree and final decision shall be taken.***

# Minor Degree Guidelines

## I. Introduction

Looking to global scenario, engineering students should have knowledge of subjects from other branches and some advanced subjects of their respective branch in which they are perusing the degree. To complement the same college has decided to take an initiative from 2020-21 in academics by introducing minor degree to the undergraduate students enrolled in the B.Tech. This gives a provision to the students to pursue minor other than the discipline in which student got admitted. An aspiring student can choose the courses and laboratories in any other discipline and can get a minor degree in the chosen specialization in addition to regular major B.Tech. degree. This way undergraduates are not restricted to learn about courses only in the discipline they get admitted to, but can choose courses of their interest to later on take up a career path of their liking. The students taking up a minor degree course will get additional credits. A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the minor degree. The department concerned will determine the required courses for award of minor degree. The subjects in minor programme would be a combination of mostly core and some electives.

## II. Objectives

The objectives of initiating the minor degree certification are:

a) To diversify the knowledge of the undergraduates.
b) To make the undergraduates more employable.
c) To have more educational and professional skills after the completion of his undergraduate courses.
d) To give a scope to specialize students in other streams of engineering in addition to the ones they are currently pursuing.

## III. Eligibility

a) The following departments are offering B.Tech. (Minor);
   - Civil Engineering
   - Electrical and Electronics Engineering
   - Mechanical Engineering
   - Electronics and Communication Engineering
   - Computer Science and Engineering
   - Information Technology

b) The B.Tech. students (both Regular and Lateral Entry) pursuing a major degree programme can register for minor degree at their choice in any other department offering minor from IV semester onwards.

c) Student pursuing major degree in any engineering branch is eligible to register for minor in any other engineering branch. For example, if a student pursuing major degree in Electrical and Electronics Engineering shall complete minor in Civil Engineering and he/she will get major degree of Electrical and Electronics Engineering with minor of Civil Engineering.

d) However, students pursuing major degree in a particular engineering branch are not allowed to register for minor in the same branch.

e) The students are permitted to opt for only a single minor degree in his/her entire tenure of B.Tech. programme.

f) The students registered for minor degree shall not be permitted to register for B.Tech. (Honors.)

g) Students who have a CGPA of 7.75 or above, without any backlogs, up to III semester for regular students and only III semester for lateral entry students will be permitted to register for a minor.

h) CGPA of more than 7.75 has to be maintained in the subsequent semesters of regular degree and also 7.75 GPA has to be maintain in Minor degree to keep the Minor degree registration active.

i) A student registered for minor in a discipline must register and pass in all subjects with a minimum CGPA of 7.75 that constitute requirement for award of minor.

j) The subjects completed under minor degree shall not be considered as equivalent subjects in case the student fails to complete the major degree programme.

**IV. Registering for Minor Degree**

a) Total number of seats offered for a minor degree programme shall be a maximum of 35% of sanctioned intake of major degree programme.

b) There is no fee for registration of subjects for minor degree programme

c) The department offering the minor will declare courses offered before the start of the semester.

d) The eligible list of students shall be displayed in the respective department notice board before the start of the semester.

e) The eligible interested students shall apply to the HoD offering the minor degree through HoD of his/her parent department and after scrutiny the department offering minor will announce the final list of the selected students for the minor degree.

f) The selected students shall submit a registration form to the HoD offering the minor degree through HoD of his/her parent department. The process of registration should be completed within one week before the start of every semester.

g) Both parent department and department offering minor shall maintain the record of students pursing the minor degree.

h) If the student wishes to withdraw, he/she shall inform the same to HoD of department offering minor degree through HoD of parent department within two weeks after registration of the minor degree.

**V. Attendance Requirement**

a) The overall attendance in each semester of regular B.Tech. courses and minor courses shall be computed separately.

b) A student shall maintain an overall attendance of 75% in all registered courses of minor degree to be eligible for attending semester end examinations. However, condonation for shortage of attendance up to 10% may be given as per college norms. On the recommendations of College Academic Committee, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee of Rs. 500/-.

c) Student having less than 65% attendance in minor courses shall not be permitted for end semester examinations.

d) A student detained due to lack of attendance in major B.Tech. programme shall not be permitted to continue minor degree programme

e) If a student is detained due to lack of attendance in minor degree courses, he/she shall not be permitted to continue minor programme

**VI. Credits requirement**

a) Minor degree shall not be awarded at any circumstances without completing the regular major B.Tech programme in which a student got admitted.

b) A Student will be eligible to get minor degree along with major degree engineering, if he/she gets an additional 20 credits offered through minor degree courses.

c) Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses of minor degree, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired with two courses through online platforms like NPTEL, etc., which shall be domain specific, each with 2 credits and with a minimum duration of 12 weeks as recommended by the Board of Studies.

d) Students shall produce a certificate issued by the online platforms like NPTEL, etc. as a proof of credit attainment.

e) Transfer of credits from a minor to regular B.Tech and Vice-Versa shall not be permitted.

f) If a student fails in any registered course of the minor degree, he/she shall not be eligible to continue the B.Tech. minor degree. However, the additional credits and grades thus far earned by the student shall be included in the separate grade card but shall not be considered to calculate the CGPA.

**VII. Examinations**

a) The examination for the minor courses offered shall be conducted along with regular B.Tech. programme.

b) The pattern of internal and semester end examinations for minor degree courses will be similar to regular B.Tech. courses.

c) A separate grade card shall be issued for the minor degree subjects passed in each semester.

d) There is no supplementary examination for the failed subjects in a minor degree programme.

e) Examination Fee to be paid will be as per the College norms.

**Note:** ***In the event of any tie during the seat allotment for a Minor degree, the concerned department offering Minor degree shall conduct a test on the prerequisite subjects of Minor degree and final decision shall be taken.***

# COURSE STRUCTURE

# &

# SYLLABUS

# COURSE STRUCTURE

## I Year - I Semester

| Sl. No. | Course Code | Name of the Course / Laboratory | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | EG3501 | Functional English | 3 | - | - | 3 |
| 2 | MA3501 | Linear Algebra and Calculus | 3 | 1 | - | 4 |
| 3 | CH3503 | Applied Chemistry | 3 | - | - | 3 |
| 4 | CT3501 | Problem Solving Using C * | 3 | - | 2 | 4 |
| 5 | UH3501 | Universal Human Values 2: Understanding Harmony | 2 | 1 | - | 3 |
| 6 | CH3504 | Applied Chemistry Lab | - | - | 2 | 1 |
| 7 | EG3502 | Functional English Lab | - | - | 2 | 1 |
| | | **Total** | **14** | **2** | **6** | **19** |
| 8 | BA3501 | Constitution of India (Mandatory Non-Credit Course) | 2 | - | - | - |

* **Integrated Course with Theory and Laboratory**

## I Year - II Semester

| Sl. No. | Course Code | Name of the Course / Laboratory | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | EG3503 | Professional Communication | 2 | - | - | 2 |
| 2 | MA3505 | Integral Transforms and Vector Calculus | 3 | 1 | - | 4 |
| 3 | PH3504 | Solid State Physics | 3 | - | - | 3 |
| 4 | EE3504 | Circuit Theory - I | 2 | 1 | - | 3 |
| 5 | MA3506 | Discrete Mathematics | 2 | 1 | - | 3 |
| 6 | ME3501 | Engineering Drawing | 1 | - | 4 | 3 |
| 7 | EG3504 | Professional Communication Lab | - | - | 4 | 2 |
| 8 | PH3505 | Solid State Physics Lab | - | - | 2 | 1 |
| | | **Total** | **13** | **3** | **10** | **21** |
| 9 | EN3501 | Environmental Studies (Mandatory Non-Credit Course) | 2 | - | - | - |

**L : Lecture** **T : Tutorial** **P : Practical**

## II Year - I Semester

| Sl. No. | Course Code | Name of the Course / Laboratory | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | CT3508 | Python Programming * | 2 | - | 2 | 3 |
| 2 | EE3508 | Circuit Theory - II | 2 | 1 | - | 3 |
| 3 | EE3509 | Control Systems | 2 | 1 | - | 3 |
| 4 | EE3510 | DC Machines and Transformers | 2 | 1 | - | 3 |
| 5 | EC3504 | Electronic Devices and Circuits | 2 | 1 | - | 3 |
| 6 | EC3505 | Digital Circuits | 3 | - | - | 3 |
| 7 | EC3506 | Electronic Devices and Circuits Lab | - | - | 2 | 1 |
| 8 | EC3507 | Digital Circuits Lab | - | - | 2 | 1 |
| 9 | SD3501 | Logic Building and Basic Coding Principles | - | - | 2 | 1 |
| | | **Total** | **13** | **4** | **8** | **21** |
| 10 | NS3501 | NSS / Fine Arts / Yoga / Self Defense (Mandatory Non-Credit Course) | - | - | 2 | - |

* **Integrated Course with Theory and Laboratory**

## II Year - II Semester

| Sl. No. | Course Code | Name of the Course / Laboratory | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | MA3514 | Numerical Methods with Computer Applications* | 2 | - | 2 | 3 |
| 2 | EE3511 | Induction & Synchronous Machines | 2 | 1 | - | 3 |
| 3 | EE3512 | Power generation Systems | 3 | 1 | - | 4 |
| 4 | EC3510 | Signals and Systems | 2 | 1 | - | 3 |
| 5 | | **Open Elective - I** | 3 | - | - | 3 |
| 6 | EE3515 | DC Machines and Transofrmers Lab | - | - | 2 | 1 |
| 7 | EE3516 | Electrical Circuits Lab | - | - | 2 | 1 |
| 8 | EE3517 | Simulation of Electrical Engineering Systems | - | - | 4 | 2 |
| 9 | SD3503 | Programming for Corporate | - | - | 2 | 1 |
| | | **Total** | **12** | **3** | **12** | **21** |
| 10 | SG3501 | Sports and Games / Cultural (Mandatory Non-Credit Course) | - | - | 2 | - |

* **Integrated Course with Theory and Laboratory**

**L : Lecture T : Tutorial P : Practical**

### III Year - I Semester

| Sl. No. | Course Code | Name of the Course / Laboratory | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | EE3519 | Electrical Measurements and Instrumentation | 3 | 1 | - | 4 |
| 2 | EE3520 | Power Transmission Systems | 2 | 1 | - | 3 |
| 3 | EC3524 | Analog and Digital IC Applications | 2 | 1 | - | 3 |
| 4 | | **Professional Elective - I** | 3 | - | - | 3 |
| 5 | | **Open Elective - II** | 3 | - | - | 3 |
| 6 | EE3526 | Control Systems Lab | - | - | 2 | 1 |
| 7 | EE3527 | AC Machines Lab | - | - | 2 | 1 |
| 8 | EE3528 | Electrical Measurements & Instrumentation Lab | - | - | 4 | 2 |
| 9 | SD3504 | Problems Solving Enhancement | - | - | 2 | 1 |
| 10 | EE3529 | Community Service Project | - | - | 8 | 4 |
| | | **Total** | **13** | **3** | **18** | **25** |

### III Year - II Semester

| Sl. No. | Course Code | Name of the Course / Laboratory | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | EC3539 | Microprocessors, Microcontrollers & its Applications** | 3 | 1 | - | 4 |
| 2 | EE3530 | Power Electronics | 3 | 1 | - | 4 |
| 3 | EE3531 | Power System Analysis | 2 | 1 | - | 3 |
| 4 | | **Professional Elective - II** | 3 | - | - | 3 |
| 5 | | **Open Elective - III** | 3 | - | - | 3 |
| 6 | EC3540 | Microprocessors, Microcontrollers & its Applications Lab | - | - | 2 | 1 |
| 7 | EE3537 | Automation of Electrical Systems Using IoT | - | - | 4 | 2 |
| 8 | SD3506 | Linguistic Competency Building | - | - | 2 | 1 |
| | | | | | | |
| | | **Total** | **14** | **3** | **8** | **21** |

** **Project base Theory Course**

**L : Lecture T : Tutorial P : Practical**

**IV Year - I Semester**

| Sl. No. | Course Code | Name of the Course / Laboratory | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | EE3538 | Utilization of Electrical Energy | 3 | 1 | - | 4 |
| 2 | | **Professional Elective - III** | 3 | - | - | 3 |
| 3 | | **Professional Elective - IV** | 3 | - | - | 3 |
| 4 | | **Professional Elective - V** | 3 | - | - | 3 |
| 5 | BA3503 | Engineering Economics & Project Management | 2 | - | - | 2 |
| 6 | EE3545 | Power Systems Lab | - | - | 2 | 1 |
| 7 | EE3546 | Power Electronics Lab | - | - | 2 | 1 |
| 8 | EE3547 | Computer Aided Electrical Drawing | - | - | 4 | 2 |
| 9 | EE3548 | Internship/Industrial Training / Practical Training | - | - | 6 | 3 |
| 10 | EE3549 | MOOCs | - | - | - | 2 |
| | | **Total** | **14** | **1** | **14** | **24** |

**IV Year - II Semester**

| Sl. No. | Course Code | Name of the Course / Laboratory | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | EE3550 | Major Project Work | - | - | 16 | 8 |
| | | **Total** | **-** | **-** | **16** | **8** |

**Open Elective - I**

| Sl. No. | Course Code | Name of the Course / Laboratory | Department Offering the Subject | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | CE3513 | Elements of Civil Engineering (other than CE) | CE | 3 | - | - | 3 |
| 2 | CE3514 | Environment Laws and Policies (other than CE) | CE | 3 | - | - | 3 |
| 3 | EE3513 | Electrical Materials (other than EEE) | EEE | 3 | - | - | 3 |
| 4 | EE3514 | Control Systems Engineering(other than EEE&ECE) | EEE | 3 | - | - | 3 |
| 5 | ME3517 | Automotive Engineering (other than ME) | ME | 3 | - | - | 3 |
| 6 | ME3518 | Elements of Mechanical Transmission (other than ME) | ME | 3 | - | - | 3 |
| 7 | EC3520 | Introduction to Embedded Systems (other than ECE/IoT) | ECE | 3 | - | - | 3 |
| 8 | EC3521 | Fundamentals of Communication Systems (other than ECE/IoT) | ECE | 3 | - | - | 3 |
| 9 | CS3503 | Information Retreival Systems (Other than CSE & AI&DS) | CSE | 3 | - | - | 3 |
| 10 | CT3522 | Computer Graphics (Other than CSE, IT & AI&DS) | CSE | 3 | - | - | 3 |
| 11 | IT3504 | System Software (Other than IT) | IT | 3 | - | - | 3 |
| 12 | IT3505 | Free & Open Source Software (Other than IT) | IT | 3 | - | - | 3 |
| 13 | MA3516 | Fuzzy Mathematics | BS&H | 3 | - | - | 3 |

## Open Elective - II

| Sl. No. | Course Code | Name of the Course / Laboratory | Department Offering the Subject | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | CE3524 | Remote Sensing & GIS (other than CE) | CE | 3 | - | - | 3 |
| 2 | CE3525 | Green Building Technology (other than CE) | CE | 3 | - | - | 3 |
| 3 | EE3524 | Modeling & Simulation of Engineering Systems (other than EEE) | EEE | 3 | - | - | 3 |
| 4 | EE3525 | Power Systems Engineering (other than EEE) | EEE | 3 | - | - | 3 |
| 5 | ME3528 | Renewable Energy Sources (other than ME) | ME | 3 | - | - | 3 |
| 6 | ME3529 | Venture Development (other than ME) | ME | 3 | - | - | 3 |
| 7 | EC3535 | Automotive Electronics (other than ECE & IoT) | ECE | 3 | - | - | 3 |
| 8 | EC3536 | Introduction to Signal Processing (other than ECE&IoT) | ECE | 3 | - | - | 3 |
| 9 | CS3504 | Network Programming (Other than CSE) | CSE | 3 | - | - | 3 |
| 10 | CT3529 | Social Network Analysis(Other than CSE/CSE(AI&ML)) | CSE | 3 | - | - | 3 |
| 11 | CT3530 | Cyber Security (Other than IT) | IT | 3 | - | - | 3 |
| 12 | IT3508 | E-Commerce (Other than IT) | IT | 3 | - | - | 3 |
| 13 | AD3502 | Intelligent Systems (Other than AI&DS) | AI&DS | 3 | - | - | 3 |
| 14 | CT3531 | Recommender Systems(Other than CSE, IT, CSE(AI&ML) & AI&DS) | AI&DS | 3 | - | - | 3 |
| 15 | IN3514 | Introduction to IoT Architecture (Other than IoT) | IoT | 3 | - | - | 3 |
| 16 | IN3515 | Introduction to Smart Sensors (Other than IoT) | IoT | 3 | - | - | 3 |

## Open Elective - III

| Sl. No. | Course Code | Name of the Course / Laboratory | Department Offering the Subject | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | CE3538 | Basics of Environmental Engineering (other than CE) | CE | 3 | - | - | 3 |
| 2 | CE3539 | Disaster Preparedness, Planning & Management (other than CE) | CE | 3 | - | - | 3 |
| 3 | EE3535 | Principles of Special Electric Machines (other than EEE) | EEE | 3 | - | - | 3 |
| 4 | EE3536 | Electrical Instrumentation (other than EEE) | EEE | 3 | - | - | 3 |
| 5 | ME3541 | Green Engineering (other than ME) | ME | 3 | - | - | 3 |
| 6 | ME3542 | 3D Printing Technologies (other than ME) | ME | 3 | - | - | 3 |
| 7 | EC3548 | Assistive Technologies(other than ECE) | ECE | 3 | - | - | 3 |
| 8 | EC3549 | Introduction to Bio-Medical Engineering (other than ECE&IoT) | ECE | 3 | - | - | 3 |
| 9 | CS3511 | DevOps (Other than CSE and IT) | CSE | 3 | - | - | 3 |
| 10 | CS3512 | Object Oriented Analysis & Design (Other than CSE) | CSE | 3 | - | - | 3 |
| 11 | IT3515 | Scripting Languages (Other than IT) | IT | 3 | - | - | 3 |
| 12 | IT3516 | Fundamentals of Software Project Management(Other than CSE&IT) | IT | 3 | - | - | 3 |
| 13 | AD3505 | Web Mining (Other than AI&DS) | AI&DS | 3 | - | - | 3 |
| 14 | AD3506 | AI Chatbots (Other than AI&DS and CSE (AI&ML)) | AI&DS | 3 | - | - | 3 |
| 15 | IN3521 | Trends in IoT (Other than IoT) | IoT | 3 | - | - | 3 |
| 16 | EG3505 | Academic Communication | ENG | 3 | - | - | 3 |

## Professional Electives

| Sl. No. | Course Code | Name of the Course / Laboratory | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| 1 | | **Professional Elective - I** | 3 | - | - | 3 |
| | EE3521 | i) Electrical Distribution Systems | | | | |
| | EE3522 | ii) Advanced Control Systems | | | | |
| | EE3523 | iii) Engineering Electro Magnetics | | | | |
| | CT3505 | iv) Data Structures | | | | |
| 2 | | **Professional Elective - II** | 3 | - | - | 3 |
| | EE3532 | i) Switch Gear & Protection | | | | |
| | EE3533 | ii) Electrical and Hybrid Vehicles | | | | |
| | EE3534 | iii) Digital Control Systems | | | | |
| | CT3540 | iv) Introduction to Data Base Systems | | | | |
| 3 | | **Professional Elective - III** | 3 | - | - | 3 |
| | EC3553 | i) Digital Image Processing | | | | |
| | EC3527 | ii) Digital Signal Processing | | | | |
| | EC3554 | iii) Principles of VLSI Design | | | | |
| | EC3555 | iv) CMOS Digital IC Design | | | | |
| 4 | | **Professional Elective - IV** | 3 | - | - | 3 |
| | EE3539 | i) Power System Operation and Control | | | | |
| | CT3553 | ii) Big Data Analytics | | | | |
| | EE3540 | iii) Power Semiconductor Drives | | | | |
| | EE3541 | iv) Special Electrical Machines | | | | |
| 5 | | **Professional Elective - V** | 3 | - | - | 3 |
| | EE3542 | i) High Voltage Engineering | | | | |
| | CT3530 | ii) Cyber Security | | | | |
| | EE3543 | iii) Flexible AC Transmission Systems | | | | |
| | EE3544 | iv) Artificial Neural Networks and Fuzzy Systems | | | | |

**L : Lecture** **T : Tutorial** **P : Practical**

# HONORS DEGREE COURSE STRUCTURE

## Electrical Engineering

| Sl. No. | Code | Year & Sem. | Name of the Course | No.of Periods per week | | | No.of Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | HEE3501 | II - II | Programmable Logic Controllers & Applications | 3 | 1 | - | 4 |
| 2 | HEE3502 | III - I | Modern Control Theory | 3 | 1 | - | 4 |
| 3 | HEE3503 | III - II | Artificial Intelligence Techniques | 3 | 1 | - | 4 |
| 4 | HEE3504 | III - II | MOOCs | - | - | - | 2 |
| 5 | HEE3505 | IV - I | Advanced Power Electronic Converters | 3 | 1 | - | 4 |
| 6 | HEE3506 | IV - I | MOOCs | - | - | - | 2 |
| | | | **Total** | **12** | **4** | **-** | **20** |

# SYLLABUS

## FUNCTIONAL ENGLISH
## (Common to All Branches)

I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To equip the students for their present and future academic pursuits involving the following:
  - listening to (and viewing) classroom lectures and other academic presentations with a reasonable degree of accuracy, understanding, and appreciation, and responding to them appropriately;
  - speaking in academic (e.g. classroom discussions) and social contexts with a fair degree of fluency, accuracy and intelligibility, and with due attention to factors such as purpose, audience, context, and culture;
  - reading a wide range of informational and functional texts, including course books and reference materials, from print and non-print sources and using them for a variety of purposes; and
  - writing for academic purposes (e.g. assignments, examination answers) in an organized way following the rules of discourse and using vocabulary and grammar appropriately and accurately; and
- To develop in them the communication strategies and social graces necessary for functioning effectively in social, academic, and other situations in which they may be called upon to use English.

**Course Outcomes**

Upon successful completion of Functional English, the students will be able to

- speak with a reasonable degree of fluency using communication strategies (i.e. using language appropriately to carry out functions such as greeting, requesting information, seeking confirmation, disagreeing) as well conventions of politeness and courtesy
- speak with a reasonable degree of fluency and accuracy in contexts requiring tasks such as narrating and describing
- listen to short audio and video clips
  - in standard Indian accent with understanding of the types listed in D (1) (a) below; and
  - in native English accent (British and American), especially clips in which the speakers or voice actors speak slowly, and gain both understanding of messages and sensitivity to native-speaker accents
- read fluently comprehending texts of different kinds using multiple strategies to understand explicitly-stated information as well as underlying meanings

- write coherent paragraphs with attention to elements of writing such as content, organization, language, style, and mechanics and the conventions of academic writing
- write survey reports with attention to conventions of report writing
- guard against mistakes Indians typically make in their speech and writing in English

**Course Content**

**UNIT – I:**

**Listening** : Listening Comprehension – Task 1 (IWE - Chapt II)
**Speaking** : Communication Functions – Conversation between Raghu and Sridhar (IWE - Chapt II)
**Reading** : Reading Comprehension – Task 1 (DPM)
**Vocabulary**: (a) GRE Words – 1.1, (b) Collocations – 2.1 (VB)
**Grammar** : Tenses – Simple Present and Present Continuous (IWE - Chapt II)
**Writing** : Paragraph-Writing (IWE - Chapt II)

**UNIT – II:**

**Listening** : Listening comprehension – Task 2 (WR)
**Speaking** : Communication Functions – Exercise (DPM)
**Reading** : Reading Comprehension – Task 2 (DPM)
**Vocabulary** : (a) Words Often Confused–3.1, (b) One-Word Substitutes–4.1 (VB)
**Grammar** : (a) Indianism and (b) *Have to* (IWE - Chapt II)
**Writing** : Paragraph-Writing (IWE - Chapt II)

**UNIT – III:**

**Listening** : Listening Comprehension – Task 3 (IWE - Chapt III)
**Speaking** : Communication Functions – Conversation between Shreya and Kalpana (IWE - Chapt III)
**Intensive Reading** : Reading Comprehension Task – 3 (DPM)
**Extensive Reading** : *The Adventures of Huckleberry Finn* by Mark Twain
**Vocabulary**: (a)Idioms – 5.1, (b) Phrasal Verbs – 6.1 (VB)
**Grammar** : Tenses – Simple Past and Present Perfect (IWE - Chapt III)
**Writing** : Paragraph-Writing – Coherence (IWE - Chapt III)

**UNIT – IV:**

**Listening** : Listening Comprehension – Task 4 (IWE - Chapt IV)
**Speaking** : Communication Functions – Conversation between professor and Mayur (IWE - Chapt IV)
**Reading** : Reading Comprehension – Task 4 (DPM)
**Vocabulary**: (a) GRE words–1.2, (b) Collocations–2.2, (c) Words Often Confused–3.2(VB)
**Grammar** : Expressing Futurity (IWE - Chapt IV)
**Writing** : Clutter-Free Writing (IWE - Chapt IV)

**UNIT – V:**

**Listening** : Listening comprehension – Task 5 (WR)

**Speaking** : (a) Communication Functions and (b) Telephone Etiquette – Exercises (IWE - Chapt IV)

**Intensive Reading** : Reading Comprehension – Task 5 (DPM)

**Extensive Reading** : *More Tales from Shakespeare* by Charles and Mary Lamb

**Vocabulary**: (a) One-Word Substitutes – 4.2, (b) Idioms – 5.2, (c) Phrasal verbs – 6.2 (VB)

**Grammar** : Structure – *Going to* (IWE - Chapt IV)

**Writing** : Technical Report Writing (DPM)

- IWE – *Innovate with English* by T Samson (Foundation)
- Chapt – Chapter
- DPM – Department-produced materials (handouts)
- WR – Web-resources
- VB – *Vocabulary Builder for Students of Engineering and Technology* by Vijaya Lakshmi et al (Maruthi)

**Text books**

1. T. Samson, Innovate with English, First Edn., Cambridge University Press India Pvt. Ltd. under the imprint of Foundation Books, Hyderabad, 2010.
   - Units TWO, THREE and FOUR only
2. M. Vijaya Lakshmi, et al., Vocabulary Builder for Students of Engineering and Technology, Second Edn., Maruthi Publications, Hyderabad, 2017.
3. The following simplified classics, one for each mid-semester, from the series, Great Stories in Easy English, published by S. Chand & Company Limited:
   - The Adventures of Huckleberry Finn by Mark Twain
   - More Tales from Shakespeare
4. Audio and video clips carefully selected by the Department in order to sensitize the students to native-speaker accents
5. Department-produced material on survey report writing

**Testing Pattern**

**First Mid-Term Examination**

The paper consists of four questions. All questions are compulsory; there is no choice.

**I.** Reading an unseen passage and answering two sets of questions on it:

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, etc. are to be set. Four of the eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 8 x ½ = 4**

b) Writing a discussion either on an aspect related to the ideas expressed in the passage but not explicitly dealt with in it, or on an idea not fully dealt with, allowing scope for discussion. **Marks: 1 x 4 = 4**

**II.** Twelve contextualized questions of the following from *Vocabulary Builder*: GRE Words: 1.1; Collocations: 2.1; Commonly confused words: 3.1; One-word substitutes: 4.1; Idioms: 5.1; and Phrasal verbs: 6.1 **Marks: 12 x ½ = 6**

**III.**

a) Correction of grammatical errors: Eight sentences with grammatical errors of the following types (dealt with in Units 2 and 3 of *Innovate with English*) will be given: simple present, present continuous, use of *have to* structure and Indianism **Marks: 8 x ½ = 4**

b) Eight objective-type questions based on one retold classic: *The Adventures of Huckleberry Finn*. **Marks: 8 x ½ = 4**

**IV.**

a) Completing a conversation (in which informational and interactional functions are performed) with appropriate expressions. **Marks: 8 x ½ = 4**

b) Reading two poorly-written paragraphs and performing the following tasks:

i. Identifying the topic sentence of paragraph (a) and the sentences that do not support the topic sentence, and writing in the answer book the topic sentence and the irrelevant sentences. **Marks: 4 x ½ = 2**

ii. Re-writing paragraph (b), which is poorly organized, into a coherent paragraph choosing appropriate sequence signals or connectives. **Marks: 4 x ½ = 2**

**Second Mid-Term Examination**

The paper consists of four questions All questions are compulsory; there is no choice.

I.a) Eight contextualized questions on the following from *Vocabulary Builder*: GRE Words: 1.1; Collocations: 2.1; Commonly confused words: 3.1; One- word substitutes: 4.1; Idioms: 5.1; and Phrasal verbs: 6.1 **Marks: 8 x ½ = 4**

b) Analyzing a service encounter – an interaction, either a direct personal one, or over the telephone (e.g. *making enquires at the reception counter in a hotel, an interaction with a salesman at a mall, asking for information on the telephone)* – and

i. identifying the reasons for the failure or breakdown of communication in the conversation **Marks: 4 x ½ = 2**

ii. rewriting the conversation making the communication successful. In the rewritten conversation, the partners in the conversation must sound polite and positive, using the communication strategies listed in the question.**Marks: 4 x ½ = 2**

**II. Reading an unseen passage and answering two sets of questions on it:**

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, etc. are to be set. Four of the Eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 8 x ½ = 4**

b) Writing a discussion either on an aspect related to the ideas expressed in the passage but not explicitly dealt with in it, or on an idea not fully dealt with, allowing scope for discussion. **Marks: 1 x 4 = 4**

**III.**

a) Writing a technical report on the given situation. The report must:
follow the conventions of technical report writing
use language and style appropriate to technical report writing
**Marks: 1 x 4 = 4**

b) Writing a paragraph of 100 - 150 words on the given topic (e.g. *Should there be a dress code in colleges?*). The paragraph must have:
adequate and relevant ideas on the topic with the ideas properly organized using strategies such as coherence and cohesion;
a topic sentence; and
proper choice of vocabulary and grammatical accuracy. **Marks: 1 x 4 = 4**

**IV.**

a) Correction of grammatical errors: six sentences with grammatical errors of the following types (dealt with in Unit 4 of *Innovate with English*) will be given: futurity and Indianism. **Marks: 6 x ½ = 3**

b) Six objective-type questions based on one retold classic: *More Tales from Shakespeare.* **Marks: 6 x ½ = 3**

**Semester End Examination**

Answer any five questions. Question one is compulsory.

**I.** Reading an unseen (unfamiliar) passage, preferably one taken from a newspaper or a magazine, on a topical event or situation and answering three sets of questions on it:

a. Seven comprehension questions:
- Critical questions requiring analysis, inference, prediction, evaluation, etc. are to be set; 'information' questions involving a mere reproduction of the content should be avoided.
- Three of the seven questions should be multiple-choice questions.
- In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 7 x 1 = 7**

b. Finding four one-word substitutes in the passage for the expressions given. **Marks: 4 x ½ = 2**

c. Writing a discussion either on an aspect related to the ideas expressed in the passage but not explicitly dealt with in it, or on an idea not fully dealt with, allowing scope for discussion. **Marks: 1 x 5 = 5**

II. Reading an incomplete conversation that takes place in an academic or social or professional context (where informational and interactional functions are performed) and answering the following questions on it:

a. Completing the conversation with appropriate expressions. The expressions are to be chosen from among the ones given in a box. In the answer book, the examinee is expected to number the blanks as 1, 2, 3, etc., and write against each the expression he/she has chosen. **Marks: 7 x 1 = 7**

b. Writing a dialogue extending the scope of the original conversation following the instructions given in the question on how it should be extended. The instructions must include five communication strategies/functions, and the examinee is expected to use them in his/her dialogue. **Marks: 1 x 7 = 7**

**III.** Analyzing a service encounter – an interaction, either a direct personal one, or over the telephone, e.g. *making enquiries at the reception counter in a hotel, an interaction with a salesman at a mall, asking for information on the telephone* – and

a. identifying the reasons for the failure or breakdown of communication in the conversation **Marks: 1 x 7 = 7**

b. rewriting the conversation making the communication successful. In the rewritten conversation, the partners in the conversation must sound polite and positive, using the communication strategies listed in the question. **Marks: 1 x 7 = 7**

**IV.** Reading two badly-written paragraphs and performing the following tasks:

a. Identifying the topic sentence of paragraph (a) and the sentences that do not support the topic sentence, and writing in the answer book the topic sentence and the irrelevant sentences. **Marks: 1 x 7 = 7**

b. Re-writing paragraph (b), which is poorly organized, into a cohesive paragraph choosing appropriate sequence signals. **Marks: 1 x 7 = 7**

**V.**

a. Writing a paragraph of 150 words on the given topic (e.g. *Should there be a dress code in colleges?*). The paragraph must have:

- adequate and relevant ideas on the topic with the ideas properly organized using strategies such as coherence and cohesion;
- a topic sentence; and
- proper choice of vocabulary and grammatical accuracy. **Marks: 1 x 7 = 7**

b. Writing a survey report using the data on the table(s)/graph(s) given. The report must:

- indicate acquaintance with the conventions of academic writing; and
- the ability to interpret data intelligently.

However, high standards of performance need not be expected as the students are in the first year of their course. It also follows that complex tables/graphs should be avoided. **Marks: 1 x 7 = 7**

VI. Contextualized vocabulary questions with two items on each one of the following from *Vocabulary Builder* (listed as 2 under F. TEXTBOOKS above):

- GRE Words (Units 1.1 and 1.2)
- Collocations (Units 2.1 and 2.2)
- Commonly Confused Words (Units 3.1 and 3.2)
- One-Word Substitutes (Units 4.1 and 4.2)
- Idioms (Units 5.1 and 5.2)
- Phrasal Verbs (Units 6.1 and 6.2)

For example, in the question on idioms, two sentences/contexts with an idiom in each may be given, and the examinee will have to identify the most appropriate meaning of the idiom from among the four options given. **Marks: 14 x 1 = 14**

**VII. Correction of grammatical errors:**

- Either a conversation with fourteen grammatical errors of the types dealt within the Textbook 1 (*Innovate with English*), or isolated sentences with fourteen grammatical errors will be given.
- The errors will include at least seven typical instances of Indianism widely believed to be inappropriate in standard English.
- If isolated sentences with errors are given, they are not to be given in isolation from their contexts; a conversation with errors of the kind specified above will serve the purpose better.
- The examinees are expected to rewrite the sentences in the answer book, correcting them. **Marks: 14 x 1 = 14**

* * *

# LINEAR ALGEBRA AND CALCULUS
## (Common to CE, EEE, ME, ECE, IoT, CSE & IT)

I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture : 3 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 4 | | External Marks | : 70 |

**Course Objectives**

- To understand the procedure to solve the system of linear equations.
- To know the method for finding eigenvalues and eigenvectors.
- To familiar with the knowledge of differential calculus to support their concurrent and subsequent engineering studies.
- To know how to find maxima and/or minima for a given surface.
- To understand the methods to evaluate areas and volumes using integrals.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- solve the system of linear equations in various engineering problems.
- evaluate the eigenvalues and eigenvectors.
- solve linear ordinary differential equations .
- apply the techniques of partial differentiation in optimization problems and solve first order partial differential equations.
- compute areas and volumes using double and triple integrals.

**Course Content**

**UNIT– I: System of Linear Equations**

Rank of a matrix – Echelon form, Normal form. System of linear equations – consistency and inconsistency - Gauss-elimination method.

**UNIT– II: Eigenvalues and Eigenvectors**

Finding eigenvalues and eigenvectors for a given matrix, Properties of Eigenvalues and Eigenvectors, Cayley –Hamilton theorem - finding inverse and powers of a matrix. Singular value decomposition.

**UNIT– III: Ordinary Differential Equations**

Review on first order ordinary differential equations. Application – Newton's Law of cooling. Solving Second and Higher Order Differential Equations : Homogeneous differential equations and Non-Homogeneous differential equations when RHS terms are of the form $e^{ax}$, sin ax, cos ax, polynomial in x, $e^{ax}v(x)$ and method of variation of parameters.

Overview of Cauchy's and legendre's differential equations.

**UNIT– IV: Partial Differentiation and Equations**

Introduction - total derivative, chain rule. Jacobian, Applications - finding maxima and minima (two & three variables).

Solutions of first order linear P.D.E. Solving Non-Linear P.D.E by charpit's method.

**UNIT– V: Multi Integrals**

Evaluation of double and triple integrals. Areas by double integrals and Volumes by triple integrals. Change the Order of integration.

**Text Books**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, Maitrey Printech Pvt. Ltd, Noida, 2014.
2. B.S.Grewal, Higher Engineering Mathematics, 44th edition, Khanna Publishers, New Delhi, 2020.

**Reference Books**

1. Schaum's Series, Differential Equations, Tata-Mc Graw Hill Company Limited.
2. Bali & Iyengar,Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd.

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# APPLIED CHEMISTRY
## (Common to EEE & ECE)
I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To impart the knowledge of electrochemical energy systems and advanced materials.
- To impart the knowledge of water quality, treatment methods and spectroscopic techniques.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- explain the electrochemistry of batteries and sensors.
- discuss various techniques used in making thin films, properties and applications of nanomaterials.
- explain the properties and applications of polymers used in making electronic devices.
- solve the numerical problems on hardness of water, discuss boiler troubles and explain water treatment methods and their significance in industry and daily life.
- interpret the spectral data to analyse the structure of simple molecules.

**Course Content**

**UNIT – I: Electrochemical Energy Systems and Sensors**

**Electrochemical Energy Systems:** Electrochemistry and applications of lead-acid battery, VRLA technology, lithium ion battery, Zinc-air battery and $H_2$- $O_2$ fuel cell.

**Solar Energy Devices:** Construction and working of Silicon solar cell – Organic solar cell and Dye sensitized solar cells.

**Sensors:** Working of an electro chemical sensor – applications – working of glucometer – applications of bio-sensors.

**UNIT – II: Nano Materials and Liquid Crystals**

**Nanomaterials:** Concept of nanomaterials – Classification, synthesis of nano materials – Sol-Gel method, Thin film preparation by Chemical vapour deposition method, Lithography, molecular beam epitaxy – Sputtering Techniques: Direct Current (DC) Sputtering, carbon nano tubes – types, preparation of carbon nano tubes by arc discharge method – properties and applications, Quantum dots – applications.

**Liquid Crystals:** Types and applications of liquid crystals, working of LCD.

**UNIT – III: Polymers**

Fibre reinforced plastics – Definition of matrix and reinforcement – Carbon fibres and Aramid fibres – preparation, properties and applications. Conducting polymers – types, applications – OLED, Bio-degradable polymers – PHA.

**UNIT – IV: Hard Water and Boiler Troubles**

Hardness of water – calculation of hardness, boilers troubles – priming and foam ing, sludge and scale formation, caustic embrittlement, boiler corrosion.Treatment of boiler feed water – Ion exchange process – Internal treatment – Calgon conditioning – Potable water – WHO standards – Production of potable water from brackish water by RO method.

**UNIT – V: Spectroscopic Techniques and Applications**

Basic concepts of spectroscopy – Beer Lambert's Law. UV-visible spectroscopy – types of electronic transitions. Applications of UV-visible spectroscopy.$^{1}$H NMR spectroscopy – Principle, chemical shift, prediction of number of signals in NMR spectra of simple molecules, interpretation of NMR spectra of methanol, ethanol and simple haloalkanes.

**Text Books**


1. Engineering Chemistry - Fundamentals and Applications by Shikha Agarwal, first edition Cambridge University Press, New Delhi, 2015.
2. A Text book of Engineering Chemistry by Dr. Bharathi Kumari Yalamanchili. VGS Techno series, sixth edition, 2019.


**Reference Books**


1. A Textbook of Engineering Chemistry by Sunita Rattan, S.K. Kataria & Sons, New Delhi, 1st edition, 2012.
2. Text book of Engineering Chemistry by Jain & Jain. Dhanpat Rai Publishing Company, 16th edition, 2015.
3. Solar Photovoltaics Fundamentals, Technologies and applications by Chetan Singh Solanki, 2nd edition, PHI, 2012.
4. Spectroscopic identification of organic compounds by Robert M.Silverstein, 6th edition,Wiley, 2005.
5. Physical chemistry, Peter Atkins, 10th edition, Oxford University Press, 2014.


* * *

# PROBLEM SOLVING USING C
# (Common to CE, EEE, ME, ECE & IoT)

I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture : 3 | Practice : 2 | Internal Marks | : 30 |
| Credits : 4 | | External Marks | : 70 |

**Course Objectives**

- To emphasize the use of flowcharts and pseudo code in problem solving.
- To apply C Programmingin problem solving.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- outline problem solving steps and solve sample problems.
- use control statements for writing the programs.
- apply the concepts of arrays, strings and pointers in problem solving.
- decompose a problem into functions to develop modular reusable code.
- use structures and files for efficient handling of data.

**Course Content**

**UNIT – I: Problem Solving Steps and Introduction of C**

**Problem Solving Steps:** Understanding problem, developing algorithm, flow chart, coding, debugging and testing.

**Introduction of C:** General form of a C program, variable declaration, C tokens, basic data types, type conversion, console i/o statements, expressions precedence and associativity, order of evaluation.

**Problem Solving:** Sample Problems such as evaluating expressions, to calculate area of geometrical shapes.

**Programs :**

1. Write a C program to calculate the area of triangle using the formula area = $(s(s-a)\ (s-b)(s-c))^{1/2}$ where s= (a+b+c)/2.
2. Write a C Program to find the largest number and smallest among three numbers using ternary operator.

**UNIT – II: Control Statements**

**Selection-Making Decisions** – single-way, two-way selection, multi-way selection statements and conditional operator.

**Iteration Statements** – concept of loops, pre-test and post-test loops in C.

**Jump Statements** – return, goto, break, exit and continue.

**Problem Solving:**Calculate the sum of first N numbers, check the given number is prime, and generate Fibonacci series.

**Programs :**

1. Design and develop a flowchart or an algorithm that takes three coefficients (a, b, and c) of a quadratic equation (ax2+bx+c=0) as input and computes all possible roots. An equation is quadratic only if a is non zero. If a is zero and b is non zero in the above equation then it becomes a linear equation (bx + c = 0).If a and b are zeros then the it becomes a constant equation. Implement a C program for the developed flowchart / algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages.
2. Read two integer operands and one operator form the user, perform the operation and then print the result. (Consider the operators +,-,*, /, % and use Switch Statement)
3. Write a C program to find the sum of n natural numbers and sum of squares of n natural numbers.
4. Read a number from the user input, print all the prime numbers up to that number and print their sum.
5. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print “Correct values”, otherwise print “Wrong values”

**UNIT – III: Arrays and Strings**

**Arrays** – Declaring, initializing, accessing and display of one dimensional and two dimensional arrays.

**Strings** – String Input /Output functions, string manipulation functions.

**Problem Solving**: Perform addition and multiplication of two matrices, C programs isomg string handling functions.

**Programs:**

1. Write a C programto search whether the given element is in the array or not.
2. Write a C programto perform addition and multiplication of two matrices.
3. Write a C program to find whether the given string is palindrome or not with and without string handling functions.

**UNIT – IV: Pointers and Functions**

**Pointers** – Declaration, Initialization and operations of Pointers.

**Functions** – General form of functions, categories of functions, types of functions, passing parameters by value and by address, recursive functions, dynamic memory allocation functions, arrays of pointers, pointers and strings.

**Problem Solving**: Programs on pointer arithmetic’s, Factorial and fibonacci calculation with recursion and without recursion.

**Programs:**

1. Write a C programto add two numbers using pointers.

2. Write a C programto find the factorial of a given integer using recursive function.
3 Write a C program to exchange (Swap) values of two integers using call by reference.

**UNIT – V: Structures and Unions and File Handling**

**Structures and Unions:** Definition, declaration, initialization, accessing members of structures and unions, nested structures, array of structures, array within structures, union within structure.

**File Handling:** Text and binary files, file operations, file handling functions, random access to files.

**Problem Solving**: Implement a structure to read and display the Name, date of Birth and salary of an Employee. Programs to access file content.

**Programs :**

1. Write a C Program using arrays of structures to read the Name, Date of Birth, Five subject marks of N students and display all the details of students along with calculated CGPA of each student.
2. Write a C program to append multiple lines at the end of a text file.
3. Write a C program to count the number of lines, words and characters in a file.

**Text Books**


1. Programming in C, Pradip Dey, Manas Ghosh, 2nd Edition, Oxford Higher Education.
2. Programming in C, Reema Thareja, 2nd Edition, Oxford Higher Education.


**Reference Books**


1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, Cengage, 2020.
2. Programming in ANSI C, E Balaguruswamy, 7thedition, McGrawHill.
3. Let Us C, Yashvant Kanetkar, 17th Edition, BPB publications.


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## UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY
**(Common to EEE, ECE, CSE & AI&DS)**

I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture : 2 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 3 | | External Marks | : 70 |

**Course Objectives**

- To help students understand the need, basic guidelines, content and process of value education.
- To help students initiate a process of dialog with in themselves to know what they really want to be in their life and profession.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
- To understand the harmony in nature and existence.
- To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- be aware of themselves and surroundings
- be responsible in life
- develop personality to be happy continuously and prosper
- handle the problems with sustainable solutions.
- possess human nature in mind
- apply what they have learnt to their own self in real life situations

**Course Content**

**UNIT – I : Value Education**

Significance of Universal human values, Value Education – Importance, content, Process. Self-exploration, Basic human aspirations, Right understanding, Natural acceptance.

**Suggested topics for Tutorial/Practice sessions:**

**Learning HVLS from the Inspiring Life Sketches of great personalities:**
Isaac Newton, Michael Faraday, JJ Thomson, Einstein, Madam Curie, Mahatma Gandhi, Abraham Lincoln, JF Kennedy, Martin Luther King, BR Ambedkar, Charles Darwin, Karl Marx, Helen Keller, Sam Pitroda, Mark Zuckerberg, SudhaMurty, Leonardo Davincy, Michelangelo, The eternal 3: Socrates, Plato, Aristotle, Alexander, Swami Vivekananda, Abdul Kalam, AB Vajapayee, Sergei Bubka.

**UNIT – II: Harmony In Myself**

Co-existence of the self and the Body, Understanding the needs of Self (I') and Body'-Sukh and Suvidha, Body as an instrument of 'I', Harmony in 'I' - Sanyam and Svasthya, correct appraisal of our Physical needs.

**Suggested topics for Tutorial/Practice sessions:**

**Leadership through Literature:** ValmikiRamayan, Vyasa MahaBharath- Bhagavad Gita, Answers of Yudhistir to Questions by Yaksha, Kaalidas- Raghu Vamsam, Abhignyana Saakuntalam and Maalavika Agnimitram, Homer- Iliad and Odyssey, Professionalism- Learning from the Jews, Buddha, The Bible- Jesus Christ, Solomon's wisdom, The Koran- Prophet Mohammad, Guru Nanak, John Milton, Shakespeare, Sigmond Freud, Robin Sharma, Ravindranath Tagore, Sadguru Jaggi Vasudev, War and Peace by Leo Tolstoy, Unto the Last by Ruskin, Social Contracts by Rousseu, If by Rudyard Kipling, The 7 Habits of highly effective people by Stephen R Covey. Art of Rhetoric by Aristotle.

**UNIT – III: Harmony in the Family and Society**

Family as the basic unit of human interaction, Harmony in the family, Justice, Trust, Respect, Intention vs competence, Respect is Differentiation.Extending relationship from family to society.Comprehensive human goal – identification, programs for achievement of the goal.Dimensions of Human endeavour, Harmony from family order to world family order.

**Suggested topics for Tutorial/Practice sessions:**

**Ideal Home:** Characteristics of Happy families, Personal hygiene and habits, Harmony, Health and happiness, Advantages of combined families.Vasudhaika Kutumbam- Universalism.Vilasa Vidya- Importance of hobbies, Music therapy. Influence of friends and peer groups- ideal friend, Friendship and faith, Avoiding vices, Advance Crime detection technologies, Law and legislation pertaining to students.

**UNIT – IV: Harmony in the Nature and Existence**

Harmony in the nature – orders in nature, existence as co-existence, co-existence of units in space, holistic perception of harmony at all levels of existence.

**Suggested topics for Tutorial/Practice sessions:**

**Leadership through languages:** Atleast 5 poems / rhymes and 10 Sentences of each among atleast 10 of the following languages: Sanskrit, Telugu, Tamil, Malayalam, Kannada, Oriya, Bengali, Hindi, Urdu, Punjabi, Maratthi, Gujarati, Latin, Greek, Chinese, Japanese, Italian, Spanish, French and German. Bionics: Technology from animals. Interpretation of Paintings.

**UNIT – V: Implications of the Right Understanding**

Values in different dimensions of Human living,definitiveness of ethical human conduct,development of Human consciousness ,implications of value based living. Identification of comprehensive Human goal, Humanistic Education,

humanistic constitution,humanistic universal order and its implications. Competence in professional Ethics, Holistic technologies and systems.

**Suggested topics for Tutorial/Practice sessions:**

**Personality Traits:** Ich Bin- Who am I? Know thyself. Self esteem, Sanyam: Self learning, self motivation, self control and self discipline, Thinking aloud, Team work, Discipline, Courage, Creativity, Sense of humour, Equanimity- love for animals and nature, Gratitude, Time and money management, Leadership skills, Importance of sports and games, Importance of Swimming, Writing and Public speaking skills, Quotable quotations: Those who quote only are quoted. Mpemba Effect – The Rags to riches concept. Commonalities of great personalities. Estimation of value of a person and his habits. SWOT Analysis.

**Text Books**

1. R.R Gaur, R.Sangal and G.P.Bagaria; "A Foundation Course in Human Values and Professional Ethics", 2011, Excel Books, New Delhi.

**Reference Books**

1. A N Tripathy, 2003, Human Values, New Age International Publishers.
2. KVSG Murali Krishna, Mastering LIFE SKILLS ,Environmental Protection Society, Kakinada, 2015.
3. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

**Note**: Tutorial/Practice sessions may be conducted with reference to Many Historical aspects, having relevance to the topic of discussion. Few of such topics are suggested.

**Methodology Suggested for Instruction:**

- Teacher is a mentor or guide or Supervisor
- Student –Teacher interactive sessions in the class.
- Student must be made to think and express his views boldly.
- Every student has to present individual PPT about the content of the subject
- Assignments need to be submitted by students and evaluated by teacher into dedication specifying critical review.

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## FUNCTIONAL ENGLISH LAB
## (Common to All Branches)
I Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 30 |
| Credits | : 1 | External Marks | : 70 |

**Course Objectives**

- Functional English (Lab) seeks to develop in the students the communication strategies and social graces necessary in order to function effectively in social and other situations in which they may be called upon to speak in English; and
- It seeks to develop in them a greater awareness of English pronunciation and provides for focused practice with the sounds of English and intonation patterns improve their pronunciation skills and to enable them to speak with a reasonable degree of intelligibility.

**Course Outcomes**

Upon successful completion of Functional English (Lab), the students will be able to

- give short impromptu speeches with confidence and fluency.
- take part in conversations in different functional contexts using English following appropriate communication strategies.
- use conventions of politeness and courtesy in speech and enhance the effectiveness of their communication in English.
- articulate the sounds of English (vowels, consonants, and diphthongs) with accuracy.
- check the pronunciation of words in a dictionary using their knowledge of phonemic symbols.
- pause at appropriate places in their speech in English, enhancing thereby the comprehensibility of their communication.
- speak English with adequate attention to stress, rhythm, and intonation.
- speak without their pronunciation being marred by regional peculiarities, achieving thereby greater intelligibility in their communication with non-Telugu speakers of English.
- read out texts of different kinds fluently with appropriate pauses, stress, and intonation.

**Course Content**

**UNIT – I:** a.Greeting, introducing and taking leave b. Pure vowels

**UNIT – II:** a.Giving information and asking for information b. Diphthongs

**UNIT – III:** a. Inviting, accepting and declining invitations b. Consonants

**UNIT – IV:** a. Commands, instructions and requests b. Accent and rhythm

**UNIT – V:** a. Suggestions and opinions b. Intonation

**Text Books**

1. Hari Prasad, et al., *Strengthen Your Communication Skills*, First Edn., Maruthi Publications, Hyderabad, 2014.
2. Handouts produced by the Department on "difficult sounds," consonant clusters, the other problems of Telugu learners of English, listening comprehension, and oral reading.
3. The following pieces of software:
   - 'Multimedia Language Lab' provided by K-Van Solution, Hyderabad
   - 'Foundation Course in Communication Skills' provided by the Andhra Pradesh State Council of Higher Education (APSCHE), Government of Andhra Pradesh.
4. Audio and video clips such as 'BBC English'

**Testing Pattern**

**I. Internal** **30 marks**

a. Regular performance in the Language/Communications Lab 15 marks

b. Completing the tasks in the lab manual 05 marks

c. Testing of listening : Listening to a short audio clip of a speech/conversation in British accent and answering questions at the 'information' level. 05 marks

d. Test of reading: Role-playing a dialogue with proper pronunciation and with reasonable attention to tone groups, stress, rhythm and intonation. 05 marks

**II. External** **70 marks**

a. Test of writing

Writing a dialogue on the situation set 10 marks

Answering 'Yes/No' questions on pronunciation 05 marks

Marking sentence stress and intonation 05 marks

Writing English word for the word in phonetic transcription 05 marks

b. Test of speaking 25 marks

Role-playing a situational dialogue (e.g. 'At the railway station,' 'At the restaurant') with proper pronunciation and with reasonable attention to tone groups, stress, rhythm, and intonation

c. Viva voce (with an external examiner) 20 marks

Speaking for one minute on a given topic

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# APPLIED CHEMISTRY LAB
## (Common to EEE & ECE)
I Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 30 |
| Credits | : 1 | External Marks | : 70 |

**Course Objectives**

- To develop the skill on chemical and instrumental methods of analysis.
- To acquire the skill in preparation of synthetic materials.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- perform quantitative analysis by using chemical and instrumental methods.
- operate the pH meter, conductivity meter for analyzing the water quality.
- analyze the corrosion rate of a given metal in a given environment by gravimetric method.
- prepare printed circuit board by electroless plating.
- synthesize polymers and obtain cell potential by construction of an electrochemical cell.

**List of Experiments**

Introduction to Chemistry Lab (the teachers are expected to teach fundamentals like Primary, Secondary Standard Solutions, Normality, Molarity, etc. and laboratory ware used, error, accuracy, precision, Theory of indicators, use of volumetric titrations).

1. Practice experiment-Determination of the amount of HCl using standard $Na_2CO_3$.
2. Determination of alkalinity of a given water sample.
3. Determination of acidity of a given water sample.
4. Determination of total hardness of the water sample by EDTA method.
5. (a) Determination of pH of different water samples by using pH meter.
   (b) Determination of conductivity of different water samples by digital conductivity meter.
6. Determination of concentration of the given acid by using standard base conductometrically.
7. Construction of an Electro Chemical Cell and determination of emf.
8. Determination of rate of corrosion of carbon steel metal in acid medium in the absence and presence of Thiourea inhibitor by gravimetric method.
9. Preparation of polyaniline.
10. (a) Preparation of Printed Circuit Board by electroless plating.
    (b) Preparation of Phenol - Formaldehyde resin.

11. Determination of concentration of Ferric Iron in a given solution spectrophotometrically.

**Lab Manual**


1. Vogel's Textbook of Quantitative Chemical Analysis, Fifth edition, John Wiley & Sons, Inc., New York
2. Fernandez, A., Engineering Chemistry, Owl Book Publishers.
3. Engineering Chemistry laboratory manual &record by Srinivasulu .D,Parshva publications.
4. Engineering Chemistry Lab Manual by K.Mukkanti, B.S publications, 2009.


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# CONSTITUTION OF INDIA
## (Common to EEE, ECE, CSE & AI&DS)
I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 2 | Internal Marks | : 30 |
| Credits | : - | External Marks | : 70 |

**Course Objectives**

- To impart knowledge on basic engineering applications.
- To enable the student to understand the importance of constitution.
- To understand the structure of Executive, Legislature and Judiciary.
- To understand Philosophy of fundamental rights and duties.
- To understand the autonomous nature of constitution bodies like Supreme Court and High Court Controller and Auditor General of India and Election Commission of India.
- To understand the Central and State relation, financial and administrative.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- understand history and philosophy of constitution with reference to Preamble, Fundamental Rights and Duties
- understand the concept of Unitary and Federal Government along with the role of President, Prime Minister and Judicial System.
- structure of the state government, Secretariat, Governor and Chief Minister and their functions.
- learn local administration viz. Panchayat, Block, Municipality and Corporation.
- learn about Election Commission and the process and about SC, ST, OBC and women.

**Course Content**

**UNIT – I:**

Introduction to Indian Constitution: 'Constitution' meaning of the term, Indian Constitution – Sources and Constitutional History, Features – Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

**UNIT – II:**

Union Government and its Administration Structure of the Indian Union: Federalism Centre – State relationship, President: Role, Power and Position. Prime Minister (PM) and Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. The Supreme Court and High Court: Powers and Functions.

**UNIT – III:**

State Government and its Administration Governor – Role and Position – Chief Minister (CM) and Council of Ministers. State Secretariat: Organisation, Structure and Functions.

**UNIT – IV:**

A Local Administration – District's Administration Head – Role and Importance, Municipalities – Mayor and Role of Elected Representative – Chief Executive Officer (CEO) of Municipal Corporation Panchayati Raj : Functions Panchayati Raj Institution (PRI), Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: Block level orgnisational Hierarchy – (Different Departments), Village level – Role of Elected and Appointed officials – Importance of grass root democracy.

**UNIT – V:**

Election Commission: Election Commission – Role of Chief Election Commissioner and Election Commissionerate State Election Commission: Functions and Commissions for the welfare of SC/ST/OBC and Women.

**Reference Books**


1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd., New Delhi.
2. Subash Kashyap, Indian Constitution, National Book Trust.
3. J.A. Siwach, Dynamics of Indian Government and Politics.
4. D.C. Gupta, Indian Government and Politics.
5. H.M.Sreevai. Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication).
6. J.C. Johari, Indian Government and Politics Hans.
7. J.Raj, Indian Government and Politics.
8. M.V. Pylee, Indian Constitution, Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd., New Delhi.
9. Noorani, A.G. (South Asia Human Rights Documentation Centre), Challenges to Civil Right). Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.


**E-Resources**:

1. nptel.ac.in/courses/109104074/8.
2. nptel.ac.in/courses/109104045.
3. nptel.ac.in/courses/101104065.
4. www.hss.iitb.ac.in/en/lecture-details.
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution.

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# PROFESSIONAL COMMUNICATION
## (Common to All Branches)

I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 2 | Internal Marks | : 40 |
| Credits | : 2 | External Marks | : 60 |

**Course Objectives**

- To equip the students with common employability skills (the skills required for gaining employment and performing successfully in different careers) which can enable them to perform communication tasks of increasing length and complexity.
- To develop in them the interactional communication strategies and social graces which have the potential to add to the effectiveness of professional communication.

**Course Outcomes**

Upon successful completion of Professional Communication, the students will be able to

- speak with a reasonable degree of fluency and accuracy in professional communication situations (such as arriving at a consensus through discussion, making a presentation, and taking part in a telephone conversation)
- add to the effectiveness of their oral communication by using communication strategies, conventions of politeness and courtesy, and stress and intonation.
- listen to short audio and video clips in native English accent (British and American), and gain both understanding of messages and sensitivity to native-speaker accents
- read fluently, comprehending texts of different kinds using multiple strategies and higher-order skills
- produce written discourses of different kinds (e.g. texts expressing opinions and making a convincing case for one's standpoint, professional emails, and summaries of lengthy texts) with attention to elements of writing such as content, organization, language, style, and mechanics
- guard against grammatical errors Indians typically make in their speech and writing in English

**Course Content**

**UNIT – I:**

**Listening** : Listening comprehension – Task 1 (IWE – Chapt VII)
**Speaking** : Communication Strategies: Conversation Amith& Mahesh (IWE – Chap VII)
**Reading** : Reading Comprehension – Task 1 (IWE – Chapt VII)
**Vocabulary**: (a) GRE words – 1.3, (b) Collocations – 2.3 (VB)
**Grammar** : *If* Clause (IWE – Chapt VII)
**Writing** : Email writing (IWE – Chapt VII)

**UNIT – II:**

**Listening** : Listening comprehension – Task 2 (WR)
**Speaking** : Exercise on Communication Strategies (IWE – Chapt VII)
**Reading** : Reading Comprehension – Task 2 (DPM)
**Vocabulary**: Words often confused – 3.3, One-word substitutes – 4.3 (VB)
**Grammar** : Modal verbs (IWE – Chap VII)
**Writing** : Email writing and Argumentative Essay (IWE – Chapt VII)

**UNIT – III:**

**Listening** : Listening comprehension – Task 3 (WR)
**Speaking** : Communication Strategies – Exercise (DPM)
**Intensive Reading** : Reading Comprehension – Task 3 (DPM)
**Extensive Reading**: *Pride and Prejudice* by Jane Austen
**Vocabulary**: (a) Idioms – 5.3, (b) Phrasal verbs – 6.3 (VB)
**Grammar** : Indianism (IWE – Chapt VII)
**Writing** : Argumentative Essay (DPM)

**UNIT – IV:**

**Listening** : Listening comprehension – Task 4 (IWE – Chapt VIII)
**Speaking** : Communication Strategies and Presentation: Conversation between Suchitra, Lakshmi, Guhan and Karan ((IWE – Chapt VIII)
**Reading** : Reading Comprehension – Task 4 (DPM)
**Vocabulary**: (a) GRE Words – 1.4, (b) Collocations – 2.4, (c) Words Often Confused – 3.4 (VB)
**Grammar** : Indefinite Articles (IWE – Chapt VIII)
**Writing** : Presentation – Analysis (DPM)

**UNIT – V:**

**Listening** : Listening comprehension – Task 5 (WR)
**Speaking** : Communication Strategies – Exercise (IWE – Chapt VIII)
**Intensive Reading** : Reading Comprehension Task – 5 (DPM)
**Extensive Reading** : *Gulliver's Travels* by Jonathan Swift
**Vocabulary**: (a) One-Word Substitutes – 4.4, (b) Idioms – 5.4, (c) Phrasal-verbs – 6.4 (VB)
**Grammar** : Definite Articles (IWE – Chapt VIII)
**Writing** : Presentation – Rewriting

- IWE – *Innovate with English* by T Samson (Foundation)
- Chapt - Chapter
- DPM – Department-produced materials (handouts)
- WR – Web-resources
- VB– *Vocabulary Builder for Students of Engineering and Technology* by Vijaya Lakshmi et al (Maruthi)

**Textbooks**

1. T. Samson, *Innovate with English*, First Edn., Cambridge University Press India Pvt. Ltd. under the imprint of Foundation Books, Hyderabad, 2010.
   - Unit SEVEN and EIGHT only
2. M. Vijaya Lakshmi, et al., *Vocabulary Builder for Students of Engineering and Technology, Second Edn.,* Maruthi Publications, Hyderabad, 2017.
3. The following simplified classics, one for each mid-semester, from the series, *Great Stories in Easy English*, published by S. Chand & Company Limited:
   - *Pride and Prejudice* by Jane Austen
   - *Gulliver's Travels* by Jonathan Swift
4. Audio and video clips carefully selected by the Department in order to sensitize the students to native-speaker accents.
5. Department-produced materials on reading comprehension.

**Testing Pattern**

**First Mid-Term Examination**

The paper consists of four questions. All questions are compulsory; there is no choice.

**I.** Reading an unseen passage and answering two sets of questions on it:

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, interpretation of the writer's ideas, etc. are to be set. Four of the Eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 8 x ½ = 4**

b) Writing an essay expressing a point of view on one or more of the issues flagged up in the question and making a convincing case for the standpoint. Length: 100 – 150 words. **Marks: 1 x 4 = 4**

**II.** Reading a poorly-written e-mail message and doing the following tasks:

a) Analyzing the reasons for the e-mail failing to meet the standards of professional e-mail communication. The analysis must identify and discuss at least five reasons. (Length: 100 – 150 words) **Marks: 1 x 3 = 3**

b) Rewriting the e-mail using the standards of professional e-mail communication. **Marks: 1 x 3 = 3**

**III.**

a) Eight contextualized questions on the following from *Vocabulary Builder*: GRE Words: 1.3; Collocations: 2.3; Commonly confused words: 3.3; One- word substitutes: 4.3; Idioms: 5.3; and Phrasal verbs: 6.3 **Marks: 8 x ½ = 4**

b) Correction of grammatical errors: Eight sentences with grammatical errors of the following types (dealt with in Unit 7 of *Innovate with English*) will be given: *if*-clause and Indianism **Marks: 8 x ½ = 4**

**IV.**

a) Completing a conversation (where informational and interactional functions are performed) with suitable expressions. **Marks: 8 x ½ = 4**

b) Answering eight 'true-or-false' questions on communication strategies and functions given in form of short dialogues. **Marks: 8 x ½ = 4**

**Second Mid-Term Examination**

The paper consists of four questions. All questions are compulsory; there is no choice.

**I.** Reading a poorly-written e-mail message and doing the following

a) Analyzing the reasons for the e-mail failing to meet the standards of professional e-mail communication. The analysis must identify and discuss at least five reasons. (Length: 100 – 150 words) **Marks: 1 x 4 = 4**

b) Rewriting the e-mail using the standards of professional e-mail communication **Marks: 1 x 4 = 4**

**II.** Reading an unseen passage and answering two sets of questions on it.

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, interpretation of the writer's ideas, etc. are to be set. Four of the Eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks 8 x ½ = 4**

b) Writing an essay expressing a point of view on one or more of the issues flagged up in the question and making a convincing case for the standpoint. Length: 100 – 150 words. **Marks: 1 x 4 = 4**

**III.**

a) Eight contextualized questions on the following from *Vocabulary Builder*: GRE Words: 1.4; Collocations: 2.4; Commonly confused words: 3.4; One- word substitutes: 4.4; Idioms: 5.4; and Phrasal verbs: 6.4 **Marks: 8 x ½ = 4**

b) Correction of grammatical errors: Eight sentences with grammatical errors of the following types (dealt with in Unit 8 of *Innovate with English*) will be given: articles and Indianism. **Marks: 8 x ½ = 4**

**IV.** Reading an expository text and doing two tasks:

a) Making notes (identifying the main points of the text and writing them down in note form) **Marks: 1 x 3 = 3**

b) Summarizing the text using the notes already made **Marks: 1 x 3 = 3**

**Semester End Examination**

Answer any five questions: **Question I is compulsory.**

**I.** Reading a poorly-writen e-mail message and doing the following task: (Compulsory)

a. Analyzing the reasons for the email failing to meet the standards of professional email communication. The analysis must identify and discuss at least seven reasons. (Length: 100-150 words) **Marks: 1 x 7 = 7**

b. rewriting the email using the standards of professional email communication. **Marks: 1 x 7 = 7**

**II.** Reading the text of a presentation made in a professional context and answering the following questions:

a. Analysing the passage from the point of view of language and style and identifying the reasons for the presentation falling short of the standards of professional presentations (Length of the answer: 100 – 150 words) **Marks: 1 x 7 = 7**

b. Rewriting the text of the presentation in the light of the analysis made in (a) above and following the conventions of professional presentations as far as language and style are concerned. **Marks: 1 x 7 = 7**

**III.** Reading an unseen (unfamiliar) passage on an issue related to engineering and technology or on a professional issue or situation and answering two sets of questions on it:

a. Seven comprehension questions: **Marks: 7 x 1 = 7**

- Critical questions requiring analysis, inference, prediction, evaluation, interpretation of the writer's ideas, pinpointing the writer's attitude/bias, etc. are to be set; 'information' questions involving a *mere* reproduction of the content should be avoided.
- At least three of the seven questions should be multiple-choice questions.
- In case of non-multiple-choice questions, the length of each answer should not exceed 50 words.

b. Writing an essay expressing a point of view on one or more of the issues flagged up in the question and making a convincing case for the standpoint. Length: 200 – 250 words. **Marks: 1 x 7 = 7**

**IV.** Filling in blanks in sentences using GRE words, collocations, one-word substitutes, commonly-confused words, idioms, and phrasal verbs. The contexts will be clearly given for each expression, and the questions will be multiple-choice ones. **Marks: 14 x 1 = 14**

- GRE Words (Units 1.3 and 1.4)
- Collocations (Units 2.3 and 2.4)
- Commonly Confused Words (Units 3.3 and 3.4)
- One-Word Substitutes (Units 4.3 and 4.4)
- Idioms (5.3 and 5.4)
- Phrasal Verbs (Units 6.3 and 6.4)

**V.** Reading a on a professional or semi-professional issue and answering two questions on it:

a. Matching suitable expressions selected from the dialogue with the given communication strategies. **Marks: 7 x 1 = 7**

b. Extending the scope of the dialogue using at least five of the given communication strategies/functions. **Marks: 1 x 7 = 7**

**VI.** Correction of grammatical errors:

- Either a conversation with twelve grammatical errors (in the areas of articles, modal verbs, prepositions, phrasal verbs, and Indianism), or isolated sentences with twelve grammatical errors will be given.
- If isolated sentences with errors are given, they are not to be given in isolation from their contexts; a conversation with errors of the kind specified above will serve the purpose better.

The examinees are expected to rewrite the sentences in the answer book, correcting hem. **Marks: 14 x 1 = 14**

**VII.** Reading an expository text and doing two tasks:

a. Making notes (identifying the main points of the text and writing them down in note form) **Marks: 6 x 1 = 6**

b. Summarizing the text using the notes already made. **Marks: 1 x 8 = 8**

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# INTEGRAL TRANSFORMS AND VECTOR CALCULUS
## (Common to All Branches)

I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture : 3 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 4 | | External Marks | : 70 |

**Course Objectives**

- To gain the knowledge of Laplace and inverse transforms.\
- To understand the concepts of Fourier series and Fourier Transforms.
- To know about vector differentiation and integration.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- evaluate improper integrals using Laplace transforms.
- apply Laplace transforms to find the solutions of initial and boundary value problems.
- find the Fourier series representation of a function in one variable and apply Fourier transform in various engineering problems.
- apply the concepts of vector differentiation in their engineering fields.
- verify the relation between line, surface and volume integrals using integral theorems.

**Course Content**

**UNIT – I: Laplace Transforms**

Laplace transforms of standard functions – Shifting Theorems - Multiplication and division by t, transforms of derivatives and Evaluation of Improper Integrals - Unit step function – Dirac Delta function.

**UNIT – II: Inverse Laplace Transforms**

Inverse Laplace transforms – by partial fractions –Convolution theorem (without proof).

**Application**: Solution of Initial value problems and Boundary value problems.

**UNIT – III: Fourier Series and Fourier Transforms**

**Fourier Series:** Fourier series in an arbitrary interval, Half-range sine and cosine series.

Fourier integral theorem (only statement). Fourier transforms and inverse Fourier transforms, Fourier sine and cosine transforms and inverses. Properties of Fourier transforms.

**UNIT – IV: Vector Differentiation**

Gradient – unit normal – angle between surfaces – directional derivative . Divergence – solenoidal vector. Curl – irrotational vector – scalar potential. Laplacian operator.

**UNIT – V: Vector Integral theorems**

Greens theorem , Stokes theorem and Gauss Divergence Theorem - related problems. Applications: Work done, flux across the surface.

**Text Books**


1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, Maitrey Printech Pvt. Ltd, Noida, 2014.
2. B.S. Grewal, Higher Engineering Mathematics, 44th edition, Khanna Publishers, New Delhi, 2020.


**Reference Books**


1. Schaum's Series, Differential Equtions, Tata-Mc Graw Hill Company Limited.
2. Bali & Iyengar,Text Book of Engineering Mathemtics, Laxmi Publications (P) Ltd.


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# SOLID STATE PHYSICS
## (Common to EEE & ECE)
I Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To comprehend the basic principles of coherent light source.
- To study an advanced communication system by using Optical Fiber.
- To impart the knowledge of solid state materials with characteristic utility in various engineering applications.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- explain construction and working of laser.
- relate the principles of propagation of light in optical fibers for communication applications.
- differentiate classical , quantum free electron theories.
- identify conductivity mechanism in semiconductors.
- Interpret polarization in dielectrics and magnetic properties of materials.

**Course Content**

**UNIT– I: Laser**

Introduction – Basic characteristics – Spontaneous and stimulated emission - Einstein's coefficient and their relations – Pumping Schemes – Ruby laser – He-Ne Laser – Semiconductor laser – Application of LASER.

**UNIT– II: Fiber Optics**

Introduction to optical fibers, Principle of light propagation in fiber-Total IR, Numerical aperture, Types of fibers, fiber optic communication system, applications.

**UNIT– III: Free Electron and Band Theory of Metals**

Classical free electron theory - Drawbacks of classical free electron theory – Fermi level and Fermi Dirac energy distribution function -Density of states-Expression for Fermi energy in conductors. Quantum free electron theory – Band theory of solids-Bloch Theorem- Kronig -penney model(qualitative) – Effective mass of electron - concept of hole.

**UNIT– IV: Semiconductors**

Introduction, intrinsic and Extrinsic semiconductors, density of charge carries, Fermi energy, Electrical conductivity - Dependence of Fermi energy on carrier concentration and temperature, direct and indirect band gap semiconductors, Hall effect, Drift and diffusion currents, applications, LED and LCD and its applications.

**UNIT– V: Dielectrics & Magnetic Materials**

Introduction, Types of polarization in Dielectrics, Frequency and temperature dependence of Polarization, Internal field in a dielectrics, Ferro and Piezo electricity and its applications, Claussius and Mosotti equation.

**Magnetic Materials** : Classification of magnetic materials – Weiss theory of Ferro magnetism – Soft and hard magnetic materials – Ferrites and its applications.

**Text Books**


1. Dr.M.N. Avadhanulu, Dr. P.G. Kshirsagar, Engineering Physics, 11th Edition, S. Chand Publications.
2. R.K. Gaur & S.L. Gupta, Engineering Physics, Dhanapat Rai publications.


**Reference Books**


1. A.J.Dekker, Solid state physics, Published by Macmillan India.
2. Charles Kittel, Introduction to solid state physics, Wiley India Pvt. Ltd.
3. B. B. Laud, Laser and Non-Linear Optics, New Age international publishers.
4. P. K. Palanisamy, Engineering Physics , SciTech publications.


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# CIRCUIT THEORY - I

I Year – II Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 2 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 3 | | | External Marks | : 70 |

**Course Objectives**

- To understand basic laws and theorems of Electrical circuits.
- To familiarize with the steady state behaviour of DC and single phase AC circuits.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- apply various circuit laws to analyze the electrical circuits.
- solve electrical networks using the principles of network topology.
- analyze the steady state behavior of DC and AC circuits,
- analyze the behavior of electrical resonance
- apply network theorems to analyze and design the electrical circuits.
- apply the concepts of magnetic circuits to various Physical Systems.

**Course Content**

**UNIT– I: Introduction to Electrical Circuits**

Network elements classification, Voltage - Current relationship for passive bilateral elements (for different input signals-square, ramp, saw tooth, triangular)-Ohm's law - Kirchhoff's laws – Network reduction techniques series, parallel, series parallel, star-to-delta or delta-to-star transformation, Nodal analysis, mesh analysis, super node and super mesh for D.C excitations.

**UNIT– II: Network Topology**

Definitions – Graph – Tree, Basic cutset and Basic Tieset matrices for planar networks – Loop and Nodal methods of analysis of Networks with independent voltage and current sources – Duality & Dual networks.

**UNIT– III: Single phase AC Circuits and Resonance**

Generation of alternating sinusoidal quantities - R.M.S, Average values and form factor for different periodic wave forms – sinusoidal alternating quantities-Phase and Phase difference – Complex and polar forms of representations, J notation, Steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation-Concept of Reactance, Impedance, Susceptance and Admittance-Power Factor and significance of Real and Reactive power, Complex Power.

Resonance-series, parallel circuits, concept of band width and Q factor.

**UNIT– IV: Network Theorems (without proof)**

Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millman's, Tellegen's and compensation theorems for D.C and sinusoidal excitations.

**UNIT– V: Magnetic Circuits**

Magnetic circuits - Basic definition of MMF, flux and reluctance - Analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction concept of self and mutual inductance-dot convention-coefficient of coupling - composite magnetic circuit-analysis of series and parallel magnetic circuits.

**Text Books**


1. William Hayt and Jack E.Kemmerley, "Engineering Circuit Analysis", 6th edition, Mc Graw Hill Company.
2. Joseph Edminister, "Theory & Problems of Electric Circuits", 6th edition, Schaum's Outline Series.


**Reference Books**


1. Alexander & Sadiku, "Fundamentals of Electric Circuits", 2nd edition, McGraw Hill Company.
2. Van Valkenburg, "Network Analysis", 8th edition, Prentice Hall of India Private Ltd.
3. N.C.Jagan and C.Lakshmi Narayana,"Network Analysis", 2nd edition, B S Publications.


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# DISCRETE MATHEMATICS

I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture : 2 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 3 | | External Marks | : 70 |

**Course Objectives**

- To know about the validity of set of statements.
- To discuss different types of relations.
- To familiar with groups and cyclic groups.
- To understand the usage of graph theory in electrical circuits.
- To know how to solve a recurrence relation.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- verify whether the set of statements gives a valid conclusion or not.
- draw Hasse diagram and verify whether a given lattice is distributve or modular.
- analyze different types of algebraic structures.
- use the concepts of graph theory in analyzing electrical circuits.
- solve the recurrence relations.

**Course Content**

**UNIT – I : Mathematical Logic**

**Propositional Calculus:** Statements and Notations, Connectives, Truth Tables, Tautologies, Equivalence of Formulas, Tautological Implications, Theory of Inference for Statement Calculus.

**UNIT – II: Relations, Functions and Lattice Theory**

**Relations:** Properties of Binary Relations, Equivalence, Compatibility and Partial order relations, Hasse Diagram. **Functions:** Inverse, Composite functions. Lattice – Definition. Principle of duality, types of lattices – distributive & modular lattices.

**UNIT – III: Algebraic Structures**

Algebraic Systems and Examples, General Properties, Semigroup, Monoid, Groups, Subgroups, and Cyclic Groups.

**UNIT – IV: Graph Theory**

Concepts of Graphs. Representation of Graphs: Adjacency Matrices, Incidence Matrices. Isomorphic Graphs, Eulerian Graph, Planar Graph, Hamiltonian Graph and Graph coloring.

**UNIT – V: Pigeon Hole Principle and Recurrence Relations**

Pigeonhole principle and its application. Recurrence relations - Homogeneous and Non-Homogeneous recurrence relations using method of characteristic roots.

**Text Books**


1. J. P. Trembley, R Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, New Delhi.
2. Mott, Kandel, Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd edition, PHI.
3. Rosen, Discrete Mathematics and its Application with combinatorics and Graph Theory: 7th editon, Tata McGraw Hill, New Delhi.


**Reference Books**


1. J K Sharma, Discrete Mathematics, 2nd edition, Macmillan Publications.
2. Schaum's Outlines, Discrete Mathematics, 2nd edition, Tata McGraw Hill, New Delhi.


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# ENGINEERING DRAWING
## (Common to EEE & ECE)
I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture : 1 | Practical : 4 | Internal Marks | : 30 |
| Credits : 3 | | External Marks | : 70 |

**Course Objectives**

- To highlight the significance of universal language of engineers.
- To introduce the concepts of drawing 3-D objects in 2-D planes.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- construct polygons and conic sections.
- draw projections of points, lines, planes and solids in different positions.
- draw orthographic and isometric views of different parts.

**Course Content**

**UNIT – I:**

**Geometrical Constructions** : Bisecting a line and arc, diving a circle, construction of polygons

**Conic Sections**: Construction of ellipse, parabola, hyperbola using general method.

**Orthographic Projections :** Principles of orthographic projections, projections of points in various quadrants.

**UNIT – II: Projections of Straight Lines**

Lines parallel to both planes, parallel to one and inclined to other plane, straight lines inclined to both planes.

**UNIT – III: Projections of Planes**

Regular Planes Perpendicular / parallel to one Reference Plane and inclined to other Reference Plane, inclined to both the Reference Planes.

**UNIT – IV: Projections of Solids**

Regular solids with axis perpendicular to one reference plane, axis inclined to one reference plane and perpendicular to other reference plane.

**UNIT – V: Isometric and Othographic Projections**

Isometric drawing of plane figures, prisms, pyramids, cylinders and cones Conversion of isometric views to orthographic views and vice versa.

**Text Books**

1. N.D. Bhatt (2014), Engineering Drawing, 53rd edition , Chariot Publications.

2. K.VenuGopal (2016), Engineering Drawing and Graphics, 5th edition , New Age International (p) Ltd Publishers.

**Reference Books**

1. B.V.R.Gupta and M.Raja Roy(2016),Engineering Drawing with Autocad,3rd edition , I.K. Publishers.
2. M. B. Shah and B. C. Rana(2009),Engineering Drawing , 2nd edition,Pearson Education.
3. Dhanunjay A Jolhe (20014),Engineering Drawing , 2nd edition,Tata Mc GrawHill Publishers.

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## PROFESSIONAL COMMUNICATION LAB
## (Common to All Branches)

I Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 4 | Internal Marks | : 30 |
| Credits | : 2 | External Marks | : 70 |

**Course Objectives**

- Professional Communication (Lab) is a career-oriented programme. It seeks to develop in the students the competence required to perform professional communication tasks of increasing length and complexity, which can help them secure employment and perform successfully in their careers.

**Course Outcomes**

Upon successful completion of Professional Communication Lab, the students will be able to

- enhance the effectiveness of their communication through body language;
- take part in interactional communication (i.e. communication that serves the purpose of social interaction or small talk) with fluency
- take part in transactional communication (i.e. communication that serves the purpose of carrying out functions such as giving directions, complaining, and apologizing) with fluency
- speak professionally in telephone conversations;
- make effective presentations using a range of strategies, including a good organization of the content, impressive opening and closing, the use of suitable visual aids, the use of stories/anecdotes to illustrate a point, effective use of body language, and good handling of the question-and-answer session;
- take part in group discussions and debates successfully;
- answer questions at an elementary level in job interviews (e.g. Can you tell us something about yourself? What kinds of things do you worry about? What are your key skills? What skills do you need to improve? What do you see as your strengths? What do you like doing in your spare time? How would you describe the way you work? Tell us about a time when you showed strong leadership skills. Tell us about a time when you had to make a difficult decision. How do you see yourself in five years' time?) ;and
- use team-building skills with impact in different situations.

**Course Content**

**UNIT–VI** : Body Language
**UNIT–VII** : Dialogues
**UNIT–VIII** : Presentation Skills
**UNIT–IX** : Group Discussion
**UNIT–X** : Interviews and Telephonic Interviews
**UNIT–XI** : Debates

**Text Books**

1. Hari Prasad, et al., *Strengthen Your Communication Skills*, First Edn., Maruthi Publications, Hyderabad, 2014.
2. The following pieces of software:
   - 'Multimedia Language Lab' provided by K-Van Solution, Hyderabad
   - 'Foundation Course in Communication Skills' provided by the Andhra Pradesh State Council of Higher Education (APSCHE), Government of AP.

**Testing Pattern**

**1. Internal** **30 marks**

a. Regular performance in the Communications Lab 15 marks
b. Completing the tasks in the lab manual 05 marks
c. Making a PowerPoint presentation (Pair/Group) 10 marks
(Note: A hard copy of the presentation is to be submitted)

**2. External** **70 marks**

a. Test of writing
A telephone conversation 10 marks
The minimum number of exchanges to be specified
- Writing a resume 10 marks

The length (1page / 2 pages) is to be specified. The features to be included in the resume are also to be specified; the examinees will, however, have the option of including more features within the length specified.
- Answering 3 job-interview questions 15 marks

Questions at an elementary level. In other words, questions that require candidates to talk about themselves, their ambitions, , why they chose to study engineering, their strengths and weaknesses, their hobbies and interests, their personality, their perception of their leadership skills, and their key skills. Industry/job-related questions could be avoided.

**Sample questions:**

*Can you tell us something about yourself?*
*What kinds of things do you worry about?*
*What are your key skills?*
*What skills do you need to improve?*
*What do you see as your strengths?*
*What do you like doing in your spare time?*
*How would you describe the way you work?*
*Tell us about a time when you showed strong leadership skills.*
*Tell us about a time when you had to make a difficult decision.*
*How do you see yourself in five years' time?*

b. Test of speaking
Group discussion 20 marks
Time: 10-15 minutes (approx.) per group

c. Viva voce with an external examiner 15 marks

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## SOLID STATE PHYSICS LAB

I Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 30 |
| Credits | : 1 | External Marks | : 70 |

**Course Objectives**

- To draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To demonstrate an ability to make physical measurements and understand the limits of precision in measurements.
- To best fit to create a graph from a series of data points.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- identify the semiconductor from the obtained energy gap and Hall coefficient
- draw characteristic curves to estimate thermal coefficient of a thermistor.
- verify magnetic field along the axis of a circular coil.
- recognize the coercivity and retentivity from B-H curve
- determine dielectric constant of a dielectric material
- calculate light gathering power of optical fiber and bending losses
- estimate wavelength of unknown light source.

**List of Experiments**

1. Calculate the bending losses in optical fiber.
2. Determination of numerical aperture of an optical fiber.
3. Evaluate the energy band gap of a semiconductor.
4. Determination of thermal resistance by thermistor.
5. Evaluate the magnetic field along the axis of circular coil by using Stewart and Gee's Apparatus.
6. Estimate the Hall coefficient by Hall Effect.
7. Draw Hysteresis curve of a Ferro magnetic material.
8. Determine the dielectric constant of a dielectric material.
9. Determination of Magnetic susceptibility by Quinke's method.
10. Estimate the wave length of laser source by means of diffraction grating
11. Laser beam divergence and spot size determination.

**Note: Any 8 out of 11 Experiments**

**Reference Books**


1. Vijay Kumar & T. Radha Krishna, Practical Physics for engineering students.
2. Dr. Y.Aparna and Dr. K.Venkateswara Rao, Lab manual of Engineering Physics, VGS Books links, Vijayawada.
3. R.Jayaraman,V.Umadevi,S.Maruthamuthu,B.Saravana Kumar, Engineering Physics laboratory manual(1st edition) Pearson publishers.


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# ENVIRONMENTAL STUDIES
## (Common to EEE, ECE CSE & AIDS)
I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 2 | Internal Marks | : 30 |
| Credits | : - | External Marks | : 70 |

**Course Objectives**

- To impart the basic knowledge about the environment and ecology.
- To develop an attitude of concern for biodiversity and its conservation.
- To create awareness on environmental pollution and waste management.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- create awareness among the people in protection of environment.
- analyze structure and functional attributes of an ecosystem.
- explain the values of biodiversity.
- identify the sources of environmental pollution, assess their effects and suggest suitable control measures.
- adopt sustainable waste management practices.

**Course Content**

**UNIT – I: Multidisciplinary Nature of Environmental Studies**

Definition – Scope – Importance - Need for Public Awareness – Multidisciplinary nature of Environmental Studies – Role of a citizen in protection of environment

**UNIT – II: Ecosystem**

Concept of an ecosystem – Structural features of an ecosystem – Functional attributes of an ecosystem: Trophic structure – Food Chains – Food Web – Ecological Pyramids – Energy Flow– Biogeochemical Cycles – Ecological Succession.

**UNIT – III: Biodiversity & Its Conservation**

Definition – Levels of Biodiversity – Bio-geographical zones of India – Values of biodiversity (Consumptive use value, Productive use value, Social value, Ethical value, Aesthetic value, Option values, Ecosystem service values) – India as a mega diversity nation–Hot spots of biodiversity-Threats to biodiversity – Endangered &Endemic species of India – Conservation of biodiversity.

**UNIT – IV: Environmental Pollution**

Definition, causes, effects & control measures of : Air pollution – Water pollution – Noise pollution-Soil pollution. Global climatic issues: IPCC- Introduction – Role of IPCC-Global warming – Acid rains – Ozone layer depletion.

**UNIT – V: Waste Management**

Waste water treatment – Municipal solid waste management – Biomedical waste management – Hazardous waste management – E-waste management – Environmental legislations: Wild life ( Protection) Act,1972 – Water (Prevention and Control of Pollution) Act, 1974 –Forest (Conservation) Act,1980 – Air (Prevention and Control of Pollution) Act, 1981 – Environmental(Protection) Act,1986.

**Text Books**


1. Anubha Kaushik, C.P.Kaushik, Environmental Studies, Fourth Edition, New Age International Publishers.
2. P.Anandan, R.Kumaravelan, Environmental Science & Engineering, Scitech Publications (INDIA) Pvt. Ltd.


**Reference Books**


1. Shashi Chawala, Environmental Studies, Tata McGraw Hill Education Private Limited.
2. Deeksha Dave & P. Udaya Bhaskar, Environmental Studies, Cengage Learning.
3. Dr.Suresh, K.Dhameja, Society and Environment, S.K. Kataria & Sons.
4. Benny Joseph, Environmental studies, Tata McGraw Hill Publishing Company Limited.


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# PYTHON PROGRAMMING

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture : 2 | Practical : 2 | Internal Marks | : 30 |
| Credits : 3 | | External Marks | : 70 |

**Course Objectives**

- To introduce Scripting Language.
- To explore various problems solving approaches of computer science.
- To be familiarized with general coding techniques to solve object-oriented programming concepts.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- solve coding tasks related to fundamental and control statements.
- design structured programs using functions.
- differentiate mutable and immutable data types.
- understand and apply the concepts of exceptions and file handling.
- analyze the importance of object-oriented programming over structured programming.

**Course Content**

**UNIT – I: Basics of Python Programming and Control Statements**

Features and History of Python, Literal Constants, Data Types, Variables, Operators, input operation.

Conditional and un-conditional branching, Iterative statements, Nesting of decision control statements and loops.

**Problem Solving:** Write a Python Program

1. to compute distance between two points taking input from the user (use Pythagorean Theorem)
2. to print out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10, using a while loop,
3. to find the factorial of given number using do-while loop,
4. find the sum of all the primes below hundred.

**UNIT – II: Functions and Strings**

Functions-Function Definition, Call, Return Statement, Types of Argument, Recursive Functions, Modules.

Strings -Basic String Operations, String Formatting Operator, Built-in functions.

**Problem Solving:** Write a Python Program

1. to create a function cumulative_product to compute cumulative product of a list of numbers.
2. to create a function compute_gcd and compute_lcm of two numbers (Each function shouldn't exceed one line).
3. that accepts a string from a user and re-displays the same after removing vowels from it.
4. to create a function to reverse a given string.

**UNIT – III: Tuples, Lists and Dictionaries**

**Tuples** – creating, accessing values, updating, deleting elements in a tuple, Basic Tuple operations.

**Lists** – accessing, updating values in Lists, Basic List operations, mutability of lists.

**Dictionaries** – Creating a Dictionary, adding an item, deleting items, sorting items, looping over a dictionary, Basic Dictionary operations, Built-in functions.

**Problem Solving:** Write a python program to

1. swap two values using Tuple assignments.
2. scan an email address and form a tuple of user name and domain name.
3. print sum and average of the elements present in the list.
4. form a list of first character of every word present in another list.
5. count the number of characters in the string and store them in a dictionary.
6. print maximum and minimum value in a dictionary.

**UNIT – IV: Exception Handling and File Handling**

**Exception Handling-**Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions

**Files-**File types, File path, File operations-open, close, read, write, file positions and command line arguments.

**Problem Solving:** Write a python program to

1. handle division by zero exception.
2. create a user-defined exception named “ShortInputException” that raises when the input text length is less than 3.
3. print each line of a file in reverse order.
4. compute the number of characters, words and lines in a file.
5. copy contents of one file into another file.

**UNIT – V: Object Oriented Programming in Python**

Classes, Objects, ‘self’ variable, Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.

**Problem Solving:** Write a python program to

1. create a class that stores the name and marks of students using classes. (use list to store marks in 3 subjects).
2. to create a class having instance variables and then get and set those values using getter and setter methods.
3. implement multiple inheritance.

**Text Books**


1. Reema Thareja, “Python Programming – Using Problem Solving Approach “, Oxford University Press, 2014 Edition.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.


**Reference Books**


1. Wesley J. Chun, “Core Python Programming”, Second Edition, Prentice Hall.
2. Martin C. Brown, “Python: The Complete Reference”, 2001 Edition, Osborne/ Tata McGraw Hill Publishing Company Limited.
3. Kenneth A. Lambert, ‘Fundamentals of Python – first programs”, 2012 Edition, CENGAGE publication.


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# CIRCUIT THEORY - II

II Year – I Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 2 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 3 | | | External Marks | : 70 |

**Course Objectives**

- To understand three phase balanced and unbalanced systems.
- To familiarize with transients, two port networks and network synthesis.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- evaluate different two port network parameters.
- analyze three phase circuits with both balanced and unbalanced loads.
- analyze the transient behavior of R-L, R-C and R-L-C circuits for different excitations.
- synthesize the given network using Foster form or Cauer form of realizations.

**Course Content**

**UNIT – I: Two port Networks**

Two port network parameters – Z, Y, ABCD and hybrid parameters and their relations, Cascaded networks.

**UNIT – II: Three Phase Circuits**

Phase sequence- Star and delta connection-Relation between line and phase voltages and currents in balanced systems - Analysis of balanced three phase circuits - Measurement of Active and Reactive power in balanced three phase systems - Two Wattmeter Method for measurement of three phase active power, single Wattmeter Method for measurement of three phase reactive power, Analysis of Three Phase unbalanced circuits - Loop Method- Application of Millman's Theorem - Star Delta transformation Technique – Measurement of Active power in unbalanced three phase systems.

**UNIT – III: Transient Analysis**

**Part-A DC Transients:** Transient response of R-L, R-C, R-L-C series circuits for D.C excitation-Initial conditions-solution using differential equation and laplace transforms,

**Part-B AC Transients**: Transient response of R-L, R-C, R-L-C series circuits for sinusoidal excitations- Solution using differential equations and laplace transforms

**UNIT – IV: Network Functions**

Network function for one port and two port networks, ladder networks, general network - poles and zeros of network functions, Restriction on poles and zeros for driving point functions and transfer functions.

**UNIT – V: Network Synthesis**

Real positive function – Basic synthesis procedure – LC Imittance Functions - RC Impedance functions – RL Impedance functions or RC admittance functions - Foster and Cauer methods.

**Text Books**

1. Network Anlaysis and Synthesis, Ravish R Sangh, 2nd edition McGrawhHll Education.
2. Electrical Circuits, A. Sudhakar and Shyammohan S Palli, 5th edition, Tata McGraw-Hill.

**Reference Books**

1.Engineering Network Analysis and Filter Design , Gopal G.Bhise, Prem R. Chada, Durgesh C. Kulshreshtha, 1st edition, Umesh Publications.

2.Engineering Circuit Analysis , William Hayt and Jack E.Kimmerley,Mc Graw Hill Company,6th edition.

**Additional Text Books**

1.Network Analysis, Van Valkenburg, 3rd edition, Prentice-Hall of India Private Ltd.

2. Electric Circuits, Joseph A Edmister, MSE, 1st edition, Schaum'Outline Series,MC Graw Hill.

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# CONTROL SYSTEMS

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture : 2 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 3 | | External Marks | : 70 |

**Course Objectives**

- To introduce the basic concepts of control systems by developing mathematical models for physical systems.
- To familiarize with the time domain behavior of linear control systems.
- To impart knowledge on analytical and graphical methods to quantify stability of linear control systems.
- To introduce concepts on the state variable theory as a pre-requisite to advanced control systems.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- develop mathematical models for physical systems.
- employ the time domain analysis to quantify the performance of linear control systems and specify suitable controllers.
- quantify time and frequency domain specifications to determine stability margins.
- apply state variable theory to determine the dynamic behavior of linear control systems.

**Course Content**

**UNIT – I: Introduction of Control Systems and its Components**

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Classification of control systems,examples of control systems. Mathematical models– Differential equations, Impulse Response and transfer function for physical systems.Transfer Function of DC Servo motor, AC Servo motor, Block diagram representation of systems-Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

**UNIT – II: Time Response Analysis**

Standard test signals - Time response of first order systems, second ordersystems– Characteristic Equation of Feedback control systems- Feedback Characteristics, Effects of feedback - Time domain specifications – Steady state response - Steady state errors and error constants. Introduction to P, PI, PD and PID controllers.

**UNIT – III: Stability Analysis in S-Domain**

**Routh stability criterion:** The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.

**Root Locus Technique:** The root locus concept - construction of root locus-Stability Analysis.

**UNIT – IV: Frequency Response Analysis**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications -Phase margin and Gain margin-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Stability Analysis.

**UNIT – V: State Space Analysis of Continuous Systems**

Concept of state, state variables and state model, derivation of state models from physical systems, solving the Time invariant state Equations- State Transition Matrix and its Properties – Concepts of Controllability and Observability.

**Text Books**


1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International Limited Publishers, 2nd edition.
2. Automatic control system – B.C.Kuo , john wiley and son's 8th edition, 2003.


**Reference Books**


1. Modern control engineering – K.Ogata , prentice Hall of India Pvt. Ltd., 5th Edition.
2. Control system – N.K.Sinha, New Age International (p) Limited Publishers, 3rd Edition, 1998.
3. Control system engineering – Norman S-Nice, Willey Studio Edition, 4th Edition. Feed back and control system – Joseph J Distefa.


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# DC MACHINES AND TRANSFORMERS

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture : 2 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 3 | | External Marks | : 70 |

**Course Objectives**

- To familiarize with the constructional details and working principles of DC machines.
- To introduce the methods of starting, speed control and testing of DC machines.
- To impart knowledge on constructional details, working principles, and performance characteristics of transformers.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- enumerate constructional details, principle of operation and the performance of DC machines for various operating conditions.
- suggest suitable starting, speed control and testing methods of DC motor for various applications.
- elucidate the operation of single phase and three phase transformers for various operating conditions.
- explicate the performance specifications of a single-phase and three phase transformer for various loading conditions.
- select suitable type of single phase and three phase transformers for various applications.

**UNIT – I: DC Generators**

D.C. Generators – Principle of operation – Constructional features– E.M.F. equation –Armature windings – Armature reaction – Commutation process– Types of DC generators–Losses and Efficiency.

**UNIT – II: DC Motors**

DC Motors – Principle of operation – Back E.M.F. – Torque equation – Characteristics of Shunt, Series and Compound motors –Necessity of starter – Three-point starter –Speed control by varying armature resistance, field flux and armature terminalvoltage– Testing methods: Direct method, Swinburne's method and Regenerativemethod – Losses and Efficiency.

**UNIT – III: Single Phase Transformers –Construction and Operation**

Single phase transformers –Construction–Principle of operation– E.M.F. equation– Phasor diagramson no-load and load for ideal and practical transformers – Equivalent circuit.

**UNIT – IV: Single Phase Transformers Testing and Auto-transformers**

Open Circuit and Short Circuit tests– Sumpner's test–Regulation–Losses and Efficiency– Auto-transformers: Conversion of two winding transformer into Auto-transformer–Equivalent circuit –Comparison with two winding transformers.

**UNIT – V: Three Phase Transformers**

Three phase transformer connections: Star-Delta connection –Delta-Star connection –Delta-Delta connection –Star-Star connection–Open-Deltaconnection–Tap-changing transformers–Parallel operation of transformers.

**Text Books**


1. Electrical Machinery – Dr.P.S.Bimbhra, Khanna Publishers, 7th Edition, 2011.
2. Electric Machinery Fundamentals – Stephen J. Chapman, McGraw-Hill, 4th Edition, 2005.
3. Electrical Machines –D.P.Kothari&I.J.Nagarth, McGraw Hill Education Pvt.Ltd, 4th Edition, 2010.
4. Theory & Performance of Electrical Machines - J.B.Gupta, S.K.Kataria & Sons, 15thEdition, 2015.


**Reference Books**


1. Principles of Electrical Machines – V.K. Mehta & Rohit Mehta, S.Chand Publishing, 2nd Edition, 2016
2. Electrical Machines – S.K. Bhattacharya, McGraw-Hill Education (India), 4th Edition, 2014.


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# ELECTRONIC DEVICES AND CIRCUITS

II Year – I Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 2 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 3 | | | External Marks | : 70 |

**Course Objectives**

- To familiarize with the volt-ampere characteristics and applications of PN junction diode, zener diode, BJT and MOSFET.
- To introduce the concepts of Feedback and Oscillators.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- identify V-I characteristics of Diodes, BJT, MOSFET
- analyze the biasing circuits of BJT and MOSFETs.
- develop small signal models for BJT and MOSFET.
- differentiate various Feedback connection types.
- design oscillator circuits using BJTs

**Course Content**

**UNIT – I: PN Junction Diode**

Open-circuited P-N Junction, forward bias and reverse bias operation, The Volt-ampere characteristic, Temperature Dependence of the diode V-I characteristic, Zener diode and its V-I characteristics, Avalanche and zener breakdown mechanisms, Diode applications: Half wave rectifier, full wave rectifier, bridge rectifier, clippers and clampers.

**UNIT – II: BJT**

Construction and working of a transistor, Transistor Configurations- CB, CE and CC, Early Effect, Comparison of CB, CE and CC, Transistor operating regions, Operating point, Bias Stability, Self bias technique.

**UNIT – III: MOSFETs**

Depletion type MOSFET: Construction, Drain characteristics and Transfer characteristics; Enhancement type MOSFET: Construction, Drain characteristics and Transfer characteristics; Comparison of N-with P-channel MOSFETs, Biasing ,Small Signal Model

**UNIT – IV: Feedback Amplifiers**

Basic concept of Feedback, Effects of Negative feedback, Feedback connection types: voltage series Feedback, voltage shunt Feedback, Current series Feedback and Current shunt Feedback.

**UNIT – V: Oscillators**

Ideal Op-Amp, Inverting and Non-inverting configurations, Basic principles of sinusoidal oscillaots, op-amp base RC oscillators - RC phase shift oscillator and Wien bridge oscillator, LC oscillators-Hartley oscillator and Colpitts oscillator, Crystal oscillators.

**Text Books**


1. Robert L Boylested and Louis Nashelsky, Electronic Devices and Circuit Theory, 8th Edition, PHI, 2003.
2. Adel S.Sefra and Kenneth C,Smith, “Microelectronic Circuits”, Oxford University Press Inc., Fifth Edition, 2004.


**Reference Books**


1. David A Bell, Electronic Devices and Circuits, 4th Edition, PHI, 2003.
2. Floyd, Thomas, Electronic devices, Pearson Education, 5th Edition.


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# DIGITAL CIRCUITS

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture : 2 | Practical : 2 | Internal Marks | : 30 |
| Credits : 3 | | External Marks | : 70 |

**Course Objectives**

- To familiarize with the concepts of different number systems and Boolean algebra.
- To familiarize with the design of combinational and synchronous sequential logic circuits.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- perform conversion between different number systems
- realize Boolean expressions using k-maps
- design combinational logic circuits.
- apply different models of Finite State Machines (FSM) for design of synchronous sequential circuits.
- implement registers and counters using flip-flops.

**Course Content**

**UNIT – I: Number Systems and Binary Codes**

Binary Numbers, Number-Base Conversions, Octal and Hexadecimal Numbers, Complements - Diminished Radix Complement, Radix Complement, Subtraction with Complements; Signed Binary Numbers - Arithmetic Addition, Arithmetic Subtraction; Binary Codes- BCD Code, BCD Addition, Other Decimal Codes, Gray Code, Error-Detecting Code.

**UNIT – II: Boolean Algebra and Gate level Minimization**

Binary Logic, Basic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Digital Logic Gates.

Gate level Minimization: The Map Method, Four-Variable Map, Product-Of-Sums Simplification**,** Don't-Care Conditions, NAND and NOR Implementation - NAND Circuits, Two-Level Implementation, NOR Implementation.

**UNIT – III: Combinational Logic Circuits**

Combinational Circuits, Design Procedure, Binary Adder -Subtractor, Decimal Adder, Magnitude Comparator, Decoders- Combinational Logic Implementation, Encoders- Priority Encoder, Multiplexers- Boolean Function Implementation.

**UNIT – IV: Synchronous Sequential Logic Circuits**

Introduction, Sequential Circuits, Storage Elements: latches, Storage Elements: Flip-Flops, Analysis of Clocked Sequential Circuits (FSM) - State Equations, State Table, State Diagram, Mealy and Moore Models of Finite State Machines, State Assignment, Design Procedure.

**UNIT – V: Registers, Counters and Programmable Logic Devices (PLDs)**

Shift Registers- Serial In Serial Out Shift Register, Universal Shift Register; Ripple Counters, Synchronous Counters- Binary Counter, Up-Down Binary Counter, BCD Counter; Other Counters- Ring Counter, Johnson Counter.

Programmable Logic Devices (PLDs), Complex Programmable Logic Devices (CPLD), Field-Programmable Gate Arrays (FPGA).

**Text Books**


1. M. Morris Mano, Micheal D.Ciletti, "Digital Design", 4th edition, Pearson Education. (Units – I to V).
2. Charles H. Roth, Larry L. Kinney, "Fundamentals of Logic Design", 7th edition, Cengage Learning. (Unit- V: PLDs).


**Reference Books**


1. Thomas L. Floyd, "Digital Fundamentals", 3rd edition, Universal Book Stall.
2. Ala B. Marcovitz, "Introduction to Logic Design", 3rd Edition, McGraw-Hill publishing.


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## ELECTRONIC DEVICES AND CIRCUITS LAB

II Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Course Objectives**

- To familiarize with various electronic components and basic electronic lab instruments.
- To conduct experiments to obtain the characteristics of diodes, MOSFETs, and BJTs.
- To conduct experiments to obtain the frequency response / functionality of RC oscillator

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- identify the semiconductor from the obtained energy gap and Hall coefficient.
- identify various electronic components and basic electronic measuring instruments and other lab equipment.
- verify the I-V characteristics of junction diode, zener diode, MOSFET, BJT.
- test the Zener voltage as voltage regulator, BJT voltage-divider bias and using it as an amplifier.
- verify the functionality of feedback amplifiers and oscillator circuits.

**List of Experiments**

**PART-A:** Orientation of electronic components and electronic equipment

**PART-B:**

1. I-V characteristics of P-N junction diode.
2. Clippers and clampers (output response and transfer characteristics)
3. Zener diode I-V characteristics and regulation characteristics.
4. Full-wave rectifier with and without using capacitor filter.
5. Common-Base transistor input & output characteristics.
6. Common-Emitter transistor input & output characteristics.
7. MOSFET characteristics (drain, transfer characteristics).
8. Transistor biasing.
9. Common Emitter Amplifier.
10. Voltage-shunt feedback amplifier, Current-series feedback amplifier.
11. RC phase shift Oscillator.

**Reference Books**


1. D.Roy Choudhury and Shail B.Jain, “Linear Integrated Circuits”, New Age International (p) Ltd, Second Edition, 2003.
2. Sergio franco, “Design with Operational Amplifier and Analog Integrated Circuits”, TMH, Fourth Edition, 2011.
3. G.B.Clayton, :Operational Amplifiers”, Elsevier Science, Fifth Edition, 2003.
4. Ramakanth a. Gayakwad, :OP-amps and Linear Integrated Circuits”, PHI, Fourth Edition, 2010.
5. Datasheets of linear 741 ICs.


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# DIGITAL CIRCUITS LAB

II Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Course Objectives**

- To acquaint with the design of various digital circuits.
- To familiarize with the simulation process of CAD tools.

**Course Outcomes**

After completion of the course, the students will be able to

- apply Boolean laws and K-map to simplify the digital circuits.
- draw the digital circuits using gate level implementation.
- demonstrate the flow of Electronic Workbench.
- develop digital circuits using Electronic Workbench.
- make oral presentations and prepare written reports.

**List of Experiments**

To design and simulate the digital circuits using Electronic Workbench

1. Logic Gates using Universal Gates.
2. Full adder using Half adder and Logic gates.
3. 4-bit Carry Look Ahead Adder.
4. Realization of Boolean Expression using 4:1 multiplexer.
5. Seven Segment Display using Decoder.
6. 8:3 Priority Encoder.
7. JK and D flip-flops.
8. Serial-In Serial-Out Shift register.
9. BCD Ripple Counter.
10. Ring counter.
11. Open ended Experiment.

**References:**


1. Thomas L.Floyd, “Digital Fundamentals”, 3rd edition, Universal Book Stall.
2. Ala B. Marcovitz, :Introduction to Logic Design”, 3rd Edition, McGraw-Hill Publishing.
3. Hill and Peterson, “Switching theory and Logic Design”, Mc-Graw Hill Publishers.2012.
4. Charles H.Roth, Jr, “Fundamentals of Logic Design”, 4th Edition, Jaico Publishers.


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## LOGIC BUILDING AND BASIC CODING PRINCIPLES
### (Common to CE, EEE & ME)

II Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

1. Understanding National Qualifier Test Patterns.
2. Practicing different patterns with different logics.

Frequent Patterns in NQTs: Practicing with Flow Chart —

Pseudo code and Programming in C

- To draw Right Staircase Pattern
- To draw Left Staircase Pattern
- To draw Pyramid Pattern
- To draw Inverse Pyramid Pattern
- To draw Inverse Right Staircase Pattern
- To draw Inverse Left Staircase Pattern
- To draw Pyramid Pattern like below
- To draw Interesting Pattern |
- To draw Diamond Pattern
- To draw Interesting Pattern II
- To draw Interesting Pattern III
- To draw Interesting Pattern IV
- To draw Interesting Pattern V

# NUMERICAL METHODS WITH COMPUTER APPLICATIONS

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture : 2 | Practical : 2 | Internal Marks | : 30 |
| Credits : 3 | | External Marks | : 70 |

**Course Objectives**

- To introduce the various numerical techniques using MATLAB
- To be aware of different methods to solve first order differential equations.
- To construct a curve for the given data.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate various commands in MATLAB programming.
- apply appropriate numerical technique to find root of an equation through MATLAB .
- demonstrate the use of interpolation methods, determine approximate derivatives by using appropriate numerical techniques with MATLAB.
- evaluate integrals, determine numerical solution of an ODE by using appropriate numerical techniques with MATLAB.
- fit a curve for the given data using MATLAB.

**Course Content**

**UNIT – I: Introduction to MAT Lab**

Vectors, functions & plots in MATLab, Matrices, Variables-Script file- Function filerectifier, clippers and clampers.

**Lab Experiments:**

- MATLab Programmes – function programs, Expressions, Array Operations

**UNIT – II: Algebraic and Transcendental Equations**

**Pre-requisite :** Commands of MATLab

Solution of Algebraic and Transcendental Equations- Introduction – Bisection Method – Method of False Position – Newton-Raphson Method.

**Lab Experiments:**

- To find out the root of the Algebraic and Transcendental equations using Bisection, Regula - falsi, and Newton - Raphson.

**UNIT – III: Interpolation and Numerical differentiation**

**Pre-requisite :** Commands of MATLab

Interpolation- Introduction – Finite differences- Forward Differences – Backward differences – Newton's Forward and Backward formulae for interpolation- Lagrange's interpolation- Approximation of derivative using Newton's forward and backward formulas

**Lab Experiments:**

- To implement Newton's Forward and Backward Interpolation formula.
- To implement Lagrange's Interpolation formula.

**UNIT – IV: Numerical integration and Numerical Solutions of Ordinary Differential Equations**

**Pre-requisite :** Commands of MATLab

Integration using Trapezoidal and simpson's rules- Euler's Method- Modified Euler's Method- Runge – Kutta Fourth order Method.

**Lab Experiments:**

- To implement Numerical Integration using Trapezoidal, Simpson 1/3 rule.
- To find out the Numerical solution of ordinary differential equations using Euler's Method.
- To find out the Numerical solution of ordinary differential equations using Runge-kutta Fourth order Method.

**UNIT – V: Curve Fitting**

**Pre-requisite :** Commands of MATLab

Fitting a straight line – Parabolic curve-exponential curve – power curve by the method of least squares.

**Lab Experiments:**

- To implement Least Square Method for curve fitting.

**Text Books**


1. Laurent V. Fausett, Applied Numerical Analysis Using MATLAB: 2nd edition, Pearson Publication, 2012, New Delhi.
2. B.S.Grewal, Higher Engineering Mathematics : 42nd edition, Khanna Publishers,2012 , New Delhi.
3. B.V.Ramana, Higher Engineering Mathematics, Tata-Mc Graw Hill company Ltd.


**Reference Books**


1. Erwin Kreyszig, Advanced Engineering Mathematics: 8th edition, Maitrey Printech Pvt. Ltd, 2009, Noida.
2. Robert J. Schilling, Sandra L.Harries, Applied Numerical Methods for Engineers using MAT Lab & C, Thomson Books.
3. John. H.Mathews, Kurtis D. Fink, Numerical methods using MAT Lab, 4th edition –PHI.
4. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 3rd Edition, TATA McGraw-Hill,2000, New Delhi.


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# INDUCTION & SYNCHRONOUS MACHINES

II Year – II Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 2 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 3 | | | External Marks | : 70 |

**Course Objectives**

- To familiarize with the constructional details, working principles, operating characteristics of three phase and single-phase induction motors.
- To introduce the concepts on constructional details, working principles and operating characteristics of synchronous machines.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- enumerate constructional details, principle of operation and the performance of three-phase and single-phase induction motors.
- suggest various starting and speed control methods of three-phase induction motor.
- elucidate the construciton and operation of synchronous machines.
- determine the performance of synchronous machines under various operating conditions.
- analyze effect of various parameters on the load sharing between alternators in parallel.

**Course Content**

**UNIT – I: Three Phase Induction Motors**

Types – Construction–Principle of operation –Production of rotating magnetic field –Slip –Rotor frequency –Rotor E.M.F. –Rotor current –Rotor power factor –Rotor torque –Torque-Speed characteristics –Starting methods – Speed control methods – Crawling – Cogging.

**UNIT – II: Performance of Three-phase and Single-phase Induction Motors**

Three-phase induction motor –Power losses and efficiency –Power flow diagram – Equivalent circuit –Phasor diagram –No-load and Blocked-rotor tests – Circle diagram.

Single-phase induction motor – Constructional features – Double field revolving theory –Equivalent circuit – Resistance split-phase motor – Capacitor-start motor – Capacitor start-and-run motor – Shaded-pole motor.

**UNIT – III: Alternators–Construction, Characteristics and Voltage Regulation**

Types – Construction –Operating principle – E.M.F. equation – Harmonics – Armature reaction – Phasor diagrams – O.C.C., S.C.C. and load characteristics

–Power developed in alternator – Voltage regulation – Determination by E.M.F., M.M.F. and Z.P.F. methods.

**UNIT – IV: Alternators–Parallel Operation and Two Reaction Theory**

Requirements for parallel operation of alternators – Synchronization of alternators –Synchronizing current, torque and power – Effect of increasing excitation, driving torque and speed– load sharing between two alternators in parallel – Alternators connected to infinite bus bar–Two reaction theory for salient pole synchronous machine – Determination of $X_d$ and $X_q$ by Slip test.

**UNIT – V: Synchronous Motors**

Principle of operation – Methods of starting –Phasor diagrams – Power developed in a synchronous motor –V and inverted V curves –Synchronous condensers – Hunting and its suppression.

**Text Books**


1. Electrical Machinery – Dr.P.S.Bimbhra, Khanna Publishers, 7th Edition, 2011.
2. Electric Machinery Fundamentals – Stephen J. Chapman, McGraw-Hill, 4th Edition, 2005.
3. Electrical Machines –D.P.Kothari&I.J.Nagarth, McGraw Hill Education Pvt. Ltd, 4th Edition, 2010.
4. Theory & Performance of Electrical Machines - J.B.Gupta, S.K.Kataria&Sons, 15th Edition, 2015.


**Reference Books**


1. Problems in Electrical Engineering – N.N. Parker Smith, CBS Publishers & Distributors Pvt. Ltd., 9th Edition, 2003.
2. Electrical Machines – S.K. Bhattacharya, McGraw-Hill Education (India), 4th Edition, 2014.


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# POWER GENERATION SYSTEMS

II Year – II Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 3 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 4 | | | External Marks | : 70 |

**Course Objectives**

- To introduce various methods of power generation from different energy sources.
- To impart knowledge on economic aspects of power generation.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the working of a thermal power station.
- identify different components of a nuclear power station.
- illustrate the working principle and operation of hydro and gas power plants.
- elucidate the process of power generation by solar and wind energy.
- enumerate various economic aspects of power generation.

**Course Content**

**UNIT – I: Thermal Power Generating Stations**

Single line diagram of Thermal Power Station showing paths of coal, steam, water, air, ash and flue gasses-Brief description of TPS components: Economizers, Boilers, super heaters, Turbines, condensers, chimney and cooling towers.

**UNIT – II: Nuclear Power Generating Stations**

Working principle, Nuclear fuels. Nuclear reactor Components: Moderators, Control roads, Reflectors and Coolants. Types of Nuclear reactors and brief description of PWR, BWR and FBR. Radiation hazards and Shielding.

**UNIT – III: Hydel and Gas Power Generating Stations**

Selection of site, block diagram approach of hydro electric power plant and classification of Hydro power plant, pumped storage power plants. Gas power stations: principle of operation and components (block diagram approach only).

**UNIT – IV: Solar and Wind Power Generation Systems**

**Solar Power:** Fundamental principles of solar power generation, working principle of PV cell and solar Ponds.

**Wind Power:** Fundamental principle of Wind power generation, efficiency of wind turbine and types of wind turbines.

**UNIT – V: Economic Aspects of Power Generation and Tariff Methods**

Load curve, load duration and integrated load duration curves, Discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity factor, utilization factor, plant use factors- Numerical Problems.

Desirable Characteristics of a Tariff. Tariff Methods: Simple rate, Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods.

**Text Books**


1. A Text Book on Power System Engineering by M. L. Soni, P. V. Gupta, U. S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd. First Edition1997-98.
2. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th Edition, 2011.
3. A Textbook of Power System Engineering by Er.R.K.Rajput, 2nd Edition, Laxmi Publications.


**Reference Books**


1. Generation, Distribution and Utilization of electrical Energy by C. L. Wadhawa New age International (P) Limited, Publishers 3rd Edition 2010.
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh, PHI, 2nd Edition 2008.
3. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme, 2nd Edition TMH, New Delhi.
4. Principles of Power Systems by V.K Mehta and Rohit Mehta S.Chand & Company Ltd. New Delhi 2004.


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# SIGNALS AND SYSTEMS

II Year – II Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 2 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 3 | | | External Marks | : 70 |

**Course Objectives**

- To familiarize with the basic concepts of signals and systems.
- To introduce various transform techniques on signals.
- To develop an understanding of sampling and correlation techniques on signals.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- classify the signals and various operations on signals.
- perform Fourier analysis on the signals.
- analyze the various systems.
- perform correlation operational on signals.
- apply the various sampling techniques on continuous time signals.
- analyze the various continuous time signals through transformation (Fourier and Laplace) techniques.

**Course Content**

**UNIT – I: Signal Analysis**

Introduction to elementary signals-Unit–step, impulse, impulse, ramp, parabolic, rectangular, triangular, sinusoidal, exponential, signum, sinc and gaussian functions, basic operations on signals - amplitude and timje scaling, time shifting, addition and multiplication, Classification of signals.

**UNIT – II: Fourier Series Representation of Continuous Time Signals**

Trigonometric and exponential Fourier series, relationship between trigonometric and exponential Fourier series, representation of a periodic function by the Fourier series over the entire interval, convergence of Fourier series, alternate form of trigonometric series, symmetry conditions-even and odd, complex Fourier spectrum.

**UNIT – III: Fourier Transform**

Representation of an arbitrary function over the entire interval: Fourier transform, Fourier transform of some useful functions and periodic function, properties of Fourier transform, energy density spectrum, Parseval's theorem.

**Sampling:** Sampling theorem for band limited signals- explanation, reconstruction of signal from samples, aliasing, sampling techniques- impulse, natural and flat top sampling.

**UNIT – IV: LTI Systems**

Properties of systems, Linear Time Invariant (LTI) system, response of LTI system-convolution integral, properties of LTI system, transfer function and frequency response of LTI system.

**Signal Transmission Through LTI Systems:** Filter characteristics of LTI systems, distortion less transmission through LTI system, signal bandwidth, System bandwidth, ideal LPF, HPF and BPF characteristics, causality and physical realizability- Paley-Wiener criterion, relationship between bandwidth and rise-time.

**UNIT – V: Correlation of Continuous Time Signals**

Cross correlation and auto correlation of continuous time signals (finite and nonfinite energy signals), relation between convolution and correlation, properties of cross correlation and autocorrelation.

**Laplace Transform**

Laplace transform of signals, properties of Region of Convergence (ROC), unilateral Laplace transform, properties of unilateral Laplace transform, inversion of unilateral Laplace transform - Partial Fraction Method.

**Text Books**


1. B.P.Lathi, "Signals, Systems &Communications", BS Publications, 2003.
2. A.V. Oppenheim, A.S. Willsky and S.H.Nawab, "Signals and Systems", PHI, 2nd Edition.


**Reference Books**


1. Simon Haykin and Van Veen, "Signals &Systems", Wiley, 2nd edition
2. Michel J. Robert , "Fundamentals of Signals and Systems", TMGH Int. Edition, 2008.
3. C.L.Philips, J.M. Parr and Eve A. Riskin, "Signals, Systems and Transforms", Pearson Education, 3rd Edition, 2004.


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# DC MACHINES AND TRANSFORMERS LAB

II Year – II Semester

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|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Course Objectives**

- To familiarize various testing methods and speed control of DC Machines.
- To disseminate knowledge on various tests and parallel operation of single phase transformers.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- select the appropriate apparatus for determining the performance of DC machines and transformers based on the capacity experimentally.
- determine the equivalent circuit parameters of transformers experimentally.
- compute the performance characteristics of transformers and DC machines through suitable tests.

**List of Experiments**

Any 10 of the following experiments are to be conducted:

1. Magnetization characteristics of DC shunt generator.
2. Load test on DC Shunt generator.
3. Load test on DC compound generator
4. Speed control of DC shunt motor.
5. Brake test on DC compound motor.
6. Swinburne's test on DC shunt machine.
7. Hopkinson's test on a pair of DC shunt machines.
8. O.C and S.C tests on single phase transformer.
9. Sumpner's test on a pair of single phase transformers.
10. Parallel operation of two single phase transformers.

**Additional experiments beyond the Syllabus**

1. Retardation test on a DC shunt machine.
2. Separation of core losses in single phase transformer.

* * *

# ELECTRICAL CIRCUITS LAB

II Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Course Objectives**

- To impart practical knowledge on electric circuits.
- To familiarize with the application of network theorems.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- verify the applicability of network theorems to practical electrical circuits.
- specify and test RLC series and parallel resonant circuits.
- evaluate the two port parameters for a two port network.
- interpret /correlate physical observations and measurements involving electrical circuits to theoretical principles.

**List of Experiments**

Any 10 experiments from the following list are required to be conducted:

1. Series and Parallel Resonance.
2. Determination of Self, Mutual Inductances and Coefficient of coupling.
3. Verification of Superposition & Reciprocity Theorems.
4. Verification of Thevenin's and Norton's Theorems.
5. Verification of Maximum Power Transfer Theorem on D.C.
6. Verification of Compensation & Millman's Theorems.
7. Z and Y Parameters.
8. Transmission and hybrid parameters.
9. Measurement of Active Power for Star connected balanced loads
10. Measurement of Reactive Power for Star connected balanced loads.
11. Time response of first order RL/RC network for periodic non-sinusoidal inputs.
12. Determination of form factor for non-sinusoidal waveform.

**Reference Books**


1. Engineering Circuit Analysis, William Hayt and Jack E.Kimmerley, Durbin, McGraw Hill, 9th edition 2016.
2. Fundamentals of Electrical Circuits, Charles K.Alexander and Mathew N.O. Sadiku. 6th edition 2017, McGraw Hill.
3. Network Analysis , Van Valkenburg, 3rd edition, Prentice-Hall of India Private Ltd.
4. A text Book Electrical Technology, Volume - I. B.L.Teraja, A.K. Teraja.
5. Electrical Circuits, A.Sudhakar and Shyammohan S Palli, 2nd edition, Tata McGraw Hill.


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# SIMULATION OF ELECTRICAL ENGINEERING SYSTEMS

II Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 4 | Internal Marks | : 15 |
| Credits | : 2 | External Marks | : 35 |

**Course Objectives**

- To get acquaint with the concepts of various simulation environments in electrical engineering.
- To familiarize with the MATLAB/SIMULINK Tool.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- analyze the behaviour of the passive circuits and verify network theorems using MATLAB.
- design and model the electrical systems in simulation environment.
- develop electrical systems using MATLAB/SIMULINK Tool.

**List of Experiments:**

Any 10 of the following experiments are to be conducted:

1. Generation of single phase and three phase electrical source.
2. Simulation study of series RLC circuit using MATLAB.
3. Verification of Superposition theorem using MATLAB/SIMULINK.
4. Verification of Thevinens theorem using MATLAB/SIMULINK.
5. Verification of Nortons theorem using MATLAB/SIMULINK.
6. Verification of Maximum Power transfer theorem using MATLAB/SIMULINK.
7. Verification of Reciprocity theorem using MATLAB/SIMULINK.
8. Simulation of series and parallel resonance using MATLAB.
9. Modeling and simulation of armature controlled DC motor using MATLAB/SIMULINK.
10. Simulation of OC and SC test on single phase transformer using MATLAB/SIMULINK.
11. Simulation of single phase half and full wave rectifiers using MATLAB/SIMULINK.
12. Simulation of regulated power supply using MATLAB/SIMULINK.

**Text Books**


1. "Getting started with MATLAB" by Rudra pratap, Oxford University, 2002.
2. MATLAB and SIMULINK for Engineers by Agam Kumar Tyagi, OUP 2011.


**Reference Books**


1. Spencer, R.L. and Ware, M (2008), Introduction to MATLAB, Brigham Young University, available online, accessed, 7, 2008.
2. David F.Griffiths, October (2012) "An introduction to MATLAB" the University of Dundee, available online, Accessed, October 2012.


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## PROGRAMMING FOR CORPORATE
### (Common to CE, EEE & ME)

II Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

Using Python

- Introduction to Object Oriented Programming and Principles.
- Programming Constructs
- Data Structures
- Arrays, Class, Struct,
- Trees, Searching and Sorting Algorithms
- Pointers, Exception Handling,
- Utility API, Collection
- Database Connectivity
- Reflections and Serialization
- File Handling
- Database/SQL
- Web UI

*Honors Degree*

## PROGRAMMABLE LOGIC CONTROLLERS & APPLICATIONS

II Year – II Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 3 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 4 | | | External Marks | : 70 |

**Course Objectives**

- To have knowledge on PLC.
- To acquire the knowledge on programming of PLC.
- To understand different PLC registers and their description.
- To have knowledge on data handling functions of PLC.
- To know how to handle analog signal and converting of A/D in PLC.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- state the need and applications of open source software.
- understand the PLCs and their I/O modules.
- develop control algorithms to PLC using ladder logic etc.
- manage PLC registers for effective utilization in different applications.
- handle data functions and control of two axis and their axis robots with PLC.
- design PID controller with PLC.

**Course Content**

**UNIT - I: PLC Basics**

PLC system, I/O modules and interfacing, CPU processor, programming equipment, programming formats, construction of PLC ladder diagrams, devices connected to I/O modules.

**UNIT - II: PLC Programming**

Input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill press operation. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams for process control: Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

**UNIT - III: PLC Registers**

Characteristics of Registers, module addressing, holding registers, input registers, output registers. PLC Functions: Timer functions and Industrial applications, counters, counter function industrial applications, Arithmetic functions, Number comparison functions, number conversion functions.

**UNIT - IV: Data Handling functions**

applications. Bit Pattern and changing a bit shift register, sequence functions and applications, controlling of two axis and three axis Robots with PLC, Matrix functions.

**UNIT - V: Analog PLC Operation**

Analog modules and systems, Analog signal processing, multi bit data processing, analog output application examples, PID principles, position indicator with PID control, PID modules, PID tuning, PID functions.

**Text Books**


1. Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A.Reiss, Fifth Edition, PHI
2. Programmable Logic Controllers – Programming Method and Applications by JR. Hackworth and F.D Hackworth Jr. – Pearson, 2004.


**Reference Books**


1. Introduction to Programmable Logic Controllers- Gary Dunning-Cengage Learning.
2. Programmable Logic Controllers –W.Bolton-Elsevier publisher.


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# ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture : 3 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 4 | | External Marks | : 70 |

**Course Objectives**

- To impart knowledge on construction, operation and working principles of electromechanical, digital measuring instruments and Transducers.
- To familiarize various methods of measurement of Resistance, Inductance and capacitance.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the operation and range extension of various types of ammeters and voltmeters.
- describe the operation and range extension of Watt meter, and operation of Energy Meter and its Calibration.
- determine the parameters of electrical circuits using potentiometer, suitable bridges and also calibrate the measuring instruments.
- select a suitable transducer for measuring non-electrical physical quantities.
- analyse the operation of various digital meters

**Course Content**

**UNIT – I: Measuring Instruments**

Types of Errors- Classification of measuring instruments, Torques - deflecting, controlling and damping torques –Moving Coil, Moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations. Extension of range of PMMC instruments using shunts and Multipliers.

**UNIT – II: Measurement of Power and Energy**

Single phase and three phase dynamometer wattmeter, expression for Deflecting and control torques – LPF and UPF-Extension of range of wattmeter using instrument transformers.

Single Phase induction type energy meter – driving and braking torques – errors and compensations –Testing of Energy meter by Phantom Loading.

**UNIT – III: Potentiometers and Bridges**

Basic slide wire Potentiometer. Principle and operation of DC Crompton's potentiometer. Standardization –Volt Ratio Box. Calibration of ammeter, volt meter and watt meter Methods of measuring low, medium and high resistance – Kelvin's double bridge, Wheat stone's bridge – loss of charge Method–Methods of measuring Inductance - Anderson's bridge and Capacitance- Schering bridge.

**UNIT – IV: Transducers**

Definition of transducer, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of resistor, inductor, and capacitor transducers, LVDT -Strain gauge and its principle of operation- gauge factor, Thermistors, Piezo electric transducers, pyro transducer, Hall sensors.

**UNIT – V: Digital Meters**

Digital Voltmeter-Successive approximation, ramp and dual slope integrating type, continuous balance type. Digital frequency Meter, phase angle meter, LCR Q-meter.

**Text Books**


1. Electrical Measurements and measuring Instruments. E.W.Golding and F.C. Widdis, Wheeler Publishing, 5th edition,1999.
2. Electrical & Electronic Measurement & Instruments. A.K.Sawhney and Puneet Sawhney, Dhanpat Rai & Co., Pvt. Ltd.,18th edition, 2010.


**Reference Books**


1. Electrical Measurements: Fundamentals, Concepts, Applications. Reissland, M.U, , New Age International (P) Ltd. Publishers,1st edition.2010.
2. Electronic and Electrical Measurements and Instrumentation,J.B. Gupta,12th edition, S.K. Katharia, 2006.
3. Modern Electronic Instrumentation and Measurement Techniques.Cooper, W. D., Helfrick, A. D.India: Pearson Education. 1st Edition (2005).
4. Electrical and Electronic Measurements –by G.K. Banerjee, PHI Learning Private Ltd, New Delhi 2012.
5. Electronic Instrumentation–by H.S.Kalsi Tata MCGraw–Hill Higher Education 4th Edition, 2018.


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# POWER TRANSMISSION SYSTEMS

III Year – I Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 2 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 3 | | | External Marks | : 70 |

**Course Objectives**

- To introduce the concepts of estimating the transmission line parameters and assessing the performance of transmission lines.
- To familiarize the electrical and mechanical design aspects of transmission lines.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- estimate the inductance for different conductor configurations of transmission lines.
- calculate the capacitance of transmission lines for different conductor configurations.
- determine the performance of short, medium and long transmission lines.
- select a suitable insulator for given specifications of the line and illustrate the effect of corona.
- evaluate the sag of a transmission line under the effect of wind and ice.

**Course Content**

**UNIT – I: Series parameters of Overhead Transmission Lines**

Types of conductors, calculation of resistance for solid conductors, skin and proximity effect, Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition.

**UNIT – II: Capacitance of Overhead Transmission Lines**

Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase circuits.

**UNIT – III: Performance of Transmission Lines**

Classification of Transmission Lines - Short, medium, long lines and their model representations -Nominal-T, Nominal-$\pi$ and end condenser method, Evaluation of A,B,C,D Constants –regulation and efficiency. Long Transmission Line–Rigorous Solution – Evaluation of A,B,C,D Constants– Interpretation of the Long Line Equations.

**UNIT – IV: Overhead Line Insulators and Corona**

Types of Insulators, String efficiency and methods for improving string efficiency, Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference.

**UNIT – V: Sag and Tension Calculations**

Sag and Tension calculations with equal and unequal heights of towers, effect of wind and ice on weight of conductor, Stringing chart , sag template and their applications.

**Text Books**


1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta,U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd., 1999
2. Electrical power systems - by C.L.Wadhwa, New Age International (P) Limited, Publishers, 1997.


**Reference Books**


1. Power System Engineering by I.J.Nagarath and D.P.Kothari, Tata McGraw-Hill, 2nd Edition, 1994
2. Power system Analysis-by John J Grainger William D Stevenson, TMC Companies, 4th edition, 1994.
3. Principles of Power Systems by V.K Mehta and Rohit Mehta S Chand &Company Ltd.New Delhi 2004.


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# ANALOG AND DIGITAL IC APPLICATIONS

III Year – I Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 2 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 3 | | | External Marks | : 70 |

**Course Objectives**

- To familiarize with the functioning of various Linear ICs such as OP-AMP, Timer.
- To introduce different digital MSI ICs and memories.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- analyze the characteristics of op-amps.
- apply op-amps concepts for various applications.
- understand A to D and D to A Conversion techniques.
- design various combinational and sequential circuits using MSI ICs.
- understand different types of memories and timing signals.

**Course Content**

**UNIT – I: Operational Amplifiers**

Basic information of op-amp, Ideal operational amplifier, operational amplifier internal circuit, Equivalent circuit of an op-amp, Ideal voltage transfer curve, open loop op-amp configurations, Basic op-amp applications, operational amplifier characteristics, V to I and I to V converters, integrator, differentiator, instrumentation amplifier.

**UNIT – II: Comparators, Waveform Generators and Active Filters**

Comparator, zero crossing detector, Schmitt trigger, Multivibrators - Astable, Monostable, Triangular wave generator, Active filters - Low pass, High pass, Band pass filters. IC-555 –functional block diagram and mention it's applications.

**UNIT – III: D-A And A-D Converters**

Basic DAC techniques, R-2R Ladder network, Binary Weighted, A/D converters - Flash ADC, Counter Type ADC, Successive Approximation ADC and Dual slope ADC, DAC/ADC specifications.

**UNIT – IV: MSI Combinational And Sequential Logic Circuits**

Design of combinational and sequential circuits using Decoders-74x139,138; Priority encoders 74x148; Multiplexers 74x151, Parity circuits 74x280, Comparators 74x85,682, Counters 74x163, Shift registers 74x95, Universal shift registers 74x194/195.

**UNIT – V: Memories**

ROM- Internal structure, types, timing and applications. Static RAM-Internal structure, SRAM timing, Dynamic RAM: Internal structure, timing diagrams.

**Text Books**


1. OP-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987. (UNIT–s - I, II & III ).
2. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Edition, 2005 (UNIT–s –IV & V).


**Reference Books**


1. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition,2003.
2. Design with Operational Amplifiers & Analog Integrated Circuits - Sergio Franco, McGraw Hill, 1988.
3. Operational Amplifiers – C.G. Clayton, Butterworth & Company Publ. Ltd. Elsevier, 1971.
4. Digital Logic and Computer Design by M Morris ManoMano, Pearson Education, 1979.


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*Professional Elective - I*

## ELECTRICAL DISTRIBUTION SYSTEMS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce concepts on design of substation and primary feeders.
- To familiarize with various coordination procedures of protective devices.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe various load models in the distribution system.
- describe the primary feeder ratings and voltage levels of primary feeder.
- design an optimum location of the substation.
- analyze various protective devices in the distribution system for coordination process.
- select appropriate voltage control method in the distribution systems.

**Course Content**

**UNIT – I: General Concepts**

Introduction to distribution systems, Load modeling and characteristics. Coincidence factor, contribution factor loss factor – relationship between the load factor and loss factor. Classification of loads (residential, commercial, agricultural and Industrial) and their characteristics.

**UNIT – II: Distribution Feeders**

Design Considerations of Distribution Feeders; Radial and loop types of primary feeders, voltage levels, feeder loading; basic design practice of the secondary distribution system.

**UNIT – III: Substations and System Analysis**

Location of Substations: Different types of substation designs-Hexagonal , square and n-type -Benefits derived through optimal location of substations. Voltage drop and power loss calculations for non three lines.

**UNIT – IV: Distribution System Protection**

Objectives of distribution system protection, Protective Devices: Principle of operation of Fuses, Circuit Reclosures, and line sectionalizes, and circuit breakers. Data requirement for coordination, general coordination procedures and various types of coordination procedures.

**UNIT – V: Compensation for Power Factor Improvement & Voltage Control**

Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), Power factor correction, capacitor allocation-Economic justification-Procedure to determine the best capacitor location. Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop compensation.

**Text Books**


1. Electric Power Distribution System Engineering. Turan Gonen, McGraw-hill Book Company,3rd Edition 2014.
2. Electric Power Distribution. A. S. Pabla, Tata McGraw – hill Publishing Company, 7th edition, 2019.


**Reference Books**


1. Principles of Power Systems by V.K Mehta and Rohit Mehta S.Chand& Company Ltd.New Delhi 2004.
2. Generation Distribution and Utilization of Electrical Energy by C.L.Wadhawa New age International (P) Limited, Publishers 3rd Edition 2011.


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*Professional Elective - I*

## ADVANCED CONTROL SYSTEMS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize the students on the concepts of design of controllers.
- To impart the knowledge on design of control systems using state variable techniques.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- design a controller for linear systems using frequency domain methods.
- develop different canonical forms to examine controllability or observability of the system.
- describe the behavour of non-linear systems.
- determine the stability of a given systems using Lypunov's theorem
- design a state feedback controller and/or observer.

**Course Content**

**UNIT – I: Classical Control Design Techniques**

Compensation techniques – lag, lead, lag-lead controllers design in frequency domain, PID controller tuning using Z-N method.

**UNIT – II: Concept of Controllability and Observability**

Controllable Canonical Form, Observable Canonical Form, Jordan Canonical Form. Tests for controllability and observability for continuous time systems –time invariant case, Principle of Duality, Controllability and observability form Jordan canonical form and other canonical forms.

**UNIT – III: Non-Linear System Analysis**

Introduction to nonlinear systems, Types of nonlinearities. Describing functions, describing function analysis of nonlinear control systems.

**UNIT – IV: Stability Analysis**

Stability in the sense of Lyapunov's, Lypanov's stability and Lypanov's instability theorems.Direct method of Lypunov's theorem for the Linear and Nonlinear continuous time autonomous systems.

**UNIT – V: Model Control**

Effect of state feedback on controllability and observability, Design of State Feedback Control through Pole placement and Ackerman's formula, State observers, Full order observer and reduced order observer, effects of the addition of the observer on a closed loop systems. Design of state feedback controller for steady state tracking.

**Text Books**


1. Modern Control Engineering – by K. Ogata, Pearson Education India, 5th edition, 2015.
2. Automatic Control Systems - by B.C. Kuo, Wiley India, 9th edition, 2014.


**Reference Books**


1. Modern Control Theory – by M. Gopal, Pearson Education India, 3rd edition, 2011.
2. Control Systems Engineering - by I.J. Nagarath and M.Gopal, New Age International (P) Ltd, 5th edition, 2009.
3. Digital Control and State Variable Methods – by M. Gopal, McGraw Hill Education, 4th edition, 2017.
4. Systems and Control - by Stainslaw H. Zak , Oxford Press, 2004.
5. Modern control systems - by Richard C. Dorf and Robert H. Bishop, Pearson Edu India, 12th Edition, 2010.


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*Professional Elective - I*

## ENGINEERING ELECTRO MAGNETICS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To impart principle of electric fields and potentials due to different static charge configurations.
- To familiarize with the applications of gauss law, Biot-Savarts law amperes law and faradays law.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- determine electric field for symmetrical charge configurations.
- estimate Potential and capacitance of a parallel plate capacitor with composite dielectrics.
- compute magnetic fields for symmetric current distributions.
- apply ampere's law to determine magnetic field and compute the self-inductance of solenoid and toroid.
- apply maxwell's equations for time variant fields.

**Course Content**

**UNIT – I: Electrostatics**

Introduction to electrostatic fields – Coulombs law - problems on Coulombs law - force due to multiple charges - problems on multiple charges - electric field intensity due different charge distributions.Gauss's law, application of Gauss's Law, Max well's first equation, Div (D).

**UNIT – II: Work done and Potential**

Work done in moving a point charge in an electrostatic field, potential and potential difference. Conduction and convection current densities, behavior of conductors and dielectrics in an electric field, concept of polarization. capacitance – capacitance of parallel plate capacitors with composite dielectrics – energy stored and energy density in a static electric field.

**UNIT – III: Magnetostatics**

Static magnetic fields – Biot-Savart's law – magnetic field intensity (MFI) – MFI due to a straight current carrying filament – MFI due to circular and solenoid current – carrying wire – relation between magnetic flux, magnetic flux density and MFI – Maxwell's second Equation, div(B)=0.

**UNIT – IV: Amperes Law and Inductance**

Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long current carrying filament – point form of Ampere's circuital law – Maxwell's third equation, Curl(H)=Jc.Lorentz force equation - force between two straight long and parallel current carrying conductors. Self and mutual inductance – Neumann's formulae – determination of self-inductance of a solenoid and toroid – energy stored and density in a magnetic field.

**UNIT – V: Time Varying Fields**

Time varying fields -Faraday's laws of electromagnetic induction- Its integral and point forms -Maxwell's fourth equation, curl (E), statically and dynamically induced EMFs - modification of Maxwell's equations for time varying fields.

**Text Books**


1. "Engineering Electromagnetics" by William H. Hayt& John. A. Buck Mc. Graw-Hill Companies, 7th Editon.2006.
2. "Theory and Problems of Electromagnetics " by Joseph A. Edminister , Schaum's outline series, Mc Grawhill publications, Second Edition, 1993.


**Reference Books**


1. "Principles Electromagnetic " by Sadiku, Oxford Publications,4th edition, 2009
2. "Introduction to Electro Dynamics" by D J Griffiths, Prentice-Hall of India Pvt. Ltd, 4theditон, 2015
3. "Electromagnetic" by J. D Kraus Mc Graw-Hill Inc. 4th edition 1992.


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*Professional Elective - I*

## DATA STRUCTURES

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To impart knowledge on linear and non-linear data structures.
- To familiarize with different sorting and searching techniques.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate the working process of sorting (bubble, insertion, selection and heap) and searching (linear and binary) methods using a programming language.
- design algorithms to create, search, insert, delete and traversal operations on linear and non-linear data structures.
- evaluate the arithmetic expressions using stacks.
- choose appropriate collision resolution techniques to resolve collisions.
- compare array and linked list representation of data structures.

**Course Content**

**UNIT – I: Searching and Sorting**

Introduction- Concept of data structures, overview of data structures.

**Searching**: Linear search, Binary search.

**Sorting (Internal)**: Basic concepts, sorting by: insertion (insertion sort), selection (selection sort), exchange (bubble sort).

**UNIT – II: Linked Lists**

Linked Lists- Basic concepts and operations of single linked list, circular linked list and double linked list.

**UNIT – III: Stacks and Queues**

Stack: Introduction, representation using arrays and linked list, operations on stack, evaluation of arithmetic expression.

Queue: Introduction, representation using arrays and linked list, operations on queue, circular queue.

**UNIT – IV: Trees**

**Binary Trees**: Basic tree concepts, properties, representation of binary trees using arrays and linked list, binary tree traversals.

**Binary Search Trees**: Basic concepts, BST operations: search, insertion, deletion and traversals, creation of binary search tree from in-order and pre (post) order traversals.

**Heap Trees**: Basic concepts, operations, application-heap sort.

**UNIT – V: Graphs and Hashing**

Graphs- Basic concepts, representations of graphs, graph traversals-breadth first search and depth first search techniques.

**Hashing**: Basic concepts, hashing functions (division method, multiplication method), collision resolution techniques- open hashing and closed hashing.

**Text Books**

1. Fundamentals of Data Structure in C, Horowitz, Sahani, Anderson Freed, University Press, 2nd edition, 2007 .
2. Data Structures, Richard F, Gilberg, Forouzan, Cengage. 2nd edition, 2004.

**Reference Books**

1. Data Structures and Algorithms ,G. A. V. Pai, TMH,2008.
2. Classic Data Structures , Debasis Samanta, 2nd edition, PHI,2008.

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# CONTROL SYSTEMS LAB

III Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Course Objectives**

- To familiarize the performance of linear control systems in a practical environment.
- To impart knowledge on effect of controllers on the performance of linear control systems experimentally.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- compute the characteristics of d.c. servo motors, a.c. servo motors, synchros.
- employ p, pi, pd and pid controllers, lag, lead and lag–lead compensators for process control systems.
- determine the transfer function of d.c. motor and d.c. generator.
- verify the truth tables of logic gates, simple boolean expressions using programmable logic controller.
- apply the programming skills to analyze the behavior of linear control system using MATLAB/Simulink environment.

**List of Experiments**

Any 10 experiments from the following list are required to be conducted:

1. Characteristics of Synchros
2. Programmable logic controller – Study and Verification of truth Tables of logic gates, and simple Boolean Expressions.
3. Effect of feedback on DC servo motor.
4. Effect of P, PD, PI, PID Controller on a second order systems
5. Lag and lead compensation – Magnitude and phase plot
6. Temperature controller using PID
7. Time response analysis of second order system for standard test signals.
8. Transfer function of armature controlled DC motor
9. Transfer function of DC generator
10. Characteristics of AC servo motor
11. Stability analysis of the given control system by Root locus, Bode plot (Simulation Experiment).
12. State space modeling of second order control system (Simulation experiment).

**Additional experiments**

1. Garage Shutter opening and closing using PLC (Virtual lab experiment )
2. Container Filling Process Using PLC (Virtual lab experiment)

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# AC MACHINES LAB

III Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Course Objectives**

- To familiarize the performance of induction and synchronous machines experimentally.
- To provide a practical environment to determine the characteristics of induction and synchronous machines.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- estimate the performance of induction motors and synchronous machines.
- describe the operational behavior of the induction motor under various loading conditions.
- determine the parameters of synchronous machine.
- operate an alternator in parallel with infinite bus bar.
- find operational characteristics of three phase transformer.

**List of Experiments**

Any 10 experiments from the following list are required to be conducted:

1. No Load and Blocked rotor tests on three phase Induction motor.
2. Equivalent circuit of a single phase Induction motor
3. Brake test on three phase slip ring Induction motor.
4. Regulation of a three phase alternator by EMF and MMF methods.
5. Regulation of a three phase alternator by ZPF method.
6. Measurement of sequence impedances of a three phase alternator.
7. Determination of $X_d$, $X_q$ of a salient pole alternator using slip test.
8. Synchronization of an alternator with infinite bus bar.
9. V and inverted V curves of a three phase synchronous motor.
10. Scott connection of transformers.
11. Load test on a three phase alternator.
12. Load test on a three phase transformer.

**Additional experiments**

1. Synchronization of alternator with infinite bus bar.
2. Line Excited Induction Generator.
3. V and inverted 'V' curves of a three phase synchronous motor (Virtual lab experiment).
4. No Load and Blocked rotor tests on three phase Induction motor (Virtual lab experiment).

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## ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB

III Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 4 | Internal Marks | : 15 |
| Credits | : 2 | External Marks | : 35 |

**Course Objectives**

- To develop the skill to perform the experiments individually for measuring various electrical parameters.
- To impart knowledge for analyzing and evaluating the results from the experiments.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- develop the fundamental knowledge and demonstrate various electrical measuring instruments.
- co-relate the theoretical knowledge with the practical electrical measuring system.
- standardize various measuring instruments with the help of standard meters.
- measure unknown values of resistance, inductance and capacitance by balancing the bridges.
- measure various physical quantities using appropriate transducers.

**List of Experiments**

Any 10 experiments from the following list are required to be conducted:

1. Calibration and testing of single phase energy meter.
2. Kelvin's double bridge – measurement of low resistance.
3. Crompton D.C. potentiometer – calibration of PMMC ammeter.
4. Capacitance measurement using Schering Bridge.
5. Inductance measurement using Anderson Bridge.
6. Measurement of parameters of a choke coil using 3 ammeter method.
7. Measurement of 3 phases reactive power with single-phase wattmeter for balanced loading.
8. Calibration LPF wattmeter – by phantom testing.
9. Dielectric oil testing using H.T. testing kit.
10. LVDT– characteristics and calibration.
11. Resistance strain gauge – strain measurement and calibration.
12. Hall effect sensor.

**Additional experiments**

1. Measurement of self inductance by Owen bridge (Virtual lab experiment ).
2. Measurement capacitance by Wien series bridge (Virtual lab experiment).
3. Q meter experiment-To determine the quality factor of an unknown coil (Virtual experiment).
4. Measurement of high resistance by Megohm bridge (Virtual lab experiment).

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## PROBLEMS SOLVING ENHANCEMENT
### (Common to CE, EEE & ME)

III Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Number System**

- Divisibility
- Numbers and Decimal Fractions
- Number System and HCF & LCM

**Mensuration**

- Geometry
- Shapes, Area & Perimeter

**Arithmetic Ability**

- Ages
- Averages
- Equations
- Probability
- Percentages
- Profit & Loss
- Work and Time
- Clocks and Calendar
- Ratios and Proportion
- Series and Progressions
- Allegations and Mixtures
- Distance , Speed and Time
- Permutations and Combinations

*Honors Degree*

## MODERN CONTROL THEORY

III Year – I Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 3 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 4 | | | External Marks | : 70 |

**Course Objectives**

- To acquire knowledge on representation of State Space System and time response on linear systems.
- To acquire knowledge different aspects related to design of state feedback control system.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- develop mathematical models of physical systems.
- analyze the time response of linear systems.
- apply the concept of controllability and observability.
- analyze issues related to the stability of automatic control systems.
- design of feedback controllers for physical systems including state observers.

**Course Content**

**UNIT - I: System Representation**

Introduction to state and state variables - system representation in state variable form - transformations - Phase variable form - Canonical forms – Physical systems - Plant models –Representation using state function .

**UNIT - II: Time Response**

State transition matrix – Properties and methods of evaluation - Time response of linear systems -State diagrams - Resolvant matrix.

**UNIT - III: Controllability and Observability**

Definition and concepts - Criteria for controllability and observability - Tests for controllability and observability for continuous time systems –time invariant case, Principle of Duality.

**UNIT - IV: Stability**

Introduction - definition of stability - stability in the sense of Lyapunov - stability of linear systems and non linear system - generation of Lyapunov functions.

**UNIT - V: Model Control**

Design of State Feedback Control through Pole placement and Ackerman's formula, State observers, Full order observer and reduced order observer, Effect of state feedback on controllability and observability.

**Text Books**

1. M. Gopal: Modern Control Systems Theory, New Age International Publications, 2nd edition, 2005.
2. Katsuhiko Ogata: Modern control Engineering, Prentice-Hall of India, 2010.

**Reference Books**

1. B.C.Kuo, Automatic control systems, Prentice Hall of India, 5thEdition,1988.

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## MICROPROCESSORS, MICROCONTROLLERS AND ITS APPLICATIONS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture : 3 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 4 | | External Marks | : 70 |

**Course Objectives**

- To familiarize with the architecture of 8086 microprocessor and 8051 microcontroller and assembly language programming.
- To emphasize on the concepts of I/O Interfacing with 8086 microprocessor and 8051 microcontroller.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- summarize the basic operations of CPU computer system.
- demonstrate the architecture of 8086 microprocessor and 8051 microcontroller.
- develop assembly language programming for 8086 and 8051.
- interface peripherals with 8086 microprocessor.
- develop the applications using 8051 microcontroller.

**Course Content**

**UNIT – I: Basics of Microprocessor & Microcontroller**

A basic microprocessor system, The CPU, memory I/O organization of microprocessor system, Microprocessor general architecture and its operations: Microprocessor initiated operations, Internal data operations, Peripheral or external initiated operations, Fetch and execute cycles, Difference between microprocessor and microcontroller.

**UNIT – II: Architecture of 8086 Microprocessor**

8086 Architecture, register organization, memory organization, 8086 pin diagram: common function signals, minimum and maximum mode signals. interrupts, Minimum mode and maximum mode based systems, interrupt structure, processing, timing diagrams.

**UNIT – III: Assembly language of 8086 & Interfacing**

Addressing modes, classification of instructions, assembly directives, assembly language programming using data transfer, arithmetic, logical, branch, string instructions, string instructions etc. interfacing with memory & I/O, interfacing with 8255- stepper motor control.

**UNIT – IV: Architechure of 8051**

8051 Architecture, Register organization, memory organization, ports, timers & serial communication, addressing modes, instructions set of 8051.

**UNIT – V: 8051 Applications**

Interfacing with Key board, display devices: LED's, 7 segment display unit& LCD, A/D, D/A, Relays, Sensors.

**Text Books**


1. D.V Hall, "Microprocessors & Interfacing", 2nd Edition, TMH, 2005.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontrollers and Embedded Systems", 2nd Edition, Pearson Education.


**Reference Books**


1. Ramesh.S.Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Prentice Hall, 4th Edition, 2002.
2. M. Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education.
3. Kenneth. J. Ayala, Dhananjay V. Gadre, "The 8051 Microcontroller & Embedded Systems Using Assembly and C", 1st Edition, Cengage learning, 2010
4. K. Ray and K.M. Bhurchandani, "Advanced Microprocessors and Peripherals", 2nd Edition, Tata McGrawHill, 2006.


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# POWER ELECTRONICS

III Year – II Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 3 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 4 | | | External Marks | : 70 |

**Course Objectives**

- To introduce the basic concepts of operation, control and design of various power electronic converters.
- To develop an understanding of the switching behavior and design of power electronics circuits for DC and AC conversions.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the characteristics of power semiconductor devices.
- analyze single phase-controlled converters for different loads.
- analyze three phase-controlled converters for different loads operation of AC voltage controllers.
- realize dc-dc converters with and without electrical isolation
- analyze single phase and three phase inverters for different loads

**Course Content**

**UNIT – I: Power Semi-Conductor Devices**

Silicon Controlled Rectifiers (SCR's) Basic theory of operation of SCR, characteristics, series, and parallel operation, firing circuits, snubbers. Power MOSFETs, Power IGBTs, their Device structure, static and dynamic characteristics, specifications.

**UNIT – II: Single Phase Converters**

Phase control technique – Single phase half wave converter, Semi converter with R, RL loads– Derivation of average load voltage and current. Fully controlled converters-Midpoint and Bridge connections with R, RL loads without and with Freewheeling Diode – Derivation of average load voltage and current, Effect of source inductance– Numerical problems.

**UNIT – III: Three Phase Converters & AC Voltage Controllers**

Three phase converters- half wave converter, semi controlled, fully controlled with R, RL loads-average load voltage with R and RL loads –Dual converters– Numerical problems.

Single phase AC voltage controllers – two SCR's in anti-parallel with R and RL loads-Derivation of RMS load voltage, current and power factor – Numerical problems.

**UNIT – IV: Choppers**

Choppers –Time ratio control and Current limit control strategies – Step down choppers, Derivation of load voltage, voltage gain and currents with R, RL loads- Step up Chopper – load voltage expression.

Buck, boost, and buck boost converters– load voltage expression- numerical problems

**UNIT – V: Inverters**

Commutation circuits of SCRs, Single phase inverter –Bridge inverter– Waveforms – Voltage control techniques for inverters-Three phase –$120^{o}$ and $180^{0}$ modes of operation- Unipolar and bipolar switching of inverters-numerical problems.

**Text Books**

1. Power Electronics – by P.S.Bhimbra, Khanna Publishers.
2. Power Electronics: Circuits, Devices and Applications – by M. H. Rashid, Prentice Hall of India, 2nd edition, 1998.
3. Power Electronics: converters, applications & design by Nedmohan, Tore M. Undeland, Riobbins by Wiley India Pvt. Ltd.

**Reference Books**

1. Power Electronics – by VedamSubramanyam, New Age International (P) Limited, Publishers.
2. Power Electronics - by V.R.Murthy , 1st edition -2005, OXFORD University Press.
3. Power Electronics-by P.C.Sen, TataMcGraw-Hill Publishing.
4. Thyristorised Power Controllers – by G. K. Dubey, S. R. Doradra, A. Joshi and R. M. K.Sinha, New Age International (P) Limited Publishers, 1996.

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# POWER SYSTEM ANALYSIS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture : 2 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 3 | | External Marks | : 70 |

**Course Objectives**

- To formulate load flow problem and develop the algorithms for the solution of it.
- To familiarize the fault analysis and stability in an inter connected power system.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- apply the concept of the per unit system in power system analysis.
- formulate and solve the power flow problem of power system.
- develop and solve the positive, negative, and zero sequence networks for systems consisting of machines, transmission lines and transformers.
- determine the fault voltages and currents for various faults.
- analyze the stability of power system under various disturbances.

**Course Content**

**UNIT – I: Power System Network Representation**

Per UNIT–quantities, single line diagram, Impedance diagram of a power system, Graph theory definition, formulation of Y-Bus by direct inspection method.

Z bus formation, Modification of Z–Bus for the changes in network (Problems).

**UNIT – II: Power Flow Studies**

Necessity of power flow studies – Derivation of Static power flow equations-Guass-Seidel method (limited to 3 buses), algorithm. Newton-Raphson method in polar coordinates form-Derivation of Jacobian matrix, Power flow solution using N-R method (3 bus), Decoupled and Fast decoupled method (3 bus), algorithms.

**UNIT – III: Symmetrical Fault Analysis & Symmetrical Components**

**Symmetrical Fault Analysis:** Three phase short circuit currents and reactance's of synchronous machines, short circuit MVA calculations.

**Symmetrical Components:** Synthesis of unsymmetrical phasors from their symmetrical components, operators, symmetrical components of unsymmetrical phasors, power in terms of symmetrical components, sequence networks-Positive, negative and zero sequence network.

**UNIT – IV: Unsymmetrical Fault Analysis**

Various types of unsymmetrical faults, LG, LL, LLG on unloaded alternator.

**UNIT – V: Power System Stability Analysis**

Classification of stability, description of steady state stability power limits, transfer reactance, synchronizing power coefficient, power angle curve and determination of steady state stability, Derivation of swing equation, determination of transient stability by equal area criterion , application of equal area criterion, methods to improve steady state and transient state stability.

**Text Books**


1. Modern Power system analysis-I.J.Nagrath and D.P.Kothari TMH,4th edition,2011.
2. Power system analysis-Grainger and Stevenson, Tata Mc.Graw Hill, 4th edition, 2017.


**Reference Books**


1. Power system analysis - A. R. Bergen, PHI. 2nd edition,1999.
2. Power system analysis and Design-B.R.Gupta – S.Chand Publications. 3rd edition, 2005.
3. Electrical Power systems –C.L.Wadhwa -New Age International, 7th edition, 2018.


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*Professional Elective - II*

## SWITCH GEAR AND PROTECTION

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To familiarize with the operation of various types of circuit breakers and Relays.
- To introduce the concepts on various protection schemes of Generator, Transformer, Transmission lines and Bus bars.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the operating principles of various types of circuit breakers
- identify suitable relay for a particular application
- select an appropriate protection scheme for the protection of generator and transformer
- apply an appropriate protection scheme for transmission line and bus-bar.
- illustrate different operational procedures to protect equipment from over voltages.

**Course Content**

**UNIT – I: Circuit Breakers**

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages. - Restriking Phenomenon, Average and Max. RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. – Description and Operation of following types of circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

**UNIT – II: Electromagnetic and Static Relays**

Principle of Operation and Construction of Attracted armature-Balanced Beam, induction Disc and Induction Cup relays. **Relays Classification**: Instantaneous, DMT and IDMT types-Application of relays: Over current/ under voltage relays-Direction relays, Differential Relays, Percentage Differential relays-Universal Torque Equation-**Distance Relays**: Impedance Relay-Reactance Mho Relay-Off-set Mho Relays-Characteristics of Distance Relays and Comparison-Static Relays verses Electromagnetic Relays.

**UNIT – III: Generator & Transformer Protection**

Protection of generators against Stator faults-Rotor faults-Abnormal Conditions-Restricted Earth fault-and Inter-turn fault Protection-Numerical Problems on %

Winding Unprotected Protection of Transformers Percentage Differential Protection-Numerical Problem on Design of CT s Ratio-Buchholtz relay Protection.

**UNIT – IV: Feeder and Bus-Bar protection & Grounding**

Introduction-Over Current, Carrier Current-Three-zone distance relay protection using Impedance relays-Translay Relay-Protection of Bus bars-Differential Protection.

**Neutral Grounding:** Grounded and Ungrounded Neutral Systems- Effects of Ungrounded Neutral on system performance- Methods of Neutral Grounding- Solid, Resistance, Reactance- Arcing Grounds.

**UNIT – V: Protection against Over Voltages**

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL, Impulse Ratio, Standard Impulse Test Wave, Volt-Time characteristics.

**Text Books**


1. Electrical Power Systems – by C.L.Wadhwa, New Age international (P) Limited, Publishers, 3rd editon.
2. Power System Engineering by B.L.Soni, Gupta, Bhatnagar, Chakrabarthy, Dhanpat Rai & Co.
3. Switchgear Protection And Power Systems by Sunil S. Rao, Khanna Publishers, 2008 edition.


**Reference Books**


1. Power System Protection and Switchgear by Badri Ram and D N VishwakarmaTata McGraw-Hill Education, 2011
2. Fundamentals of Power System Protection by Paithankar and S.R.Bhide.,PHI, 2003.
3. Principles of Power Systems by V.K Mehta and Rohit Mehta S.Chand& Company Ltd.New Delhi 2004.


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*Professional Elective - II*

## ELECTRICAL AND HYBRID VEHICLES

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To introduce the concepts on working principles of electric drives used for different hybrid electric vehicles.
- To familiarize with the different energy storage systems and their management strategies

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- analyze the impact of electric vehicles on energy, environment and economy
- describe different hybrid drive train topologies and their performance
- analyze various power converter configurations of hybrid electric drives.
- analyze and suggest possible energy storage systems for different applications.
- choose the appropriate energy management strategies for various applications

**Course Content**

**UNIT – I: Introduction to Hybrid Electric Vehicles**

History of hybrid and electric vehicles, electric vehicles, impact of modern drive-trains on energy supplies.

**UNIT – II: Hybrid Electric Drive-trains**

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies.

**UNIT – III: Electric Drive-trains**

Basic concept of electric traction Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC and AC Motor drives

**UNIT – IV: Energy Storage**

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis.

**UNIT – V: Hybridization of energy storage and management strategies**

Hybridization of different energy storage devices.Sizing the drive system: Matching the electric machine, sizing the power electronics, selecting the energy storage

technology. Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies.

**Text Books**


1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press,1st Edition 2004.
2. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles:
3. Principles and Applications with Practical Perspectives", John Wiley & Sons, 2nd Edition2017.


**Reference Books**


1. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2nd Edition, 2020


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*Professional Elective - II*

## DIGITAL CONTROL SYSTEMS

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To introduce the concepts on digital control systems and their associated components.
- To familiarize with the concepts on state model representation of discrete–time systems and its stability testing methods.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the components of digital control systems.
- evaluate the Z- Transforms and mathematical models of linear discrete-time control systems using pulse transfer functions.
- determine the stability of digital control systems.
- employ the state-space models and tests for controllability and observability.
- design a state feedback controller for the desired specifications.

**Course Content**

**UNIT – I: Introduction**

Introduction to analog and digital control systems – Block diagram – Advantages of digital systems – Typical examples – Signals and processing – Sample and hold devices – Sampling theorem and data reconstruction – Frequency domain characteristics of zero order hold.

**UNIT – II: Z–Transformations**

Z–Transforms – Theorems – Finding inverse z–transforms – Formulation of difference equations and solving – Block diagram representation – Pulse transfer functions and finding open loop and closed loop responses.

**UNIT – III: Stability Analysis**

Mapping between the s–plane and the z–plane – Primary strips and complementary strips – Stability criterion – Modified Routh's stability criterion and jury's stability test.

**UNIT – IV: State Space Analysis and the Concepts of Controllability and Observability**

**State Space analysis:** State Space Representation of discrete time systems – solving discrete time state space equations - Discretization of continuous state space equations.

**Controllability and Observability, Canonical Forms:** Concepts of controllability and observability – Tests, canonical forms-controllable canonical form, observable canonical form and jordan canonical form.

**UNIT – V: State Feedback Controllers**

Design of state feedback controller through pole placement – Necessary and sufficient conditions – Ackerman's formula.

**Text Books**


1. Discrete Time Control Systems – K. Ogata, Pearson Education/ PHI, 2nd Edition,2005.
2. Digital Control and State Variable Methods – M. Gopal, Tata McGraw-Hill Companies,4th edition, 2017.


**Reference Books**


1. Digital Control Systems - Kuo, Oxford University Press, 2nd Edition, 2003.
2. Digital Control Systems - H.Houpis Gary G.Lamont Tata McGraw - Hill Companies, 2nd Edition,2007.
3. Modern Digital Control Systems - Raymond G,Jacqot Routledge Publications, 2nd Edition,2019.
4. Digital Control Engineering -M.Sami Fadali Antonio Visioli, Academic Press,2nd Edition,2013.


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*Professional Elective - II*

## INTRODUCTION TO DATA BASE SYSTEMS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize with the concepts of database systems and different issues involved in the database design.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- analyze an information storage problem and derive an information model in the form of an entity relationship diagram.
- write simple and complex queries using Structured Query Language (SQL) for storage, retrieval and manipulation of data in a relational database.
- employ principles of normalisation for designing a good relational database schema.
- describe the issues and techniques relating to transation management and concurrency.

**Course Content**

**UNIT – I: Introduction to Database**

Introduction, Advantages of using DBMS, Data Models, Levels of Abstraction, Entity- Relationship Model: Attributes and Keys, Relationship Types, Weak Entity set, Strong Entity Set, Enhanced E–R Modeling: Specialization and Generalization.

**UNIT – II: Relational Model and SQL**

Relational Model: Basic Concepts, Schema and Instances, Keys, SQL: DDL, DML, Integrity constraints, Defining different constraints on a table, Set operations, Aggregate Functions, Group by and Having clauses, Nested queries.

**UNIT – III: Database Design**

**Functional dependencies**: Partial, full, transitive and trivial dependencies, Axioms, Attribute closure.

**Normal Forms:** 1NF, 2NF, 3NF, and BCNF

**UNIT – IV: Transaction Management**

Transaction concept, ACID properties, Transaction State Diagram, Schedules-Serial, Concurrent and Serializable Schedules, Serializability- Conflict and View serializability.

**UNIT – V: Concurrency Control**

Concurrent Execution of Transactions, Anomalies due to Concurrent Execution, Lock-based protocols-2PL, Strict 2PL and Rigorous 2PL, Timestamp-based protocols, Thomas Write Rule.

**Text Books**

1. Database System Concept , Korth and Sudarshan, 3rd edition, MH.
2. DatabaseManagement Systems Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, MH.

**Reference Books**

1. Fundamentals of Database Systems Elmasri Navrate, 5th Pearson Education.
2. Introduction to Database Systems C.J.Date, 8th Pearson Education.
3. Database Systems design, Implementation, and Management Peter Rob and C Coronel, 7th Edition.

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## MICROPROCESSORS, MICROCONTROLLERS AND ITS APPLICATIONS LAB

III Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Course Objectives**

- To introduce the assembly language programming concepts and interfacing with 8086 microprocessor and 8051 microcontroller.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- perform I/O interface with 8086 microprocessor and 8051 microcontroller.
- perform various programming operations with 8086 microprocessor and 8051 microcontroller.

**List of Experiments**

Part A: Assembly Language Programming Experiments using 8086

1. Implementation of simple Hexadecimal, decimal arithmetic, and bit manipulation operations.
2. Implementation of code conversion between BCD, Binary, Hexadecimal and ASCII.
3. Implementation of searching and sorting of 8-bit & 16-bit numbers, String manipulations. Ex: Block transfer of data etc.

**Part B: Interfacing Experiments with 8086 through Assembly Language Programming**

4. Develop a stepper motor interface and write a program for rotating through any given sequence.
5. Develop a Digital-to-Analog Converter interface and write a program for waveform generation.
6. Develop an Analog-to-Digital Converter interface and write a program for analog signal to digital conversion.
7. Implementation of 2's complement and decoder functionalities using DIDO interface.

**Part C: Assembly Language Programming Experiments in 8051 using Keil**

8. Develop a Program to interface seven segment display to port1 and port2 and display the count from 00 to FFH
9. Implement the functionality of traffic signal controller using 8051 microcontroller.

10. Develop a Program to display the given string on LCD.
11. Open ended Experiment.

**Reference Books**


1. D. V. Hall, "Microprocessors and Interfacing", 2nd Edition, Tata McGrawHill,2006
2. Barry B.Brey, "The Intel Microprocessors", 7thEdition, PHI, 2006.
3. M.A. Mazidi, J.G. Mazidi, R.D. Mckinlay, "The 8051 microcontroller and embedded systems", 2nd Edition, Pearson Education.


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# AUTOMATION OF ELECTRICAL SYSTEMS USING IOT

III Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 4 | Internal Marks | : 15 |
| Credits | : 2 | External Marks | : 35 |

**Course Objectives**

- To familiarize with method of interfacing different sensors with Arduino/ Raspberry Pi.
- To provide skill for implementing IoTconceptsto Electrical applications.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- interface different sensors to Arduino / Raspberry Pi.
- interface Bluetooth to Arduino / Raspberry Pi and communicate data to Smartphone.
- operate a motor, relay, monitor data and detect faults using IoT.
- create servers for IoT applications.

**List of Experiments**

Any 10 experiments from the following list are required to be conducted:

**Assembly Language Programming Exercises/Experiments using 8086 Trainer kit**

1. Familiarization with Arduino/ Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer/push button with Arduino/Raspberry Pi and write a program to turn on LED for 1 sec after every 5 seconds and whenever the push button is pressed.
3. To interface digital sensor (IR/LDR/DHT11) with Arduino /Raspberry Pi and write a program to print the readings.
4. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send data to a smart phone using Bluetooth.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn on when push button is pressed.
6. Operation of Smart Energy Grid with IoT.
7. To operate Circuit Breaker with IoT based system.
8. Energy Meter with Current, Voltage and Cost Monitoring System with theft based on IoT.

9. Solar Power Monitoring using IoT.
10. To Detect Underground Cable Fault using IOT.
11. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
12. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidly data to UDP client when requested.

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## LINGUISTIC COMPETENCY BUILDING
### (Common to All Branches)

III Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

- Analytical skills
- Innovative and creative thinking
- A lateral mindset
- Adaptability and flexibility
- Level-headedness
- Initiative
- Teamwork
- Influencing skills
- Preparing professional resume
- Preparing for ivrs — Communication Skills evaluation tools like = VERSANT (pearson), SWAR(Aspiring Minds) Etc.

**Elementary Statistics**

- Mean, Median, Mode, Standard Deviation and Variance

**Data Interpretation**

- Tabular Data Interpretation
- Graphical Data Interpretation
- Pie Charts Data Interpretation

**Simplifications & Approximations**

- Simple Arithmetic Calculations

**Usage of Language - Corporate Context**

- Body Language and Professional Phrases
- Corporate etiquette
- protocol to be followed in Virtual Interview
- Online Meetings and Telephonic Interviews

*Honors Degree*

## ARTIFICIAL INTELLIGENCE TECHNIQUES

III Year – II Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 3 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 4 | | | External Marks | : 70 |

**Course Objectives**

- To have knowledge on concept of neural network and training algorithms.
- To have the knowledge on fuzzy logic and design of fuzzy logic controllers.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe fundamental principles of artificial intelligent techniques
- explain learning tasks and algorithms for Neural Networks.
- create, analyze and work with fuzzy sets.
- design fuzzy logic controller for an appropriate system with fuzzy logic components.
- design fuzzy logic controllers for power engineering applications.

**Course Content**

**UNIT - I: Artificial Neural Networks**

**Introduction**: Artificial Neural Networks (ANN) – definition and fundamental concepts – Biological neural networks – Artificial neuron – activation functions – setting of weights – typical architectures – biases and thresholds – learning/ training laws and algorithms. Perceptron – architectures, ADALINE and MADLINE – linear separability.

**UNIT - II: ANN Paradigms**

ADALINE – feed forward networks – Back Propagation algorithm- number of hidden layers – gradient decent algorithm – Radial Basis Function (RBF) network.)– Hopfield Neural Network.

**UNIT - III: Classical and Fuzzy Sets**

Introduction to classical sets- properties, Operations and relations; Fuzzy sets, Membership, Operations, Properties, Fuzzy relations, Cardinalities, Membership functions.

**UNIT - IV: Fuzzy Logic System Components**

Fuzzy Logic Controller (FLC): Fuzzy logic system components: Fuzzification, Inference engine (development of rule base and decision making system), Defuzzification to crisp sets- Defuzzification methods.

**UNIT - V: Application of AI Techniques**

Speed control of DC motors using fuzzy logic –load flow studies using back propagation algorithm, single area and two area load frequency control using fuzzy logic.

**Text Books**


1. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.
2. Fuzzy logic with Fuzzy Applications – T.J Ross – McGraw Hill Inc, 1997.


**Reference Books**


1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S.Rajasekaran and G.A.VijayalakshmiPai – PHI Publication. 2011
2. Introduction to Fuzzy Logic using MATLAB by S N Sivanandam, SSumathi,S N Deepa- Springer,2007.


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# UTILIZATION OF ELECTRICAL ENERGY

IV Year – I Semester

| | | | | | |
|---|---|---|---|---|---|
| Lecture | : 3 | Tutorial | : 1 | Internal Marks | : 30 |
| Credits | : 4 | | | External Marks | : 70 |

**Course Objectives**

- To impart knowledge on electric heating and welding methods for residential, commercial and industrial applications.
- To familiarize the laws of illumination, working principle of different lamps and concepts of electric traction.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe various electric heating methods.
- identify a suitable welding method for a given application.
- design illumination systems for residential, commercial and industrial environments.
- analyze various speed time curves of electric traction.
- determine the tractive effort, power and specific energy consumption of electric traction.

**Course Content**

**UNIT – I: Electric Heating**

Advantages and methods of electric heating; resistance heating, induction heating and dielectric heating-Working principle and applications.

**UNIT – II: Electric Welding**

Electric welding: Types of electric welding, resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding, resistance and arc welding comparison.

**UNIT – III: Illumination**

**Introduction to sources of light:** Different sources of light, terms used in illumination, laws of illumination.

**Types of Lamps:** Incandescent lamp and fluorescent tubes, MV and SV lamps, Comparison between Incandescent lamp and fluorescent tube, design of interior and exterior lighting systems.

**UNIT – IV: Electric Traction – I**

Systems of electric traction and track electrification.-Review of existing electric traction systems in India, Special features of traction motor, Mechanics of train movement, Speed-time curves for different services, trapezoidal and quadrilateral speed time curves.

**UNIT – V: Electric Traction – II**

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.

**Text Books**


1. Utilization of Electric Energy by Garg and Giridhar, Khanna Publishers, First Edition, 1982.
2. Art & Science of Utilization of electrical Energy by H.Partab, Dhanpat Rai & Sons, second edition, 1999.


**Reference Books**


1. Utilization of Electrical Power including Electric drives and Electric Traction by N.V.Suryanarayana, New Age International (P) Limited, First Edition, 1996.
2. Generation, Distribution and Utilization of electrical Energy by C.L. Wadhwa, Wiley Eastern Limited, second edition, 1997.


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*Professional Elective - III*

## DIGITAL IMAGE PROCESSING

IV Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To introduce fundamental concepts of image processing and different operations on image elements.
- To expose students to the practical problems associated with processing of an image and to familiarize with advanced image processing operations.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- review the fundamental concepts of a digital image processing system.
- evaluate the techniques for image enhancement
- differentiate various image restoration techniques.
- interpret image segmentation and representation techniques.
- categorize various compression techniques

**Course Content**

**UNIT – I: Digital Image Fundamentals**

Digital Image fundamentals, Components of Digital Image Processing, Sampling and Quantization, Relationship between pixels.

**Image Transforms**: 2-D FFT, Walsh transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform.

**UNIT – II: Image Enhancement (Spatial Domain)**

Introduction, Image Enhancement in Spatial domain, Enhancement through point operation, Types of point operation, Histogram manipulation, Linear and nonlinear gray level Transformation, Local or neighborhood operation, Median filter, Spatial domain High-pass filtering.

**Image Enhancement (Frequency Domain):** Filtering in Frequency domain, Obtaining frequency domain filters from spatial filters, Generating filters directly in the frequency domain, Low pass (Smoothing) and High pass (Sharpening) filters in frequency domain.

**UNIT – III: Image Restoration**

Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration.

**UNIT – IV: Image Segmentation**

Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation.

**Morphological Image Processing**: Dilation and Erosion; Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, The Hit or Miss Transformation.

**UNIT – V: Image Compression**

Redundancies and their removal methods, Fidelity criteria, Image compression models, Huffman and Arithmetic Coding, Error free compression, Lossy compression, Lossy and Lossless Predictive Coding, Transform based Compression, JPEG 2000 Standards.

**Text Books**


1. Digital Image Processing Rafael C. Gonzalez and Richard E. Woods, 2nd edition, Pearson Eduction, 2003. except image transforms).
2. Digital Image Processing , S.Sridhar, Oxford University Press, 2011.


**Reference Books**


1. Fundamentals of Digital Image Processing, Anil K. Jain, Prentice Hall of India,2nd edition, 2004.
2. Digital Image Processing , S.Jayaraman, Tata McGraw-Hill Education, 2011.


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*Professional Elective - III*

## DIGITAL SIGNAL PROCESSING

IV Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To familiarize with the basic concepts of discrete time signals and systems
- To introduce the concepts of Z-transform and frequency domain representation of discrete time signals and to familiarize with the designing of digital filters and their realization.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- distinguish the signals, perform various operations on signals and process signals in the discrete domain.
- compute the Fourier series coefficients and z-transform of discrete time signals.
- apply various transform techniques on discrete time signals.
- design IIR filters for a given specifications.
- categorize various windowing techniques to design FIR filters.

**Course Content**

**UNIT – I: Discrete Time Signals and Systems**

Discrete time signals - elementary discrete time signals, basic operations on sequences, classification, discrete time systems - classification, discrete time linear Time Invariant systems and their properties, convolution sum.

**UNIT – II: Z-Transform and Discrete Fourier Series**

Z Transform of sequence, properties of ROC, properties of Z transform, inverse Z transform- partial fraction method.

**Discrete Fourier series:** Fourier series for discrete time periodic signals, Fourier Transform for discrete time non-periodic signals, energy density spectrum, relationship of Fourier transform to Z transform, frequency response.

**UNIT – III: Discrete Fourier Transform**

Frequency sampling- Discrete Fourier Transform (DFT), properties of DFT, linear convolution of sequences using DFT, relationship between DFT and Z transform.

**Fast Fourier Transforms (FFT):** Fast Fourier Transform-Radix-2 decimation in time and in frequency FFT algorithms, IDFT using FFT algorithms.

**UNIT – IV: Design of IIR Filters**

Analog filter approximation-Butterworth and Chebyshev (Type-I) filters, design of IIR filters from analog filters- Impulse Invariant technique, Bilinear transformation.

**UNIT – V: Design of FIR Filters**

Linear Phase FIR filters-frequency response, Fourier Series method of designing FIR filter, design of FIR filters using windows (Rectangular, Bartlett, Hamming, Hanning)

**Realization of Digital Filters:** Realization of IIR Filters**-** Direct form I, II; realization of FIR filters**-** transversal structure, cascade realization

**Text Books**

1. Digital Signal Processing, Principles, Algorithms, and Applications, John G. Proakis, Dimitris G.Manolakis, Pearson Education / PHI, 2013.

**Reference Books**

1. Discrete Time Signal rocessing, A.V.Oppenheim and R.W. Schaffer, 2nd Edition, PHI.
2. Digital Signal Processing, Andreas Antoniou, TATA McGraw Hill, 2006.
3. Digital Signal Processing ,MH Hayes, Schaum's Outline Series, TATA Mc-Graw Hill, 2007.

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*Professional Elective - III*

## PRINCIPLES OF VLSI DESIGN

IV Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To introduce about planar technology, electrical properties of MOS, CMOS and BiCMOS circuits.
- To familiarize with scaling concepts in VLSI, and design of logic gates, subsystems, using CMOS logic and to introduce the concepts of FPGA design flow.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- dissimate various IC fabrication technology and various electrical properties of MOS, CMOS and BiCMOS circuits.
- realize various logic circuits using nMOS, CMOS, and BiCMOS logic.
- apply scaling models to MOS circuit
- design subsystem components using different logic styles in CMOS
- construct CMOS static and dynamic circuits

**Course Content**

**UNIT – I: Introduction to IC Technology**

Moore's Law, IC Era, International Technology Roadmap for Semiconductor (ITRS), Fabrication processing steps for Bipolar and MOS transistors (NMOS, PMOS, CMOS and BiCMOS).

**UNIT – II: Basic Electrical Properties of MOS, CMOS and BiCMOS Circuits**

Threshold Voltage $V_t$, $I_{ds}$ -$V_{ds}$ relationship, Transconductance$g_m$, Output conductance gds, Figure of merit $ù_0$; MOS, CMOS and BiCMOS inverters, $Z_{pu}$/ $Z_{pd}$ ratios of inverters, latch-up in CMOS circuits.

**UNIT – III: MOS Circuit Concepts and Scaling**

Sheet resistance, Rs concept applied to MOS transistors and inverters, area capacitance of layers, standard unit of capacitance, wiring capacitances, delay unit and inverter delays. Scaling models and factors, scaling factors for device parameters, limitations of scaling.

**UNIT – IV: Subsystem Design & Processes**

Switch logic, Pass transistors and Transmission gates, Inverter, Two-input NMOS, CMOS, & BiCMOS NAND and NOR gates, other forms of CMOS logic : Pseudo

NMOS, dynamic CMOS, $C^2$MOS logic, CMOS domino logic, np CMOS logic, some general considerations, illustration of design processes: general arrangement of a 4 – bit arithmetic processor.

**UNIT – V: Semiconductor Memories**

Dynamic RAM, DRAM cell types, operation of Three-transistor DRAM cell, Operation of One- transistor DRAM cell, Static RAM, Full CMOS SRAM cell, CMOS SRAM cell design strategy, operation of SRAM, SRAM Read and Write Circuitry.

**Text Books**


1. Essentials of VLSI Circuits and Systems", by Kamran Eshraghian, Douglas A Pucknell and Sholeh Eshraghian, Prentice-Hall of India, 2018.
2. CMOS Digital Integrated Circuits: Analysis and Design", by Sung-Mo Kang, Yusuf Leblebici, Tata McGraw Hill, 3rd Edition, 2006.


**Reference Books**


1. Principles of CMOS VLSI Design: A systems perspective, by Weste, Neil H.E, & Kamran Eshraghian, 2nd Edition, Pearson Education, 2000.
2. Digital Design: Principles & practices", by John F.Wakerly, 3rd Edition, Prentice Hall, 2001.


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*Professional Elective - III*

## CMOS DIGITAL IC DESIGN

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce about planar technology, electrical properties of MOS, CMOS and BiCMOS circuits.
- To familiarize the students with the design of CMOS digital circuits.
- To make the students understand the impact of interconnects on the delay offered by digital logic circuits.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- characterize the behaviour of CMOS inverter
- design various combinational and sequential circuits using CMOS logic
- identify different components contributing to delay offered by interconnects
- design complex digital circuits.
- design memory based array structures.

**Course Content**

**UNIT – I: The CMOS Inverter**

The static CMOS inverter, static behavior, dynamic behavior, power, energy and energy delay, technology scaling and its impact on the inverter metrics.

**UNIT – II: Combinational Logic Design in CMOS**

Static CMOS design, dynamic CMOS design, choosing a logic style, designing logic for reduced supply voltages.

**UNIT – III: Sequential Logic Design in CMOS**

Timing metrics for sequential circuits, classification of memory elements, static latches and registers, dynamic latches and registers, pipelining, non-bistable sequential circuits.

**UNIT – IV: Interconnects and Designing Complex Digital Integrated Circuits**

Capacitive parasitics, resistive parasitics, inductive parasitics.

Standard-cell design approach, array-based design, configurable and reconfigurable design.

**UNIT – V: Designing Memory Array Structures**

Semiconductor memories, memory core, memory peripheral circuitry, design of PLA.

**Text Books**

1. Digital Integrated Circuits: A Design Perspective, by Jan M. Rabaey, Anantha Chandrakasan, BorivojeNikolic, Pearson Education Inc., Second Edition.

**Reference Books**

1. CMOS Digital Integrated Circuits: Analysis and Design. Sung-Mo Kang, by Yusuf Leblebici, TMH Education, Third Edition, 2003.
2. Analysis and Design of Digital Integrated Circuits, by David A. Hodges, Horace G. Jackson, Resve A Saleh,, McGraw-Hill Higher Education, 3rd edition (2003)
3. Digital Integrated Circuits", by Amitava Dasgupta, NPTEL Video Course, Department of Electrical Engineering, IIT Madras.

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*Professional Elective - IV*

## POWER SYSTEM OPERATION AND CONTROL

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize with the optimal generation allocation of power system with and without losses.
- To introduce the concepts of load frequency control and steady state response of single and two area systems.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- estimate optimal generation schedule with and without losses and to compute loss coefficients and transmission losses.
- find the solution for short term hydrothermal scheduling problems.
- determine the steady state changes in frequency in single area load frequency control.
- determine the steady state changes in frequency in two area load frequency control.
- suggest suitable voltage control method for different applications.

**Course Content**

**UNIT – I: Economic Operation of Power System**

Optimal operation of Generators in Thermal Power Stations, heat rate Curve – Cost Curve, Incremental fuel cost, input output characteristics, Optimum generation allocation with line losses neglected. Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula.

**UNIT – II: Hydrothermal Scheduling**

Optimal scheduling of Hydrothermal System, scheduling problems – short term Hydrothermal scheduling problem.

**UNIT – III: Single Area Load Frequency Control**

Necessity of keeping frequency constant, modeling of speed governing system, modeling of steam turbine, generator, Definition of Control area – Single area control – Block diagram representation of isolated power system – Steady state analysis – Dynamic response – Uncontrolled case.

**UNIT – IV: Load Frequency Controllers & Two Area Load Frequency Control**

Proportional plus integral control of single area and its block diagram representation, steady state response – Load frequency control and economic dispatch control. Load frequency control of two area system – uncontrolled case and controlled case, tie-line bias control.

**UNIT – V: Voltage Control & Emergency Control**

Different voltage control methods: Shunt, Series compensation, on-load tap changing transformer, booster transformer, Alternator voltage regulator (AVR), Emergency control: Concepts, Coherent area dynamics, stability enhancement methods, Average system frequency, center of Inertia.

**Text Books**

1. Electric Energy systems theory: Olle I.Elgerd TMH, 2nd edition.
2. Power Systems Engineering : IJ Nagarath & DP Kothari – TMH.

**Reference Books**

1. Power System Analysis: Hadi Saadat - TMH.
2. Power System Analysis & Stability – S.S vadhera Khanna Publishers.
3. Power System Engineering, Chakravarthy, Soni, Gupta & Bhatnagar, Dhanapat Rai & Sons.
4. Power System Stability and Control, by P. Kundur, New York, McGraw-Hill, 1994.

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*Professional Elective - IV*

## BIG DATA ANALYTICS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To optimize business decisions and create competitive advantage with Big Data analytics
- To introduce the architectural concepts of Hadoop, HDFS and Map Reduce paradigm.
- To introduce programming tools Pig , Hive in Hadoop echo system.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- illustrate the importance of big data and challenges of conventional systems.
- outline the building blocks of hadoop and basic file system operations.
- analyze data with hadoop Map Reduce framework.
- process the data in hadoop environment using Pig and Hive to solve real world and industrial problems.
- enumerate the open source frameworks used to efficiently store and process large data sets.

**Course Content**

**UNIT – I: Introduction to Big Data**

What is big data, Meet Hadoop – Data, Characteristics of Big Data, Data Storage and Analysis, Comparison with other systems: Relational Database Management Systems, Grid computing and Volunteer Computing.

**UNIT – II: Hadoop and HDFS**

Introduction to Hadoop, Brief history of Hadoop, Apache Hadoop eco system. The design of Hadoop Distributed File System (HDFS), Architecture, Building blocks of Hadoop: Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker, Basic File System Operations.

**UNIT – III: Map Reduce**

JAVA Map Reduce, Introduction to Weather Dataset, Analyzing weather data with UNIX tools, Analyzing weather data with Map and Reduce, Word Count Program using Map Reduce, Combiner Functions, Running a Distributed Map Reduce Job, Anatomy of a Map Reduce Job Run, Shuffle and Sort.

**UNIT – IV: Pig - Hadoop Programming Made Easier**

Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Uncovering Pig Latin structures, Looking at Pig data types and syntax, Evaluating Local and Distributed Modes of Running Pig scripts, Checking Out the Pig Script Interfaces, Scripting with Pig Latin.

**UNIT – V: Hive –A data warehouse in Hadoop**

What is Hive? The Hive shell, Hive Services, The Metastore, Comparison with traditional Databases, HiveQL, Data types, Operators and Functions, Tables, Managed tables and External Tables, Partitions and Buckets, Importing data, Altering Tables, Dropping Tables,. Querying Data, Sorting and Aggregating, Joins, Subqueries, Views, What is UDF ? Types of Hive UDFs.

**Text Books**


1. Tom White, "Hadoop: The Definitive Guide", O'reilly Media, Fourth Edition, 2015.
2. Dirk deRoos, Paul C. Zikopoulos, "Hadoop for Dummies" John Wiley & Sons, Inc., 2014.


**Reference Books**


1. Paul Zikopoulos, Chris Eaton, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st edition, TMH.
2. Chuck Lam, "Hadoop in Action", 1st edition, Manning Publications.


**Web Link**

1. Hadoop:http://hadoop.apache.org/
2. Hive:https://cwiki.apache.org/confluence/display/Hive/Home.
3. Piglatin: http://pig.apache.org/docs/r0.7.0/tutorial.html.

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*Professional Elective - IV*

## POWER SEMICONDUCTOR DRIVES

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize the need of Electrical drive system and to envisage the use of single phase, three - phase full controlled, half controlled converter and chopper to different motor drives.
- To introduce the control operation of synchronous and asynchronous drives.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- identify an appropriate converter for speed control of dc drive to meet the requirements of application in Industry.
- describe the operational characteristics of DC drive in all four quadrants.
- analyze the concepts of Chopper controlled DC drives.
- choose an appropriate speed control method for Induction motor drive to meet the requirements of application in Industry.
- select an appropriate speed control scheme for Synchronous motor drive to meet the requirements of application in Industry

**Course Content**

**UNIT – I: Control of DC Motors by Single Phase and Three Phase Converters**

Introduction, Single Phase fully controlled converter for separately excited DC motor drives and DC series excited motor- (continuous current operation only), Speed and Torque expressions and characteristics, numerical problems.

Three phase fully controlled converters fed to DC separately excited and DC series motors (continuous current operation only) – Speed and Torque expressions and characteristics – numerical problems.

**UNIT – II: Four Quadrant Operation of DC Drives**

Introduction to Four quadrant operation – Four quadrant operation of D.C motors by dual converters, Electric Braking – Plugging, Dynamic and Regenerative Braking operations. Closed Loop operation of converter controlled for separately excited DC motor (Block Diagram Only).-Numerical problems.

**UNIT – III: Control of DC Motors by Choppers**

Introduction, principle of chopper operation, control techniques used in DC choppers. Single quadrant, two –quadrant and four quadrant chopper fed dc separately excited

and series excited motors (Continuous current operation) and their Output voltage and current wave forms – Speed torque expressions. Numerical Problems.

**UNIT – IV: Control of Induction Motor from Stator and Rotor Side**

Stator voltage control: Stator voltage control, Variable frequency characteristics, voltage source inverter (VSI) fed Induction motor drive .Variable voltage and frequency control of induction motor by Voltage source Inverter —speed torque characteristics. Numerical problems on voltage control, frequency control and v/f control method.

Rotor Side control: Static rotor resistance control – Slip power recovery Schemes – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – Numerical Problems on static rotor resistance control

**UNIT – V: Control of Synchronous Motors**

Types of control, Separate control &self-control of synchronous motors –VSI fed self-controlled synchronous motor drive, synchronous operation from fixed frequency supply.

**Text Books**


1. Fundamentals of Electric Drives – by G K Dubey Narosa Publications-Second Edition (***1*** January 2010)
2. Power Semiconductor Drives By P. V. Rao - BSP - *Publication* - 20 November 2019


**Reference Books**


1. "S K Pillai", A First course on Electrical Drives, New Age International (P) Ltd. 2nd Edition. 1989.
2. Modern Power Electronics and AC Drives by B.K.Bose, 1st Edition, Pearson Education, 2003.
3. Power semiconductor drives by S. Shivanagaraju, M Bala subbareddy, A. Mallikarjun prasad, PHI publications, Eastern economy Edition, 2012.


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*Professional Elective - IV*

## SPECIAL ELECTRICAL MACHINES

IV Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To familiarize the students with the constructional details, operating principles, theory of torque production, control and characteristics of various Special electrical machines.
- To expose the students to different control practices associated with various Special electrical machines and applications of special electrical machines.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the working principles and applications of Switched Reluctance Motors.
- describe the operating principles , constructional details , and applications of Synchronous Reluctance Motors.
- analyze the speed-torque characteristics of Permanent Magnet Brushless D.C. Motors.
- describe the types of stepper motors ,constructional and operating principles, control schemes and applications of various Stepper Motors.
- explain the importance of various linear motors , constructional details and principle of operation and applications of linear motors.

**Course Content**

**UNIT – I: Switched Reluctance Motors**

Constructional features – Principle of operation – Torque Equation – Torque Speed characteristics – Closed loop control of SRM – Applications.

**UNIT – II: Synchronous Reluctance Motors**

Constructional features – Types – Axial and Radial flux motors – Operating principles – Synchronous Reluctance Motors – Phasor diagram and Torque Equation – Voltage equation – Applications.

**UNIT – III: Permanent Magnet Brushless D.C. Motors**

Constructional features – Principle of operation – EMF equations – Torque and Speed characteristics – control of PMBLDC motor –Applications.

**UNIT – IV: Stepper Motors**

Constructional features – Types – VR and permanent magnet motors – Principle of operation – Closed loop control – Applications.

**UNIT – V: Linear Motors**

Goodness Factor – Linear Induction motor (LIM) classification – Construction – Principle of operation – Linear Synchronous motor (LSM) – Types –constructional features – Applications of Linear Motors.

**Text Books**


1. 'Special Electrical Machines' K. Venkata Ratnam, University press, New Delhi, 2009.
2. Special Electrical Machines' E.G.Janardhan,PHI Learning Pvt. Ltd., 2014.
3. "Brushless Permanent Magnet & Reluctance Motor Drives', T.J.E. Miller, Clarenden press, 1989, Oxford
4. 'Stepping Motors and their Microprocessor Controls', Kenjo, T., Clarendon Press, 1984.


**Reference Books**


1. 'Special Electrical Machines', Dayalini, Anuradha Publishers, 2018
2. 'Electric Motor Drives - Modeling, Analysis, and Control', R.Krishnan, Prentice Hall of India Pvt Ltd, 2003.
3. A History of Linear Electric Motors, Eric R. Laithwaite, Macmillan Education UK, 1987.


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*Professional Elective - V*

## HIGH VOLTAGE ENGINEERING

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize breakdown mechanisms in solids, liquid, gases, dielectrics and applications of high voltage engineering.
- To impart knowledge on various methods to generate and measure of high DC, AC and impulse voltages.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- analyze the behavior of gases, liquid and solid dielectric material under different circumstances.
- explain principles of theory of high voltage generation and impulse currents.
- describe the principles of theory of measurement of high voltages and currents.
- identify the testing techniques for high voltage apparatus.
- apply the high voltage engineering to industry.

**Course Content**

**UNIT – I: Break down in Gaseous, Liquid and Solid Dielectric**

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. Breakdown mechanisms in solid dielectric- intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice.

**UNIT – II: Generation of High Voltages and Impulse Current**

Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents.

**UNIT – III: Measurement of High Voltages and Currents**

Measurement of high direct current voltages, measurement of high voltages alternating and impulse, measurement of high currents-direct current, alternating and impulse.

**UNIT – IV: High Voltage Testing of Electrical Apparatus**

Testing of insulators, testing of bushings, testing of circuit breakers, testing of cables, testing of surge arresters, radio interference measurements.

**UNIT – V: Industrial Application to High Voltage Engineering**

Electrostatic precipitator, electrostatic separator, electrostatic imaging, electrostatic coating/painting.

**Text Books**


1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition, 2004.
2. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition, 2000 .
3. High-voltage engineering: theory and practice by mazen abdel-salam, new york : m. Dekker, . 2nd edition, 2000.


**Reference Books**


1. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 3rd Edition, 1997.
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.


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*Professional Elective - V*

## CYBER SECURITY

IV Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To expose the multiple cyber security technologies, processes, and procedures.
- To analyze the threats, vulnerabilities and risks present in these environments.
- To develop appropriate strategies to mitigate potential cyber security problems.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate the fundamentals of cyber crimes and information security systems.
- analyze and resolve security vulnerabilities in networks and computer systems to secure an it infrastructure.
- develop a security architecture for an organization which can handle mobile, wireless devices and related security issues.
- use the cybercrime tools and methods in solving real world problems
- analyze web and internet security threats and find the solutions

**Course Content**

**UNIT – I: Introduction to Cybercrime**

Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

**UNIT – II: Cyber offenses**

Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

**UNIT – III: Cybercrime-Mobile and Wireless Devices**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT – IV: Tools and Methods Used in Cybercrime**

Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (IDTheft).

**UNIT – V: Web and Network Security**

Introduction, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Overview of Vulnerability Scanning, Scanning for Web vulnerabilities, Firewalls, Packet Filters, How a firewall protects a network.

**Text Books**

1. Nina Godbole and SunitBelpure, ¯Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives , 1st Edition Publication Wiley, 2011.
2. Mike Shema, ¯Anti-Hacker Tool Kit (Indian Edition) ,1st Edition Publication Mc Graw Hill.

**Reference Books**

1. Mark Rhodes, Ousley, Information Security, 1st Edition ,MGH, 2013.

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*Professional Elective - V*

## FLEXIBLE AC TRANSMISSION SYSTEMS

IV Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To Introduce the Flexible AC Transmission System devices for understanding the control of power flow in transmission lines.
- To familiarize the students with the basic types of FACTS controllers.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the role of FACTS devices for enhancing power handling capacity in the transmission network.
- apply the knowledge of voltage source converters and / or current converter in FACTS concepts.
- develop the knowledge of static shunt compensation using various FACTS devices.
- describe the operation of SVC and STATCOM.
- identify suitable controller of series compensation.

**Course Content**

**UNIT – I: FACTS Concepts**

FACTS concepts, Transmission interconnections, power flow in an AC System, loading capability limits, Dynamic stability considerations, importance of controllable parameters, basic types of FACTS controllers, benefits from FACTS controllers.

**UNIT – II: Converters**

Single phase, three phases, full wave bridge converters, transformer connections for 12 pulse, 24 and 48 pulse operation. Three level voltage source converter, pulse width modulation converter, basic concept of current source converters, and comparison of current source converters with voltage source converters.

**UNIT – III: Static Shunt Compensation**

Objectives of shunt compensation, midpoint voltage regulation, voltage instability prevention, improvement of transient stability, Power oscillation damping, methods of controllable var generation, variable impedance type static var generators, switching converter type var generators, hybrid var generators**.**

**UNIT – IV: SVC and STATCOM**

The regulation and slope transfer function and dynamic performance, transient stability enhancement and power oscillation damping, operating point control and summary of compensation control.

**UNIT – V: Static Series Compensators**

Concept of series capacitive compensation, improvement of transient stability, power oscillation damping, functional requirements. GTO thyristor controlled series capacitor (GSC), thyristor switched series capacitor (TSSC), and thyristor controlled series capacitor (TCSC), control schemes for GSC, TSSC and TCSC.

**Text Books**

1. Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems by NARAIN G. HINGORANI and LASZLO GYUGY of Wiley - IEEE press 10 December 1999.
2. HVDC & FACTS Controllers: applications of static converters in power systems, by Vijay K.Sood-. Print ©2004 Kluwer Academic Publishers

**Reference Books**

**1.** "Flexible AC Transmission systems" by Sang.Y.H and John. A.T, IEEE Press (2006).

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*Professional Elective - V*

## ARTIFICIAL NEURAL NETWORKS AND FUZZSY SYSTEMS

IV Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To introduce the concepts on Neural Networks and fuzzy logic
- To familiarize with the applications of AI techniques.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe fundamental principles of Artificial Intelligent Techniques (AIT).
- explain learning tasks and algorithms for Neural Networks.
- analyze different architectures of artificial neural networks and/or discuss ANN applications.
- create, analyze and work with fuzzy sets.
- design fuzzy logic controller for an appropriate system with fuzzy logic components.

**Course Content**

**UNIT – I: Introduction to AI techniques**

Introduction to artificial intelligence systems– humans and computers – knowledge representation – learning process – learning tasks – AI techniques.

**UNIT – II: Neural Networks**

Organization of the brain – biological neuron – biological and artificial neuron models, MC Culloch-pitts neuron model, activation functions, learning rules, neural network architectures - single-layer feed-forward networks: – perceptron, learning algorithm for perceptron - limitations of perceptron model

**UNIT – III: ANN Paradigm**

Multi-layer feed-forward network (based on back propagation algorithm)– radial-basis function networks- bidirectional associative memory, BAM stability theorem. ANN applications : load forecasting.

**UNIT – IV: Classical and Fuzzy Sets**

Introduction to classical sets – properties – operations and relations – fuzzy sets –membership – uncertainty – operations – properties – fuzzy relations – cardinalities – membership functions.

**UNIT – V: Fuzzy Logic System Components**

Fuzzification – membership value assignment – development of rule base and decision making system – defuzzification to crisp sets – defuzzification methods, fuzzy logic applications : speed control of DC and AC motors.

**Text Books**

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by S.Rajasekaran and G.A. Vijayalakshmi Pai – PHI Publications.
2. Fuzzy logic with fuzzy applications- by T.J. Ross, TMH, 2010.

**Reference Books**

1. Introduction to Artificial Neural Systems – Jacek M. Zurada, Jaico Publishing House, 1997.
2. Fundamentals of Neural Networks Architectures, Algorithms and Applications by laurene Fausett, Pearson.
3. Neural Networks, Algorithms, Applications and programming Techniques by James A. Freeman, David M. Skapura.
4. Introduction to Neural Networks using MATLAB 6.0 by S N Sivanandam, S Sumathi, SN Deepa TMGH.

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# ENGINEERING ECONOMICS AND PROJECT MANAGEMENT

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 2 | Internal Marks | : 30 |
| Credits | : 2 | External Marks | : 70 |

**Course Objectives**

- To illustrate the importance of Managerial Economics and know its significant role in achieving business objectives.
- To understand and articulate the importance of Project Management in any business project.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- apply managerial economic concepts in business decision making and identify the influencing factors of demand for a product.
- categorize production with respect to time and cost.
- relate the market structures and pricing to a product.
- establish the suitable business organization with available resources.
- plan and evaluate a project and also apply network concepts.

**Course Content**

**UNIT – I: Introduction to Engineering Economics**

Concept of Engineering Economics, Nature and Scope of Managerial Economics.

**Demand Analysis:** Demand Determinants, Law of Demand and its exceptions, Types of Elasticity of Demand, Methods of Demand forecasting.

**UNIT – II: Theory of Production and Cost Analysis**

Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas production function. Laws of Returns.

**Cost Analysis:** Cost concepts & BEP Analysis with simple problems.

**UNIT – III: Introduction to Markets & Pricing strategies**

Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition.

**Pricing strategies:** Methods of Pricing: Cost based pricing, Demand based pricing, Competition based pricing and Strategy based pricing.

**UNIT – IV: Introduction to Business Organizations**

Factors Affecting the choice of business organisation, forms of business organisations – sole proprietorship, partnership, joint stock company.

**UNIT – V: Project Management**

Concept and Characteristics of a Project, Project Planning: Project Evaluation, Development of Project Network, Time Estimation, Determination of the Critical Path, PERT Model, CPM Model, Network Cost System (simple problems)

**Text Books**

1. Managerial Economics and Financial Analysis: by Aryasri, 2/e, TMH, 2005.
2. Project Management by Shivathanu Pillay, University Press, New Delhi, 2009.

**Reference Books**

1. Managerial Economics:Varshney & MaheswariSultan Chand, 2003.
2. Jack R Meredith: Project Management, Wiley India Publishers, New Delhi, 2010.

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# POWER SYSTEMS LAB

IV Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Course Objectives**

- To impart knowledge on protective relays, over voltage, over current and impedance relays.
- To familiarize with the concepts of load frequency control and load flow in MAT Lab/ Simulink.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- determine the sub transient reactance of a Salient Pole Machine.
- verify the characteristics of the over voltage and over current relay.
- plot the characteristics of PV Module in the laboratory environment.
- analyze the load flow for a given power system by using Gauss seidel method.
- verify the load frequency control of single area system with and without controller.

**List of Experiments**

Any 10 experiments from the following list are required to be conducted:

1. Characteristics of Static Negative Sequence Relay.
2. Characteristics of Microprocessor based Over Voltage Relay.
3. Simulation of 220KV Transmission line model.
   i) Ferranti Effect ii) Transmission line constants
4. Determination of I-V and P-V characteristics of PV module with varying radiation.
5. Characteristics of Induction Motor Protection relays.
6. Determination of I-V and P-V characteristics of series and parallel combination of PV module.
7. Determination of Sub-Transient Reactance of a Salient Pole Machine.
8. Characteristics of impedance relay.
9. Testing of Buchholz relay

**Simulation experiments**

10. Obtain the $Y_{bus}$ for the given power system network.
11. Obtain the load flow solution for a given power system by using Gauss Seidel algorithm.
12. Load frequency control of single area system with and without integral controller.

**Additional Experiments:**

1. To study the differential Protection of a three phase delta-delta connected Transformer (Virtual lab experiment).
2. To determine the sub-transient ($x_d3$ ), transient ($x_d2$ ) and steady state reactance ($x_d$) of a synchronous machine (Virtual lab experiment).

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## POWER ELECTRONICS LAB

IV Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 2 | Internal Marks | : 15 |
| Credits | : 1 | External Marks | : 35 |

**Course Objectives**

- To provide knowledge on behavior of power electronic circuits using different power converters experimentally.
- To familiarize with the practical problems associated with control and firing circuits of power electronics.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- plot the characteristics of various power semiconductor switches.
- trigger the SCR using various methods.
- analyze and test the operation of simple power electronic circuits.
- operate the given drive in all four quadrants.
- analyze the performance of PWM converter.
- perform closed loop control of DC motor.

**List of Experiments**

Any 10 experiments from the following list are required to be conducted:

1. Study of Characteristics of SCR, MOSFET & IGBT.
2. UJT triggering circuit for silicon controlled rectifier (SCR)
3. Single Phase Half controlled bridge converter with R and RL load.
4. Single Phase Fully controlled bridge converter with R and RL load.
5. Single Phase AC Voltage Controller with R and RL load.
6. Single Phase bridge inverter with R and RL load.
7. Single Phase dual converter with RL load
8. Three Phase half controlled bridge converter with R and RL load.
9. Three Phase fully controlled bridge converter with R and RL load
10. Three Phase half controlled bridge converter with RLE load
11. Three Phase fully controlled bridge converter with RLE load
12. Buck boost converter with R load.

**Additional Experiments:**

1. Four quadrant control of DC Motor using chopper
2. Closed loop control of DC motor.
3. Single phase Half Wave Uncontrolled Rectifier for R and L load (Virtual lab experiment).

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# COMPUTER AIDED ELECTRICAL DRAWING

IV Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 4 | Internal Marks | : 15 |
| Credits | : 2 | External Marks | : 35 |

**Course Objectives**

- To impart practical knowledge on electrical drawing.
- To familiarize with the application of CAD software.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- draw the circuit diagram of Godown wiring
- draw the single line diagrams of substations
- design the dimensions of the DC machines
- draw the sectional views and line diagrams of single phase transformers and Induction Machines.
- draw the transmission tower diagrams

**List of Experiments**

Any 10 experiments from the following list are required to be conducted:

1. Draw the circuit diagram of Godown wiring with three lamps
2. Draw the single line diagram of 33kV/11kV substation
3. Draw the single line diagram of 11kV/415kV substation
4. Design the armature windings of a given DC Machine data and draw the winding diagrams machine with the given dimensions
5. Design the dimensions of a DC machine and draw the General Assembly of a DC Machine in end view.
6. Design the parameters of a single phase core type transformer and draw Sectional elevation and end-view for the given data.
7. Design the parameters of a Three phase core type transformer and draw sectional elevation and end-view for the given data.
8. Draw the half sectional end view and elevation of slip Induction motor with the given dimensions.
9. Draw the half sectional end view and elevation of squirrel cage Induction motor with the given dimensions.

10. Draw the diagram of three-phase Induction motor with DOL starter
11. Draw the line diagram of Three-phase slip ring induction motor with star–delta starter.
12. Draw the transmission tower diagram for the given dimensions.

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*Honors Degree*

## ADVANCED POWER ELECTRONIC CONVERTERS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture : 3 | Tutorial : 1 | Internal Marks | : 30 |
| Credits : 4 | | External Marks | : 70 |

**Course Objectives**

- To gain knowledge of ac to dc conversion and different ac to dc converter topologies.
- To understand multilevel inverter configuration to improve the quality of the inverter output voltage.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- analyze the performance of single phase AC-DC converters.
- analyze the performance of three phase AC-DC converters
- analyze the operation of power factor correction converters
- analyze the voltage control techniques of three phase inverters.
- describe the principles of operation of multi- level inverters and their applications.

**Course Content**

**UNIT - I: AC-DC Converters (single- phase)**

Single phase fully controlled converters with RL load– Evaluation of input power factor and harmonic factor Continuous and Discontinuous load current, Power factor improvements, Extinction angle control, symmetrical angle control, PWM control.

**UNIT - II: AC-DC Converters (Three-Phase)**

Three Phase AC-DC Converters, fully controlled converters feeding RL load with continuous and discontinuous load current, Evaluation of input power factor and harmonic factor-three phase dual converters.

**UNIT - III: Power Factor Correction Converters**

Single-phase single stage boost power factor corrected rectifier, power circuit principle of operation, and steady state- analysis, three phase boost PFC converter.

**UNIT - IV: PWM Inverters**

Principle of operation-Voltage control of single-phase inverters - sinusoidal PWM – modified PWM – phase displacement Control – Trapezoidal, staircase, stepped, harmonic injection and delta modulation. Voltage Control of Three-Phase Inverters- Sinusoidal PWM- $60^0$PWM- Third Harmonic PWM- Space Vector Modulation.

**UNIT - V: Multi Level Inverters**

Introduction, Multilevel Concept, Types of Multilevel Inverters- Diode-Clamped Multilevel Inverter, Principle of Operation, Flying-Capacitors Multilevel Inverter- Principle of Operation - Cascaded Multilevel Inverter- Principle of Operation- Features of Cascaded Inverter

**Text Books**


1. Power Electronics: Converters, Applications, and Design- Ned Mohan, Tore M. Unde land, William P. Robbins, John Wiley& Sons, 2nd Edition, 2003.
2. M.H. Rashid: Power Electronics-Circuits, Devices & Applications, Pearson, 4th edition, 2013.


**Reference Books**


1. Power Electronics: Essentials and applications- L. Umanand, Wiley publications- 2009
2. Switching Power Supply Design-Abraham I. Pressman, McGraw-Hill Ryerson, Limited, 1991.


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*Open Elective - I*

## ELEMENTS OF CIVIL ENGINEERING

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce basics of Civil Engineering concepts in the fields of surveying, building materials, water resources, Water Supply, Sanitary, Electrical Works in Building and Highway Engineering.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- familiarize with basics of civil engineering.
- carryout various civil engineering survey works.
- identify the various properties of building materials and various types of buildings.
- get acquainted with fundamentals of Water Resources, Water Supply, Sanitary and Electrical Works in Building.
- enumerate the fundamental concepts highway engineering.

**Course Content**

**UNIT - I: Introduction**

Introduction of Civil Engineering, Scope of Civil Engineering, Role of Civil Engineer in Society. Impact of infrastructural development on economy of country.

**UNIT - II: Surveying and Leveling**

**Introduction:** Definition of Surveying, Fundamental principles of surveying, Classification of surveying.

**Linear Measurement**: Methods, Instruments used in chain surveying, Selection of stations, Chaining and Ranging

**Angular Measurement:** Instruments used, Types of compass, Types of meridians and bearings, Measurement of bearings, computation of angles. Compass traversing local attraction.

**Leveling**: Objectives and applications-terminology-Instruments,component parts of dumpy level, Types of leveling, levelling staff.

**UNIT - III: Building Materials and Construction**

**Materials**: Introduction to construction materials - Stones, Bricks, Lime, Cement, Timber, Sand, Aggregates, Mortar, Concrete and bitumen.

**Construction:** Classification of buildings, Building components and their functions.

**UNIT - IV: Water Resources, Water Supply, Sanitary and Electrical Works in Building**

Hydrologic cycle, water use and its conservation, Introduction to dams, barrages and check dams.

Introduction, water supply system, water supply layout of a building, housedrainage, traps, electrical works in building.

**UNIT - V: Transportation Engineering**

classification of roads, Introduction of flexible and rigid pavements, Introduction to road traffic and traffic control mechanism.

**Text Books**

1. Elements of Civil Engineering, Mimi Das Saikia, Bhargab Mohan Dasand Madan Mohan Das Publisher: PHI Learning Private Limited New Delhi.
2. Basic Civil Engineering, Dr. B.C Punmia,Ashok.K. Jain and Arun K. Jain: Laxmi Publications,Delhi.
3. Surveying Vol. I, Dr. B. C. Punmia, Ashokkumar Jain, ArunkumarJain, 17th Edition Publisher: Laxmi Publications ,Delhi.

**Reference Books**

1. Surveying and Leveling, R. Subramanian, Publisher: Oxford University.
2. Building drawing, M.G.Shah, C.M.Kale and S.Y.Patki Publisher: TataMcGraw Hill.

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*Open Elective - I*

## ENVIRONMENTAL LAWS AND POLICIES

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To equip the students to have a basic awareness on environmental and socioeconomic Factors.
- To impart the knowledge of environmental pollution problem.
- To elucidate the rules and regulations of patents and trade laws.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- comprehend different moral perspectives and one's own Ethical standards.
- understand the concept of safety and risk.
- explain different initiatives to protect nature.
- identify the role of Environmental Engineering.
- understand different types of infringement of Intellectual Property Rights.

**Course Content**

**UNIT - I: Introduction**

Introduction to trade and environment - International environmental laws, Right to Environment as Human Right, International Humanitarian Law and Environment, Environment and conflicts management, Famous international protocols like Kyoto.

**UNIT - II: Environmental Laws**

Overview of environment, Nature and eco system, Concept of laws and policies, Origin of environmental law, Introduction to environmental laws and policies, Environment and Governance, Sustainable development and environment, Understanding climate change, Carbon crediting, Carbon foot print etc.

**UNIT - III: Air and Noise Pollution Control Laws**

Air pollutants, Sources, classification, Combustion, Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects-Smoke, Smog and ozone layer disturbance, Greenhouse effect. Air sampling and pollution measurement methods, Principles and instruments, Overview of air pollution control laws and their mitigation measures. Sound power, Sound intensity and sound pressure levels; Plane, Point and line sources, Multiple sources; Outdoor and indoor noise propagation;

Psychoacoustics and noise criteria, Effects of noise on health; Special noise environments: Infrasound, Ultrasound, Impulsive sound and sonic boom; Noise standards and limit values; Noise instrumentation and monitoring procedure, Noise control methods.

**UNIT - IV: Water Quality Laws**

Introduction to water quality laws development, calibration and verification cost: benefit analysis using models, Laws for estuary and lakes, Waste water treatment legislation; Introduction to water quality management systems and procedures, Consequence Analysis; Socioeconomic aspects, Measures of effectiveness of pollution control activities.

**UNIT - V: Environmental Impact Assessment and Life Cycle Analyses**

Evolution of EIA: Concepts of EIA methodologies, Screening and scoping; Rapid EIA and comprehensive EIA; General framework for environmental impact assessment, Characterization and site assessment. Environmental Risk Analysis, Definition of risk, Matrix method - Checklist method, Fault tree analysis, Environmental Audit: Cost Benefit Analysis; Life Cycle Assessment; Resource balance, Energy balance & management review; Operational control; Case studies on EIA.

**Text Books**


1. Kuehn, T.H., Ramsey, J.W. and Threlkeld, J.L., Thermal Environmental Engineering, 3rd Edition, Prentice Hall, 1998.
2. A Textbook of Environmental Chemistry, by O. D. Tyagi and M. Mehra
3. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, economical and Working Environment, 120th ASEE Annual Conference and Exposition.


**Reference Books**


1. Larry W. Canter, “Environmental Impact Assessment”, 1st edition, McGraw-Hill (international edition).
2. David P. Lawrence, “Environmental Impact Assessment - Practical Solutions to Recurrent Problems”, 1st Edition, Wiley-Interscience.
3. Advanced Air and Noise Pollution Control, Lawrence K. Wang, Norman C. Pereira, Yung-Tss Hung, 2005 Edition, Humana Press.
4. Municipal Solid Waste Management, P. Jayarami Reddy, 1st Edition, B.S. Publications.


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*Open Elective - I*

# ELECTRICAL MATERIALS

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce the concepts of dielectric and ferro-magnetic materials.
- To impart knowledge on semiconductor materials, materials used in batteries and solar cells.
- To familiarize the materials required for specific electrical applications.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the properties of liquid, gaseous and solid dielectric materials used in electrical applications.
- analyze the properties of Ferro electric, Peizo electric and Pyro electric materials.
- classify different magnetic materials and examine the effects of aging and impurities on magnets.
- elucidate various semiconductor materials and their applications in integrated circuit.
- choose appropriate material for a given electical and special purpose application.

**Course Content**

**UNIT - I: Dielectic Materials**

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics.

**UNIT - II: Ferromagnetic Materials**

Properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials, applications of Ferro-electric materials.

**UNIT - III: Magnetic Materials**

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, Magnetostriction, magnetically soft and hard materials, ageing of magnets, Superconductivity and its origin, Zero resistance and Meissner Effect.

**UNIT - IV: Semiconductor Materials**

Properties of semiconductors, Classification of Semiconductors, Silicon wafers - Wafer manufacturing process, Resistor, Fabrication processes of MOSFET on IC.

**UNIT - V: Materials for Electrical Applications**

Materials used for Resistors, rheostats, heaters, stranded conductors, fuses, electric contact materials, Solid Liquid and Gaseous insulating materials. Effect of moisture on insulation, Testing of Transformer oil as per ISI standards - Galvanization methods, Materials for battery and solar cells.

**Text Books**


1. R K Rajput: A course in Electrical Engineering Materials, Laxmi Publications. 2009.
2. David Linden, Thomas B. Reddy "The Handbook of Batteries" McGraw-Hill Hand Books 2010.
3. T K BasaK: A course in Electrical Engineering Materials:, New Age Science Publications 2009.


**Reference Books**


1. TTTI Madras: Electrical Engineering Materials
2. Adrianus J.Dekker: Electrical Engineering Materials , THM Publication


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*Open Elective - I*

## CONTROL SYSTEMS ENGINEERING

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To equip the students with the basic concepts of control systems by developing mathematical models for physical systems.
- To familiarize with the time domain behavior of linear control systems.
- To impart knowledge on analytical methods to quantify stability of linear control systems.
- To introduce the state space analysis to continues time systems.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- apply the basic concepts and properties of feedback control systems for mathematical modeling of physical systems.
- explore the transfer function analysis using singal flow graph representation of control systems.
- employ the time domain analysis to quantify the performance of linear control systems and specify suitable controllers.
- perform frequency domain analysis of control systems required for stability analysis.
- use the concept of state variable theory to determine the dynamic behavior of linear control systems.

**Course Content**

**UNIT - I: Introduction**

Concepts of Control Systems- Open loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer function for physical systems.

**UNIT - II: Control Systems Components**

Transfer Function of DC Servo motor - AC Servo motor -, Block diagram representation of systems considering -Block diagram algebra – Representation by signal flow graphs - Reduction is using Mason's gain formula.

**UNIT - III: Time Response Analysis**

Standard test signals - Time response of first order systems – Characteristic equation of feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.

**UNIT - IV: Stability Analysis in S-Domain**

The Concept of Stability – Routh's Stability Criterion – Qualitative Stability and Conditional Stability –Limitations of Routh's Stability.

**Root Locus Technique:** The root locus concept - construction of root loci – simple problems.

**UNIT - V: State Space Analysis of Continuous Systems**

Concept of state, state variables and state model, derivation of state models from physical systems, solving the Time invariant state equations- State Transition Matrix and its Properties, concept of controllability and observability.

**Text Books**


1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International Limited Publishers, 6th edition, 2017.
2. Automatic control system – B.C.Kuo , john wiley and son's 8th edition, 2003.


**Reference Books**


1. Modern control engineering – K.Ogata , prentice Hall of India Pvt. Ltd., 5th Edition, 2015.
2. Control system – N.K.Sinha, New Age International (p) Limited Publishers, 3rd Edition, 1998.
3. Control system engineering – Norman S-Nice, Willey Studio Edition, 4th Edition. Feed back and control system – Joseph J Distefa.
4. Modern control systems - Richard C. Dorf and Robert H. Bishop, Pearson Prentice Hall Publications, 12th Edition, 2010.


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*Open Elective - I*

## AUTOMOTIVE ENGINEERING

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce various components and sub systems of an automobile.
- To impart knowledge on various safety systems of an automobile and emission norms.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- outline the various components and sub systems of an automobile.
- specify different safety norms for the operation of an automobile.

**Course Content**

**UNIT - I:**

**Introduction:** classification of automobiles, components of four wheeler automobile-chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive.

**Fuel supply systems:** Simple fuel supply system in petrol and diesel engines. working of simple carburettor, direct fuel injection system in diesel engine.

**UNIT - II:**

**Lubricating System:** Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.

**Cooling System:** Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

**UNIT - III:**

**Ignition System:** Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, electronic ignition system.

**Transmission system:** Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

**UNIT - IV:**

**Suspension System:** Objectives of suspension system, front suspension systemrigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

**Braking System:** Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

**UNIT - V:**

**Emissions from Automobile:** Emission norms - Bharat stage and Euro norms. engine emissions - exhaust and non-exhaust.

**Safety Systems:** seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

**Text Books**


1. Kirpal Singh, "Automobile Engineering Vol-1 & vol-2", Standard Publishers Distributors, 14 th edition, 2017 .
2. William H Crouse & Donald LAnglin, Automotive Mechanics, Tata Mc Graw Hill Publications, 10th edition, 2017.


**Reference Books**


1. R.B Gupta , Automobile Engineering, Satya Prakashan Publications, 6th edition,2016.
2. Newton steeds & Garrett, "The Motor vehicle", Society of Automotive Engineers, 13th edition,2001.
3. G.B.S. Narang, "Automobile Engineering", Khanna Publishers, 5th edition, 1995.


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*Open Elective - I*

## ELEMENTS OF MECHANICAL TRANSMISSION

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize with the principles of mechanical power transmission elements.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- choose suitable shaft couplings for a given application.
- propose suitable transmission element for a given application.
- identify suitable power screw for motion transmission.

**Course Content**

**UNIT - I: Shaft Couplings**

Shaft couplings: Rigid couplings – muff, split muff and flange couplings, flexible coupling-modified flange coupling.

**UNIT - II: Belt Drives**

Flat Belts: Introduction, selection of a belt drive, types of belt drives, length of belts, materials, belt joints, types of flat belt drives, power transmitted.

**UNIT - III: V-Belt, Rope Drives & Chain Drives**

**V-belts:** Introduction, Types of V-belts, ratio of driving tensions for V-belt, power transmitted.

**Rope Drives:** Introduction, classification of rope drives, power transmitted.

**Chain drives:** Introduction, chain drives, polygonal effect, selection of roller chains, length of chain.

**UNIT - IV: Power Screws**

Forms of threads, multi-start threads, right hand and left hand threads, nut, compound screw, differential screw.

**UNIT - V: Gears and Gear Trains**

Types, terminology, materials, law of gearing, velocity of sliding, forms of teeth, path of contact, arc of contact, interference, gear Trains - types, differential of an automobile.

**Text Books**

1. Bhandari, “Design of Machine Elements”, Tata McGraw Hill book Co.,5th Edition, 2020.
2. P.C. Sharma & D.K. Agarwal, “Machine Design”, S.K.Kataria & Sons ,13th Edition, 2018.

**Reference Books**

1. Sharma & Purohit, “Design of Machine Elements”, PHI, 10th Edition,2011.
2. Kannaiah, “Design of Machine Elements”, Scitech Publications, 2nd Edition, 2015.

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*Open Elective - I*

## INTRODUCTION TO EMBEDDED SYSTEMS

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce the classification, characteristics, applications of embedded systems.
- To provide clear understanding about the role of firmware in correlation with hardware systems.
- To familiarize with the architecture of 8051 microcontroller.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- compare embedded and general computing systems.
- select the processors for an embedded system application.
- understand the architecture and instruction set of 8051 microcontroller.
- program the timers/counters and serial communication components of 8051 microcontroller.

**Course Content**

**UNIT - I: Introduction to Embedded Systems**

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

**UNIT - II: Typical Embedded System: Core of the Embedded System**

Elements of Embedded Systems, General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

**UNIT - III: Embedded Firmware**

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

**UNIT - IV: Introduction to 8051 Microcontroller**

Overview of 8051 microcontroller, Architecture, I/O Ports, Memory organization, Addressing modes and Instruction set of 8051, Simple programs.

**UNIT - V: 8051 Real Time control**

Interrupts- 8051 Interrupts, Interrupt Vector table of 8051, IE Register, IP register;Timers and Counters-Timer 0, Timer 1, TMOD Registers, TCON Register,Mode1 Programming; Serial Port- SBUF, SCON Registers, Doubling baud rate using PCON register, program for serial data transmission.

**Text Books**


1. K.V Shibu, "Introduction to Embedded System", TMH Education private limited, 2009.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontrollers and Embedded Systems", 2nd Edition, Pearson Education.


**Reference Books**


1. Kenneth. J. Ayala, Dhananjay V. Gadre, "The 8051 Microcontroller & Embedded Systems Using Assembly and C", 1st edition, Cengage learning, 2010.
2. Rajkamal," Embedded Systems" 2nd Edition, TMH, 2008.
3. Frank Vahid, Tony Givargis, "Embedded System Design", 2nd Edition, John Wiley Publishers.


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*Open Elective - I*

## FUNDAMENTALS OF COMMUNICATION SYSTEMS

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce various analog and digital modulation and demodulation techniques
- To familiarize with various multiplexing schemes and cellular telephone systems

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- understand the concepts of basic communication system
- compare different multiplexing techniques.
- differentiate DSB-SC, SSB and frequency modulation schemes.
- distinguish ASK, PSK and FSK modulations.
- know the concepts of the cellular telephone systems

**Course Content**

**UNIT - I: Introduction to Communication Systems**

**Introduction, Communication Process:** Elements of communication system, Concept of Bandwidth and frequency spectrum, Sources of information: Classification of signals, Baseband and Band pass signals, Communication channels, Classification of communication systems.

**UNIT - II: Basic Models of Communication**

Need of modulation, Different types of modulation systems, Multiplexing, Basic Models of Communication. Primary Communication Resources, Survey of communication applications, Analog and digital signals, Conversion of analog signals to digital signals, electromagnetic spectrum (EM) Spectrum.

**UNIT - III: Linear Modulation**

Basics of Amplitude Modulation: Definition and Physical Appearance, Single tone an AM wave, Frequency Spectrum and Bandwidth of an AM wave, Modulation Index, Power distribution in an AM wave; Forms of an AM signal (theoretical concepts): Double Side Band-suppressed Carrier (DSB-SC), Single Side Band (SSB).

**UNIT - IV: Angle Modulation**

Basics of Frequency Modulation: Definition and Physical Appearance, Frequency Deviation Curve, Equation of FM wave, Frequency Deviation, Modulation Index, Deviation Ratio; Comparison of FM and AM Signals.

Phase Modulation: Definition and Physical Appearance, Equation of PM wave.

**UNIT - V: Digital Transmission**

Digital communication system model, advantages and disadvantages of digital communication, pulse code modulation (PCM), ASK, FSK, PSK, Basics of cellular telephone systems.

**Text Books**


1. Wayne Tomasi, “Electronics Communication systems”, Pearson Education, 5th edition, 2004.
2. Dr. Sanjay Sharma, "Communication Systems: Analog and Digital", Katson Books, 7th Reprint Edition, 2018.


**Reference Books**


1. Simon Haykin, John Wiley, “Principles of Communication Systems”, 2nd Edition, John Wiley & Sons.
2. V. Chandra Sekar, "Analog Communication", Oxford University Press, 2010.
3. Dr. Sanjay Sharma, "Digital Communications", Katson Books.
4. B.P.Lathi, “Modern Analog and Digital Communication”, 3rd Edition, Oxford reprint, 2004.


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*Open Elective - I*

## INFORMATION RETRIEVAL SYSTEMS

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce basic concepts in information retrieval.
- To familiarize with applications of information retrieval techniques in the Internet or Web environment.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- identify the basic theories in information retrieval systems.
- use inverted file as an index data structure to retrieve the documents from the database.
- create signature files for fast retrieval of text data.
- build PAT treesand PAT arrays for the given text document.
- use stemming algorithms to improve the performance of IR systems.

**Course Content**

**UNIT - I: Introduction to Information Storage and Retrieval System**

Introduction, Domain Analysis of IR systems and other types of Information Systems, IR System Evaluation. Introduction to Data Structures and Algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms.

**UNIT - II: Inverted files**

Introduction, Structures used in Inverted Files, Building Inverted file using a sorted array, Modifications to Basic Techniques.

**UNIT - III: Signature Files**

Introduction, Concepts of Signature Files, Compression, Vertical Partitioning, Horizontal Partitioning.

**UNIT - IV: New Indices for Text**

**PAT Trees and PAT Arrays:** Introduction, PAT Tree structure, algorithms on the PAT Trees, Building PAT trees as PATRICA Trees, PAT representation as arrays.

**UNIT - V: Stemming Algorithms**

Introduction, Types of Stemming Algorithms, Experimental Evaluations of Stemming to Compress Inverted Files.

**Text Books**

1. Frakes W.B., Ricardo Baeza-Yates, “Information Retrieval Data Structures and Algorithms”, Prentice Hall, 1992.
2. Ricardo Baeza-Yates, Bertheir Ribeiro-Neto, “Modern Information Retrieval”, Pearson Education.
3. Robert Korfhage, “Information Storage & Retrieval”, John Wiley & Sons.

**Reference Books**

1. Kowalski, Gerald, Mark T Maybury, “Information Retrieval Systems-Theory and Implementation”, Kluwer Academic Press, 1997.
2. Information retrieval Algorithms and Heuristics, 2nd edition, Springer.

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*Open Elective - I*

## COMPUTER GRAPHICS

II Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To emphasize on functionalities of various graphic systems and geometric transformations
- To familiarize on visible surface detection methods and computer animations.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- outline different graphical display devices and drawing algorithms.
- illustrate different 2-D geometrical transformations on graphical objects
- interpret different line and polygon clipping algorithms
- infer different 3- D transformations and viewing functions on objects.
- summarize different surface detection methods and computer animations

**Course Content**

**UNIT - I: Introduction**

Introduction: Application of computer graphics, raster scan and random scanDisplays.

Filled Area Primitives: Points and lines, inside and outside tests, line drawing algorithms, Scan line polygon fill algorithm.

**UNIT - II: 2-D Geometrical Transforms**

Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transformations.

**UNIT - III: 2D Viewing**

The viewing pipeline, window to view-port coordinate transformation, Cohen-Sutherland line clipping algorithm, Sutherland – Hodgeman polygon clipping algorithm.

**UNIT - IV: 3D Geometric Transformations**

Translation, rotation, scaling, reflection and shear transformations, composite transformations, types of projections.

**UNIT - V: Visible Surface Detection Methods and Animation**

Classification – types, back-face detection, depth-buffer, BSP tree, area sub-division method.

**Animations:** General computer animation, raster animation, key frame systems, Graphics programming using Open GL .

**Text Books**

1. Donald Hearn, M. Pauline Baker, "Computer Graphics *C* version", 2nd e edition, Pearson Education.
2. Francis S.Hill, Stephen M. Kelley, "Computer Graphics using Open GL", 3rd edition, Pearson Education.

**Reference Books**

1. Foley, VanDam, Feiner, Hughes, "Computer Graphics Principles and Practice", 2nd edition, Pearson Education.
2. Rajesh K Maurya, "Computer Graphics with Virtual Reality Systems", Wiley.

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*Open Elective - I*

## SYSTEM SOFTWARE

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize with the implementation details of assemblers, loaders, linkers, and macro processors.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- outline the relationship between system software and machine architecture.
- analyze working of assembler for a simplified Instructional computer.
- describe the important features of linkage Editors and Dynamic Linking .
- identify the mostly used macro processors algorithms and data structures.
- compare the functions of Absolute Loader , Bootstrap Loaders.

**Course Content**

**UNIT - I: Introduction**

System software and machine architecture, The Simplified Instructional Computer (SIC), Machine architecture, Data and instruction formats, addressing modes, instruction sets, I/O and programming System.

**UNIT - II: Assemblers**

Basic assembler functions, SIC assembler, assembler algorithm and data structures, machine dependent assembler features.

**UNIT - III: Implementation of Assemblers**

Instruction formats and addressing modes, program relocation, machine independent assembler features, literals, symbol, defining statements, expressions, one pass assemblers, multi pass assemblers, implementation example, MASM assemble.

**UNIT - IV: Loaders & Linkers**

Basic loader functions, design of an absolute loader, simple bootstrap loader, machine dependent loader features, relocation, loader options, program linking, algorithm and data structures for linking loader, linkage editors, dynamic linking, implementation example.

**UNIT - V: Macro Processors**

Basic macro processor functions, macro definition and expansion, macro processor algorithm and data structures, machine independent macro processor features, concatenation of macro parameters, generation of unique labels, conditional macro expansion.

**Text Books**

1. Leland L. Beck, "System Software – An Introduction to Systems Programming", 3rd edition, Pearson Education Asia, 2000.

**Reference Books**

1 D. M. Dhamdhere, "Systems Programming and Operating Systems", 2nd Revised edition, Tata McGraw-Hill, 1999.

2. John J. Donovan "Systems Programming", Tata McGraw-Hill Edition, 1972.

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*Open Elective - I*

## FREE & OPEN SOURCE SOFTWARE

II Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To impart the opportunities for open source software in the global market.
- To familiarize with different steps in implementing the open source.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- state the need and applications of open source software.
- compare and Contrast between Open source and commercial software
- demonstrate LINUX operating systems concepts.
- create database in MYSQL and perform operations on it.
- design and develop a web application using PHP.

**Course Content**

**UNIT - I: Introduction**

Introduction to Open sources, Need of Open Sources, Advantages of Open Sources and Application of Open Sources.

**UNIT - II: LINUX**

LINUX Introduction, General Overview, Kernel Mode and user mode, Process, Advanced Concepts-Personalities, Cloning, Signals.

**UNIT - III: PHP**

PHP- Introduction, Programming in web environment, variables, constants, data types, operators Statements, Arrays.

**UNIT - IV: MySQL**

MySQL: Introduction, Setting up account, Starting, terminating and writing your own SQL programs, Record selection Technology, Working with strings, Date and Time, Generating Summary, Working with metadata.

**UNIT - V: Advanced PHP**

OOP–String Manipulation, PHP and SQL database, PHP Connectivity, Debugging and error handling.

**Text Books**

1. M.N.Rao, “Fundamentals of Open Source Software”, PHI Learning.
2. Steve Suchring,”MySQLBible”, John Wiley, 2002

**Reference Books**

1. Remy Card, Eric Dumas and Frank Mevel, “The Linux Kernel Book”, Wiley Publications, 2003.

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*Open Elective - I*

## FUZZY MATHEMATICS

II Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To impart the knowledge of fuzzy set theory and its applications in Engineering.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- state the need and applications of open source software.
- distinguish between crisp set and fuzzy set.
- know different operations on fuzzy relations.
- use defuzzification methods to crisp sets.
- draw inferences using fuzzy logic.
- develop membership value assignments.

**Course Content**

**UNIT - I: Classical Sets And Fuzzy Sets**

Classical sets – Operations – Properties. Fuzzy sets – Operations – Properties – membership functions - Features of the membership function.

**UNIT - II: Fuzzy Relations**

Fuzzy Cartesian product and composition - Fuzzy relations - Operations - Properties of fuzzy relations - Fuzzy tolerance and equivalence relations.

**UNIT - III: Fuzzification And Defuzzification**

Fuzzification - defuzzification to crisp set - Defuzzification to scalars (centroid method, centre of sums method, mean of maxima method).

**UNIT - IV: Fuzzy Logic**

Classical logic – Fuzz logic – Approximate reasoning [ "if ... then" approach and "if ... then ....else" approach ] – Other forms of the implication operation.

**UNIT - V: Development Of Membership Functions**

Membership value assignments – Inference – Rank ordering – Neural networks – Genetic algorithms – Inductive reasoning.

**Text Books**

1. Timothy J.Ross., Fuzzy Logic with Engineering Applications - Second Edition, Wiley Publications, 2015, New Delhi.

2. S.Rajasekaran, G.A.Vijayalakshmi Pai, Neural networks, Fuzzy logic, and genetic algorithms synthesis and applications- – Prentice-Hall of India private limited, 2008, New Delhi.

**Reference Books**

1. H.J. Zimmarman, Fuzzy set theory and its applications, 4th edition — Springer, 2013. New Delhi.
2. S.Nanda and N.R.Das "Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi.

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*Open Elective - II*

## REMOTE SENSING AND GIS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce the basic concepts and principles of Remote Sensing.
- To familiarize with structure and function of Geographic Information Systems.
- To illustrate the multidisciplinary nature of Geospatial applications.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- relate the scientific theories to the behaviour of electromagnetic spectrum
- distinguish between different types of satellites and identify appropriate remote sensing data products for mapping, monitoring and management applications
- interpret Satellite images and processed outputs for extracting relevant information
- structure the concept of a spatial decision support system in its analog and digital forms
- list and elaborate applications of Remote Sensing and GIS in various fields

**Course Content**

**UNIT - I: Electro-Magnetic Radiation (EMR), Its Interaction with Atmosphere & Earth**

Definition of remote sensing and its components – Electromagnetic spectrum, wavelength regions important to remote sensing, wave theory, particle theory, Stefan-Boltzmann and Wien's Displacement Law – Atmospheric scattering, absorption, atmospheric windows, spectral signature concepts, typical spectral reflective characteristics of water, vegetation and soil.

**UNIT - II: Platforms and Sensors**

Types of platforms, orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors, resolution concept, payload description of important Earth Resources and Meteorological satellites – Airborne and Space-borne TIR (Thermal Infrared Radiation) and microwave sensors.

**UNIT - III: Image Interpretation and Analysis**

Types of Data Products – types of image interpretation, basic elements of image interpretation, visual interpretation keys – Digital Image Processing, pre-processing, image enhancement techniques – multispectral image classification, supervised and unsupervised.

**UNIT - IV: Geographic Information System**

Introduction to Maps, definitions, map projections, types of map projections, map analysis – GIS definition, basic components of GIS, standard GIS software's – Data types, spatial and non-spatial (attribute) data - Data models – Data input - measurement scales – Data Base Management Systems (DBMS).

**UNIT - V: RS and GIS Applications**

Land cover and land use classification, crop productivity and crop monitoring, Smart city applications, Forest fire detection using image analysis.

**Text Books**


1. Remote Sensing and Image Interpretation by Thomas. M. Lillesand and Ralph. W. Kiefer,7th Edition, John Wiley and Sons, 2015.
2. Remote Sensing and Geographical Information Systems by M. Anji Reddy, 4th Edition, B.S. Publications.


**Reference Books**


1. Remote Sensing and GIS by Basudeb Bhatta, 2nd Edition, Oxford University Press.
2. Principles of Geographical Information Systems by Burrough P.A. and Rachel A. Mc Donell,3rd Edition, Oxford Publication, 2016.


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*Open Elective - II*

## GREEN BUILDING TECHNOLOGY

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce the different concepts of sustainable design and green building techniques.
- To explore the techniques available of best fit for the specific construction project.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the concepts of sustainable design and green building techniques
- understand the energy efficiency and indoor environmental quality management
- explain the energy efficiency techniques and concepts of embodied energy
- apprise the drawings and models of their own personal green building project
- select the Indoor Environmental Quality and comfort

**Course Content**

**UNIT - I: Introduction to Green Buildings**

Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

**UNIT - II: Site Selection and Planning**

Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc. Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

**UNIT - III: Energy Efficiency**

Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone

depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

**UNIT - IV: Green Building Materials**

Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management.

**UNIT - V: Occupant Comfort and Wellbeing**

Daylighting, air ventilation,exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc. Suggested.

**Text Books**


1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao, New Age International, New Delhi.


**Reference Books**


1. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
2. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
3. Green Building Fundamentals by Mike Montoya, Pearson, USA, 2010.
4. Sustainable Construction – Green Building Design and delivery by Charles J. Kibert, John Wiley &Sons, New York, 2008.
5. Sustainable Construction and Design by Regina Leffers, Pearson/ Prentice Hall, USA, 2009.


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*Open Elective - II*

## MODELING AND SIMULATION OF ENGINEERING SYSTEMS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize with programming skills using basic MATLAB and its associated tool boxes.
- To impart knowledge on building SIMULINK and Graphical user interface

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- create, modify and work with variables and its related operations
- develop MATLAB program to solve real time engineering problems.
- solve and visualize the dynamic performance of engineering systems through MATLAB plotting features.
- compute and analyze the numerical data of a physical system using advanced features in MATLAB.
- analyze the performance of physical system using toolboxes and GUI.

**Course Content**

**UNIT - I: Introduction to MATLAB**

Getting Started, MATLAB as language, MATLAB windows-Direct and Indirect windows, and Functions of Windows, MATLAB Environment, File Types, Inputting and Outputting methods.

**UNIT - II: Variables, Scripts and Functions**

Making Variables, Manipulating Variables, Vectorization, Scripts, , creating and working with scripts, Basic Functions, creating and working with function files, Flow Control-if, for, while and switch cases, Signal routing-break, continue and return, examples with engineering applications.

**UNIT - III: Plotting**

Basic Plotting, 2D Plotting – line, bar, area; 3D plotting-mesh and surface; plotting types - Multiple plotting, Sub plotting; Line styles, examples with engineering applications.

**UNIT - IV: Solving Equations and Curve Fitting**

Linear Algebra, Polynomials, Optimization, Differentiation / Integration, Differential Equations, Probability and Statistics, Data Structures, Images and Animation, Debugging, examples with engineering applications.

**UNIT - V: Toolboxes and GUIs**

Introduction to Neural networks, Fuzzy logic, Control systems, Symbolic Math, Simulink, File I/O, Graphical User Interfaces, examples with engineering applications.

**Text Books**


1. Getting started with MATLAB-A quick introduction for scientists and engineers, Rudra Pratap, Oxford University Press, January, 2010.
2. MATLAB and SIMULINK for Engineers, Agam Kumar Tyagi, Oxford University Press, 2012.


**Reference Books**


1. Introduction to MATLAB, Spencer, R.L. and Ware, M, Brigham Young University, available online accessed, May, 2008.
2. An introduction to MATLAB, David F. Griffiths, The University of Dundee, available online, accessed, October 2012.
3. MATLAB an introduction with applications, Amos Gilat, Wiley publications, January 2012.


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*Open Elective - II*

## POWER SYSTEMS ENGINEERING

III Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To introduce the working of various types of power plants and layout of substations.
- To familiarize the concepts of corona, insulators and various tariff methods.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the operation of thermal power station.
- illustrate the operation of hydro power plants.
- identify various components and their role in the operation of nuclear power plant
- distinguish various bus bar arrangements and insulators used in substation
- analyze the phenomenon of corona and describe various tariff methods.

**Course Content**

**UNIT - I: Thermal Power Stations**

Single line diagram of Thermal Power Station showing paths of coal, steam, water, air, ash and flue gasses-Brief description of TPS components: Economizers, Boilers, super heaters, Turbines ,condensers, chimney and cooling towers.

**UNIT - II: Hydro Power stations**

Selection of site, block diagram approach of hydro electric power plant and classification of pumped storage power plants.

**UNIT - III: Nuclear Power Stations**

Working principle, Nuclear fuels. Nuclear reactor Components: Moderators, Control roads, Reflectors and Coolants. Types of Nuclear reactors and brief description of PWR, BWR and FBR.

**UNIT - IV: Air insulated substations**

Equipments used in substations, Types of Insulators, Classification of substations: - Indoor & Outdoor substations: Single line diagram of substation. Bus bar arrangements and their classification.

**UNIT - V: Corona and Tariff Methods**

Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss.

Tariff Methods: Simple rate, Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods.

**Text Books**


1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd., 1999.
2. A Textbook of Power System Engineering by Er.R k Rajput, Laxmi Publications ,2nd Edition, 2015.


**Reference Books**


1. Principles of Power Systems by V.K Mehta and Rohit Mehta S.Chand& Company Ltd.New Delhi 2004.
2. Generation Distribution and Utilization of Electrical Energy by C.L.Wadhawa New age International (P) Limited, Publishers 3rd Edition 2011.
3. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2008.


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*Open Elective - II*

## RENEWABLE ENERGY SOURCES

III Year – I Semester

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|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To impart knowledge on renewable sources of energy and techniques used in exploiting solar, wind, biomass, geothermal and ocean sources of energy.
- To introduce direct energy conversion systems such as thermo electric, MHD and Fuel Cells.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- classify various types of renewable sources of energy and illustrate the principles of solar radiation.
- illustrate various solar energy storage methods and applications.
- describe the techniques of exploiting wind, biomass and geothermal energies in power generation.
- illustrate the methods of tapping ocean thermal in power generation
- describe the working of various direct energy conversion systems and their applications.

**Course Content**

**UNIT - I:**

**Introduction:** Energy Sources and their availability, role and potential of renewable source.

**Solar Radiation:** Structure of the sun, the solar constant, sun-earth relationships, extraterrestrial and terrestrial solar radiation, instruments for measuring solar radiation, solar radiation geometry, Numerical problems on solar radiation.

**UNIT - II:**

**Solar Energy Storage and Collectors:** Different methods - sensible, latent heat and stratified storage, solar ponds. solar collectors- flat plate, concentric collectors.

**Applications of Solar Energy:** Solar heating/cooling technique, solar distillation, drying, photovoltaic energy conversion, solar central power tower concept and solar chimney.

**UNIT - III:**

**Wind Energy:** Sources and potentials, horizontal and vertical axis wind turbines, Betz criteria.

**Bio-Mass Energy:** Biomass energy Sources, methods for obtaining energy from biomass, Biomass gasification.

**UNIT - IV:**

**Geothermal Energy**: Resources, types of wells, methods of harnessing the energy.

**Ocean Energy:** Requirements of OTEC, classifications of OTEC, Environmental impacts of OTEC.

**UNIT - V:**

**Direct Energy Conversion:** Need for DEC, limitations, principles of DEC. Thermo electric Power – See-beck, Peltier, joule, Thomson effects, Thermo-electric Power generators, applications.

**MHD power Generation:** Principles, dissociation and ionization, Hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, advantages and disadvantages of MHD power generator, applications.

**Fuel cells:** Principles, types of fuel cells.

**Text Books**


1. Tiwari and Ghosal, "Renewable Energy Resources: Basic Principles and Applications", Narosa.
2. B.H.Khan "Non – conventional Energy Resources", Tata McGraw Hill education Pvt. Ltd.
3. G.D. Rai, "Non-Conventional Energy Sources", Dhanpat Rai and Sons.


**Reference Books**


1. Twidell & Weir, "Renewable Energy Sources ", Routledge (Taylor &Francis Group).
2. SP Sukhatme, "Solar Energy: Principles of thermal collection and storage". Tata McGraw Hill.


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*Open Elective - II*

## VENTURE DEVELOPMENT

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize the learner with the concepts of venture development

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- explain the significance of entrepreneurship for economic development.
- distinguish among micro, small, and medium enterprises.
- discuss the role of various agencies to raise the capital.
- apply marketing strategies for a given situation.
- analyse contemporary issues in entrepreneurship.

**Course Content**

**UNIT - I: Entrepreneurship and Entrepreneur**

Introduction; characteristics of an entrepreneur, types of entrepreneurs, entrepreneurship in India, women entrepreneurship, rural entrepreneurship.

**UNIT - II: Small Scale Industries in India**

Concept and definition of micro, small, and medium enterprises, scope and trends of small enterprises in India, role of government in promoting ssi in india, problems of entrepreneurs, planning for setting up an industry, agencies for supporting the process, the businesses planning processes.

**UNIT - III: Institutional Finance to Entrepreneur**

Small Industries Development Bank of India (SIDBI), export-import Bank, Andhra Pradesh State Trading Corporation (APSTC), Integrated Rural Development Programme (IRDP), Export Credit Guarantee Corporation (ECGC).

**UNIT - IV: Entrepreneurial Strategies**

Management of small industries- small entreprises and marketing strategies- product life cycle-marketing activities, channels of distribution- market research-marketing problems of small scale industries.

**UNIT - V: Contemporary Issues in Entrepreneurship**

Introduction- ecological entrepreurship, legal issues, international business opportunities- risk management strategies, diversification strategies , and bankruptcy, social and ethical responsibility of entrepreneurs.

**Text Books**

1. Robert D.Hisrich, Mathew J. Manimala, Michael P.Peters, A.Shepherd, "Entrepreneurship" , McGraw Hill Education, 2016 .
2. P.Narayana Reddy, "Entrepreneurship - Text and Cases", Cengage Learning, 2011.

**Reference Books**

1. G.G. Meredith, R.E.Nelson and P.A. Neek, "The Practice of Entrepreneurship", ILO, 1982.
2. David H.Holt, "Entrepreneurship New venture Creation", PHI Learning Limited.
3. MadhuriLall, ShikhaSahai, "Entrepreneurship", Excel Books, Second Edition.

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*Open Elective - II*

## AUTOMOTIVE ELECTRONICS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize with the electronic systems inside an automotive vehicle.
- To introduce the concepts of advanced safety systems.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the fundamentals of automotive technology.
- differentiatedigital andanalog systems.
- classify various automotive sensors and control systems.
- develop communications & navigation/routing in automotive vehicles.

**Course Content**

**UNIT - I: Automotive Fundamentals**

Use of electronics in the automobile, evolution of automotive electronics, theautomobile physical configuration, evolution of electronics in the automobile, surveyof major automotive systems.

**UNIT - II: Automotive Micro-Computer System**

Microcomputer fundamentals-digital versusanalog computers, basic computer block diagram, microcomputer operations,CPU registers, accumulator registers, condition code register-branching;microprocessor architecture, memory-ROM, RAM; I/O parallel interface, digitalto analog converter and analog to digital converters with block diagram.

**UNIT - III: Basics of Electronics Engine Control**

Motivation for electronic engine control, exhaust emissions, fuel economy, conceptof an electronic engine control system, engine functions and control, electronicfuel control configuration, electronic ignition with sensors.

**UNIT - IV: Sensors and Actuators**

Basic sensor arrangement; types of sensors such as oxygen sensors,crank angle position sensors, fuel metering/vehicle speed sensors and detonation sensors, flow sensors, throttle position sensors, solenoids,actuators – fuel metering actuator, fuel injector, and ignitionactuator.

**UNIT - V: Electronic Vehicle Management System**

Cruise control system, antilock braking system, electronic suspension system,electronic steering control, safety: air bags, collisionavoidance radar warning system with block diagram, low tire pressure warningsystem.

Sensor multiplexing, control signal multiplexing with blockdiagram, automotive internal navigation system, GPS navigation system, Distributed Control Area Network example - a network of embedded systems in automobile.

**Text Books**


1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition SAMS/ElsevierPublishing.
2. Raj Kamal, "Embedded Systems - Architecture, Programming and Design", 3rd Edition, McGraw-Hill Education.
3. Robert Bosch Gambh, "Automotive Electrics Automotive Electronics Systems and Components", 5th edition, John Wiley& Sons Ltd., 2007.


**Reference Books**


1. Ronald K Jurgen, "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
2. G. Meyer, J. Valldorf, W. Gessner, "Advanced Microsystems for AutomotiveApplications", Springer, 2009.
3. Robert Bosch, "Automotive Hand Book", 5th Edition, SAE, 2000.


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*Open Elective - II*

## INTRODUCTION TO SIGNAL PROCESSING

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize with the basic concepts and operation on signals.
- To introduce various transform techniques on signals.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- classify the signals and various operations on signals.
- compute Fourier analysis on the signals.
- applyvarious sampling techniques on continuous time signals.
- analyzecontinuous time signals using Fourier and Laplace transforms.

**Course Content**

**UNIT - I: Signal Analysis**

Classification of signals, basic operations on signals-amplitude and time scaling, time shifting, addition and multiplication, introduction to elementary signals-unit step, impulse, ramp, parabolic, rectangular, triangular, sinusoidal, exponential, signum, sinc and gaussian functions.

**UNIT - II: Fourier Series**

Trigonometric and exponential Fourier series, relationship between trigonometric and exponential Fourier series, convergence of Fourier series, symmetry conditions-even and odd, complex Fourier spectrum.

**UNIT - III: Fourier Transform**

Representation of an arbitrary function over the entire interval: Fourier transform, ourier transform of some useful functions and periodic function, properties of Fourier transform, Parseval's theorem.

**UNIT - IV: Sampling**

Sampling theorem for band limited signals- explanation, reconstruction of signal from samples, aliasing, sampling techniques- impulse, natural and flat top sampling.

**UNIT - V: Laplace Transform**

Laplace transform of signals, properties of Region of Convergence (ROC), unilateral Laplace transform, properties of unilateral Laplace transform, inversion of Laplace transform, relationship between Laplace and Fourier Transforms.

**Text Books**

1. B.P.Lathi, “Signals, Systems &Communications”, BS Publications, 2003.
2. A.V. Oppenheim, A.S. Willsky and S.H.Nawab, “Signals and Systems”, 2nd EditionPHI.

**Reference Books**

1. Simon Haykin and Van Veen, “Signals &Systems”, 2nd edition, Wiley Publishers.
2. Michel J. Robert , “Fundamentals of Signals and Systems”, International Edition, Tata McGraw-Hill, 2008
3. C.L.Philips, J.M. Parr and Eve A. Riskin, “Signals, Systems and Transforms”, 3rd Edition, Pearson Education, 2004.

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*Open Elective - II*

## NETWORK PROGRAMMING

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce the basics of network Technologies.
- To impart in-depth knowledge in socket creation and client-server communication in TCP and UDP.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- analyze the requirements of a networked programming environment and identify the issues to be solved.
- interpret the basic network technologies and protocols usage by common internet application.
- develop client-server communication using TCP for communicating processes exist in the different systems.
- apply theoretical principles and use appropriate functions for establishing client-server communication.
- develop client-server communication using UDP protocols by writing socket programming.

**Course Content**

**UNIT - I: Introduction to Network Programming**

OSI model, UNIX standards, TCP and UDP and TCP connection establishment and termination, port numbers, TCP port numbers and concurrent servers, buffer sizes and limitation, protocol usage by common internet application.

**UNIT - II: Sockets**

Address structures, value–result arguments, byte ordering and manipulation functions. Elementary TCP sockets–socket, connect, bind, listen, accept, fork function, concurrent servers.

**UNIT - III: TCP Client-Server**

Introduction, TCP echo server functions, normal startup, termination, POSIX signal handling, termination of server process, crashing and rebooting of server host, shutdown of server host.

**UNIT - IV: I/O Multiplexing and Socket Options**

I/O models, select function, poll function, TCP echo server, getsockopt and setsockopt functions.

**UNIT - V: Elementary UDP Sockets**

Introduction, UDP echo server function, lost datagrams, UDP example, lack of flow control with UDP.

**Text Books**


1. W.Richard Stevens, Bill Fenner, Andrew M. Rudoff, "UNIX Network Programming: The Sockets Networking API", Volume 1, 3rd edition, Addison-Wesley.
2. W. Richard Stevens, "UNIX Network Programming", 1st edition, PHI.


**Reference Books**


1. Graham Glass, King Ables, "UNIX for Programmers and Users", 3rd edition, Pearson Education.
2. Marc. J. Rochkind, "Advanced UNIX Programming", 2nd edition, Pearson Education.


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*Open Elective - II*

## SOCIAL NETWORK ANALYSIS

III Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To provide students with essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate social network analysis and measures.
- analyze random graph models and navigate social networks data
- apply the network topology and Visualization tools.
- analyze the experiment with small world models and clustering models.
- compare the application driven virtual communities from social network Structure.

**Course Content**

**UNIT - I: Graphs**

Graphs as models of Networks, Paths and Connectivity, Distance and Breadth-First Search, The Strength of Weak Ties, Structual Holes, Betweenness measure, Homophily, Affiliation, Structural Balance.

**UNIT - II: Link Analysis and Web Search**

Web as Directed Graph, Searching the Web, Link Analysis Using Hubs and Authorities, Page Rank, Applying Link Analysis in Modern Web Search.

**UNIT - III: Cascading Behavior in Networks**

Power Laws, Rich-Get-Richer Phenomenon, Diffusion, Cascading Behavior, Cascades and Clusters, Role of Weak Ties.

**UNIT - IV: Small World Phenomenon**

Six Degrees of Separation, Structure and Randomness, Decentralized search, Empirical Analysis and Generalized Models.

**UNIT - V: Basics of Game Theory**

Games, Reasoning about behavior in games, Best Responses and Dominant Strategies, Nash Equilibrium, Multiple Equilibria, Mixed Strategies.

**Text Books**

1. D. Easley and J. Kleinberg, Networks, Crowds and Markets: Reasoning about a highly connected world-2010.
2. Tanmoy Chakraborthy, Social Network Analysis, Wiley.

**Reference Books**

1. Social Network Analysis: Methods and Applications (Structural Analysis in the Social Sciences) by Stanley Wasserman, Katherine Faust, 1994.

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*Open Elective - II*

## CYBER SECURITY

III Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To expose the multiple cyber security technologies, processes, and procedures.
- To analyze the threats, vulnerabilities and risks present in these environments.
- To develop appropriate strategies to mitigate potential cyber security problems.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate the fundamentals of cyber crimes and information security systems.
- analyze and resolve security vulnerabilities in networks and computer systems to secure an it infrastructure.
- develop a security architecture for an organization which can handle mobile, wireless devices and related security issues.
- use the cybercrime tools and methods in solving real world problems
- analyze web and internet security threats and find the solutions

**Course Content**

**UNIT - I:**

Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

**UNIT - II:**

Cyber offenses: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

**UNIT - III:**

Cybercrime-Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Authentication Service Security, Attacks on Mobile/Cell Phones,

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT - IV:**

Tools and Methods Used in Cybercrime: Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (IDTheft).

**UNIT - V:**

Web and Network Security: Introduction, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Overview of Vulnerability Scanning, Scanning for Web vulnerabilities, Firewalls, Packet Filters, How a firewall protects a network.

**Text Books**


1. Nina Godbole and SunitBelpure ¯ Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives , 1st Edition Publication Wiley, 2011.
2. Mike Shema, ¯Anti-Hacker Tool Kit (Indian Edition) ,1st Edition Publication Mc Graw Hill.


**Reference Books**


1. Mark Rhodes, Ousley, Information Security, 1st Edition ,MGH, 2013.


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*Open Elective - II*

## E-COMMERCE

III Year – I Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To introduce the basic concepts of E-Commerce.
- To gain the knowledge on various Mercantile Process models.
- To identify the concepts of E-Payment Systems and Web Marketing Strategies.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- outline the fundamentals in E-Commerce Frame work and Concepts.
- describe various Mercantile Process models for Consumers and Merchants.
- analyze Electronic Data Interchange (EDI) problems to perform e-transactions.
- categorize and classify various E-Payment systems used in online transaction procesing.
- distinguish various web marketing Strategies to improve customer relationship and marketing.

**Course Content**

**UNIT - I: Electronic Commerce Framework**

Introduction, Electronic Commerce Framework, Anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

**UNIT - II: Consumer Oriented Electronic Commerce**

Consumer Oriented Applications, Mercantile process models, Mercantile models from the consumer's perspective, Mercantile models from the merchant's perspective.

**UNIT - III: Inter and Intra Organizational Commerce**

Inter Organizational Commerce-EDI, EDI implementation, Value Added Networks, Intra Organizational Commerce -Work flow automation and coordination, Supply chain management.

**UNIT - IV: Payment Systems for Electronic Commerce**

Online Payment basics, payment cards, Electronic Cash, Electronic Wallets, Stored-Value Cards, Internet Technologies and the Banking Industry.

**UNIT - V: Marketing on the Web**

Web Marketing Strategies, Communicating with Different Market Segments, Advertising on The Web, E-Mail Marketing, Technology enabled Customer Relationship Management. Search engine Positioning and Domain Names.

**Text Books**


1. Kalakota, Winston , Frontiers of electronic commerce , Pearson, 2nd Edition, 2012.
2. Gary P.Schneider Thomson , Electronic Commerce, 7th Edition, 2012


**Reference Books**


1. S.Jaiswal ,E-Commerce, Galgotia publications.
2. Efrain Turbon, Jae Lee, David King ,E-Commerce, H.Michael Chang.


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*Open Elective - II*

## INTELLIGENT SYSTEMS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To understand the fine structure or deeper origin of knowledge
- To generate intelligent behavior on the basis of statistical evidence.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate Data representation and Logical operations.
- analyze backward reasoning and solving problems by reduction.
- learning of Verification and Validation of Rule Bases .
- explain the architecture of real time expert systems.
- define Quantitative simulation.

**Course Content**

**UNIT - I: Knowledge Representation**

Data and knowledge: Data representation and data items in traditional databases, Data representation and data items in relational databases. Rules: Logical operations, Syntax and semantics of rules, Data log rule sets, the dependence graph of data log rule sets, objects.

**UNIT - II: Rule Based Systems**

Solving problems by reasoning: The structure of the knowledge base, the reasoning algorithm, Conflict resolution, Explanation of the reasoning.

Forward reasoning: The method of forward reasoning, a simple case study of forward reasoning, backward reasoning: Solving problems by reduction, the method of backward reasoning, a simple case study of backward reasoning, Bidirectional reasoning.

**UNIT - III: Verification and Validation of Rule Bases**

Contradiction freeness: The notion of contradiction freeness, Testing contradiction freeness, The search problem of contradiction freeness .Completeness: The notion of completeness, Testing Completeness, The search problem of completeness. Decomposition of knowledge bases: Strict decomposition, Heuristic decomposition.

**UNIT - IV: Real-Time Expert Systems**

The architecture of real-time expert systems: The real-time subsystem, The intelligent subsystem Synchronization and communication between real-time and in-

telligent subsystems: Synchronization and communication primitives, Priority handling and time-out. Data exchange between the real-time and the intelligent subsystems: Loose data exchange, the blackboard architecture. Software engineering of real- time expert systems: The software lifecycle of real time expert systems, Special steps and tool, An Example of A Real-Time expert System.

**UNIT - V: Qualitative Reasoning**

Sign and interval calculus, Qualitative simulation: Constraint type qualitative differential equations, The solution of QDEs: the qualitative simulation algorithm: Initial data for the simulation, Steps of the simulation algorithm, Simulation results. Qualitative physics, Signed directed graph (SDG) models.

**Text Books**


1. Intelligent Control Systems-An Introduction with Examples by Katalin M. Hangos, RozáliaLakner ,MiklósGerzson, Kluwer Academic Publishers.
2. Intelligent Systems and Control: Principles and Applications Paperback – 12 Nov 2009 by Laxmidhar Behera, Indrani Kar by OXFORD.


**Reference Books**


1. Intelligent Systems and Technologies Methods and Applications by Springer publications.
2. Intelligent Systems - Modeling, Optimization and Control, by Yung C. Shin and Chengying Xu, CRC Press, Taylor & Francis Group, 2009.


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*Open Elective - II*

## RECOMMENDER SYSTEMS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To learn basic techniques for building recommender Systems.
- To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- identify the importance of Recommender Systems.
- model Recommender System by using Content-based Filtering technique.
- build Recommender System by Collaborative Filtering technique.
- design Recommender System by Hybrid approaches.
- evaluate Recommender Systems.

**Course Content**

**UNIT - I: Introduction**

Introduction, Recommender Systems Function, Data and Knowledge Sources, Recommendation Techniques, Application and Evaluation, Challenges.

**UNIT - II: Content-based Filtering**

High level architecture of content-based systems, Content representation and content similarity, Similarity-based retrieval, Other text classification methods, Comparative evaluation, Limitations.

**UNIT - III: Collaborative Filtering**

User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, About ratings, Further model-based and preprocessing-based approaches, Recent practical approaches and systems.

**UNIT - IV: Hybrid Approaches**

Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade, Meta-level.

**UNIT - V: Evaluating Recommender System**

Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets.

**Text Books**


1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st edition.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st edition.


**Reference Books**


1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1st edition.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st edition.


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*Open Elective - II*

## INTRODUCTION TO IoT ARCHITECTURE

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To impart the basic characteristics and different technologies with the IoT.
- To familiarize with architectures, enabling technologies and design methodologies of IoT.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate the concepts of IoT and its characteristics.
- make use of the design methodologies of IoT.
- compare IoT and M2M.
- outline different technologies used in IoT.
- explain the case studies on IoT.

**Course Content**

**UNIT - I: Internet of Things Concepts**

Introduction to Internet of Things, Block diagram of IoT, characteristics of IoT, architectural view of IoT, Physical Design of IoT, Logical Design of IoT.

**UNIT - II: IoT Design Templates & Design Methodology**

IoT Enabling Technologies, IoT levels, Development Templates, Developing Internet of Things: Introduction, IoT Design Methodology.

**UNIT - III: IoT and M2M**

M2M, Differences between IoT and M2M, SDN and NFV for IoT, Software defined Networking, Network Function Virtualization.

**UNIT - IV: IoT Technologies**

Basic building blocks of IoT, Introduction to cloud storage models, Role of Machine learning, Artificial Intelligence and Data Science in IoT, Categories of ML, Applications of ML, Tools in ML, Requirement of Data analytics in IoT.

**UNIT - V: Case Studies**

Case studies on Domain specific IoT's, Home Automation, cities, environment, Agriculture and health monitoring and energy, Health and fitness monitoring.

**Text Books**

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On-Approach”, Arshdeep & Vijay Madisetti Publishers, 2014.
2. V.K.Jain, “Data science and Analytics”, Khanna Publishing, 2018.
3. Rajkamal, Internet of Things Architecture & Design Principles”, Mc.Grawhill

**Reference Books**

1. Vlasios Tsiatsis Stamatis Karnouskos Jan Holler David Boyle Catherine Mulligan, “InternetofThings”, Academic Press, 2018.
2. Daniel Kellmereit, “The Silent Intelligence: The Internet of Things”, Lightning Source Inc., 2014.

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*Open Elective - II*

## INTRODUCTION TO SMART SENSORS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce the fundamentals of smart sensors and provides interfacing with embedded hardware.
- To gain knowledge of the latest developments in measurement and sensors expose with the various types of smart sensors.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- classify different types of smart sensor for iot applications
- apply signal conditioning circuit for sensor interface to digital computer.
- gain the knowledge required for interfacing the smart sensor
- demonstrate the various packaging types of smart sensor

**Course Content**

**UNIT - I: Sensor Devices**

Piezoresistive pressure sensor, Piezoresistive Accelerometer, Capacitive Sensing-Accelerometer and Microphone, Resonant Sensor and Vibratory Gyroscope Nano Sensors.

**UNIT - II: Interfacing Sensor Information and MCU**

Amplification and Signal Conditioning- Integrated Signal Conditioning- Digital conversion- MCU Control MCUs for Sensor Interface- Techniques and System Considerations- Sensor Integration.

**UNIT - III: Control Techniques and Standards**

Control of Sensors using - State Machines, Fuzzy Logic, Neural Networks, adaptive Control.

**UNIT - IV: Communication for Smart Sensor**

Wireless Data Communications- RF Sensing- Telemetry- Automotive Protocols-Industrial Networks, Home Automation- MCU Protocols.

**UNIT - V: Packaging, Testing and Reliability Implications of Smart Sensors**

Semiconductor Packaging- Hybrid Packaging- Packaging for Monolithic Sensors-Reliability Implications Testing Smart Sensors- HVAC Sensor Chip.

**Text Books**

1. Randy Frank, “Understanding Smart Sensors”, Artech House, Second Edition, 2011Boston.
2. Minhang Bao, “Analysis and design principles of MEMS devices”, Elsevier Publications, 2005,USA.

**Reference Books**

1. Nadim Maluf and Kirt Williams, “An Introduction to Micro Electro Mechanical Systems Engineering”, Second Edition, Artech House Publishers, June 2004, USA.
2. Gabriel M. Rebeiz, “RF MEMS: Theory, Design, and Technology”, Wiley-Inter science; 1st edition, 2002,UK

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*Open Elective - III*

## BASICS OF ENVIRONMENTAL ENGINEERING

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To understand the basic of water borne diseases,drinking water standards and treatment of wastewater and disposal
- To expose the students to understand to treatment of wastewater and disposal
- To learn the basics of air pollution and effects, noise pollution and solid waste disposal

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate water sources, water borne diseases, water treatment and potable water standards
- understand basicsof wastewater treatment and disposal methods
- identity air pollution sources and understand air pollution effects
- identity noise pollution sources and understand noise pollution effects
- understand sources and basic principles of solid waste

**Course Content**

**UNIT - I: Water**

Sources of water; Availability of fresh water; Water borne diseases; Brief explanation on ground and surface water treatment; Potable water standards as per IS and WHO standards; Water conservation; Role of public health engineering department in the prevention of the water borne diseases.

**UNIT - II: Wastewater**

Wastewater sources; Sewage characteristics; Brief explanation on treatment of sewage; Disposal of treated wastewater; Practise on reuse of treated wastewater; Effects of wastewater without treatment disposal in streams, on land

**UNIT - III: Air Pollution Sources and Effects**

Layers of atmosphere; Sources and classification of air pollutants – Man made, Natural sources; Type of air pollutants; Pollution due to automobiles; Effect of air pollution on health, vegetation and materials; Global warming; Worst environmental disasters caused by humans.

**UNIT - IV: Noise Pollution**

Sources of noise pollution - plane, point and line sources, multiple sources; Effect of noise pollution on humans; Control of noise pollution; Outdoor and indoor noise propagation; Intensity of noise pollution; Noise pollution permissible limits as per CPCB and WHO

**UNIT - V: Solid Waste**

Sources of solid waste – classification solid waste - Basic principles of Solid Waste storage, collection, transportation, processing and Disposal.

**Text Books**


1. Water supply Engineering – Environmental Engineering (Vol. I) by S.K. Garg (2019)– Khanna Publishers.
2. Sewage Disposal and Air Pollution Engineering – Environmental Engineering (Vol. II)S.K. Garg (2019) – Khanna Publishers.
3. Water Supply Engineering by Punmia B.C., Ashok Jain & Arun Jain (2014), Laxmi Publication Pvt., Ltd., New Delhi
4. Wastewater Engineering by Punmia B.C., Ashok Jain & Arun Jain (2014), Laxmi Publication Pvt., Ltd., New Delhi


**Reference Books**


1. Environmental Engineering by Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, McGraw Hill Inc., New York, 2017.
2. Handbook of Solid Waste Management by Frank Kreith and George Tchobanoglous, McGraw-Hill, 1994.


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*Open Elective - III*

## DISASTER PREPAREDNESS, PLANNING AND MANAGEMENT

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To provide an exposure to disasters, their significance and types.
- To impart the knowledge on different approaches of disaster preparedness.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- analyse the concepts, terminologies and developments in thefield of disaster and disaster management.
- differentiate the types of disasters, causes and their impact on environment and society.
- explain the process of risk and vulnerability.
- assess different types of disaster preparedness.
- explain the role of technology in disaster management.

**Course Content**

**UNIT - I: Disaster and Disaster Management**

Introduction, Disaster, Hazard – Classification of hazard, Magnitude of disasters, Vulnerability – Categorization of vulnerabilities, Coping Capacity, Risk – Disaster risk management, Risk formula, Disaster Management – Monitoring and evaluation, Disaster management cycle.

**UNIT - II: Disasters Classification**

Introduction, Types of disasters, Natural disasters - Earthquakes, Cyclones, Flood, Drought, Landslides, Avalanches, Manmade disasters – Chemical disaster, Industrial wastes, Hazardous wastes, Radioactivity, Traffic disasters.

**UNIT - III: Risk and Vulnerability**

Building codes and land use planning, social vulnerability, Macroeconomic management and sustainable development, environmental vulnerability, climate change risk rendition, financial management of disasterrelated losses.

**UNIT - IV: Disaster Preparedness**

Introduction, Components of preparedness, Formulation of preparedness plan, Types of disaster preparedness, Principles of preparedness, Problems associated with preparedness.

**UNIT - V: Role of Technology in Disaster Management**

Disaster management for infra structures, Mitigation program for earthquakes, Geospatial information in agricultural drought assessment, Multimedia technology in disaster risk management training, Transformable indigenous knowledge in disaster reduction.

**Text Books**


1. Disaster Management – Global Challenges and Local Solutions, by Rajib shah & R R Krishnamurthy, Universities press, 2009.
2. Disaster management,M.M. Sulphey, PHI Learning Pvt. Ltd, 2016.


**Reference Books**


1. Disaster Science & Management by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazard by S. Vaidyanathan, CBS Publishers& Distributors Pvt. Ltd.
3. Disaster Management - Future Challenges and Opportunities by Jagbir Singh I K International Publishing House Pvt. Ltd, 2007.


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*Open Elective - III*

## PRINCIPLES OF SPECIAL ELECTRIC MACHINES

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To familiarize the students with the constructional details, operating principles, theory of torque production, and characteristics of various special electrical machines.
- To expose the students to different control practices associated with various special electrical machines and applications of special electrical machines.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe the constructional and operating principles, control schemes and applications of various types of Stepper Motors.
- explain the constructional details, working principles, control practices and applications of Switched Reluctance Motors.
- analyze the speed-torque characteristics, construction and principle of operation, control techniques and applications of Permanent Magnet Brushless D.C. Motors.
- acquire the knowledge of operating principles, constructional details and applications of Servomotors and Tachometers.
- compare the constructional details, principle of operation and applications of various single phase special electrical machines.

**Course Content**

**UNIT - I: Stepper Motors**

Constructional features – Types – Variable Reluctance and Permanent Magnet motors – Principle of operation – Dynamic Characteristics –Closed loop control of Stepper Motor – Applications.

**UNIT - II: Switched Reluctance Motors**

Constructional features – Principle of operation – Torque Equation – Torque Speed characteristics –Closed loop control of SRM – Applications.

**UNIT - III: Permanent Magnet Brushless D.C. Motors**

Constructional features – Principle of operation – EMF equations – Torque and Speed characteristics – control of PMBLDC motor –Applications.

**UNIT - IV: Servomotors and Tachometers**

Servomotor – Types – Constructional features – Principle of Operation – Characteristics – Applications of Servomotors – AC Tachometers – Schematic diagram – Operating Principle.

**UNIT - V: Single Phase Special Electrical Machines**

AC series Motor – Repulsion Motor – Reluctance Motor - Hysteresis Motor – Constructional features, Principle of Operation, Characteristics and Applications of the above motors.

**Text Books**


1. Special Electrical Machines by E.G.Janardanan, PHI Learning Pvt Ltd, Delhi, 2014.
2. Principles of Special Electrical Machines by J.Gnanavadivel, Dr.S.Muralidharan and J.Karthikeyan, Anuradha Publications, Chennai, 2013.


**Reference Books**


1. Stepping Motors and their Microprocessor Controls by Takashi Kenjo, Clarendon Press, 1984.
2. Special Electrical Machines by K.Venkata Ratnam, University press, New Delhi, 2009.
3. Basic Electrical Engineering by C.L.Wadhwa, New Age
4. International (P) Limited Publishers, New Delhi, 2007.
5. Principles of Electrical Machines by V.K.Mehta andRohit
5. Mehta, S.Chand Publishing,New Delhi, 2014.
6. Stepping Motors: A Guide to Modern theory and practice by P.P.Acarnley, Peter Peregrines, London, 2002.
7. Brushless Permanent Magnet & Reluctance Motor Drives by T.J.E. Miller, Clarenden press, Oxford, 1989.


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*Open Elective - III*

## ELECTRICAL INSTRUMENTATION

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To familiarize various types of signals, their representation and measurements using CRO.
- To impart knowledge on construction, operation and working principles of digital measuring instruments and Transducers.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- analyze various types of signals, and errors in digital instruments.
- measure various parameters like amplitude, phase and frequency of a signal using CRO.
- select a suitable transducer working on electrical principles to measure non electrical quantities.
- select a suitable transducer working on non-electrical principles to measure physical parameters.
- analyse the operation of various digital meters.

**Course Content**

**UNIT - I: Signals and their Representation**

Measuring Systems, Performance Characteristics, – Static characteristics – Dynamic Characteristics – Errors in Measurement – Gross Errors – Systematic Errors – Statistical analysis of random errors. Signal and their representation – Standard test, periodic, aperiodic, modulated signal – Sampled data pulse modulation and pulse code modulation.

**UNIT - II: Cathode Ray Oscilloscope**

Basic operation of Oscilloscope Cathode ray oscilloscope – Cathode ray tube – Time base generator – Horizantal and vertical amplifiers – Measurement of phase and frequency – Lissajous patterns.

**UNIT - III: Transducers**

Classification of transducers – Characteristics and choice of transducers – Principle operation of resistor, inductor, and capacitor transducers – LVDT – Strain gauge and its principle of operation – Gauge factor– Thermistors – Thermocouples– Piezo electric transducers -– Pyro transducer – Hall sensor.

**UNIT - IV: Measurement of Non–Electrical Quantities**

Velocity – Angular Velocity – Acceleration – Force – Torque – Measurement of Temperature, Pressure, Vacuum, Flow, Liquid level.

**UNIT - V: Digital Voltmeters**

Digital voltmeters – Successive approximation, ramp, dual–Slope integration continuous balance type – Micro-processor-based ramp type – DVM digital frequency meter – Digital phase angle meter – Q Meter.

**Text Books**


1. Electronic Instrumentation–by H.S.Kalsi Tata MCGraw–Hill Higher Education 4thEdition, 2018.
2. Electrical & Electronic Measurement & Instruments,A.K.Sawhney and Puneet Sawhney, Dhanpat Rai & Co., Pvt. Ltd., 18th edition, 2010.


**Reference Books**


1. Measurement and Instrumentation: Theory and Application, Alan S.Morris and Reza Langari, S. Netherlands: Elsevier Science, 2nd edition,2015.
2. Measurement Systems: Application and Design. Doebelin, E., Japan: McGraw – Hill Higher Education, 4th edition, 2003.
3. Modern Electronic Instrumentation and Measurement Techniques. Cooper,W. D., Helfrick, A. D.India: Pearson Education. 1st edition, 2005.
4. Transducers and Instrumentation. by D. V. S.MURTY, India, PHI Learning 2nd edition, 2010.


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*Open Elective - III*

## GREEN ENGINEERING

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To impart the knowledge needed to minimize impacts of products, processes on environment for sustainable development.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- evaluate the impact of technology on environment.
- compare biological ecology to industrial ecology.
- create sustainable products, facilities, processes and infrastructure.
- assess the life cycle of a product to evaluate its impact on energy and materials use.
- analyze technological systems.

**Course Content**

**UNIT - I: Introduction**

Humanity and technology, the concept of sustainability, quantifying sustainability.

**UNIT - II: Frame Work for Green Engineering**

Industrial ecology, relevance of biological ecology to industrial ecology, metabolic analysis, technology and risk, the social dimensions of industrial ecology.

**UNIT - III: Implementation**

Technological product development, design for environment and sustainability-customer products- buildings and infrastructure.

**UNIT - IV: Life Cycle Assessment**

An introduction to life cycle assessment, the LCA impact and interpretation stages, streamlining the LCA process.

**UNIT - V: Analysis of Technological Systems**

Systems analysis, industrial ecosystems, material flow analysis, energy and industrial ecology, air quality impacts, carbon cycles and energy balance, water quality impacts.

**Text Books**

1. T E Graedel, Braden R Allenby, “Industrial Ecology and Sustainable Engineering”, Prentice Hall, 2010.

2. David T. Allen, David R Shonnard, “Sustainable Engineering Concepts, Design and Case Studies”, Prentice Hall, 2012.

**Reference Books**

1. Bradley A. Striebig, Adebayo A. Ogundipe, Maria Papadakis, “Engineering Applications in Sustainable Design and Development”, Cengage Learning, 2016.
2. Anastas, Paul T, Zimmerman, Julie B, “Innovations in Green Chemistry and Green Engineering”, Springer, First Edition, 2013.
3. Daniel A. Vallero, Chris Brasier, “Sustainable Design: The Science of Sustainability and Green Engineering”, Wiley, First Edition, 2008.

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*Open Elective - III*

## 3D PRINTING TECHNOLOGIES

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To present the various 3D printing technologies for manufacturing.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- explain the fundamental principles of Rapid prototyping.
- explain the RP processes and analyze their process parameters.
- select appropriate 3D printing technique for a given application.

**Course Content**

**UNIT - I:**

**Introduction:** Brief description on design process**,** Prototyping fundamentals, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

Rapid Prototyping Data Formats: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file repairs: generic solutions, other translators, newly proposed formats- AMF Files Format.

**UNIT - II:**

**Liquid-Based Rapid Prototyping Systems**: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies.

**Solid Ground Curing (SGC):** models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

**UNIT - III:**

**Solid-Based Rapid Prototyping Systems:** Laminated object manufacturing (LOM) – models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM) – models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

**UNIT - IV:**

**Powder Based Rapid Prototyping Systems:** Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. three dimensional printing (3DP): models and

specifications, process, working principle, applications, advantages and disadvantages, case studies.

**UNIT - V:**

**RP Applications**: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis.

**Text Books**


1. Ian Gibson, et.al., "Additive Manufacturing Technologies – 3D Printing, Rapid Prototyping and Direct Digital Manufacturing", Springer Publications, 2nd Edition, 2015.
2. Chua C.K., Leong K.F. and LIM C.S, "Rapid prototyping: Principles and Applications", World Scientific publications, 2010.


**Reference Books**


1. D.T. Pham and S.S. Dimov, "Rapid Manufacturing – The Technologies and Applications of Rapid Prototyping and Rapid Tooling", Springer Publications, 2001.
2. Andreas Gebhardt, Jan – Steffen Hotter, "Additive Manufacturing – 3D Printing for Prototyping and Manufacturing", Hanser Publishers, Munich, 2016.
3. Zimmers&P.Groover, "CAD/CAM", Pearson Education, 1st Edition, 2003.


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*Open Elective - III*

## ASSISTIVE TECHNOLOGIES

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce different assistive technology devices.
- To familiarize with the concepts of enhancing speech communication and Independent Living.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- identify the adaptation framework connected with assistive technologies.
- demonstrate various types of assessments for assistive technologies.
- explore the processes to enhance speech communication.
- describe the process to enhance mobility and information access.
- analyze the technology aspects needed for independent living.

**Course Content**

**UNIT - I: Introduction to Assistive Technology and Adaptation Framework**

Definition and historical overview of assistive technology, multidisciplinary nature of service provision, introduction to adaptations framework, selecting specific characteristics, evaluation of effectiveness of adaptations.

**UNIT - II: Assistive Technology Assessments**

Overview of assessment issues, overview of general assessments, assistive technology assessments, assessment components.

**UNIT - III: Enhance Speech Communication**

Nature of spoken language, introduction to augmentative and alternative communication systems, selection techniques for aided communication systems, overview of non-electronic systems and electronic devices.

**UNIT - IV: Mobility and Access to Information**

Introduction to mobility adaptations, basic design considerations, seating and positioning issues, introduction to information access, computer access, telecommunication, listening and print access.

**UNIT - V: Enhance Independent Living**

Introduction to independent living, devices for daily life, switches and scanning, environmental control units, access to management devices.

**Text Books**

1. Diane P edrotty Bryant, Brian R. Bryant, Allyn, Bacon, “Assistive Technology for People with Disabilities”, 2nd Edition, Psycho Educational Services.

**Reference Books**

1. Marion A. Herash, Michael A. Johnson, “Assistive Technology for the Hearing Impaired, Deaf and Deafblind”, Springer Publications, 2003.
2. Meeko Mitsuko K. Oishi, Ian M. Mitchell, H.F. MachielVanderloss, “Design and use of Assistive Technology”, Springer Publications, 2010.
3. Eckehard Fozzy Moritz, “Assistive Technologies for the Interaction of the Elderly”, Springer Publications, 2014.

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*Open Elective - III*

## INTRODUCTION TO BIO-MEDICAL ENGINEERING

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To introduce the basics of biological concepts and relate it to engineering.
- To familiarize with physiology of cardio-vascular system, respiratory system and the elements of Patient Care Monitoring.
- To impart the knowledge on the diagnostic techniques and shocking hazards.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate the novel theory related to human body and various components in cardio vascular system.
- relate the concept of electrode theory and transduction principles to bio-medical instrumentation.
- analyze the operation of measuring the cardio-vascular and respiratory systems by knowing its inner organization.
- outline the patient care monitoring.
- apply the fundamental principles & techniques of diagnosis and demonstrate shocking hazards related to biomedical instrumentation.

**Course Content**

**UNIT - I: Introduction to Bio-Medical Instrumentation and Electro-Cardiography**

Man instrumentation system-introduction & components, physiological system of the body, sources of bio-electric potentials, resting & action potentials,The heart & cardiovascular system, Electro-Cardiography, Electro-Cardiogram(ECG),Electro-Encephalogram(EEG).

**UNIT - II: Electrodes& Transducers**

Bio-potential electrodes, basic transducers-transduction principles, biochemical transducers, active & passive transducers, transducers of bio-medical applications.

**UNIT - III: Measurements of Cardio-Vascular & Respiratory Systems**

Blood pressure measurement, pulse sensors, the physiology of the respiratory system, tests & instrumentation for the mechanics of breathing, respiration sensors, respiratory therapy equipment.

**UNIT - IV: Patient Care & Monitoring**

Elements of intensive care monitoring, patient monitoring displays, diagnosis,organization of the hospital for patient care monitoring, pace-makers, defibrillators.

**UNIT - V: Diagnostic Techniques &Shocking Hazards**

Principles of ultrasonic measurement, Ultrasonic Imaging, Ultrasonic Diagnosis, X-Ray &CT Scan, MRI,shock hazards & prevention, physiological effects & electrical equipment, methods of accident prevention

**Text Books**


1. Onkar N. Pandey, Rakeshkumar, "Bio-Medical Electronics and Instrumentation", S. K. Kataria& Sons, 2007.
2. Cromewell, Wiebell, P.feiffer, "Biomedical instrumentation and measurements",Prentice-Hall, 1973.


**Reference Books**


1. Joseph J.Carr, John M.Brown, "Introduction to Bio-Medical EquipmentTechnology", 4th Edition, Pearson Publications.
2. Khandapur, "Handbook of Bio-Medical Instrumentation", 2nd Edition, Tata McGrawHill.


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*Open Elective - III*

## DEVOPS

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To familiarize with precise knowledge of tools to architect effective pipelines by selecting tools suitable for specific scenarios.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- explain fundamentals and advance concepts of Agile and DevOps.
- describe Usage of multiple tools for unit functions in a DevOps pipeline.
- illustrate various types of version control systems, continuous integration tools.
- elaborate on various tools to orchestrate, deployment, infrastructure management.
- outline Devops and Cloud work together.

**Course Content**

**UNIT - I: The World without DevOps and Agile Methodology and DevOps**

Introduction- Problem Case Definition, Benefits of fixing Application Development Challenges, DevOps Adoption Approach through Assessment.

Agile Methodology and DevOps - Before Agile-Waterfall, Agile Development, What is DevOps, DevOps Importance and Benefits, Devops Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing.

**UNIT - II: Tool Suits**

Introduction, Atlassian Tools - Key Features, where can Atlassian be Best Utilized, Pros and cons of Atlassian, Phabricator - Key Features, where can Phabricator be Best Utilized, Pros and cons of Phabricator.

**UNIT - III: Orchestration**

Introduction, Jenkins- Features, Example of Reference Architecture. Ansible - Key Features, Pros and Cons, Example of Reference Architecture, Bamboo- Key Features, Pros and Cons, Example of Reference Architecture.

**UNIT - IV: Application Lifecycle Management and Deployment and Infrastructure Management**

Introduction, JIRA - Key Features, Pros and Cons, Example of Reference Architecture, Chef - Key Features, Pros and Cons, Example of Reference Architecture.

**UNIT - V: DevOps with Cloud**

Introduction, DevOps and Cloud Adoption- Benefits of using DevOps along with Cloud, Few best practices for DevOps in the Cloud. AWS- Reasons for selecting AWS for DevOps. Features of AWS, AWS tools and services for Orchestrating DevOps Capability, Pros and Cons.

**Text Books**


1. Deepak Gaikwad, Viral Thakkar, DevOps Tools, from Practitioner's viewpoint, 1st edition, Wiley.
2. Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, 1st edition, 2010.


**Reference Books**


1. Jenkins and Kubernetes, Pierluigi Rit, Pro DevOps with Google Cloud Platform With Docker, Apress.


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*Open Elective - III*

## OBJECT ORIENTED ANALYSIS AND DESIGN

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To get familiar with the Object Oriented Analysis and Design in software development, develop UML structural and behavioral models of an application.
- To describe and choose an appropriate Design Pattern to refine the model.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- apply the object oriented analysis and designs in software development and familiar with the UML concepts.
- develop static conceptual models of the system.
- create dynamic behavioral models of the system to meet user needs.
- design object oriented architecture models.

**Course Content**

**UNIT - I: Introduction to UML**

Importance of modeling, principles of modeling, object oriented modeling, Conceptual model of the UML, Architecture of UML.

**UNIT - II: Structural Modelling**

Structural Modeling:Classes, Relationships: Dependency, Generalization, Realization and Association- advanced features of association, Class diagrams, Interfaces and Packages, Object Diagrams.

**UNIT - III: Behavioral Modelling**

Behavioral Modeling: Use case, Use case Diagrams, Interactions, Interaction Diagrams- Sequence diagram, Collaboration diagrams.

**UNIT - IV: Advanced Behavioral Modelling**

Activity diagrams, Common modeling techniques of Activity diagram.

Advanced Behavioral Modeling: Events and signals, state machines, state chart diagrams.

**UNIT - V: Architectural Modelling**

Architectural Modeling: Components, Component diagrams, Deployment, Deployment diagrams.

**Text Books**

1. "The Unified Modeling Language User Guide", Booch, James Rumbaugh, Ivar Jacobson, Pearson Education 13th Edition,2004.
2. "Fundamentals of Object Oriented Design in UML", Meilir Page-Jones, Pearson Education.

**Reference Books**

1. "Object Oriented Analysis and Design with Applications", Grady Booch, Pearson Education Asia, 2nd Edition.
2. "Object-Oriented Systems Ananlysis And Design Using UML", Simon Bennett, Steve McRobb and Ray Farmer , TATA McGrawHill, 2nd Edition.

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*Open Elective - III*

## SCRIPTING LANGUAGES

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To familiarize with JQuery, JSON, PERL, Ruby, AJAX to develop client-side and server-side web applications.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- make use of jQuery with DOM to manipulate HTML elements, attributes and CSS.
- develop script to exchange data between server and browser using JSON.
- develop PERL scripts using arrays, hashes, control structures and subroutines.
- create Ruby scripts using data types, arrays, hashes, control structures and classes.
- develop script to retrieve data from a database using PHP and AJAX.

**Course Content**

**UNIT - I: jQuery**

Introduction, Selectors, Events, Effects, Manipulating HTML and CSS using jQuery.

**UNIT - II: JSON**

Introduction, Syntax rules, JSON vs XML, Data types, Objects, Arrays, Parsing JSON and using stringify() function.

**UNIT - III: PERL**

Basic Syntax, Perl Language Elements: Variables, Operators, Control Flow Statements, Arrays, Hashes, Subroutines, Packages and Modules, File Handling and Operations on Files, Retrieving Documents from the Web using Perl LWP.

**UNIT - IV: Ruby**

Introduction to Ruby, Variables, types, simple I/O, Control, Arrays, Hashes, Methods, classes, Iterators.

**UNIT - V: AJAX A New Approach**

Introduction, Creating XMLHttp Request object, Integrating AJAX with PHP, Retrieving data from a database using PHP and AJAX, Handling XML data using PHP and AJAX.

**Text Books**

1. Kogent , HTML 5 Black Book, 2nd Edition, Dreamtech Press
2. Dave Thomas, Programming Ruby 1.9 & 2.0: The Pragmatic Programmers' Guide, 4th Edition, Pragmatic Bookshelf.

**Reference Books**

1. Randal L. Schwartz Brian D. Foy, Tom Phoenix, Learning Perl, 6th edition, O'REILLY Publications.

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*Open Elective - III*

## FUNDAMENTALS OF SOFTWARE PROJECT MANAGEMENT

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To plan and manage projects at each stage of software development life cycle (SDLC).
- To develop effective software projects that support organization's strategic goals.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- interpret various necessary rudiments of software project management.
- apply improvement strategies to see the inline growth in economic concerns of the project.
- develop project plans that address real time management challenges.
- design efficient work break down structures that meet real time deadlines of a project.
- use software metrics to measure the quality of software projects and to gain insights of management issues related to the project.

**Course Content**

**UNIT - I: Introduction to Software Project Management**

Introduction, project definition, software project vs other types of project, activities covered by software project management, ways to categorize software projects, project as a system, management definition, problems with software projects , management control, stakeholders, requirement specification.

**UNIT - II: Conventional Software Management**

The waterfall model, conventional software Management performance, Evolution of Software Economics: Software Economics, pragmatic software cost estimation, Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness

**UNIT - III: The Old Way and The New**

**The Old Way and The New:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

**Life Cycle Phases:** Engineering and production stages, inception, Elaboration, construction, transition phases.

**UNIT - IV: Checkpoints of the Process**

**Checkpoints of the Process:** Major mile stones, Minor Milestones, Periodic status assessments.

**Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

**UNIT - V: Project Organizations and Responsibilities**

**Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations.

**Project Control and Process Instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations.

**Text Books**


1. Bob Hughes , Software Project Management, 4th edition, Mike Cotterell, TMH.
2. Walker Royce, Software Project Management, Pearson Education, 2005.


**Reference Books**


1. Joel Henry , Software Project Management, Pearson Education.
2. Pankaj Jalote , Software Project Management in practice, Pearson Education, 2005.


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*Open Elective - III*

## WEB MINING

III Year – II Semester

| | |
|---|---|
| Lecture : 3 | Internal Marks : 30 |
| Credits : 3 | External Marks : 70 |

**Course Objectives**

- To impart machine learning techniques to mine the web and other information networks like social networks and social media.
- To introduce search, retrieval, classification and recommendation methods.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- describe classic and recent developments in information retrieval, web search and web mining.
- apply Page Rank and HITS algorithm for social network data analysis.
- differentiate Universal, Focused and Topical crawlers in internet.
- analyze complex information and social networks using Information Integration techniques.
- discover sentiment from social media data using opinion mining and web usage mining.

**Course Content**

**UNIT - I: Information Retrieval and Web Search**

Basic concepts of information retrieval, IR models, text and web page preprocessing, inverted index and its compression, web search, meta-search.

**UNIT - II: Link Analysis**

Social network analysis, page rank algorithm, HITS algorithm, community discovery.

**UNIT - III: Web Crawling**

Crawler algorithm, implementation issues, universal crawlers, focused crawlers, topical crawlers.

**UNIT - IV: Information Integration**

Schema matching, pre-processing, schema level match, domain and instance level match, 1: m match, integration of web query interfaces.

**UNIT - V: Opining and Web Usage Mining**

Opining Mining - Sentiment classification, feature based opinion mining, comparative sentence and relation mining, opinion search.

Web Usage Mining - Data collection, data modelling for web usage mining, discovery and analysis.

**Text Books**

1. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data”, Springer Science & Business Media.
2. Charu C. Aggarwal, “Social Network Data Analytics”, Springer Science & Business Media.

**Reference Books**

1. GuandongXu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking Techniques and applications”, Springer Science & Business Media.

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*Open Elective - III*

## AI CHATBOTS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To learn how artificial intelligence powers chatbots, get an overview of the bot ecosystem and bot anatomy, and study different types of bots and use cases.
- To identify best practices for defining a chatbot use case and use a rapid prototyping framework to develop a use case for a personalized chatbot.

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- develop an in-depth understanding of conversation design, including onboarding, flows, utterances, entities, and personality.
- design, build, test, and iterate a fully-functional, interactive chatbot using acommercial platform.
- deploy the finished chatbot for public use and interaction.

**Course Content**

**UNIT - I: Introduction**

Benefits from Chatbots for a Business,A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape, Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR).

**UNIT - II: Chatbot Development Essentials**

Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent

**UNIT - III: Building a Chatbot Solution**

Business Considerations, Chatbots Vs Apps, Growth of Messenger Applications, Direct Contact Vs Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots.

**UNIT - IV: Natural Language Processing, Understanding, and Generation**

Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.

**UNIT - V: Introduction to Microsoft Bot, RASA, and GoogleDialogflow**

Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialogflow.

Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module.

**Text Books**


1. Abhishek Singh, Karthik Ramasubramanian, ShreyShivam, "Building an Enterprise Chatbot: Work with Protected Enterprise Data Using Open Source Frameworks",ISBN 978-1-4842-5034-1, Apress,2019.


**Reference Books**


1. Janarthanam and Srini, Hands-on chatbots and conversational UI development: Build chatbots and voice user interfaces with C (1 ed.), Packt Publishing Ltd, 2017. ISBN 978-1788294669.
2. Galitsky, Boris., Developing Enterprise Chatbots (1 ed.), Springer International Publishing, 2019. ISBN 978-303004298
3. Kelly III, John E. and Steve Hamm, Smart machines: IBM's Watson and the era of cognitive computing (1 ed.), Columbia University Press, 2013. ISBN 978- 0231168564.
4. Abhishek Singh, Karthik Ramasubramanian and ShreyShivam, Building an Enterprise Chatbot (1 ed.), Springer, 2019. ISBN 978-1484250334.


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*Open Elective - III*

## TRENDS IN IoT

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To introduce the advanced concepts in IoT
- To familiarize the digital transformation in various fields with the advent of IoT

**Course Outcomes**

Upon successful completion of the course, the students will be able to

- demonstrate the advantages of edge computing.
- describe the concepts of various technologies in IoT.
- analyze the digital transformation in IoT and future marketing.
- summarize the trust issues in IoT.

**Course Content**

**UNIT - I: Edge Computing**

Introduction, Edge Computing Architecture, Background Essentials: IoT Devices, Networking Architecture, Network Management and Control.

**UNIT - II: IoT Ecosystems and Technologies**

Introduction, support for IoT Ecosystem creation, spurring innovation in lead markets, outlook IoT vision, IoT strategic Research and Innovation Directions, IoT smart environments and applications, IoT and related future technologies.

**UNIT - III: IoT and Digital Transformation**

IoT Standardization, IoT security, IoT enabling the Digital Transformation of Industry, Case study - Farming Food and IoT: where we are going and challenges.

**UNIT - IV: IoT in Future Marketing**

Introduction, EU Initiatives and IoT Platforms for Digital Manufacturing, Digital Factory Automation, IoT Applications for Manufacturing.

**UNIT - V: Trust in IoT**

The need for evaluating trust in IoT, Trust management in IoT, Trust for devices, Trust for IoT services, consent and trust in personal data sharing, using trust in authorization

**Text Books**

1. Edge computing: Fundamentals, Advances and Applications, K.Anitha Kumari, G.Sudha Sada sivam, D.Dharani, M.Niranjamurthy, CRC Press,Taylor Francis Group,2022
2. Digitising the Industry Internet of Things Connecting the Physical, Digital and Virtual Worlds, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publisher series.

**Reference Books**

1. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”,Apress 2016.
2. Vijay Madisetti, Arshdeep Bahga,” Internet of Things A Hands-On- Approach”, 2014.

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*Open Elective - III*

## ACADEMIC COMMUNICATION

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 | Internal Marks | : 30 |
| Credits | : 3 | External Marks | : 70 |

**Course Objectives**

- To acquaint the students with the process and elements of academic writing.
- To help them gain accuracy in the academic writing tasks they will be called upon to perform as part of their graduate and postgraduate studies.
- To empower them to carry out academic writing tasks such as project report writing with success.

**Learning Outcomes**

Upon successful completion of the course, the student will be able to produce successful academic writing tasks (such as designing and reporting a survey/project, writing discussion essays, and composing formal letters) with attention to:

- the writing process involving a good understanding of the purpose and the register as well as organizational strategies such as introduction, main body, conclusion, paragraphing;
- the elements of academic writing such as argument, cause and effect, cohesion and coherence, generalizations, references, style, and visual information; and
- the kind of accuracy, technical as well as grammatical, that writing in academic contexts demands

**Course Content**

**I. The Writing Process**

**a. Background to writing**

i. The purpose of academic writing
ii. Common types of academic writing
iii. The features of academic writing
iv. Writing in paragraphs

**b. From understanding to planning**

i. The planning process
ii. Analyzing essay titles
iii. Brainstorming

**c. Organizing paragraphs**

i. Paragraph structure
ii. Development of ideas
iii. Linking paragraphs together

**d. Introductions and conclusions**

i. Introduction contents ii. Introduction structure

iii. Opening sentences iv. Conclusions

**e. Re-writing and proof-reading**

i. Re-writing ii. Proof-reading

**II. Elements of Writing**

**a. Cohesion**

i. Reference words ii. Preventing confusion

**b. Comparisons**

i. Comparison structures ii. Forms of comparison

iii. Using superlatives

**c. Style**

i. Components of academic style ii. Guidelines

**d. Visual information**

i. The language of change ii. Types of visuals

iii. Describing visuals iv. Labelling

**III. Accuracy in Writing**

a. Academic vocabulary b. Remedial grammar

c. Punctuation

**IV. Writing Models**

a. Formal/Professional emails b. CVs

c. Reports d. Scholarly essays

**Suggesting Reading**

1. Bailey, Stephen. (2011). *Academic Writing A Handbook for International Students*. Routledge: London.

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